Organic Chemistry Days

29 > 31 October 2025
École polytechnique
Palaiseau, France

Société Chimique de France
Le réseau des chimistes

JCO 2025

Programme & Book of abstracts

www.jco2025.com

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Cyril OLLIVIER
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Yann TROLEZ
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Sébastien VIDAL
ICSN | Université Paris-Saclay | Gif-sur-Yvette, France
Guillaume VIVES
IPCM | Sorbonne Université | Paris, France

As chairman of the Journées de Chimie Organique (JCO 2025) of the French Chemical Society, and on behalf of the organizing committee, I am delighted to warmly welcome you all to Palaiseau for this major event, held under the auspices of the Organic Chemistry Division of the SCF.

The JCO, organized every three years, bring together an international panel of world-renowned plenary speakers who will present cutting-edge lectures in areas such as synthetic methodology, catalysis, total synthesis, medicinal chemistry, chemobiology, bioorganic chemistry, material science, chemistry of the origins, supramolecular chemistry and sustainable chemistry. In front of an audience of over 700 participants, 16 plenary and invited lectures will be accompanied by 60 oral communications delivered by young scientists, along with more than 330 poster presentations. In addition, prizes for oral communications and posters will be awarded. This meeting provides a valuable opportunity for our entire community to engage in scientific exchange while exploring emerging areas that may foster future synergies.

We are very grateful to the École Polytechnique for hosting us. We also warmly thank all our academic and industrial sponsors for their generous support.

Together, we hope that this conference will not only promote new discoveries, but also the exchange of ideas leading to future collaborations and developments. We therefore hope that all participants will make JCO 2025 a rewarding and memorable event, and contribute to maintaining the JCO as a key event for chemistry in our country.

Arnaud Voituriez
Symposium Chairman
President of the Organic Chemistry Division of the French Chemical Society

Organized by

Société Chimique de France
Le réseau des chimistes
DCO Division de Chimie Organique

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Edward ANDERSON

University of Oxford
UNITED KINGDOM

Thiophene S,S-dioxides as Tools for Asymmetric Synthesis



Thorsten BACH

Technische Universität München
GERMANY

Enantioselective Catalysis in the Excited State



Tatiana BESSET: Prix JM Lehn 2025

CARMeN Institute
FRANCE

Unveiling Routes to Fluorinated Molecules



Nessa CARSON

AstraZeneca
UNITED KINGDOM

From experimentation to insights: Leveraging hardware and software automation in pharma development



Ben L. FERINGA

University of Groningen
THE NETHERLANDS

From molecular switches to motors



Lilian GENILLER: Prix D. Surdin 2025

Institut Charles Gerhardt Montpellier
FRANCE

Development of Photochemical Transformations by Halogen Atom Transfer (XAT) for Organic Synthesis



Clément GHIAZZA: Prix M. Julia 2025

Institut Lavoisier de Versailles - UVSQ/U. Paris Saclay
FRANCE

Rebirth of 1,2-Diazepines: Improved protocol and reactivity



Laurence GRIMAUD

ENS Paris
FRANCE

Merging Electrochemical Activation, Mechanistic Insight, and Machine Learning for Next-Generation Synthesis



John F. HARTWIG

University of California Berkeley
USA

Laboratory Metal-Catalyzed Organic Chemistry in a Protein…within a Cell… and within Artificial Biosynthesis



Ohyun KWON

University of California Los Angeles
USA

Synthesis through CC Bond Scission



Cornelia MEINERT

CNRS - Université Côte d'Azur
FRANCE

Interstellar molecules and their stereochemistry: Implications for prebiotic organic chemistry



Anat MILO

Ben-Gurion University of the Negev
ISRAEL

Data Science Strategies in Organocatalysis



Sophie ROUSSEAUX
University of Toronto
CANADA

Photochemical approaches for the synthesis of highly functionalized cyclopropanols



Matthieu SOLLOGOUB
Sorbonne Université
FRANCE

Site-selective synthesis for biomimesis



Hiroaki SUGA
The University of Tokyo
JAPAN

De Novo Pseudo-Natural Peptides and Products



Zhiwei ZUO
Shanghai Institute of Organic Chemistry
CHINA

LMCT Catalysis for selective functionalizations of strong bonds

WEDNESDAY 29 OCTOBER		
08:00	Registration	Main Hall
09:00	Opening Ceremony	Amphithéâtre Poincaré
09:30	PL1 | Ben FERINGA *Sponsored by Sanofi*	Amphithéâtre Poincaré
10:15	IL1 | Zhiwei ZUO	Amphithéâtre Poincaré
10:45	Flash communication exhibitors 1	Amphithéâtre Poincaré
11:00	Coffee Break	Main Hall
11:40	PL2 | Laurence GRIMAUD	Amphithéâtre Poincaré
12:25	Flash communication exhibitors 2	Amphithéâtre Poincaré
12:45	Lunch	Main Hall
14:15	PL3 | Ohyun KWON	Amphithéâtre Poincaré
15:00	Oral Communications session #1a	Amphithéâtre Poincaré
	Oral Communications session #1b	Amphithéâtre Arago
	Oral Communications session #1c	Amphithéâtre Gay-Lussac
17:15	Group Picture	Main Hall
17:30	Poster session #1 & Juice/Beer Break	Main Hall



THURSDAY 30 OCTOBER		
09:00	PL4 | Matthieu SOLLOGOUB	Amphithéâtre Poincaré
09:45	IL2 | Nessa CARSON	Amphithéâtre Poincaré
10:15	IL3 | Lilian GENILLER Prix D Surdin 2025	Amphithéâtre Poincaré
10:35	Flash communication exhibitors 3	
10:55	Coffee Break	Main Hall
11:35	IL4 | Clément GHIAZZA Prix M Julia 2025	Amphithéâtre Poincaré
12:05	PL5 | Hiroaki SUGA	Amphithéâtre Poincaré
12:50	Lunch	Main Hall
14:30	PL6 | John HARTWIG *Sponsored by Activation*	
15:15	Oral Communications session #2a	Amphithéâtre Poincaré
	Oral Communications session #2b	Amphithéâtre Arago
	Oral Communications session #2c	Amphithéâtre Gay-Lussac
17:30	Poster session #2 & Juice/Beer Break	Main Hall

FRIDAY 31 OCTOBER		
09:00	PL7 | Tatiana BESSET Prix JM Lehn 2025 *Sponsored by Sanofi*	Amphithéâtre Poincaré
09:45	PL8 | Edward ANDERSON	Amphithéâtre Poincaré
10:30	Coffee Break	Main Hall
11:10	IL5 | Anat MILO	Amphithéâtre Poincaré
11:40	PL9 | Sophie ROUSSEAUX *Sponsored by Minakem*	Amphithéâtre Poincaré
12:25	Lunch	Main Hall
14:00	IL6 | Cornelia MEINERT	Amphithéâtre Poincaré
14:30	PL10 | Thorsten BACH	Amphithéâtre Poincaré
15:15	Poster & oral communication awards *Sponsored by Syngenta, euroAPI, Servier, ChemistryEurope*	Amphithéâtre Poincaré
15:45	Closing ceremony	Amphithéâtre Poincaré

WEDNESDAY 29 OCTOBER

08:00 Registration

09:00 - 09:30 Opening Ceremony
Arnaud VOITURIEZ, President of the DCO - **Kees VAN DER BEEK**, Director of Research at the Ecole Polytechnique
Frédéric LEROUX, CNRS Chimie - **Gilberte CHAMBAUD**, President of the SCF

Chair: Arnaud VOITURIEZ

09:30 - 10:15 PL1 | **Ben L. FERINGA** - University of Groningen, THE NETHERLANDS ***Sponsored by Sanofi***
From molecular switches to motors

10:15 - 10:45 IL1 | **Zhiwei ZUO** - Shanghai Institute of Organic Chemistry, CHINA
LMCT Catalysis for selective functionalizations of strong bonds

10:45 - 11:00 Flash communication exhibitors 1

11:00 - 11:40 Coffee Break

Chair: Yann TROLEZ

11:40 - 12:25 PL2 | **Laurence GRIMAUD** - ENS Paris, FRANCE
Merging Electrochemical Activation, Mechanistic Insight, and Machine Learning for Next-Generation Synthesis

12:25 - 12:45 Flash communication exhibitors 2

12:45 - 14:15 Lunch

Chair: Cyril OLLIVIER

14:15 - 15:00 PL3 | **Ohyun KWON** - University of California Los Angeles, USA
Synthesis through CC Bond Scission

15:00 - 17:15 Oral Communications session #1

	ORAL COMMUNICATIONS SESSION #1A	ORAL COMMUNICATIONS SESSION #1B	ORAL COMMUNICATIONS SESSION #1C
	AMPHITHÉÂTRE POINCARÉ *Chair: Vincent COEFFARD - Gaëlle BLOND*	AMPHITHÉÂTRE ARAGO *Chair: Angélique FERRY - Erica BENEDETTI*	AMPHITHÉÂTRE GAY-LUSSAC *Chair: Cyril OLLIVIER - Stellios ARSENIYADIS*
15:00	**OC01 Cassandre QUINTON** One reaction, six nanohoops: Unravelling the origins of unexpected structural diversity	**OC11 Gaël TRAN** Synergistic Nickel/LMCT catalysis: A powerful strategy for cross-coupling of feedstock chemicals	**OC21 Lucile CLUZEAU** Metal-Free Upcycling of Polyethylene into Reactive Platforms Through Direct and Selective Nitrosation and Carbonylation
15:13	**OC02 Rahma GHAZALI** Skeletal Editing of Azetines	**OC12 Diana DEAIBESS** Divergent Reactivity of Nitrostyrene Derivatives With Supramolecular Helical Catalysts	**OC22 Anna ABRAMOVA** Extending Bioorthogonal Chemistry to Natural Oxylipins: A Tri-Functional Probe for 4-F4t-Neuroprostane

15:26	**OC03 Bastien CHAMPCIAUX** Silylium based asymmetric synthesis of endoperoxides directed by chiral counteranions	**OC13 Théo BISSONNIER** Synthesis of Diamines via Selective Catalytic C-H Amination	**OC23 Clara TESTARD** ^{11}C labelling of mRNA for PET imaging of new vaccines and therapies
15:39	**OC04 Diana LAMAA** N-Tosylhydrazones as Key Precursors for Visible-Light-Promoted C–N and C–C Bonds Formation	**OC14 Ya-Qing HUANG** Asymmetric [3,3]-Sigmatropic Rearrangements of Sulfoniums and Applications	**OC24 Lou ROCARD** Dynamic Cyclic Peptides for the Inhibition of Protein-Protein Interactions
15:52	**OC05 Corentin BEDOUET** Activation of small molecules thanks to non-metallic radical complexes	**OC15 Lamine SAADI** Catalytic Alkoxysilylation of C–H Bonds Using Novel Alkoxysilyldiazenes	**OC25 Mélanie SEBASTIEN** Synthesis and optimization of novel peptidomimetics derivatives inhibiting the efflux pumps of Pseudomonas aeruginosa
16:05	**OC06 Thomas DEFUENTES** Development of O-H and N-H insertions on O-protected α-diazo-β-hydroxy esters	**OC16 Camille GADONA** Rare Ketose Synthesis from Glycolaldehyde by C2 Elongation of Aldoses Catalyzed by Transketolase Variants	**OC26 Chloe BRETON-PATIENT** Targeting SARS-CoV-2 Main protease: Synthesis of epoxyazepinoindole derivatives as potential inhibitors
16:18	**OC07 Pauline ADLER** Catalytic approach for amide coupling for the synthesis of peptide-oligonucleotide conjugates	**OC17 Navod Angelo AMARATUNGA** Exploring the applications of pyridazino-1,3a,6a-triazapentalenes (PyTAP) as photocatalysts	**OC27 Méline ANTOINE** Synthesis of acyclonucleosides fluoroalkenyl mimics
16:31	**OC08 Biraveena SINNIAH KANDIAH** Photocatalytic Construction of the Key Central Bond of the Tetrameric Alkaloid Alasmontamine A	**OC18 Fanny MORVAN** Well-defined iridium complexes containing chiral cyclic (alkyl)(amino)carbenes for asymmetric hydrogenation	**OC28 Maria J. PUERTO MADORRAN** Amphiphilic photocontrolled DNA delivery systems
16:44	**OC09 Zélie FAUDEMER** New phase transfer agents for fluorine-18 radiolabeling	**OC19 Matthieu LAVAYSSIERE** Harnessing extrusion forces for the thermo-mechanochemical synthesis of amides through Machine Learning	**OC29 Pierre Nicolas BIZAT** Towards the enzymatic labelling of oligonucleotides with triantennary N-acetyl galactosamine
16:57	**OC10 Nicolas KERN** Catalytic radical cascades driven by triple H-atom transfer	**OC20 Josue Arturo LEDEZMA FIERRO** From lignin degradation products to indanone building blocks	**OC30 Sébastien BILLOTTE** Photopharmacological tools with π-extended coumarins based on TAM kinase inhibitor UNC2025

17:15 - 17:30 **Group Picture**

17:30 Poster session #1 & Juice/Beer Break

THURSDAY 30 OCTOBER

Chair: Adrien QUINTARD

09:00 - 09:45 PL4 | Matthieu SOLLOGOUB - Sorbonne Université, FRANCE
Site-selective synthesis for biomimesis

09:45 - 10:15 IL2 | Nessa CARSON - AstraZeneca, UNITED KINGDOM
From experimentation to insights: Leveraging hardware and software automation in pharma development

10:15 - 10:35 IL3 | Lilian GENILLER Prix D. Surdin 2025 - Institut Charles Gerhardt Montpellier, FRANCE
Development of Photochemical Transformations by Halogen Atom Transfer (XAT) for Organic Synthesis

10:35 - 10:55 Flash communication exhibitors 3

10:55 - 11:35 Coffee Break

Chair: Frédéric LAMATY

11:35 - 12:05 IL4 | Clément GHIAZZA Prix M JULIA 2025 - Institut Lavoisier de Versailles - UVSQ/U. Paris Saclay, FRANCE
Rebirth of 1,2-Diazepines: Improved protocol and reactivity

12:05 - 12:50 PL5 | Hiroaki SUGA - The University of Tokyo, JAPAN
De Novo Pseudo-Natural Peptides and Products

12:50 - 14:30 Lunch

14:30 - 15:15 *Chair: Stellios ARSENIYADIS*
PL6 | John F. HARTWIG - University of California Berkeley, USA ***Sponsored by Activation***
Laboratory Metal-Catalyzed Organic Chemistry in a Protein…within a Cell…and within Artificial Biosynthesis

15:15 - 17:30 Oral Communications session #2

	ORAL COMMUNICATIONS SESSION #2A	ORAL COMMUNICATIONS SESSION #2B	ORAL COMMUNICATIONS SESSION #2C
	AMPHITHÉÂTRE POINCARÉ *Chair: Adrien QUINTARD - Frédéric LAMATY*	AMPHITHÉÂTRE ARAGO *Chair: Erica BENEDETTI - Gaëlle BLOND*	AMPHITHÉÂTRE GAY-LUSSAC *Chair: Stéphanie NORSIKIAN – Guillaume VIVES*
15:15	OC31 Morgane MANDO Synthesis of 1,3-bis-trifluoromethylated-(hetero) cyclohexane-2-carboxylates	OC41 Romain MELOT An Electrochemical Study of Catalytically Relevant Gold Complexes	OC51 Jordan LEHOUX Total Synthesis and Analysis of Phenolic Phytoprostanes
15:28	OC32 Marc BUSICCHIA Cycloadditions of 5 Vinyloxazolidine-2,4-diones: A Straightforward access to the (Thio)hydantoin Scaffold	OC42 François GENEVOIS Towards New Organic Posolytes Based on Imidazolium Cores	OC52 Dania DAOU Not going back: Unidirectional movement by intramolecular one-way ratcheting of functionalized cyclodextrin

15:41	OC33 Illia RUZHYLO Light-Driven Synthesis of Diversely Substituted Indoles	OC43 Chaimae JBILOU Development of Pyrroloquinolone-Based Push-Pull Fluorescent Dyes	OC53 Louise BURELLER Functionalization of the BODIPYs allowing integration into MOFs by different pathways
15:54	OC34 Rémi PEREIRA Catalytic synthesis of highly functionalized chiral polycyclic compounds bearing quaternary stereocenters	OC44 Félix MANDELAIRE σ C–O bond cleavage and protodecarboxylation of formates	OC54 Antoine GAMET Total synthesis of latrunculin B photoswitches and their application in actin chemical biology
16:07	OC35 Virgile ROUFFETEAU ML-guided Electrochemical Isocyanides-based Csp2-H carbamoylation of arenes	OC45 Lukmonjon MUTALLIEV Silicon-Assisted Sustainable Gold(I)-Catalysis	OC55 Yohan GISBERT Intramolecular Mechanics with Motors: Coupling Rotation to Selective Helicene Inversion
16:20	OC36 Pandidurai SOLAI Organocatalyzed Enantioselective Synthesis of N and S- Containing Chiral Heterocyclic Compounds	OC46 Basile WEYL Heterogeneous Photocatalysis in Flow for Applications in Organic Synthesis	OC56 Iris SANCHEZ Tuning of photophysical and chiroptical properties by encapsulation inside a hydrogen-bonded cavity
16:33	OC37 Arthur BAUDEMENT Spirocyclisation and Subsequent Dyotropic rearrangement: A Sequential Route to the Synthesis of Exotines Scafold	OC47 Vanessa DELAHAYE B2pin2-mediated Ligand Deprotonation Enables Selective Iridium-catalyzed C-H Borylations Revealed by Click Ligands	OC57 Elisa COLL Bioinspired Total Syntheses of Indole Alkaloids: Spirocyclic Assembly of Pseudo-Dimeric Oligomers
16:46	OC38 Tingting FENG Electrochemical Synthesis of Allenyl Silanes and Allenyl Boronic Esters	OC48 Romain LOSA Toward fluorine-free weakly coordinating borate anions for lithium-ion batteries, ionic liquids and catalysis	OC58 Oscar CHARPENTIER Synthesis and optoelectronic properties of original pyrano-carbazole based chiral structures
16:59	OC39 Abdelati NAGHIM Controlling Multiple Stereogenicity in Diaryl Ethers	OC49 Kun-Long SONG Dication disulfuranes as photoactivatable sources of radical organocatalysts	OC59 Mainak DAS Harnessing Conformational Dynamics to Tune π-Magnetism in Flexible Macrocycle
17:12	OC40 Chao ZHOU Kinetic Resolution of Heterocyclic Lactams by a Photocatalytic Cobalt-Catalyzed Dehydrogenation	OC50 Abdul Halim OBEID Low-coordinate Iron(II)-Complex for Catalytic Alkene Isomerization via Two-state Reactivity	OC60 Yoann COTELLE Electron Deficient Hemicryptophanes: From Anion-π Interactions to Functional Receptors

17:30 Poster session #2 & Juice/Beer Break

FRIDAY 31 OCTOBER

Chair: Morgan DONNARD

09:00 - 09:45 PL7 | Tatiana BESSET Prix JM Lehn 2025 - CARMeN Institute, FRANCE ***Sponsored by Sanofi***
Unveiling Routes to Fluorinated Molecules

09:45 - 10:30 PL8 | Edward ANDERSON - University of Oxford, UNITED KINGDOM
Thiophene S,S-dioxides as Tools for Asymmetric Synthesis

10:30 - 11:10 Coffee Break

Chair: Abderrahmane AMGOUNE

11:10 - 11:40 IL5 | Anat MILO - Ben-Gurion University of the Negev, ISRAEL
Data Science Strategies in Organocatalysis

11:40 - 12:25 PL9 | Sophie ROUSSEAUX - University of Toronto, CANADA ***Sponsored by Minakem***
Photochemical approaches for the synthesis of highly functionalized cyclopropanols

12:25 - 14:00 Lunch

Chair: Sami LAKHDAR

14:00 - 14:30 IL6 | Cornelia MEINERT - CNRS - Université Côte d'Azur, FRANCE
Interstellar molecules and their stereochemistry: Implications for prebiotic organic chemistry

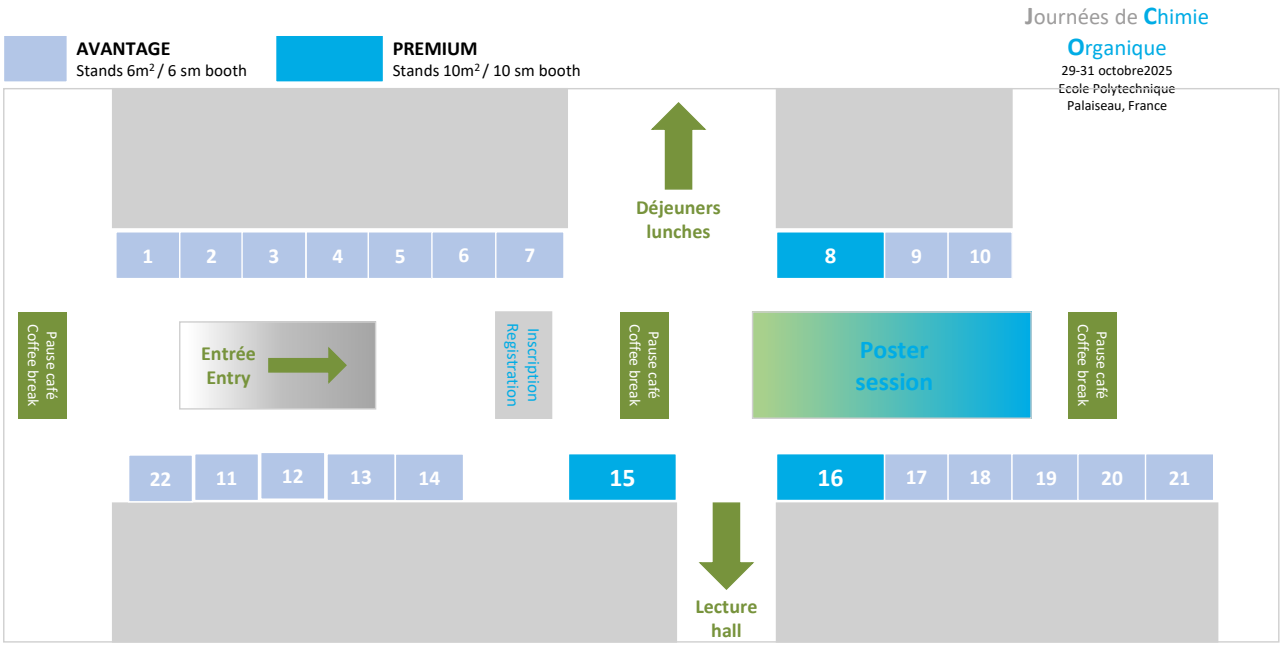
14:30 - 15:15 PL10 | Thorsten BACH - Technische Universität München, GERMANY
Enantioselective Catalysis in the Excited State

15:15 - 15:45 *Chair: Angélique FERRY*
Poster & oral communication awards ***Sponsored by Syngenta, euroAPI, Servier, ChemistryEurope***

15:45 Closing ceremony

OPENING HOUR OF THE EXHIBITION

Wednesday, October 29: 9h00- 18h30
Thursday, October 30: 9h00- 18h30
Friday, October 31: 9h00- 14h00



EXHIBITORS

1- HEIDOLPH
2- ANR
3- MERCK
4- BLD PHARMA
5- KNF
6- CEM
7- ANTON-PAAR
8- CLOUP
9- HUBER
10- OPTIMUS INSTRUMENT
11- INTERCHIM
12- BIOTAGE
13- BUCHI
14- BRUKER
15- MAGRITEK
16- SERLABO
17- VACUUBRAND
18- ABCR
19- ROSACHEM
20- TCI
21- WATERS
22- CORNING

The event will be held at the École Polytechnique de Palaiseau.

COFFEE BREAKS

Coffee breaks will be served at the time scheduled in the programme in the main Hall of École Polytechnique.

LUNCHES

Lunches could be taken at the restaurant of the École polytechnique. The amount of selected lunches will be added to the registration fees and tickets will be given to participants at the welcoming desk.

Lunch tickets can be purchased on site from polytechnique vending machines or directly at the self.

ORAL SESSIONS

You must arrive 15 minutes before your session starts. Oral communications are limited to 10 STRICT minutes for presentation, and up to 2 minutes for questions. Please note that the official language of the conference is English. All oral presentations must be delivered in English.

You will not be able to use your personal computer. You will be using an available computer. These laptops will also be available in the main hall (at the registration desk) every morning before each OC session to upload.

PPT or PDF files will be accepted. In case you are using a PPT file, please prepare also a PDF file as a backup. The slide size can be 16/9.

POSTER SESSIONS

Two poster sessions will be organized. The 1st one on Wednesday, October 29, and the second one on Thursday, October 30.

You will find your reserved place by referring to the number assigned to you. Authors are asked to stand close to their poster throughout the session, so as to be available for questions.

Each panel will measure 100 cm wide by 240 cm high (portrait orientation). Your poster should ideally be printed on A0 format (height 118.9 x width 84.1 cm). A fastening system will be provided (Velcro pads). Please ensure that your poster is not too heavy.

Posters have to be installed on the same morning of the day of presentation, it must be removed from the billboard at the end of the day.

WIFI

Wireless internet access is available through the Ecole Polytechnique network using the account «Guest».
Eduroam connection will also be available.

Plenary lectures & Biographies



Ben L. FERINGA

University of Groningen
THE NETHERLANDS

BIOGRAPHY AND RESEARCH INTERESTS

Ben L. Feringa obtained his PhD degree at the University of Groningen in the Netherlands. After working as a research scientist at Shell in the Netherlands and the UK, he was appointed lecturer and in 1988 full professor at the University of Groningen and named the Jacobus H. van 't Hoff Distinguished Professor of Molecular Sciences in 2004. He is a member of the Royal Netherlands Academy of Sciences. In 2008 he was appointed Academy Professor and he was knighted by Her Majesty the Queen of the Netherlands.

Feringa's research has been recognized with numerous awards including the 2016 Nobel prize in Chemistry, the Tetrahedron Prize (2017) and the European Chemistry Gold Medal (2018). In 2019 he was elected as member of the European Research Council and Foreign Member of the US National Academy, USA, and in 2020 as a Foreign Member Royal Society (London) UK.

Feringa's research interest includes stereochemistry, organic synthesis, asymmetric catalysis, molecular switches and motors, self-assembly, molecular nanosystems and photo pharmacology.

PL1

From molecular switches to motors

Ben L. Feringa[1]
[1] *Stratingh Institute for Chemistry, University of Groningen*
Nijenborgh 4, 9747 AG Groningen, The Netherlands
b.l.feringa@rug.nl

In the art of building small we explore the fascinating field of molecular machines. The molecular beauty, structural diversity and ingenious functions of the machinery of life, which evolved from a remarkably limited repertoire of building blocks, offers a tremendous source of inspiration to the synthetic chemist entering the field of dynamic molecular systems.
However, far beyond Nature's design, the creative power of synthetic chemistry provides unlimited opportunities on our route from molecules to dynamic functions along length scales. Among the major challenges ahead in the design of complex artificial molecular systems and molecular machines is the control over dynamic functions and responsive behaviour. Important goals are to explore translational and rotary motion. The focus in this lecture is on my journey in the world of molecular switches and rotary motors creating opportunities ranging from smart drugs to responsive materials.

Information on http://www.benferinga.com



Laurence GRIMAUD

ENS Paris
FRANCE

BIOGRAPHY AND RESEARCH INTERESTS

Dr. Laurence Grimaud is a Research Director (DR1) at CNRS, working at the Laboratoire Chimie Physique et Chimie du Vivant (UMR 8228, ENS-PSL, Paris). She obtained her PhD in Organic Chemistry from École Polytechnique in 1999 and her Habilitation in 2006. Her research focuses on isonitrile chemistry, multicomponent and heterocyclic reactions, as well as organometallic catalysis. She has also developed expertise in physical organic chemistry, mechanistic studies, and molecular electrochemistry, and more recently has explored the integration of machine learning approaches in chemistry. Dr. Grimaud has published over 150 peer-reviewed articles, authored several book chapters, and holds a patent. She served as Deputy Head of the Chemistry Department at ENS for three years and has taught at École Polytechnique for more than a decade.

PL2

Merging Electrochemical Activation, Mechanistic Insight, and Machine Learning for Next-Generation Synthesis

Laurence Grimaud[1]

[1] *Laboratoire Chimie Physique et Chimie du Vivant, UMR 8228, ENS-PSL, Department of Chemistry, 24 rue Lhomond, 75005 Paris, France*

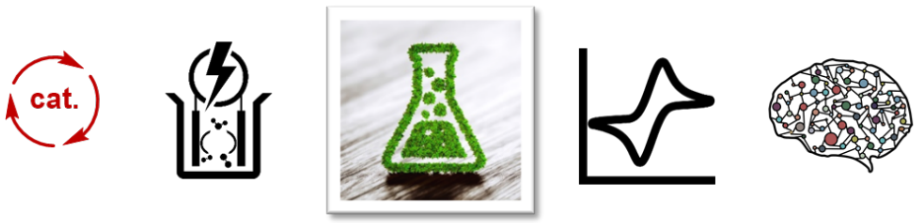
laurence.grimaud@ens.psl.eu

The design of sustainable chemical syntheses relies on efficiency and mechanistic understanding, which are strongly correlated notions. Recent advances in synthetic chemistry have shown how combining innovative activation techniques with multicomponent reactions can lead to more efficient and sustainable ways to build complex molecules. In our work, we have explored how isocyanide-based multicomponent reactions, well known for their versatility, can be enhanced through the use of electricity.[1] These approaches allow us to perform challenging chemical transformations under mild conditions, using readily available starting materials.

In parallel, we have focused on understanding how metal catalysts like palladium and nickel facilitate carbon–carbon bond formation in widely used cross-coupling reactions.[2] While these reactions are essential tools in modern synthesis, the underlying mechanisms are still not fully understood. By combining experimental techniques and computational modeling, we have gained new insights into how these catalysts work.

More recently, we have begun integrating machine learning approaches to accelerate reaction optimization.[3] This data-driven strategy can not only improve the efficiency of synthetic planning but also help uncover subtle patterns in reactivity across both multicomponent and metal-catalyzed transformations.

Together, these studies illustrate the possibility to expand the toolbox of synthetic chemistry by a rationalized approach, and move toward more sustainable and efficient chemical processes.



[1] Electrochemical TEMPO-Catalyzed Oxidative Ugi-Type Reaction. Pan, N.; Lee, M. X.; Bunel, L.; Grimaud, L.; Vitale, M. *ACS Organic & Inorganic Au* **2021**, *1*, 18-22. Electrochemical Benzylic CH Functionalization with Isocyanides. Tang, S.; Guillot, R.; Grimaud, L.; Vitale, M. R.; Vincent, G. *Org. Lett.* **2022**, *24*, 2125-2130. Electromediated Alcohol-based Passerini-Type Reaction. Simon, A.; Bachollet, S. P. J. T.; Pan, N.; Grimaud, L.; Vitale, M. R. *Synlett* **2024,** *35*, A-E.

[2] *In Situ* Formation of Cationic π-Allylpalladium Precatalysts in Alcoholic Solvents: Application to C–N Bond Formation. Steinsoultz, P.; Bailly, A.; Wagner, P.; Oliva, E.; Schmitt, M.; Grimaud, L.; Bihel, F. *ACS Catal.* **2022**, 1, 560–567. Oxidative Addition of Nitro-Perylenediimide onto Palladium(0): A theoretical and experimental study. Schleinitz, J.; Chinchilla-Garzon, C.; Perfetto, A.; Escoudé, E.; Makhloutah, A.; Gontard, G.; Vitale, M. R.; Goujon, A.; Felpin, F.-X.; Binet, L.; Ciofini, I.; Hudhomme, P.; Grimaud, L. *Organometallics* **2025**, *44*, 29–35.

[3] Machine Learning Yield Prediction from NiCOlit, a Small-Size Literature Dataset of Nickel Catalyzed C-O Couplings. Schleinitz, J.; Langevin, M.; Smail, Y.; Wehnert, B.; Grimaud, L.; Vuilleumier, R. *J. Am. Chem. Soc.,* **2022**, *144*, 14722–14730.



Ohyun KWON

University of California Los Angeles
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BIOGRAPHY AND RESEARCH INTERESTS

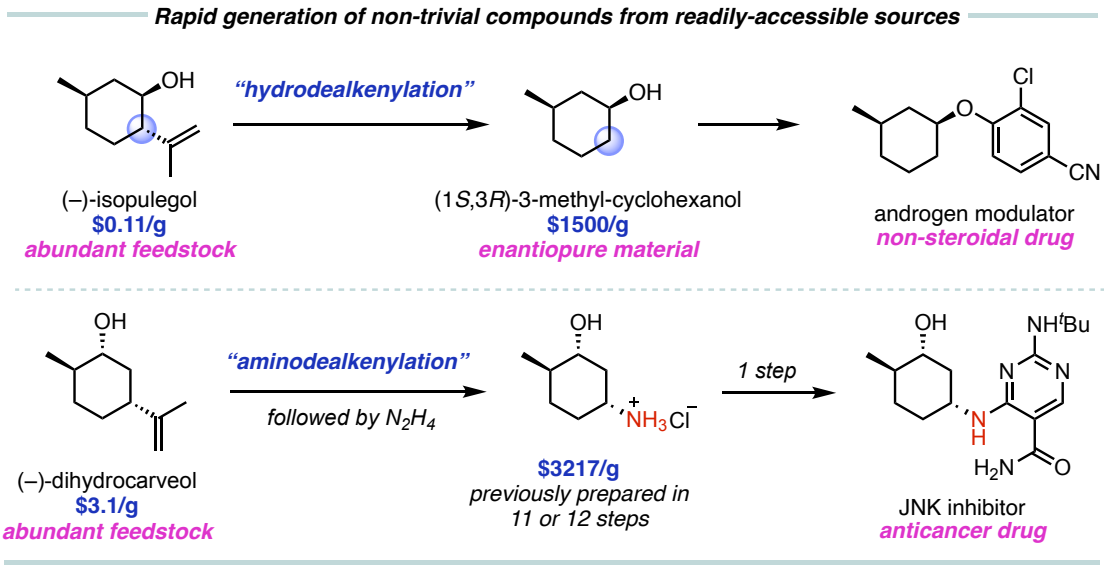
Ohyun Kwon obtained her BS degree from Seoul National University, where she also obtained her MS degree. She received her Ph.D. from Columbia University in 1998 under the mentorship of Prof. Samuel Danishefsky. Following postdoctoral research at Harvard University with Prof. Stuart Schreiber, she began her independent career at UCLA in 2001. Her research focuses on developing defunctionalization techniques for C–C bond editing, with applications in the synthesis of biologically active compounds. Additionally, she is recognized as a leading contributor to the field of phosphorus organocatalysis. Notable recognitions of her research accomplishments include the inaugural Amgen Young Investigator's Award (2003), Novartis Chemistry Lectureship Award (2019), and ACS Arthur C. Cope Scholar Award (2024).

Research interest: At the core of the Kwon group's research lies the design and development of new reactions and reagents that empower the chemical synthesis of natural products and unnatural small molecules of significance. One of the central themes of the group's research is the reconstructive radical chemistry of natural products, such as terpenes, terpenoids and steroids, and commodity chemicals based on controlled scission of C–C bonds, whereas another involves enantioselective phosphorus organocatalysis and the development of novel chiral phosphines such as the HypPhos and CarvoPhos catalysts, the former of which are sold by Sigma–Aldrich.

PL3
Synthesis through CC Bond Scission

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The topic of this talk is the radical chemistry based on C–C bond scission. The presentation will begin with another area of research endeavors in my group—***phosphorus organocatalysis***. It then will present how our need to create chiral phosphines, CarvoPhos, of particular configuration inspired our invention of a series of new reactions based on C–C bond cleavage. To be specific, we have implemented one-pot processes to ozonize alkenes into α-methoxyhydroperoxides, for subsequent Fe(II)-mediated reductive fragmentations that yield alkyl radical intermediates. Various radical trapping agents are capable of seizing the alkyl radical, enabling the conversion of the alkene C(sp^3)–C(sp^2) bond to C(sp^3)–H,[1] C(sp^3)–S, C(sp^3)–O, C=O,[2] C(sp^3)–C(sp^2), C(sp^3)–C(sp), C(sp^3)–halogen bonds, the last two of which were facilitated by catalytic Fe(II) with vitamin C as the stoichiometric reductant. More recently implemented is a pathway for the Cu(I)-catalyzed dealkenylative amination for the late-stage modification of hormones, pharmaceutical reagents, peptides, and nucleosides.[3] Beyond alkenes, generalized methods for converting the C(sp^3)–C(sp^2) bonds of ketones to C(sp^3)–X linkages (X = H/C/heteroatom) will also be presented.[4] Utilities of our inventions, particularly of "hydrodealkneylation" and "aminodealkenylatuion" are illustrated by facile production of medicinally relevant molecules shown below:



[1] Smaligo, A. J.; Swain, M.; Quintana, J. C.; Tan, M. F.; Kim, D. A.; Kwon, O. Hydrodealkenylative C(sp^3)–C(sp^2) bond fragmentation. *Science* **2019**, *364,* 681–685.
[2] Smaligo, A. J.; Wu, J.; Burton, N. R.; Hacker, A. S.; Shaikh, A. C.; Quintana, J. C.; Wang, R.; Xie, C.; Kwon, O. Oxodealkenylative Cleavage of Alkene C(sp^3)–C(sp^2) Bonds: A Practical Method for Introducing Carbonyls into Chiral Pool Materials. *Angew. Chem. Int. Ed.* **2020**, *59,* 1211–1215.
[3] He, Z.; Moreno, J. A.; Swain, M.; Wu, J; Kwon, O. Aminodealkenylation: Ozonolysis and copper catalysis convert C(sp^3)–C(sp^2) bonds to C(sp^3)–N bonds. *Science* **2023**, *381*, 877–886.
[4] Šimek, M.; Mahato, S.; Dehnert, B. W.; Kwon, O. Deacylative Homolysis of Ketone C(sp^3)–C(sp^2) Bonds: Streamlining Natural Product Metamorphosis. *J. Am. Chem. Soc.* **2025**, *147*, 2664–2674.



Matthieu SOLLOGOUB

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BIOGRAPHY AND RESEARCH INTERESTS

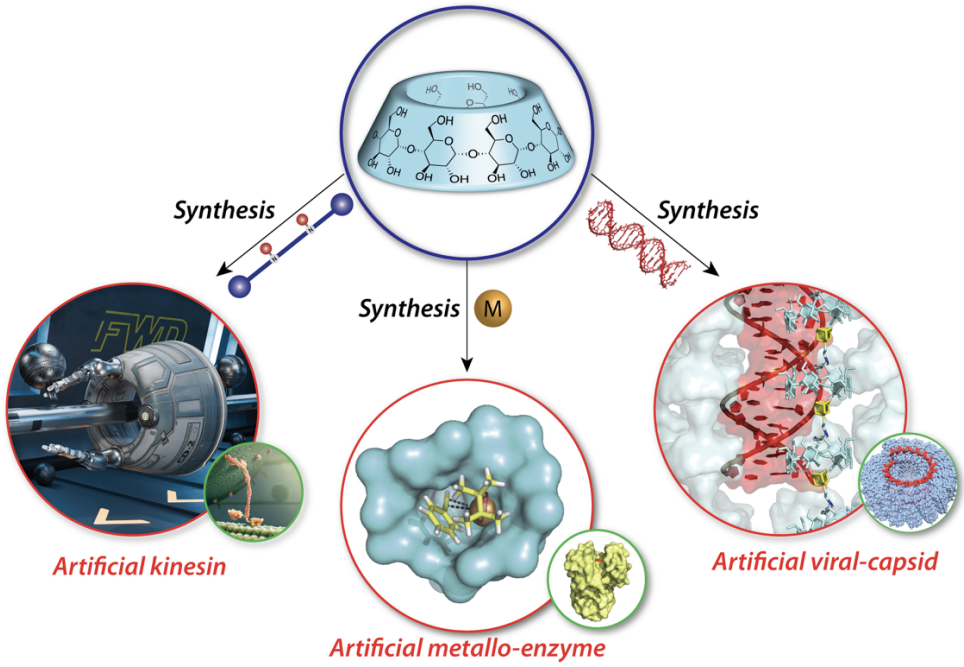
Matthieu Sollogoub is Professor of Molecular Chemistry at Sorbonne Université, where his research focuses on the regioselective hetero-functionalization of cyclodextrins to engineer sophisticated molecular systems. By introducing precise and asymmetric chemical modifications, his group creates cyclodextrin-based ligands that encapsulate metal centers within well-defined chiral cavities, enabling finely tuned stereo- and regioselective catalysis in both organic and complex biological environments. These tailored cyclodextrins also serve as programmable molecular bricks, designed to self-assemble into hierarchical, supramolecular architectures that exhibit controlled biological activities. His team is further using these structures in dynamic molecular machinery, including the development of cyclodextrin-based artificial motors capable of unidirectional motion.

PL4

Site-selective synthesis for biomimesis

Matthieu Sollogoub[1]
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Biomimesis is a scientific and design approach that involves studying and emulating biological systems and processes to create new materials, products, or technologies that are more sustainable, efficient, and adaptable. In chemistry, it involves the design and synthesis of molecules, catalysts, and materials that mimic or are inspired by biological systems and processes, such as enzyme catalysis, photosynthesis, and molecular recognition.
Cyclodextrins are cyclic oligosaccharides possessing a cavity used in our daily life as deodorants, excipients or in chiral stationary phases. In these applications, they are unfunctionalized or randomly functionalized. The concept of "artificial enzyme" has been proposed by Breslow using these cavitand molecules[1] assimilating their cavity to the active site of an enzyme. However, a bottle-neck for their development was the lack of efficient functionalization. Over the years, we delineated several strategies to access poly-hetero-functionalized cyclodextrins.[2] The ability to place a function anywhere on a complex cavitand allowed us to mimic proteins. Hence we could add metallic reactive centers to imitate ***metallo-enzymes***.[3] We also conferred the ability to self-assemble around DNA as ***capsid proteins***[4] and we designed a kinesin-like ***molecular motor***.[5]



[1] Breslow, R.; Overman, L. E. *J. Am. Chem. Soc.* **1970**, *92*, 1075-1077.
[2] Sollogoub, M. et al. *Nature Commun.* **2014**, *5*, 5354; *Angew. Chem. Int. Ed.* **2021**, *60*, 12090
[3] Sollogoub, M. et al. *Chem* **2017**, *3*, 174; *Angew. Chem. Int. Ed.* **2017**, *56*, 10821; *Angew. Chem. Int. Ed.* **2020**, *59*, 7591.
[4] Sollogoub, M. et al. *Angew. Chem. Int. Ed.* **2018**, *57*, 7753; *ChemRxiv* **2024**, DOI 10.26434/chemrxiv-2024-v90l8; *Angew. Chem. Int. Ed.* **2025**, e202507069.
[5] Sollogoub, M. et al. *Chem* **2023**, *9*, 1147; *Chem* **2025**, *11*, 102623.



Hiroaki SUGA

The University of Tokyo
JAPAN

BIOGRAPHY AND RESEARCH INTERESTS

Hiroaki Suga is a Professor of the Department of Chemistry, Graduate School of Science in the University of Tokyo. He received Ph. D. in Chemistry (1994) from the Massachusetts Institute of Technology. He started his academic career as Assistant Professor in the Department of Chemistry in the State University of New York at Buffalo (1997) and promoted to the tenured Associate Professor (2002). In 2003, he moved to the Research Center for Advanced Science and Technology in the University of Tokyo. In 2010, he changed his affiliation to the current position. He is the recipient of Akabori Memorial Award 2014, Japanese Peptide Society, Max-Bergmann Gold Medal 2016, Vincent du Vigneaud Award 2019, The Research Award of the Alexander von Humboldt Foundation 2020, MIT T.Y. Shen Lectureship 2022, ETHZ Prelog Medal Lecture 2022, Wolf Prize in Chemistry 2023, Japan Academy Prize 2024, and Kobe Grand Prize 2025. He is a founder of PeptiDream Inc. Tokyo (2006), a publicly traded company in the Tokyo stock market and a founder of MiraBiologics Inc. (2017).

PL5

De Novo Pseudo-Natural Peptides and Products

Hiroaki Suga[1]

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This lecture discusses recent advances in generating “de novo pseudo-natural” peptides and products via translation from mRNA followed by specific modifications of sidechain or/and backbone by enzymes. The enzymes were discovered by genome mining and clustering analysis, revealing their unique functions for specific or promiscuous post-translation modification. We have reconstituted the biosynthesis machinery of one of thiopeptides (thiazole-containing peptides), called lactazole A (LazA), and displayed the library of LazA analogs (>10^{12} members) on mRNA. Then, we screened active species by this Laz-RaPID (Random nonstandard Peptides Integrated) system. Moreover, prenylation on certain amino acids on peptides enables to access rapid and one-pot synthesis of de novo pseudo-natural peptides. This lecture further discusses recent advances in applications.

Representatives References:

[1] "De Novo Discovery of Thiopeptide Pseudo-natural Products Acting as Potent and Selective TNIK Kinase Inhibitors." A.A. Vinogradov; Y. Zhang; K. Hamada; J.S. Chang; C. Okada; H. Nishimura; N. Terasaka; Y. Goto; K. Ogata; T. Sengoku; H. Onaka; H. Suga* **J Am Chem Soc**, 144, 20332-20341 (2022)

[2] "Solid-Phase-Based Synthesis of Lactazole-Like Thiopeptides." Y. Zhang; A.A. Vinogradov; J.S. Chang; Y. Goto; H. Suga* **Org Lett**, 24, 7894-7899 (2022)

[3] "Accurate Models of Substrate Preferences of Post-Translational Modification Enzymes from a Combination of mRNA Display and Deep Learning." A.A. Vinogradov; J.S. Chang; H. Onaka; Y. Goto; H. Suga* **ACS Cent Sci**, 8, 814-824 (2022)

[4] "Accurate Broadcasting of Substrate Fitness for Lactazole Biosynthetic Pathway from Reactivity- Profiling mRNA Display." A.A. Vinogradov; E. Nagai; J.S. Chang; K. Narumi; H. Onaka; Y. Goto; H. Suga* **J Am Chem Soc**, 117 (43) 26728-26738 (2020)

[5] “Promiscuous enzymes cooperate at the substrate level en route to lactazole A” A.A. Vinogradov; M. Shimomura; N. Kano; Y. Goto; H. Onaka, H. Suga* **J Am Chem Soc**, 142, 13886-13897 (2020)

[6] "Switching Prenyl Donor Specificities of Cyanobactin Prenyltransferases." Y. Zhang; K. Hamada; M. Satake; T. Sengoku; Y. Goto; H. Suga* **J Am Chem Soc**, 145, 23893-23898 (2023)

[7] "LimF is a versatile prenyltransferase for histidine-C-geranylation on diverse non-natural substrates." Y.C. Zhang; K. Hamada; D.T. Nguyen; S. Inoue; M. Satake; S. Kobayashi; C. Okada; K. Ogata; M. Okada; T. Sengoku; Y. Goto; H. Suga* **Nature Catalysis** 5, 682-693 (2022)

[8] "De Novo Discovery of Pseudo-Natural Prenylated Macrocyclic Peptide Ligands." S. Inoue; D.T. Nguyen; K. Hamada; R. Okuma; C. Okada; M. Okada; I. Abe; T. Sengoku; Y. Goto; H. Suga* **Angew Chem Int Ed Engl**, e202409973 (2024)



John F. HARTWIG

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BIOGRAPHY AND RESEARCH INTERESTS

Professor Hartwig's research focuses on the discovery and understanding of new reactions for organic synthesis catalyzed by transition metal complexes. He is well known for contributions to widely practiced cross-coupling chemistry that forms arylamines, aryl ethers, aryl sulfides, and □-aryl carbonyl compounds and for the discovery of practical C-H bond functionalization reactions. During the past several years, he has published a series of functionalizations of C-H bonds to form C-Si, C-N, and C-F bonds, in addition to his continued studies on the formation of C-B bonds by C-H activation. He has also published extensively on diastereoselective and enantioselective, iridium-catalyzed allylic substitution, cross-coupling of amines and enolates with palladium and nickel, and hydrofunctionalization of fully unactivated arenes. Finally, he has published on artificial metalloenzymes for a series of abiological reactions and the application of C–H bond functionalization to the upcycling and deconstruction of polyolefins.

For these accomplishments, he has received numerous awards, including the most recent Arthur C. Cope Award (2021), the 2019 Wolf Prize and Tetrahedron Prize, the ACS award in Organometallic Chemistry, the H.C. Brown Award for Synthetic Methods, an A.C. Cope Scholar Award, the Centenary Prize, the Nagoya Gold Medal, and the Janssen Pharmaceutica Prize for Creativity in Organic Synthesis. He was elected to the National Academy of Sciences in 2012 and the American Academy of Arts and Sciences in 2015. He has served as advisory board member for a series of startup companies, consultant for a series of pharmaceutical companies and chemical companies, member and now Chair of NIH study sections, member of the advisory board for many journals, and member of the evaluation teams for multiple chemistry departments. He is the author of a leading textbook on organometallic chemistry and has taught industrial short courses on combinatorial catalyst discovery, organometallic catalysis, cross coupling, and C-H bond functionalization. He currently leads the Lawrence Berkeley National Laboratory Catalysis Program.

Publications: 485 research articles (>112,000 citations, h-index from Google Scholar = 183)

Patents: 11 issued patents and 8 pending full and provisional applications

Books: Organotransition Metal Chemistry – From Bonding to Catalysis

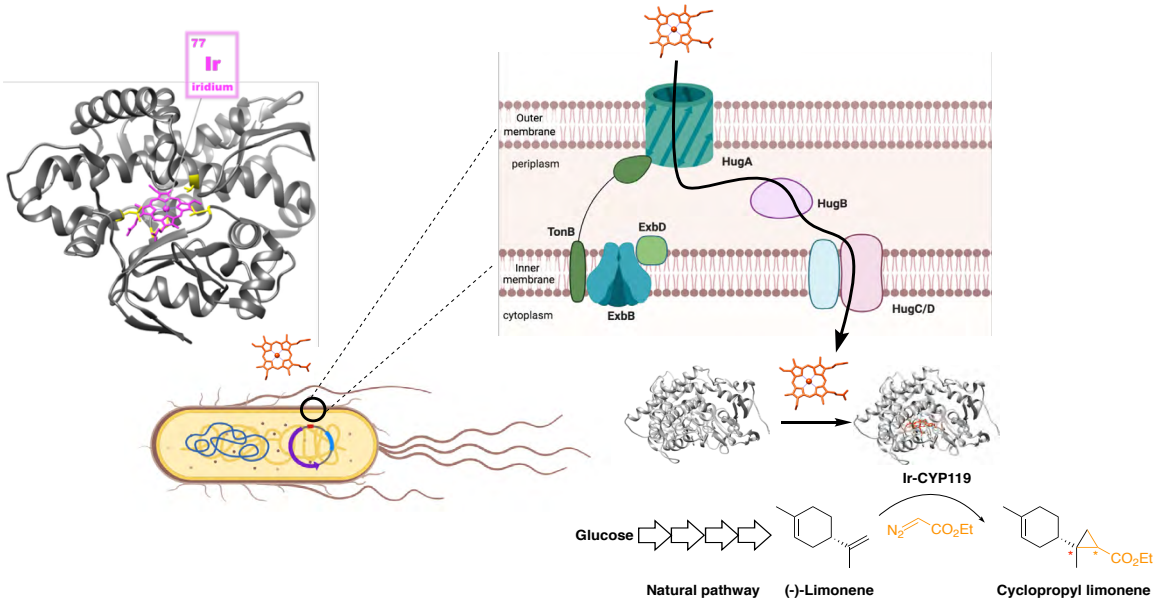
PL6

Laboratory Metal-Catalyzed Organic Chemistry in a Protein… within a Cell…and within Artificial Biosynthesis

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The introduction of functional groups at the positions of typically unreactive C-H bonds site-selectively and the stereo- and regio-selective functionalization of unconjugated C=C bonds have been longstanding challenges in catalysis. To this end, our group has been motivated by the limits of small-molecule catalysts for such reactions to begin to investigate artificial metalloenzymes. These artificial metalloenzymes contain synthetic cofactors possessing abiotic metal centers that catalyze unnatural reactions with control over selectivity resulting from the protein environment. In the best-case scenario such reactions could occur within the cells of *E. coli* or other microorganisms and in the long-term to occur as part of an unnatural biosynthetic pathway to produce unnatural products by fermentation.

This talk will include results on new transformations, new mechanisms, new reactive intermediates, and new methods for *in vivo* assembly of artificial metalloenzymes. This set of results has enabled us to combine an unnatural carbene-transfer reaction catalyzed by natural and artificial metalloenzymes with the biosynthesis of diazo compounds and natural reactions of a heterologous biosynthetic pathway to create engineered microorganisms that produce unnatural products by artificial biosynthesis encompassing organometallic chemistry.[1]



[1] Notes: (1) Key, H. M.; Dydio, P.; Liu, Z.; Rha, J. Y. E.; Nazarenko, A.; Seyedkazemi, V.; Clark, D. S.; Hartwig, J. F. Beyond Iron: Iridium-Containing P450 Enzymes for Selective Cyclopropanations of Structurally Diverse Alkenes. *ACS Cent. Sci.* **2017**, *3* (4), 302-308. DOI: 10.1021/acscentsci.6b00391. Huang, J.; Liu, Z.; Bloomer, B. J.; Clark, D. S.; Mukhopadhyay, A.; Keasling, J. D.; Hartwig, J. F. Unnatural biosynthesis by an engineered microorganism with heterologously expressed natural enzymes and an artificial metalloenzyme. *Nat. Chem.* **2021**, *13* (12), 1186-1191. DOI: 10.1038/s41557-021-00801-3



Tatiana BESSET: Prix JM Lehn 2025

CARMeN Institute
FRANCE

BIOGRAPHY AND RESEARCH INTERESTS

Tatiana Besset got her Ph.D. in Chemistry in 2009 from the University of Grenoble under the supervision of Dr. Greene. She subsequently joined WWU Münster University as a postdoctoral researcher in the group of Prof. Glorius. In 2011, she undertook a second postdoctoral position in the group of Prof. Reek at the University of Amsterdam as part of an industrial collaboration with Eastman Chemical Company. From 2012 to 2021, she held a CNRS Research Scientist position in the "Synthesis of Fluorinated Biomolecules" group at the COBRA Laboratory (UMR 6014, Rouen, France), where she obtained her habilitation in 2018. She was promoted to CNRS Research Director in 2022.

Throughout her research career, she has been awarded competitive funding, including an ERC Starting Grant (2017). She has received several prestigious distinctions, such as the CNRS Bronze Medal (Young Researcher Award, 2018), the Jean-Pierre Sauvage Prize (2018) awarded by the Organic Chemistry Division (DCO) of the French Chemical Society (SCF), and the Thieme Chemistry Journals Award (2020). In 2022, she was elected Fellow of Chemistry Europe (class of 2020/21). She received the Fluorine Prize from the Royal Society of Chemistry (RSC) in 2023 and the Jean-Marie LEHN award by the Organic Chemistry Division (DCO) of the French Chemical Society (SCF) in 2025.

Her current research program at the CARMeN Institute (UMR 6064, formerly COBRA Laboratory) is structured around two main thematic areas: the development of new tools for the synthesis of fluorinated molecules, and the advancement of innovative transition metal-catalyzed and photocatalyzed synthetic methodologies aimed at achieving more efficient and environmentally sustainable chemical transformations.

PL7

Unveiling Routes to Fluorinated Molecules

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Organofluorine chemistry is a fascinating research field in rapid expansion. Beyond the strong interest that represent fluorinated molecules in materials science, pharmaceuticals, agrochemicals, and modern drug design,[1] innovation is still required to push further the boundaries of knowledge in this appealing research field and achieve new synthetic challenges.[2] Combining homogeneous catalysis (including new activation modes)[3,4] with emergent fluorinated groups, our group has designed original synthetic methods to access high-added value organofluorinated molecules. This talk will present an overview of our last contributions to the field.[5]

[1] a) Liu, Y.-F.; Lu, L.; Shen, Q. *Angew. Chem. Int. Ed.* **2017**, *56*, 9930. For selected reviews, see: b) Furuya, T.; Kamlet, A. S.; Ritter, T. *Nature* **2011**, *473*, 470. c) Ni, C.; Hu, J. *Chem. Soc. Rev.* **2016**, *45*, 5441.

[2] Inoue, M.; Sumii, Y.; Shibata, N. *ACS Omega* **2020**, *5*, 10633 and references therein.

[3] a) Capaldo, L.; Ravelli, D.; Fagnoni, M. *Chem. Rev.* **2022**, *122*, 1875. b) Special issue on C-H activation, *Chem. Rev.* **2017**, *117*, 8481-9520.

[4] a) Xiong, H.-Y.; Pannecoucke, X.; Besset, T. *Chem. Eur. J.* **2016,** *22*, 16734. b) Pannecoucke, X.; Besset, T. *Org. Biomol. Chem.* **2019**, *17*, 1683. c) Xiao, X.; Zheng, Z.-T.; Li, T.; Zheng, J.-L.; Tao, T.; Chen, L.-M.; Gu, J.-Y.; Yao, X.; Lin, J.-H.; Xiao, J.-C. *Synthesis* **2019**, *52*, 197.

[5] a) Ruyet, L.; Lapuh, M. I.; Koshti, V. S.; Földesi, T.; Jubault, P.; Poisson, T.; Novák, Z.; Besset, T. *Chem. Commun.* **2021**, *57*, 6241. b) Vuagnat, M.; Tognetti, V.; Jubault, P.; Besset, T. *Chem. Eur. J.* **2022**, *28*, e202201928. c) Petit-Cancelier, F.; Ruyet, L.; Couve-Bonnaire, S.; Besset, T. *Adv. Synth. Catal.* **2022**, *364*, 1498. d) Doche, F.; Escudero, J.; Petit-Cancelier, F.; Xiong, H.-Y.; Couve-Bonnaire, S.; Audisio, D.; Poisson, T.; Besset, T. *Chem. Eur. J.* **2022**, *28*, e202202099. e) Nobile, E.; Castanheiro, T.; Besset, T. *Chem. Commun.* **2021**, *57*, 12337. f) Doche, F.; Poisson, T.; Besset, T. *ACS Catal.* **2023**, *13*, 14112. g) Nobile, E.; Doche, F.; Castanheiro, T.; Musaev, D. G.; Besset, T. *Chem. Eur. J.* **2024**, *30*, e202303362.



Edward A. ANDERSON

University of Oxford
UNITED KINGDOM

BIOGRAPHY AND RESEARCH INTERESTS

Prof. Edward Anderson is currently the Head of Organic Chemistry at the University of Oxford, and a tutorial fellow at Jesus College, Oxford. Ed completed his PhD in 2001 at the University of Cambridge under the supervision of Prof. Andrew Holmes FRS. Following postdoctoral research with Prof. Erik Sorensen at the Scripps Research Institute La Jolla, he took up a Junior Research Fellowship at Homerton College, Cambridge, with Prof. Ian Paterson. In 2007, he was appointed as an EPSRC Advanced Research Fellow in Oxford, and took up a Lectureship at Jesus College, Oxford, in 2009; he was promoted to Full Professor in 2016. His work has been recognised by the 2019 Novartis Chemistry Lectureship and the 2020 Royal Society of Chemistry Bader Award.

The research interests of the Anderson group are centred on synthetic organic chemistry. Areas of expertise include the synthesis of small cage molecules that have become popular as novel building blocks and bioisosteres in medicinal chemistry, as well as the related synthesis and reactivity of propellanes; the chemistry of heteroatom-substituted alkynes such as ynamides and yndiamides; and cascade reactions including transition metal-catalyzed processes. His group is extensively engaged in natural product research, including anti-parasitic natural products, polyketide antibiotics, and alkaloids. His work in these areas stimulates further development of synthetic methodology, with a recent example being research on thiophene S,S-dioxides. Throughout, his group collaborates closely with theoretical chemists to understand reaction mechanisms, closely connected to experimental investigations.

PL8

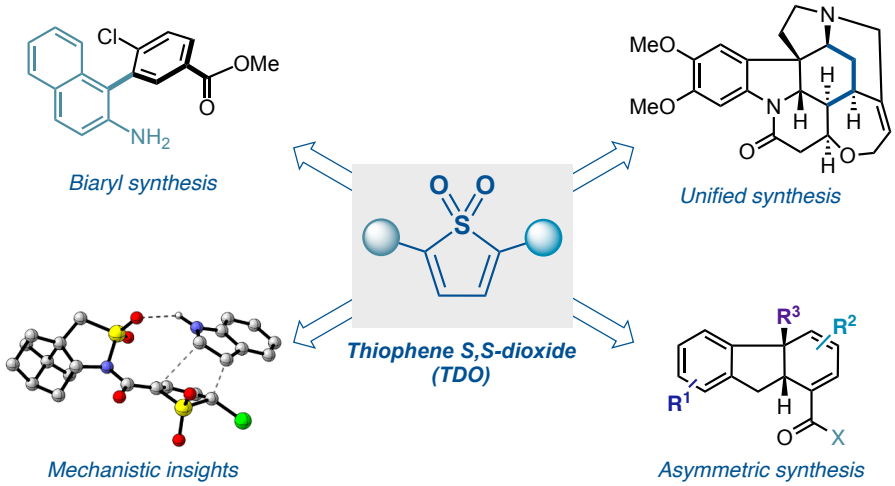
Thiophene *S,S*-dioxides as Tools for Asymmetric Synthesis

Edward A. Anderson,[1] Kun Ho (Kenny) Park,[1] Jisook Park,[1] Peilin Tian,[1] Nils Frank,[1] Hanwen Zhang,[1] Jordi Soler i Parpal,[1] Viktor K. Saraiva Câmara, Margarita Valentine,[1] Fernanda Duarte[1]

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Thiophene *S,S*-dioxides (TDOs), dearomatised sulfur heterocycles prepared by oxidation of thiophenes, are powerful but underutilised substrates for inverse electron-demand Diels-Alder reactions. This lecture will describe our recent work to deploy TDOs in target oriented synthesis, which has culminated in collective syntheses of the illudalane sesquiterpene[1] and *Strychnos* indole alkaloid families.[2] These studies stimulated the development of the first asymmetric cycloadditions of TDOs, using chiral auxiliary and also catalytic asymmetric approaches.[3] The products arising from cycloadditions with indoles and benzofurans are particularly versatile, in offering access to biaryl anilines and tricyclic lactones.[4] Theoretical calculations will be described that rationalise both selectivity and reactivity trends observed with these fascinating building blocks.



[1] Park, K. H. K.; Frank, N.; Duarte, F.; Anderson, E. A. Collective Synthesis of Illudalane Sesquiterpenes via Cascade Inverse Electron Demand (4 + 2) Cycloadditions of Thiophene S,S-Dioxides. *J. Am. Chem. Soc.* **2022**, *144*, 10017-10024.

[2] Park, K. H. K.; Park, J.; Frank, N.; Zhang, H.; Duarte, F.; Anderson, E. A. Collective asymmetric synthesis of the Strychnos alkaloids via thiophene S,S-dioxide cycloaddition cascades. *ChemRxiv* **2024**, doi: 10.26434/chemrxiv-2024-tk00d.

[3] Tian, P.; Saraiva Câmara, V. K.; Soler i Parpal, J.; Duarte, F.; Anderson, E. A. Unpublished results.

[4] Tian, P.; Soler i Parpal, J.; Valentine, M.; Duarte, F.; Anderson, E. A. Unpublished results.



Sophie ROUSSEAUX

University of Toronto
CANADA

BIOGRAPHY AND RESEARCH INTERESTS

Sophie Rousseaux is an Associate Professor of Chemistry at the University of Toronto, where she also holds a Canada Research Chair (Tier 2) in Organic Chemistry and serves on the Scientific Leadership Team of the Acceleration Consortium. Dr. Rousseaux obtained her PhD from the University of Ottawa in 2012, working with the late Prof. Keith Fagnou on Pd-catalyzed aliphatic C–H bond functionalization reactions. In 2010, she moved to MIT to complete her graduate research with Prof. Stephen L. Buchwald. From 2012–2015, she worked with Prof. Harry L. Anderson, University of Oxford, on the self-assembly of porphyrin nanorings as an NSERC postdoctoral fellow and Glasstone Research Fellow, before starting her independent career at the University of Toronto. Her group's research interests include organic synthesis, catalysis, and organometallic chemistry, with a particular focus on the synthesis of small rings and nitrile-containing molecules. Selected recent awards include the ACS Arthur C. Cope Scholar Award (2026), CSC Keith Fagnou Award (2023), the McLean Award (2022), the University of Toronto School of Graduate Studies Early Career Supervision Award (2022), the Organic Letters Outstanding Publication of the Year Lectureship (2022), a Sloan Research Fellowship (2021), and the Dorothy Shoichet Women Faculty Science Award of Excellence (2020).

PL9

Photochemical approaches for the synthesis of highly functionalized cyclopropanols

Sophie Rousseaux[1]

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Cyclopropanes are found in numerous biologically active molecules, including natural products, pharmaceuticals and agrochemicals. My group has had a long-standing interest in the chemistry of cyclopropanol derivatives including the development of new methods to functionalize the C–O bond in these compounds. In this presentation, I will highlight our recent efforts to prepare cyclopropanols from β-borylated acyl silanes and β-borylated aryl ketones under photochemical conditions. The latter method provides a streamlined approach to a wide scope of functionalized cyclopropanols under mild conditions.



Thorsten BACH

Technische Universität München
GERMANY

BIOGRAPHY AND RESEARCH INTERESTS

Thorsten Bach was born in Ludwigshafen/Rhein, Germany in 1965. He obtained his education at the University of Heidelberg and the University of Southern California, where he conducted his Diplom thesis with G. A. Olah. He received his Ph.D. in 1991 from the University of Marburg with M. T. Reetz and did postdoctoral work as a NATO fellow with D. A. Evans at Harvard University. He completed his Habilitation at the University of Münster in 1996, moved to the University of Marburg as an associate professor in 1997, and was appointed to his current position as Chair of Organic Chemistry I at the Technische Universität München in 2000. He is an elected member of the German Academy of Sciences Leopoldina since 2006 and the Bavarian Academy of Sciences since 2009. His research interests revolve around organic photochemistry, enantioselective catalysis, and natural product synthesis.

PL10

Enantioselective Catalysis in the Excited State

Thorsten Bach[1]

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The creation of chirality is one of the most fundamental challenges in synthetic organic chemistry. Our group has worked for some time on enantioselective catalytic photochemical reactions based on triplet energy transfer[1,2] and on chromophore activation.[3,4] The first approach is based on a triplet energy transfer by hydrogen-bonding chiral catalysts, which in turn are derived from a previously described template. The second approach relies on the use of Brønsted or Lewis acids, which change the photophysical properties of the chromophore and ideally allow for a selective excitation in the chiral environment which they provide. The presentation provides a summary of our key findings and discusses in detail the latest results in the area of photochemical deracemization.[5,6]

[1] Großkopf, J.; Kratz, T.; Rigotti, T.; Bach, T., Enantioselective Photochemical Reactions Enabled by Triplet Energy Transfer. *Chem. Rev.* **2022**, *122*, 1626-1653.

[2] Pflaum, N.; Pauls, M.; Kumar, A.; Kutta, R. J.; Nuernberger, P.; Hauer, J.; Bannwarth, C.; Bach, T., Oxetane Cleavage Pathways in the Excited State: Photochemical Kinetic Resolution as an Approach to Enantiopure Oxetanes. *J. Am. Chem. Soc.* **2025**, *147*, 13893-13904

[3] Schwinger, D. P.; Bach, T., Chiral 1,3,2-Oxazaborolidine Catalysts for Enantioselective Photochemical Reactions. *Acc. Chem. Res.* **2020**, *53*, 1933-1943

[4] Yan, P.; Stegbauer, S.; Wu, Q.; Kolodzeiski, E.; Stein, C. J.; Lu, P.; Bach, T., Enantioselective Intramolecular ortho Photocycloaddition Reactions of 2-Acetonaphthones. *Angew. Chem. Int. Ed.* **2024**, *63*, e202318126

[5] Hölzl-Hobmeier, A.; Bauer, A.; Silva, A. V.; Huber, S. M.; Bannwarth, C.; Bach, T., Catalytic deracemization of chiral allenes by sensitized excitation with visible light. *Nature* **2018**, *564*, 240-243.

[6] Iglhaut, M.; Bach, T., Stereochemical Editing at sp3-Hybridized Carbon Centers by Reversible, Photochemically Triggered Hydrogen Atom Transfer. *Acc. Chem. Res.* **2025,** *58*, 777-786.

Invited lectures & Biographies



Zhiwei ZUO

Shanghai Institute of Organic Chemistry
CHINA

BIOGRAPHY AND RESEARCH INTERESTS

Zhiwei Zuo received his B.S. in Chemistry from Nanjing University and his Ph.D. in Organic Chemistry from the Shanghai Institute of Organic Chemistry (SIOC), under the supervision of Prof. Dawei Ma. After postdoctoral studies with Prof. David MacMillan at Princeton University, he began his independent career at ShanghaiTech University in 2015. He returned to SIOC in 2020, where he was promoted to Professor. His research focuses on photocatalytic methodologies for rapidly assembling molecular complexity, particularly using ligand-to-metal charge transfer (LMCT) catalysis for selective functionalization of inert C(sp^3)–H and C(sp^3)–C(sp^3) bonds. Zhiwei has received several prestigious accolades, including the TAN KAH KEE Young Science Award, the Chinese Academy of Sciences Young Scientist Excellence Award.

IL1

LMCT Catalysis for selective functionalizations of strong bonds

Zhiwei Zuo[1]

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The selective functionalizations of C(sp3)–H bonds and C(sp3)–C(sp3) bonds can provide intriguing opportunities for the rapid construction of molecular complexity. However, the inherent inertness of those chemical bonds has posed formidable challenges for the development of efficient catalytic systems. Recently, an innovative catalytic sequence of in situ coordination, LMCT excitation, and ligand homolysis has been applied to generate high energy radical intermediates for the selective functionalizations of C(sp3)–H bonds and C(sp3)–C(sp3) bonds. In this catalytic paradigm, in situ generated transition metal complexes are employed to initiate concurrent photoexcitation and substrate activation, which has rendered intriguing opportunities to harness photon energy for the selective functionalizations of strong chemical bonds. This catalytic system has been demonstrated as a general strategy for the catalytic and selective radical coupling of methane, ethane, and other feedstock alkanes.[1] Furthermore, the synergistic combination of LMCT and b-scission strategy has been proven effective for the selective cleavage C(sp3)-C(sp3) bonds, enabling the direct use of C–C bonds as functional handles for the development of ring expansion, fragment coupling, macrolactone synthesis, and deracemization transformations.[2]

[1] (1) Hu, A.; Guo, J.-J.; Pan, H.; Zuo, Z.*, *Science* **2018**, *361*, 668. (2) Hu, A.; Guo, J.-J.; Pan, H.; Tang, H.; Gao, Z.; Zuo, Z.* *J. Am. Chem. Soc.* **2018**, *140*, 1612. (3) An, Q.; Wang, Z.; Chen, Y.; Wang, X.; Zhang, K.; Pan, H.; Liu W.;* Zuo, Z.* *J. Am. Chem. Soc.* **2020**, *142*, 6216. (4) An, Q.; Xing, Y.-Y.; Pu, R.; Jia, M.; Chen, Y.; Hu, A.; Zhang, S.-Q.; Yu, N.; Du, J.; Zhang, Y.; Chen, J.;* Liu W.;*, Hong X.;* Zuo, Z.* *J. Am. Chem. Soc*. **2023**, *145,* 359.

[2] (1) Wang, L.; Ding, J.; Duan, L.; Wang, S.; An, Qing.; Wang, H.; Zuo, Z.*, *Science* **2023**, *10.1126/science.adj0040*. (2) Chen, Y.; Wang, X.; He, X.; An, Q.; Zuo, Z.*, *J. Am. Chem. Soc*. **2021**, *143*, 4896. (3) Du, J.; Yang, X.; Wang, X.; An, Q.; He X.; Pan, H.; Zhiwei Zuo*, *Angew. Chem. Int. Ed*. **2021**, *60*, 5370. (4) Chen, Y.; Du, J.; Zhiwei Zuo*, *Chem*. **2020**, *6*, 266. (5) Zhang, K.; Chang, L.; An, Q.; Wang, X.; Zuo, Z.* *J. Am. Chem. Soc.* **2019**, *141*, 10556. (6) Hu, A.; Chen, Y.; Guo, J.-J.; Yu, N.; An, Q.; Zuo, Z.* *J. Am. Chem. Soc.* **2018**, *140*, 13580. (7) Guo, J.-J.; Hu, A.; Chen, Y.; Sun, J.; Tang, H.; Zuo, Z.* *Angew. Chem. Int. Ed.* **2016**, *55*, 15319



Nessa CARSON

AstraZeneca
UNITED KINGDOM

BIOGRAPHY AND RESEARCH INTERESTS

Nessa Carson received Master's degrees in synthesis and catalysis from Oxford University and the University of Illinois at Urbana-Champaign. She started out as a synthetic chemist for AMRI, then moved within the company to run the high-throughput automation facility for Eli Lilly in Windlesham, working across discovery and process chemistry, then in high-throughput reaction optimization at Pfizer and then Syngenta. Nessa moved to AstraZeneca Early Chemical Development in 2022 as Digital Champion, focussing on digital transformation and making life easier for scientists. She was awarded the Salters' Institute Centenary Award for early-career chemists with the potential to make an outstanding long-term contribution to industrial chemistry.

IL2

From experimentation to insights: Leveraging hardware and software automation in pharma development

Nessa Carson[1]
[1] *Early Chemical Development, Pharmaceutical Sciences, R&D, AstraZeneca, Macclesfield, UK*
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Modern chemistry is undergoing a transformative change with the advent of data, digitalization, and automation. The digitalization of chemistry involves tools including smart sensors, intelligent data aggregators, advanced computation, and laboratory robots, providing more and higher-quality data than ever before. However, chemists need to be able to access these through intuitive and user-friendly interfaces that save, not waste, time. At AstraZeneca Pharmaceutical Sciences, we seek to augment scientists' experiences by enabling any scientist to use state of the art tools to accelerate innovation in early process chemistry.

This talk will focus on scientist-focussed tools used to accelerate pharmaceutical development. Equally importantly, it will also highlight that close attention to scientific detail remains indispensable for deriving excellent quality from these bigger-picture advances, illuminated using current projects in the context of chemical synthesis.



Lilian GENILLER: Prix D. Surdin 2025

Institut Charles Gerhardt Montpellier
FRANCE

BIOGRAPHY AND RESEARCH INTERESTS

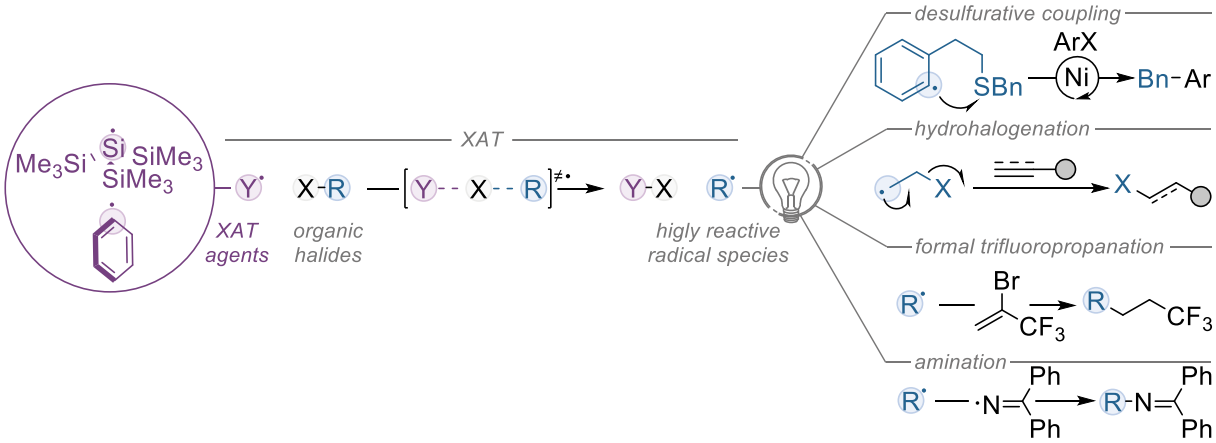
Lilian Geniller obtained his M.Sc. in Organic Chemistry and Biomolecules in 2021 after completing his studies at ENSCM and the University of Montpellier. He carried out his M.Sc. thesis in the research department of Sanofi near Paris, focusing on the development of bioactive molecules transformation using dual photoredox/nickel catalysis. He then pursued his PhD under the supervision of Dr. Florian Jaroschik and Dr. Alexis Prieto at ICGM, aiming to develop novel photo-mediated processes in organic synthesis. During the final year of his PhD, he spent two months working in Prof. Hirohisa Ohmiya's laboratory in Kyoto, Japan, where he contributed to the development of dual photoredox/cobalt-catalyzed coupling reactions. He is now about to begin a postdoctoral fellowship in Prof. Luca Dell'Amico's group in Padova, Italy.

IL3

Development of Photochemical Transformations by Halogen Atom Transfer (XAT) for Organic Synthesis

Lilian Geniller,[1] Marc Taillefer,[2] Florian Jaroschik,[2] Alexis Prieto[2]
[1] *Dell'Amico Research Group, Department of Chemical Sciences, Via Marzolo 1, Padova, Italy*
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In recent years, photochemistry has experienced significant growth, as it enables the generation and utilization of highly reactive radical species under mild conditions.[1] Among the processes enabling the formation of these radicals, halogen atom transfer reactions (XAT) are prevalent as they allow the valorization of organic halides in complex transformations, aiming at the formation of strategic bonds.[2] In the course of this thesis work, we have focused on the development of new chemical reactions involving photo-induced XAT processes applying different types of XAT agents. We have initially used silyl radicals derived from supersilane as XAT agents to develop a desulfurizing nickel-catalyzed cross-coupling methodology involving XAT-activatable thiol radical precursors and aryl halides.[3] We then exploited this XAT agent to generate unstable carbon radicals which, through radical β-fragmentation, allowed the generation of more stable halogenated radicals subsequently valorized in hydrohalogenation reactions.[4] Subsequently, we have developed a system enabling the use of a catalytic amount of supersilane to achieve the formal trifluoropropanation of organic halides as well as the synthesis of bis-deuterated analogues.[5] Finally, we have investigated the synthesis of primary amines using oximes esters as precursors of aryl radicals, an emerging class of XAT agents.[6]



[1] Bell, J. D.; Murphy, J. A. Recent Advances in Visible Light-Activated Radical Coupling Reactions Triggered by (i) Ruthenium, (Ii) Iridium and (Iii) Organic Photoredox Agents. *Chem. Soc. Rev.* **2021**, *50* (17), 9540–9685.
[2] Juliá, F.; Constantin, T.; Leonori, D. Applications of Halogen-Atom Transfer (XAT) for the Generation of Carbon Radicals in Synthetic Photochemistry and Photocatalysis. *Chem. Rev.* **2022**, *122* (2), 2292–2352.
[3] Geniller, L.; Taillefer, M.; Jaroschik, F.; Prieto, A. Nickel Metallaphotoredox Catalysis Enabling Desulfurative Cross Coupling Reactions. *Adv. Synth. Catal.* **2022**, *364* (24), 4249–4254.
[4] Geniller, L.; Taillefer, M.; Jaroschik, F.; Prieto, A. Photo-Induced Halogen-Atom Transfer: Generation of Halide Radicals for Selective Hydrohalogenation Reactions. *Chemistry* **2022**, *28* (43), e202201495.
[5] Geniller, L.; Taillefer, M.; Jaroschik, F.; Prieto, A. Photo-Induced Formal Trifluoropropanation of Organic Halides. *ACS Catal.* **2023**, *13* (13), 8624–8630.
[6] Geniller, L.; Taillefer, M.; Jaroschik, F.; Prieto, A. Photocatalyzed Amination of Alkyl Halides to Access Primary Amines. *J. Org. Chem.* **2023**, *89* (1), 656–664.



Clément GHIAZZA: Prix M. Julia 2025

Institut Lavoisier de Versailles - UVSQ/U. Paris Saclay
FRANCE

BIOGRAPHY AND RESEARCH INTERESTS

After earning his Master's degree in 2016 from the University Claude Bernard Lyon 1 (France), Clément Ghiazza began a PhD focused on the development of new synthetic methodologies for the preparation of fluoroalkylselenylated compounds, under the supervision of Dr. Thierry Billard and Dr. Anis Tlili. He completed his PhD in 2019 and was awarded the Dina Surdin Thesis Prize by the Division of Organic Chemistry (DCO).

In 2020, he joined the group of Dr. Josep Cornella at the Max Planck Institut für Kohlenforschung in Mülheim an der Ruhr (Germany) as an Alexander von Humboldt Postdoctoral Fellow. Since October 2022, Clément has held a permanent research position (Chargé de Recherche CNRS) at the Institut Lavoisier de Versailles (France).

His current research focuses on the development of novel strategies for heterocycle interconversion via dearomative insertion reactions, as well as enantioselective catalysis. In recognition of his contributions, Clément Ghiazza was awarded the Marc Julia Emergence Prize by the DCO in 2025.

IL4

Rebirth of 1,2-Diazepines: Improved protocol and reactivity

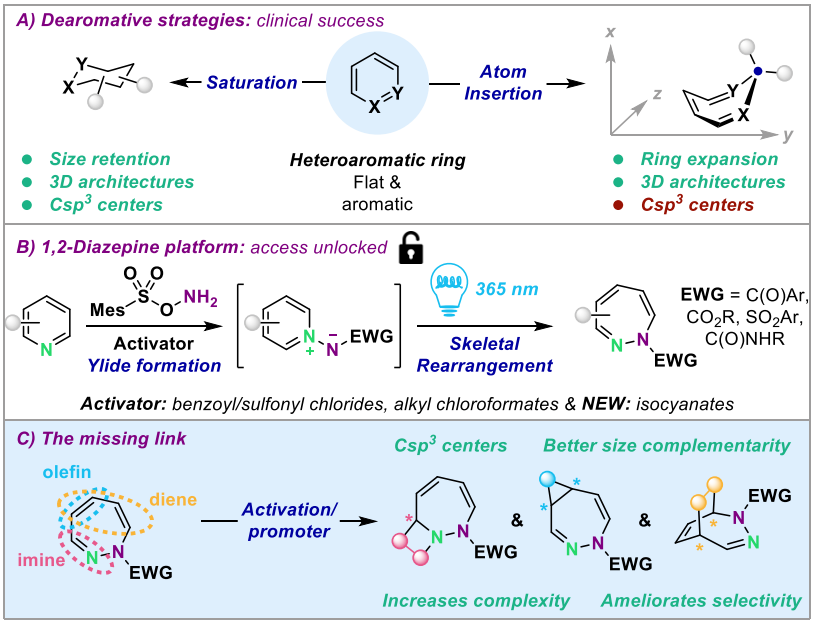
Clément Ghiazza[1]

[1] *Institut Lavoisier de Versailles (ILV), Univ. Versailles-St-Quentin-en-Yvelines, Univ. Paris Saclay, UMR CNRS 8180, 78035 Versailles Cedex, France*

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Molecular complexity is commonly invoked as a milestone in drug discovery and R&D programs.[1] Behind this general concept, precise parameters can be specifically scrutinized. In fact, the design of an active substance can be rationalized by its shape complementary with the targeted receptor. Hence, tridimensional compounds with a reduced aromatic character are more prone to clinical success.[2] If saturation strategies are considered as the traditional approach,[3] a recent concept recently blossomed; namely the dearomative enlargement of aromatic rings (**A**).[4]

Our group was recently involved in the development of innovative sequences enabling the incorporation of nitrogen atoms for the synthesis of 1,2-diazepines from readily available pyridines enabled by photochemical irradiation (**B**).[5] More recently, we could improve this protocol by replacing chlorinated activating groups by isocyanates. As a result, the overall yields were significantly enhanced and the stability of the formed heterocycles greatly improved. Moreover, the protocol became amenable to prepare grams of product.[6]



Having established a robust route to synthesized this underconsidered motif, we just launched a research program aiming at merging the best of the 2 approaches: the saturation and the atom insertion. Indeed, the 1,2-diazepine ring can be regarded as an imine, an olefin, or even a diene; thus, opening a plethora of new opportunities to generate Csp^3 stereocenters (**C**). Altogether, this missing link should remarkably increase both the complexity and the selectivity of the newly formed molecules and place the 1,2-diazepines on the foreground as valuable targets for future clinical successes. A first effort has been recently accomplished by our group for the synthesis of 1,2-diazepine-fused b-lactams via a Staudinger-type [2+2] reaction.[7]

1. F. Lovering, J. Bikker, C. Humblet, *J. Med. Chem.* **2009**, *52*, 6752–6756. 2. T. J. Ritchie, S. J. F. Macdonald, *Drug Discov. Today* **2009**, *14*, 1011–1020. 3. D.-H. Liu, P. M. Pflüger, A. Outlaw, L. Lückemeier, F. Zhang, C. Regan, H. Rashidi Nodeh, T. Cernak, J. Ma, F. Glorius, *J. Am. Chem. Soc.* **2024**, *146*, 11866–11875. 4. X. Moreau, C. Ghiazza, *Synthesis* **2024**, *56*, 3119–3130. 5. E. Boudry, F. Bourdreux, J. Marrot, X. Moreau, C. Ghiazza, *J. Am. Chem. Soc.* **2024**, *146*, 2845–2854. 6. C. Ghiazza, A. Damond, J. Marrot, X. Moreau, *Adv. Synth. Catal.* **2024**, 367, e202401201. 7. J. God—Carles, F. Bourdreux, A. Damond, J. Marrot, X. Moreau, C. Ghiazza, *Submitted article.*



Anat MILO

Ben-Gurion University of the Negev
ISRAEL

BIOGRAPHY AND RESEARCH INTERESTS

IL5



Cornelia MEINERT

CNRS - Université Côte d'Azur
FRANCE

BIOGRAPHY AND RESEARCH INTERESTS

Cornelia Meinert is a CNRS Research Director at the Institut de Chimie de Nice (Université Côte d'Azur), where she leads interdisciplinary work at the interface of chemistry, astrophysics, and the origins of life. After completing her PhD in chemistry at Halle-Wittenberg University (2011) and postdoctoral research supported by CNES, she joined CNRS in 2013 and obtained her HDR in 2018, the same year she received the CNRS Bronze Medal. She currently coordinates the ERC Consolidator project ICE-EEVOLVE, which investigates how interstellar ices and asymmetric photochemistry could have impacted molecular chirality into prebiotic chemistry. By combining spectroscopic techniques, synchrotron radiation, and laboratory simulations of extraterrestrial environments, her research has shown how chiral organic molecules can form in space and seed planetary systems. These contributions provide key insights into the origin of biomolecular homochirality and highlight the cosmic dimension of life's emergence on Earth — and this, beyond the traditional boundaries of chemistry.

IL6

Interstellar molecules and their stereochemistry: Implications for prebiotic organic chemistry

Cornelia Meinert,[1] Vanessa Leyva,[1] Manuel Robert,[1] Jérémie Topin,[1] Jana Bocková[1]
[1] *Institut de Chimie de Nice, CNRS UMR7272, Université Côte d'Azur, 06108 Nice, FR*
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The origin of life's molecular asymmetry—its homochirality—remains one of the most compelling and unresolved questions in prebiotic chemistry. Key biomolecules such as amino acids, sugars, and lipids are chiral, and life on Earth consistently favors one handedness over the other. But how and where did this selectivity arise? In this talk, I will present our recent experimental investigations into the abiotic synthesis and asymmetric photochemistry of chiral organic molecules beyond Earth.

Focusing on the fundamental chiral building blocks of life, i.e. amino acids, sugars, and lipids, I will first highlight laboratory simulations that probe their formation in interstellar ices and solar system analogs. Interstellar ices, widely observed around protostellar objects from which planets, but also debris such as comets and asteroids form—are considered primary reservoirs of organic molecules. Our results show that ultraviolet (UV) and cosmic-ray processing of ices composed of simple molecules such as H_2O, CO, CO_2, CH_3OH, and NH_3 can produce a diverse range of prebiotic compounds[1–3]. These findings are supported by our studies of Kuiper Belt analogs, such as Arrokoth[4], and by analyses of samples returned from asteroid Ryugu, both of which highlight the potential role of comets and asteroids in delivering complex organic molecules to early Earth.

The second part of the talk will focus on the asymmetric synthesis and degradation of these chiral molecules under the influence of stellar UV circularly polarized light (CPL), a promising candidate for inducing the first molecular-level symmetry breaking in space. Using chiroptical spectroscopy, we predict and quantify CPL-induced enantiomeric excesses[5,6], which we then validate through asymmetric photolysis experiments with synchrotron and laser CPL sources[7]. These studies reveal that chiral bias can be transferred to chiral biomolecules such as amino acids, supporting the idea that astrophysical CPL may have imprinted an early chiral signature in organic matter delivered to the primitive Earth. Together, these experiments bridge molecular astrophysics, stereoselective photochemistry, and prebiotic chemistry, and shed light on the potential cosmic origins of life's building blocks as well as their molecular handedness.

[1] Meinert, C.; *et al*. Ribose and Related Sugars from Ultraviolet Irradiation of Interstellar Ice Analogues. *Science* **2016**, *352*, 208–212.
[2] McAnally, M.; *et al*. Abiotic Formation of Alkylsulfonic Acids in Interstellar Analog Ices and Implications for Their Detection on Ryugu. *Nat. Commun.* **2024**, *15*, 4409.
[3] McAnally, M.; *et al*. Abiotic Origin of the Citric Acid Cycle Intermediates. *PNAS* **2025**, *122*, e2501839122.
[4] Zhang, C.; *et al*. Ionizing Radiation Exposure on Arrokoth Shapes a Sugar World. *PNAS* **2024**, *121*, e2320215121.
[5] Meinert, C.; *et al*. Amino Acid Gas Phase Circular Dichroism and Implications for the Origin of Biomolecular Asymmetry. *Nat. Commun.* **2022**, *13*, 502.
[6] Bocková, J.; Jones, N. J.; Hoffmann, S. V.; Meinert, C. The Astrochemical Evolutionary Traits of Phospholipid Membrane Homochirality. *Nat. Rev. Chem.* **2024**, *8*, 652–664.
[7] Bocková, J.; Jones, N. J.; Topin, J.; Hoffmann, S. V.; Meinert, C. Uncovering the Chiral Bias of Meteoritic Isovaline through Asymmetric Photochemistry. *Nat. Commun.* **2023**, *14*, 3381.

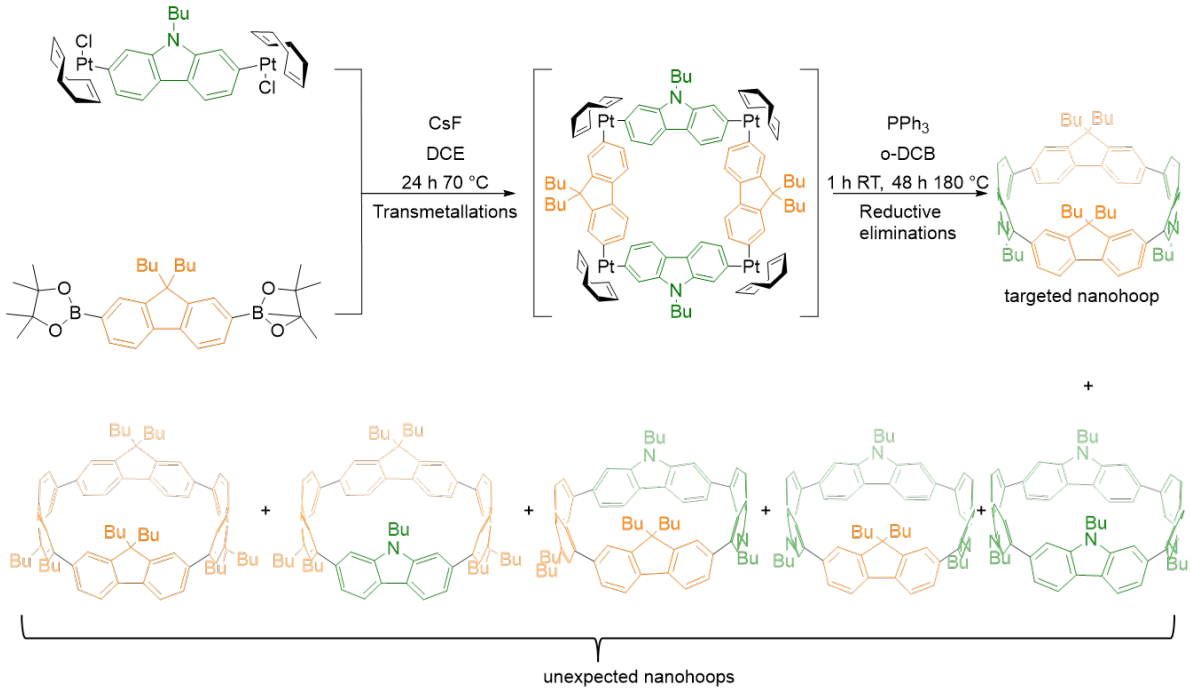
Oral Communications

OC01

One Reaction, Six Nanohoops: Unraveling the Origins of Unexpected Structural Diversity

Cassandre Quinton,[1] Clément Brouillac,[1] Olivier Jeannin,[1] Joëlle Rault-Berthelot,[1] Cyril Poriel[1]
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Nanohoops are the cyclic association of π-conjugated units to form a hoop-shaped molecule. Their complex architecture inducing a high ring strain makes them very difficult to synthesize. One strategy consists in synthesizing an unstrained square-shaped tetraplatinum complex as a key intermediate by transmetalation of a bis-borylated π-conjugated unit in stoechiometric amount with $PtCl_2(cod)$, followed by a reductive elimination.[1] In a previous study, we used a sequential approach for the transmetalation step involving two different fragments, aiming to synthesize a nanohoop alternating fluorenone and carbazole units.[2] To our surprise, we obtained four different nanohoops with varying numbers and arrangements of these two fragments.
In this presentation, we will report our theoretical and experimental studies, which provides interesting finding to explain the mechanism at the origin of the synthesis of all the nanohoops. Unravelling such a type of reaction appears of significant interest to develop efficient molecular tools, which can improve the diversity of the nanohoops.



[1] Yamago, S.; Watanabe, Y.; Iwamoto, T., Synthesis of [8]Cycloparaphenylene from a Square-Shaped Tetranuclear Platinum Complex. *Angew. Chem. Int. Ed.* **2010,** *49* (4), 757-759
[2] Brouillac, C.; Dureau, E.; Jeannin, O.; Rault-Berthelot, J.; Poriel, C.; Quinton, C., Donor-Acceptor Nanohoops: Impact of the Ratio and Arrangement of the Fluorenone and Carbazole Moieties. *J. Am. Chem. Soc.* **2025,** *147* (13), 11267-11276

OC02

Skeletal Editing of Azetines

Rahma Ghazali,[1] Elias Schick,[1] Dorian Didier[1]

[1] *Department of Chemistry, Technical University of Darmstadt, Peter-Grünberg-Straße 4, 64287 Darmstadt, Germany*

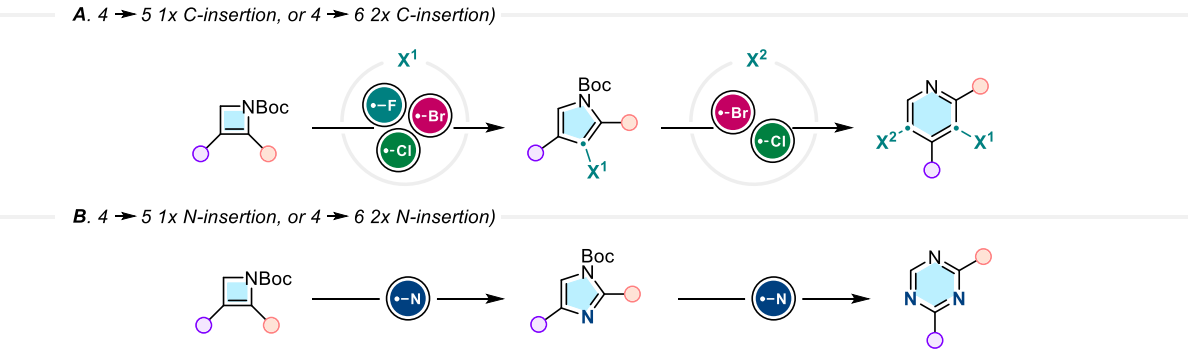
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While classical reaction design relies on fine retrosynthetic planning, skeletal editing strategies offer the opportunity to change the shape of pre-existing molecular scaffold in a selective way. Among these approaches, ring expansion by atom insertion represents a well-defined transformation with significant potential for molecular innovation.[1]

Despite numerous strategies exist for the synthesis of five- and six-membered *N*-heterocycles, efficient access to polysubstituted scaffolds such as pyrroles, pyridines, imidazoles and triazines still represents a major synthetic challenge.[2]

For the last decade, our group has focused on creating efficient and reliable strategies to access polysubstituted four-membered heterocycles, including 2*H*-azetines and azetidines.[3] We envisioned that adequate conditions that would use the inherent reactivity of the double bond in 2*H*-azetines could trigger a ring-expanding rearrangement towards the corresponding halogenated pyrroles[4] and bis-halogenated pyridines (**A**) using simple *in situ* generated dihalogenocarbenes, but also the corresponding imidazoles and triazines (**B**) *via in situ* generated nitrenes.

We will show that a single starting material provides access to a wide range of substituted structures in a chemodivergent way.



Regiospecific ring expansion - Synthesis of new halogenated pyrroles, bis-halogenated pyridines, imidazoles and triazines - >50 examples - Up to 99% yield - Post-functionnalization - One-pot and gram-scale synthesis - Simple protocol

[1] (a) Ciamician, G. L.; Dennstedt, M. Über die Einwirkung des Chloroforms auf die Kaliumverbindung Pyrrols. *Ber. Dtsch. Chem. Ges.* **1881**, *14*, 1153–1163. (b) Levin, M. D. Retrosynthetic Simplicity. *Synlett* **2023**, *35*, 1471–1474. (c) Kelly, P. Q.; Filatov, A. S.; Levin, M. D. Dearomative Ring Expansion of Polycyclic Arenes. *Angew. Chem. Int. Ed.* **2022**, *61*, e202213041.

[2] Jangir, N.; Surbhi Dhadda P.; Dhadda, S.; Jangid, D. K. Recent advances in the synthesis of five- and six-membered heterocycles as bioactive skeleton: A concise overview. *ChemistrySelect* **2022**, *7*, e202103139.

[3] (a) Baumann, A. N.; Eisold, M.; Music, A.; Haas, G.; Kiw, Y. M.; Didier, D. Methods for the Synthesis of Substituted Azetines. *Org. Lett.* **2017**, *19*, 5681–5684. (b) Trauner, F.; Ghazali, R.; Rettig, J.; Thiele, C. M.; Didier, D. Stereoselective polar radical crossover for the functionalization of strained-ring systems. *Commun. Chem.* **2024**, *7*, 139. (c) Reiners, F.; Joseph, E.; Nißl, B.; Didier, D. Stereoselective Access to Azetidine-Based α-Amino Acids and Applications to Small Peptide Synthesis. *Org. Lett.* **2020**, *22*, 8533–8537.

[4] Ghazali, R.; Schick, E.; Lèpre, S.; Kranich, J.; Didier D. Regiospecific Skeletal Editing of Azetines towards Halogenated Pyrroles. *ChemRxiv.* **2025**; doi:10.26434/chemrxiv-2025-25grb.

OC03

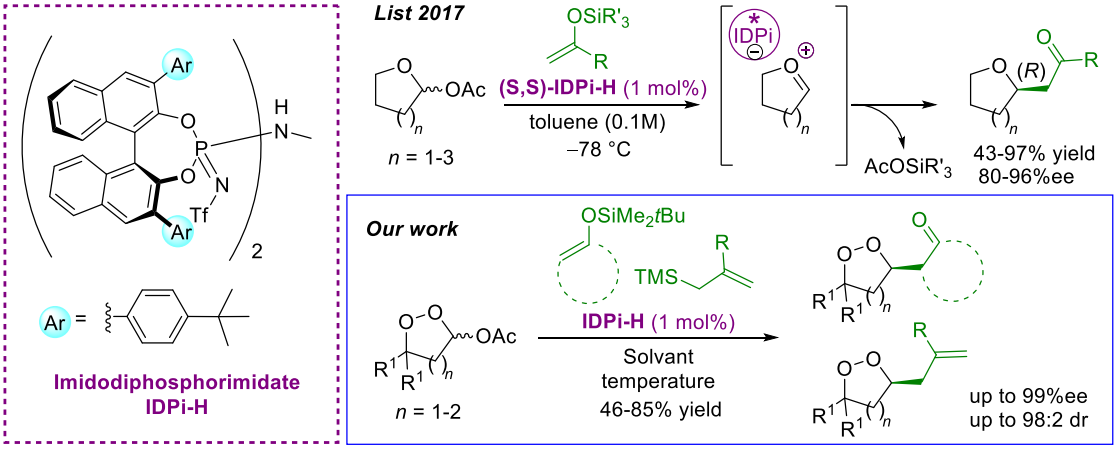
Silylium Based Asymmetric Synthesis of Endoperoxides directed by Chiral Counteranions

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Endoperoxides are molecules containing a cyclic oxygen-oxygen bond and form an original class of natural products numbering several hundred members. Most display significant antiparasitic, antifungal, or cytotoxic activities.[1]

However, access to these products by synthesis is difficult due to the limited synthetic methods available and the relative fragility of the peroxide bond.[2] Consequently, direct enantioselective methods for endoperoxides synthesis have been only scarcely explored. Besides, Nobel Prize B. List developed imidophosphorimidates (IDPi), chiral Brönsted acids combining high acidity and structural confinement, enabling a silylium catalyzed enantioselective S_N1 addition of enoxysilanes to cyclic ether acetals[3], opening new opportunities for asymmetric endoperoxides synthesis.

Using this IDPi catalysis, we achieved asymmetric insertion of a wide variety of silylated nucleophiles, with excellent enantio- and, when relevant, diastereoselectivity.[4] Although some nucleophiles remain challenging to react, careful conditions screening allows reactions with previously inaccessible reagents such as allylsilanes. The different findings open new ways for pharmacomodulation and total synthesis of natural endoperoxides.[5]



[1] Tamez-Fernández, J. F.; Melchor-Martínez, E. M.; Ibarra-Rivera, T. R.; Rivas-Galindo, V. M. Plant-Derived Endoperoxides: Structure, Occurrence, and Bioactivity. *Phytochem Rev* **2020**, *19* (4), 827–864. https://doi.org/10.1007/s11101-020-09687-4.

[2] Ferrié, L. Advances in the Synthesis of 1,2-Dioxolanes and 1,2-Dioxanes. In *Advances in Heterocyclic Chemistry*; Elsevier, 2021; Vol. 135, pp 57–146. https://doi.org/10.1016/bs.aihch.2021.03.001.

[3] Schreyer, L.; Properzi, R.; List, B. IDPi Catalysis. *Angewandte Chemie International Edition* **2019**, *58* (37), 12761–12777. https://doi.org/10.1002/anie.201900932.

[4] Champciaux, B.; Jamey, N.; Figadère, B.; Ferrié, L. Peroxycarbenium-Mediated Asymmetric Synthesis of 1,2-Dioxanes and 1,2-Dioxolanes. *J. Am. Chem. Soc.* **2025**, *147* (4), 3353–3359. https://doi.org/10.1021/jacs.4c13899.

[5] Jamey, N.; Ferrié, L. Stereodivergent Total Synthesis of Ethyl Plakortide Z. *Org. Lett.* **2024**, *26* (27), 5741–5745. https://doi.org/10.1021/acs.orglett.4c01893.

OC04

N-Tosylhydrazones as Key Precursors for Visible-Light-Promoted C–N and C–C Bonds Formation

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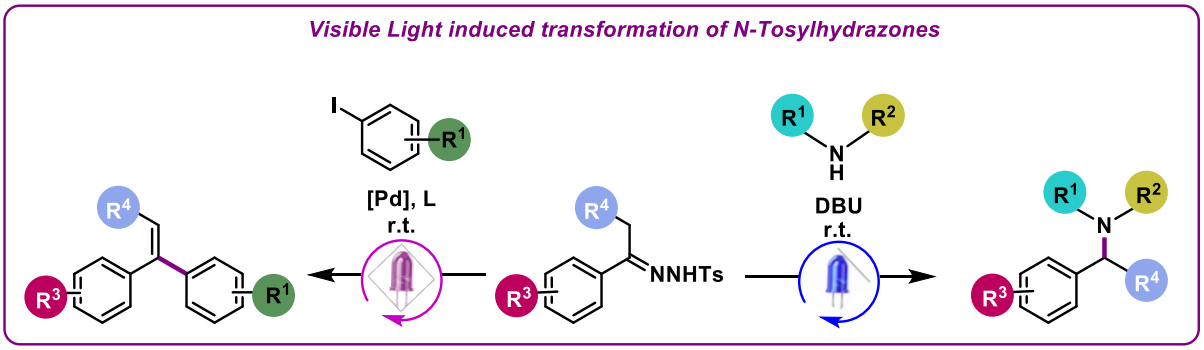
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Diazo compounds are a versatile class of intermediates in organic synthesis, enabling a broad range of transformations including cyclopropanations,[1] olefinations,[2] and X–H insertion reactions.[3] While stabilized and semi-stabilized diazo compounds have been extensively studied, recent advances have focused on their *in situ* generation from readily available precursors such as *N*-sulfonylhydrazones. Under basic conditions, these intermediates can serve as carbene precursors under thermal, transition-metal-catalyzed, or photoinduced conditions, opening opportunities for diverse bond-forming reactions.

In this work, we explore the potential of visible light as a mild and sustainable activation mode for N-tosylhydrazone-derived diazo chemistry. We demonstrate its applicability in both metal-free and Pd-catalyzed transformations, enabling the efficient formation of C–N[4] and C–C[5] bonds under ambient conditions. These strategies highlight the versatility of light-driven processes for building complex molecular scaffolds with broad functional group tolerance.



[1] Allouche, E. M. D.; Charette, A. B. Cyclopropanation Reactions of Semi-Stabilized and Non-Stabilized Diazo Compounds. *Synthesis* **2019**, *51* (21), 3947–3963. https://doi.org/10.1055/s-0037-1611915.

[2] Zhang, Z.; Wang, J. Recent Studies on the Reactions of α-Diazocarbonyl Compounds. *Tetrahedron* **2008**, *64* (28), 6577–6605. https://doi.org/10.1016/j.tet.2008.04.074.

[3] Gillingham, D.; Fei, N. Catalytic X–H Insertion Reactions Based on Carbenoids. *Chem. Soc. Rev.* **2013**, *42* (12), 4918–4931. https://doi.org/10.1039/C3CS35496B.

[4] Faure, C.; Benmaouche, S.; Belmont, P.; Brachet, E.; Lamaa, D. N–H Insertion of Anilines on N-Tosylhydrazones Induced by Visible Light Irradiation. *J. Org. Chem.* **2024**, *89* (16), 11620–11630. https://doi.org/10.1021/acs.joc.4c01317.

[5] Sharshonov, J.; Duchemann, V.; Sun, Y.; Tran, C.; Belmont, P.; Hamze, A.; Lamaa, D.; Brachet, E. Illuminating the Path of Rearrangement: Visible Light-Driven Pd-Catalyzed Substituted Olefins Synthesis. *Adv. Synth. Catal.* **2025**, *367* (12), e202500161. https://doi.org/10.1002/adsc.202500161.

OC05

Activation of small molecules thanks to non-metallic radical complexes

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In modern catalysis, the activation of small molecules such as H_2, O_2, and CO_2 is most commonly achieved with transition metals. Although effective, these metals are toxic, scarce, and expensive. In recent years, metal-free strategies based on main-group elements have emerged as powerful tools, with Frustrated Lewis Pairs (FLPs) representing a key breakthrough for small-molecule activation and reduction of unsaturated substrates.[1]

More recently, a radical-based approach has been introduced: Frustrated Radical Pairs (FRPs).[2] Operating through open-shell pathways, FRPs can lower activation barriers and unlock reactivity distinct from classical FLPs.[3]

Our project focuses on developing a novel FRP system combining a Lewis base with a persistent, sterically hindered radical that remains reactive after hydrogen cleavage. In addition, we will investigate how the electronic and steric properties of different Lewis base scaffolds influence the stability and reactivity of these radical pairs under various conditions.

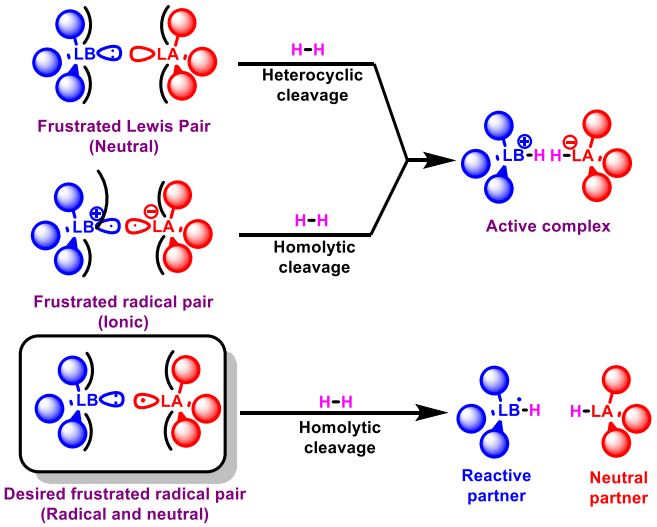


Figure 1: Comparison of classical hydrogen activation by FLPs and the proposed FRP strategy

[1] Welch, G. C.; San Juan, R. R.; Masuda, J. D.; Stephan, D. W. *Science*, **2006**, *314*, 1124–1126.

[2] Liu, L. L.; Cao, L. L.; Shao, Y.; Ménard, G.; Stephan, D. W. *Chem* **2017**, *3*, 259–267.

[3] Ju, M.; Lu, Z.; Novaes, L. F. T.; Martinez Alvarado, J. I.; Lin, S. *J. Am. Chem. Soc.*, **2023**, *145*, 19478–19489.

OC06

Development of O-H and N-H insertions on *O*-protected α-diazo-β-hydroxy esters

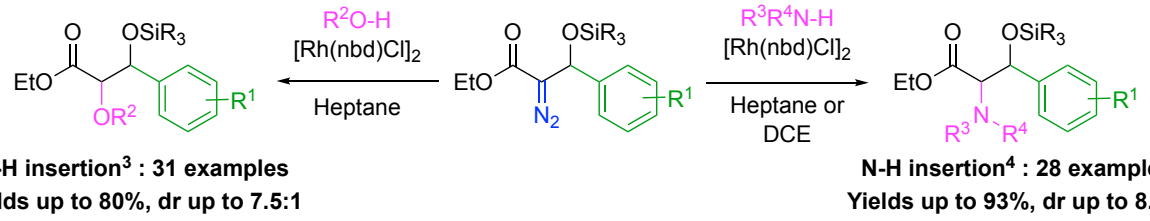
T. Defuentes,[1] O. Montiège,[1] F. Rouzier,[1] J. Lhoste,[1] C. Gaulon-Nourry,[1] A.-S. Castanet,[1] A.-C. Chany[1]

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In the context of diverted total synthesis, the development of new methods enabling the access to both natural products and structurally diverse analogues from a common advanced intermediate is highly valuable. Our team is currently pursuing a diverted total synthesis of chaxalactins, 22-membered macrolactones with antibacterial activity, by incorporating a diazo substituent on a key fragment. This reactive functionality opens access to diverse transformations (C-H insertion, X-H insertion, migration, cyclopropanation, …),[1] enabling broad structural diversification.

To this end, we are investigating the reactivity of *O*-protected α-diazo-β-hydroxy esters in the presence of acids[2] or rhodium catalysts.[3,4] Until our recent work, no X-H insertion had been reported for this class of diazocarbonyl compounds, due to competitive 1,2-H and 1,2-R migration reactions. The main challenge was therefore to identify reaction conditions which favor the insertion reactions over these 1,2-migrations. We have now succeeded to overcome this limitation using a Rh(I) catalyst. In this communication, we will present our journey through the development of Rh(I)-catalyzed O-H[3] and N-H[4] insertions on *O*-silylated α-diazo-β-hydroxyesters, providing α,β-dioxygenated and α,β-diheterofunctional esters (**Scheme 1**). This breakthrough paves the way for the stereoselective functionalization of these challenging diazocarbonyl compounds and expand the synthetic toolbox for structural diversification of natural products.



Scheme 1. X-H insertions on O-silylated α-diazo-β-hydroxyesters

[1] a) Ford, A.; Miel, H.; Ring, A.; Slattery, C. N.; Maguire, A. R.; McKervey, M. A. Modern Organic Synthesis with α-Diazocarbonyl Compounds, *Chem. Rev.* **2015**, *115*, 9981, b) Wang, J. Diazo compounds : Recent applications in synthetic organic chemistry and beyond, *Tetrahedron Letters* **2022**, *108*, 154135.

[2] Rouzier, F.; Montiège, O.; Lhoste, J.; Gaulon-Nourry, C.; Castanet, A.-S.; Chany, A.-C. Acid-Catalyzed Decomposition of *O*-Silylated α-Diazo-β-hydroxy Esters: Access to Mixed Monosilyl Acetals, *J. Org. Chem.* **2022**, *87*, 14264.

[3] Montiège, O.; Rouzier, F.; Lhoste, J.; Gaulon-Nourry, C.; Castanet, A.-S.; Chany, A.-C. Rhodium(I)-Catalyzed O–H Insertions on *O*-Protected α-Diazo-β-Hydroxyesters, *J. Org. Chem.* **2024**, *89*, 3194.

[4] Defuentes, T.; Lhoste, J.; Gaulon-Nourry, C.; Castanet, A.; Chany, A. Access to *Syn* α-Amino-β-Hydroxyesters by N–H Insertion on *O*-Protected α-Diazo-β-Hydroxyesters, *Asian J Org Chem* **2025**, *14*, e202400539.

OC07

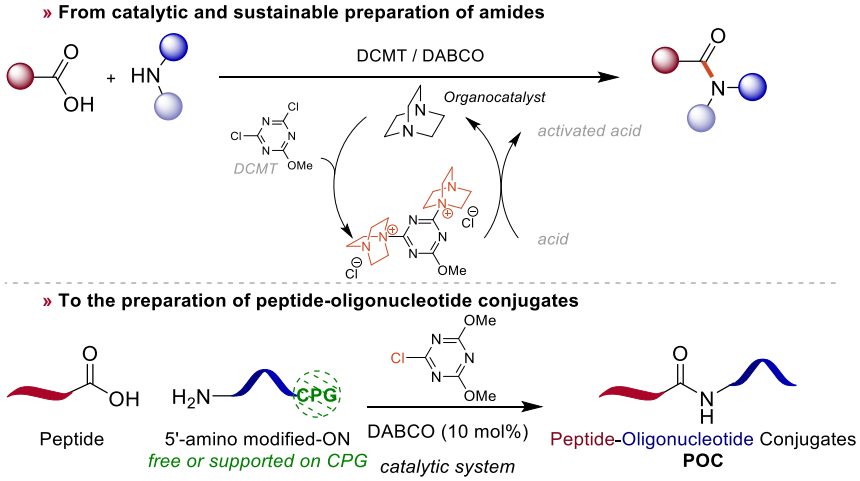
Catalytic approach for amide coupling for the synthesis of peptide-oligonucleotide conjugates

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Amides are among the most important functional groups in organic chemistry, playing essential roles in both the pharmaceutical industry and life sciences. However, the inherent reactivity of carboxylic acids and amines makes their direct coupling a significant challenge, often resulting in inefficient, non-atom-economic processes that generate significant amounts of nonrecoverable by-products.[1] Despite the impressive number of coupling reagents available, sustainable methods for amide bond formation are still needed.

To address this challenge, we developed a new catalytic approach for the direct synthesis of amides from carboxylic acids and amines. This method has demonstrated good efficiency on a wide range of substrates, preserving chiral stereocenters without epimerization and showing compatibility with SPPS.[2]

The method was further extended to the chemistry of oligonucleotides for the preparation of peptide – oligonucleotide conjugates (POC) using an amide linker.[3] POC are biologically relevant compounds in which the oligonucleotide serves as the therapeutic agent (*e.g.*, anti-sense RNA, siRNA) while the peptide enhances cellular uptake, amongst other applications.[4] In this context, our method was adapted both in aqueous solution and on CPG solid support.



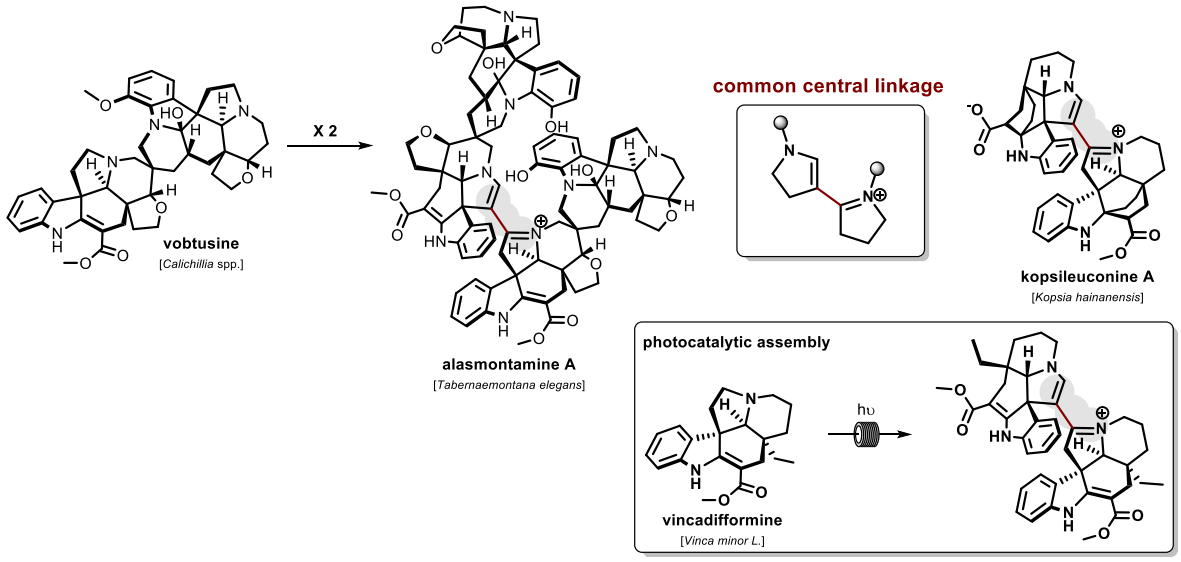
[1] Wang, L.; Wang, N.; Zhang, W.; Cheng, X.; Yan, Z.; Shao, G.; Wang, X.; Wang, R.; Fu, C. Therapeutic Peptides: Current Applications and Future Directions. *Sig. Transduct. Target. Ther.* **2022**, *7*, 1–27.
[2] Adler, P.; Gras, M.; Smietana, M. Catalytic and Sustainable Amide Bond Formation Using a DABCO/Dichlorotriazine System. *ChemCatChem* **2023**, *15*, e202300264.
[3] Gras, M.; Adler, P.; Smietana, M. A Catalytic Approach for the Synthesis of Peptide−Oligonucleotides Conjugates in Aqueous Solution or On-Column. *Chem. Eur. J.* **2024**, *30*, e202401069.
[4] Lu, K.; Duan, Q.-P.; Ma, L.; Zhao, D.-X. Chemical Strategies for the Synthesis of Peptide−Oligonucleotide Conjugates. *Bioconjugate Chem.* **2010**, *21*, 187–202.

OC08

Photocatalytic Construction of the Key Central Bond of the Tetrameric Alkaloid Alasmontamine A

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Alasmontamine A, discovered in 2009, isolated from *Tabernaemontana elegans*,[1] is a tetrameric monoterpene indole alkaloid composed of four pseudo-monomers and can be considered as a dimer of two vobtusine-type dimeric alkaloids. Within the framework of a collaborative total synthesis project, we focused on the key assembly step responsible for forging the bond between the two vobtusine-type subunits. We developed a photocatalytic strategy using vincadifformine that enables in a single step the formation of this unusual linkage for an indole–monoterpene alkaloid. This assembly process involves both the bond formation itself and two oxidative events. During the development of the reaction, we identified both a metal catalyst and an organic catalyst exhibiting excellent performance. Capitalizing on the optimized conditions, the reaction was adapted to a modular, low-cost 3D-printed PhotoFlow reactor, to improve kinetics and conversion during scale-up. Using the developed methodology, the optimized conditions were applied to vobtusine to assemble the core skeleton of the tetrameric alkaloid alasmontamine A and the studies are ongoing. This approach also provides access to kopsileuconine A,[2] a recently isolated dimeric alkaloid from *Kopsia hainanensis*. To access kopsileuconine A, the total synthesis of its constitutive monomer, kopsinine, was initiated.



[1] Hirasawa, Y.; Miyama, S.; Hosoya, T.; Koyama, K.; Rahman, A.; Kusumawati, I.; Zaini, N. C.; Morita, H. Alasmontamine A, A First Tetrakis Monoterpene Indole Alkaloid from *Tabernaemontana elegans*. *Org. Lett.* **2009**, *11*, 5718–5721.
[2] Li, N.-P.; Chen, S.-N.; Su, W.-F.; Liu, F.; Li, L.-J.; Song, J.-G.; Cheng, M.-J.; Li, Y.-Y.; Chen, R.-Q.; Lei, X.-P.; Ye, W.-C.; Wang, L. Kopsileuconines A–D: Bisindole Alkaloids with Cytotoxic Activity from *Kopsia hainanensis*. *Phytochemistry* **2024**, *228*, 114245.

OC09

New phase transfer agents for fluorine-18 radiolabeling

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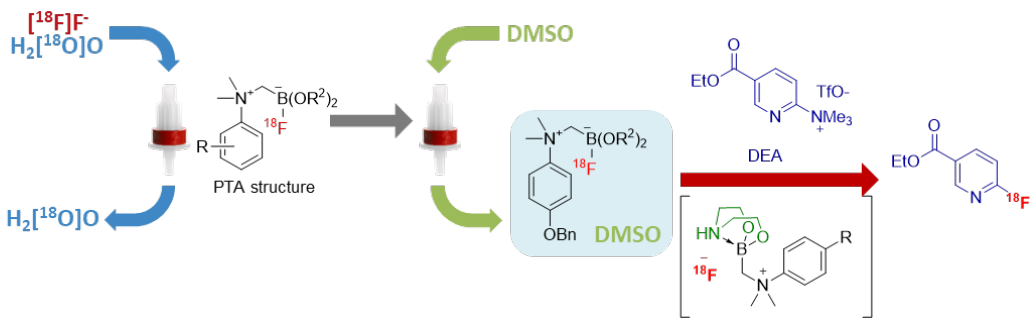
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PET imaging has become an indispensable diagnostic method, with fluorine-18 labelled tracers being the most commonly used clinically. The activation of the cyclotron-produced aqueous [^{18}F]fluoride is a central issue in fluorine-18 radiolabeling. [^{18}F]fluoride anion is highly unreactive in water and has to be dehydrated in the presence of a phase transfer catalyst to restore its reactivity. The azeotropic drying step is time-consuming and systematic in the radiosynthesis process, which is critical given the short half-life of fluorine-18 (109.7 min). For these reasons, several alternative approaches have been proposed to shorten the radiolabelling processes[1,2]. This work aims to develop original phase transfer agents (PTAs) featuring a dimethyl-ammoniomethylene boronic ester scaffold, designed to exploit the boron-fluorine affinity in conjunction with charge stabilization for the selective trapping of [^{18}F]fluoride in water.

A series of 20 PTAs with varying phenyl substituents and boronic esters were synthesized, adsorbed on solid-phase cartridges, and tested for [^{18}F]fluoride trapping and release. Their reactivity was next assessed for the radiofluorination of electron-deficient pyridines via nucleophilic aromatic substitution. This screening showed that the best results were obtained using an electron-rich aromatic ring and a less hindered diol. Importantly, radiochemical conversions (RCCs) were only obtained in the presence of a nitrogen-based additive forming a tridentate interaction with boron, enabling controlled fluoride release and restoring its reactivity for nucleophilic substitution. The most efficient PTA featured a benzyl ether substituent and a dioxaborinane (95% trapping, 45% elution, and 95% RCC). The optimized PTA was subsequently applied to Cu-mediated fluorination of boronic ester and arylstannane precursors. More than 20 compounds were successfully radiolabeled, including preclinical radiotracers such as Dolutegravir (73%), MPPF (50%), and SDM8 (73%).

This new class of easily accessible PTAs allowed the radiolabelling of several compounds, with different leaving groups and with comparable to better yields than with the traditional method using K[^{18}F]F·K222. Based on these promising results, this method is being adapted and automated on synthesizers to demonstrate its potential at high activity levels.



[1] Perrio, C. *et al.* [^{18}F]-Fluoride Capture and Release: Azeotropic Drying Free Nucleophilic Aromatic Radiofluorination Assisted by a Phosphonium Borane. Chem. Commun. 2017, 53 (2), 340–343.

[2] Pees, A. *et al.* Fast and Reliable Generation of [^{18}F]Triflyl Fluoride, a Gaseous [^{18}F]Fluoride Source. Chem. Commun. 2018, 54 (72), 10179–10182.

OC10

Catalytic radical cascades driven by triple H-atom transfer

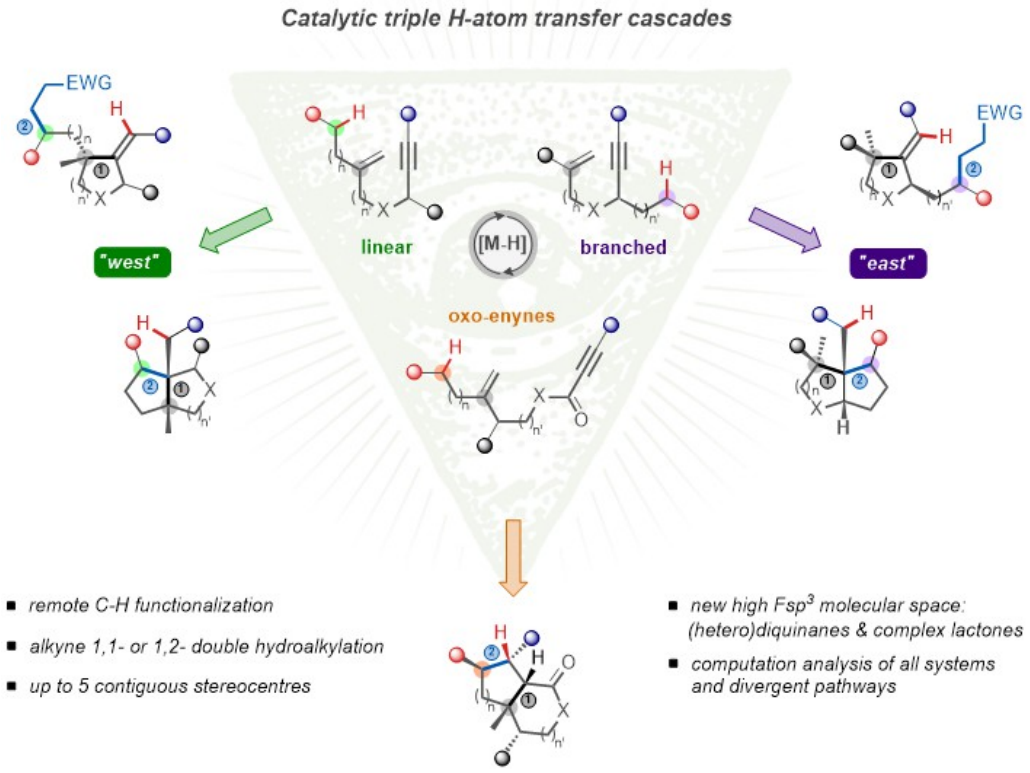
Natalia Kiprova,[1] Damien Tardieu,[1] Joseph El-Khoury,[1] Alla Achour,[1] Philippe Compain,[1] Christophe Gourlaouen,[2] Nicolas Kern[1]

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Free-radical chemistry has witnessed impressive progress over the last decades, thanks to the rise of photoredox catalysis. However, the development of new cascade sequences,[1] enhancing diversity with respect to 'privileged' substrates leading to analogous scaffolds, may call for the exploration of alternative strategies. In this regard, metal-catalyzed direct hydrogen atom transfer reactions[2] allow predictable and regioselective radical generation from alkenes, which could be leveraged to design new sequences from simple precursors. We will present our combined experimental and theoretical studies to develop "programmed" triple H-atom transfer cascades, converting diverse 1,n-enyne derivatives into remotely functionalized heterocycles and polycyclic structures rich in stereochemistry.



[1] See for example.: Hung, K.; Hu, X.; Maimone, T. J Total synthesis of complex terpenoids employing radical cascade processes. *Nat. Prod. Rep.* **2018**, *35*, 174.

[2] For selected reviews see : (a) Crossley, S. W. M.; Obradors, C.; Martinez, R. M.; Shenvi, R. A. Mn-, Fe-, and Co-Catalyzed Radical Hydrofunctionalizations of Olefins. *Chem. Rev.* **2016**, *116*, 8912. (b) Shevick, S.L.; Wilson, C. V.; Kotesova, S.; Kim, D.; Holland, P. L.; Shenvi, R. A. Catalytic hydrogen atom transfer to alkenes: a roadmap for metal hydrides and radicals. *Chem. Sci.* **2020**, *11*, 12401.

OC11

Synergistic Nickel/LMCT catalysis: A powerful strategy for cross-coupling of feedstock chemicals

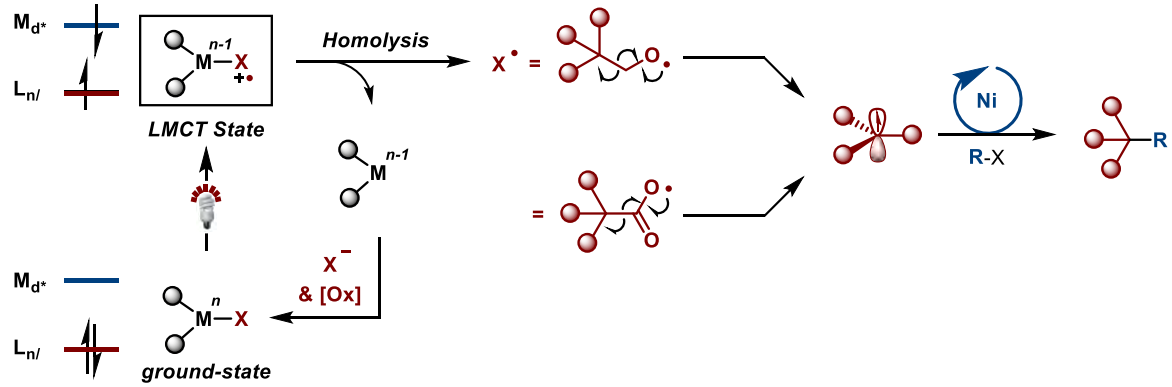
Mohammad Jaber,[1] Yasemin Ozbay,[1] Emmanuel Chefdeville,[1] Gaël Tran,[1] Abderrahmane Amgoune[1]

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Ligand-to-metal charge-transfer (LMCT) processes involve the photoinduced transfer of an electron from a ligand-based to a metal-based orbital, allowing the generation of highly reactive open-shell intermediates under mild conditions. This mode of activation has recently emerged as a transformative strategy in synthetic organic chemistry, enabling the direct transformation of native feedstock chemicals into value-added products.[1] However, despite the power and promise of LMCT-based platforms, the versatility of these methods has remained limited, particularly with respect to the valorization of the resulting radical intermediates. To overcome these limitations and expand the synthetic utility of LMCT activation, its integration with nickel-catalyzed cross-coupling has emerged as a particularly promising approach.[2]

In this talk, we will present two photocatalytic platforms that combines nickel and iron ligand-to-metal charge transfer (LMCT) catalysis, enabling direct transformation of native alcohols or carboxylic acids into cross-coupled products. In addition to synthetic developments, we will provide mechanistic insights into the crucial role of the ancillary ligand surrounding the iron catalyst in stabilizing high-valent photo-catalytically active intermediates.



[1] a) An, Q.; Chang, L.; Pan, H.; Zuo, Z. Ligand-to-Metal Charge Transfer (LMCT) Catalysis: Harnessing Simple Cerium Catalysts for Selective Functionalization of Inert C–H and C–C Bonds. *Acc. Chem. Res.* **2024**, *57*, 2915-2927. b) Juliá, F. Ligand-to-Metal Charge Transfer (LMCT) Photochemistry at 3d-Metal Complexes: An Emerging Tool for Sustainable Organic Synthesis. *ChemCatChem* **2022**, *14*, e202200916.

[2] a) Chen, Y.; Wang, X.; He, X.; An, Q.; Zuo, Z. Photocatalytic Dehydroxymethylative Arylation by Synergistic Cerium and Nickel Catalysis. *J. Am. Chem. Soc.* **2021**, *143*, 4896–4902. b) Zou, L.; Wang, X.; Xiang, S.; Zheng, W.; Lu, Q. Paired Oxidative and Reductive Catalysis: Breaking the Potential Barrier of Electrochemical C(sp^3)–H Alkenylation. *Angew. Chem. Int. Ed.* **2023**, *62*, e202301026. c) Zou, L.; Xiang, S.; Sun, R.; Lu, Q. Selective C(sp^3)–H Arylation/Alkylation of Alkanes Enabled by Paired Electrocatalysis. *Nat. Commun* **2023**, *14*, 7992.

OC12

Divergent Reactivity of Nitrostyrene Derivatives With Supramolecular Helical Catalysts

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Non-covalent interactions have emerged as pivotal tools in the design of ligands for diverse catalytic asymmetric reactions. Our group is particularly interested on benzene-1,3,5-tricarboxamides (**BTAs**), disk-like molecules featuring hydrogen bonding groups, which self-assemble into stable threefold hydrogen-bonded helices. Thanks to efficient chirality induction and amplification processes[1], supramolecular BTA helices appended with intrinsically achiral phosphine copper complexes demonstrated good efficacy in asymmetric catalysis, providing good enantioselectivities for well-established hydrosilylation and hydroamination reactions[2,3]. Leveraging this supramolecular catalytic copper hydride system, we probed the reactivity of nitrostyrene derivatives. While 3-nitrostyrene (**3NS**) yielded the expected hydroamination product in good selectivity, 2- and 4-nitrostyrene (**2NS, 4NS**) derivatives underwent an unexpected diastereo- and enantioselective dimerization reaction leading to 1,2-diaryl-1,2-dimethyl ethane derivatives (**Figure 1**). Mechanistic investigation revealed that the former reaction operated through a highly unusual pathway: a copper-mediated diastereo- and enantioselective recombination of benzylic type radicals!

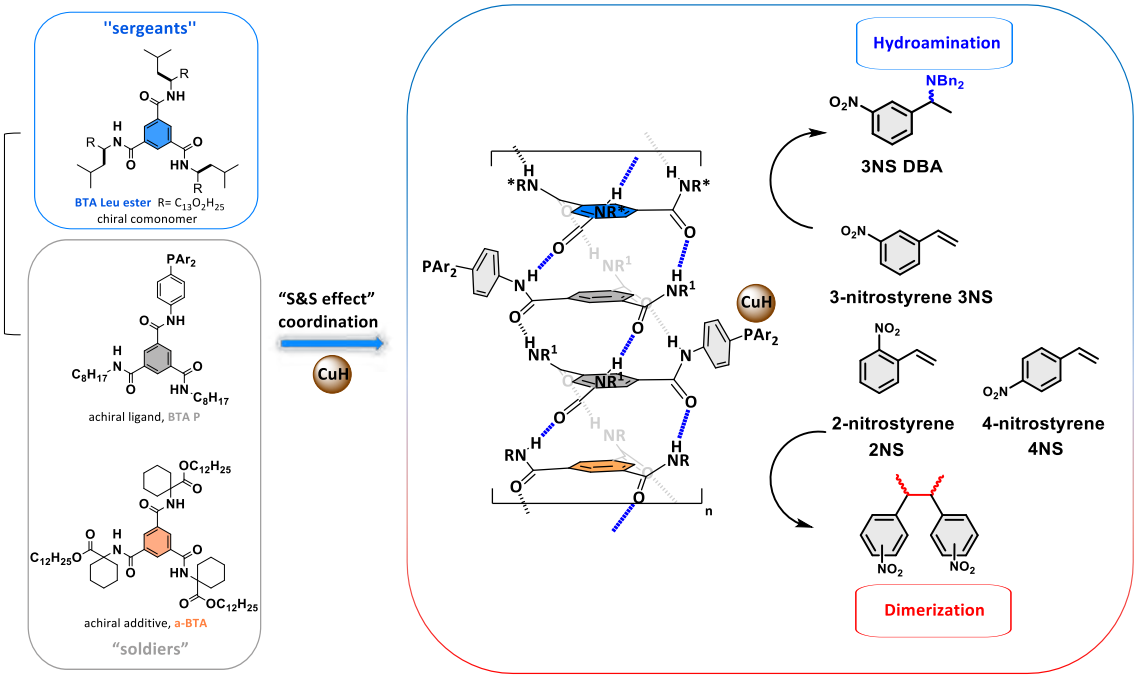


Figure 1. Reactivities of nitrostyrene derivatives with supramolecular helical copper catalysts SS1

[1] Kong, H. *et al. Angew. Chem. Int. Ed.* **2025**, *64*, e20242199.
[2] Chen, R. *et al. Nat. Commun.* **2024**, *15*, 4116.
[3] Aoun, P. *et al. Catal. Sci. Technol.* **2022**, *12*, 834–842.

OC13

Synthesis of Diamines via Selective Catalytic C-H Amination

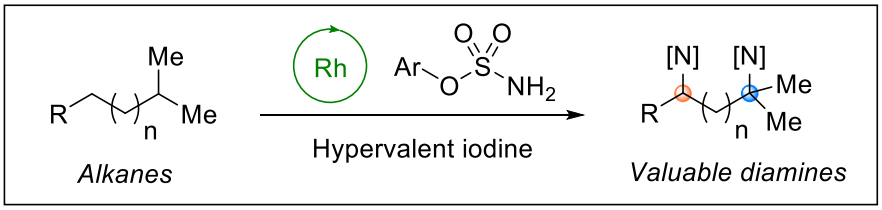
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Diamines are important motifs in pharmaceuticals and catalysis. However, their syntheses reported to date generally rely on functional group transformations, which limit the scope for the formation of 1,2- or 1,3-diamines.[1,2] Over the past 20 years, catalytic C-H amination has emerged as a direct way to form amines from alkanes. In this context, our group developed selective methods for the intermolecular amination of benzylic,[3] tertiary [4] or homobenzylic position.[5] Based on these results, we recently studied the possibility of performing a one-pot sequence of two C(sp^3)–H amination reactions. If successful, such a strategy should give access to various 1,n-diamines depending on the length of the alkyl chain.

In this communication, we will report the results of our investigations that led to develop three methods for the regio- and enantioselective formation of diamines.[6] The crucial role of the oxidant will be discussed in light of preliminary results obtained from mass spectrometry analysis.



☐ Regioselective ☐ Enantioselective ☐ Gram-scale

☐ Low catalytic loading ☐ Mass Spectrometry studies

[1] Cardona, F.; Goti, A. Metal-Catalyzed 1,2-Diamination Reactions. *Nat. Chem.* **2009,** *1*, 269–275.

[2] Yang, B.; Liu, X.; Yu, A.; Yang, Q.; Wang, Y. Rhodium(II)-Catalyzed Allylic 1,3-Diamination. *ACS Catal.* **2022,** *12*, 13411–13417.

[3] Nasrallah, A.; Boquet, V.; Hecker, A.; Retailleau, P.; Darses, B.; Dauban, P. Catalytic Enantioselective Intermolecular Benzylic C(sp^3)–H Amination. *Angew. Chem., Int. Ed.* **2019,** *58*, 8192–8196.

[4] Brunard, E.; Boquet, V.; Van Elslande, E.; Saget, T.; Dauban, P. Catalytic Intermolecular C(sp^3)–H Amination: Selective Functionalization of Tertiary C–H Bonds vs Activated Benzylic C–H Bonds. *J. Am. Chem. Soc.* **2021,** *143*, 6407–6412.

[5] Brunard, E.; Boquet, V.; Saget, T.; Carrizo, E. D. S.; Sircoglou, M.; Dauban, P. Catalyst-Controlled Intermolecular Homobenzylic C(sp^3)–H Amination for the Synthesis of β-Arylethylamines. *J. Am. Chem. Soc.* **2024,** *146*, 5843–5854.

[6] Bissonnier, T.; Brunard, E.; Andresini, M.; Poyer, S.; Saget, T.; Dauban, P. Synthesis of 1,n-Diamines via Selective Catalytic C–H Diamination. *J. Am. Chem. Soc.* **2025,** *147*, 24684–24690.

OC14

Asymmetric [3,3]-Sigmatropic Rearrangements of Sulfoniums and Applications

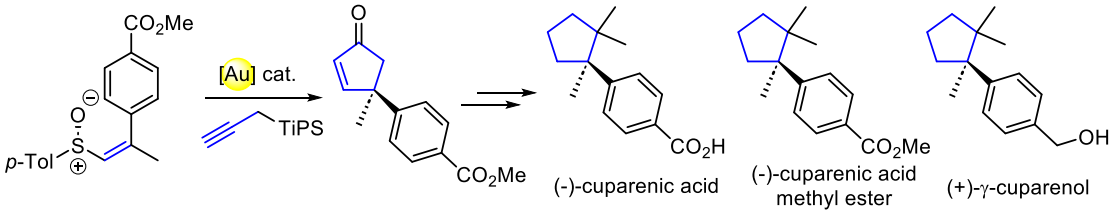
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Homogeneous catalysis has emerged as a powerful method in organic synthesis due to the unique ability of Lewis or Brønsted acids to activate unsaturated bonds. In addition, [3,3]-sigmatropic rearrangement is standing at the central position of organic synthesis for efficient and selective generation of carbon-carbon σ-bond.[1] Recently, in the group, we have developed the synthesis of cyclopentenones with C4-quaternary stereocenters through a stereospecific gold-catalyzed [3,3]-sigmatropic rearrangement of sulfoniums, using substrates such as vinylsulfoxides and propargyl silanes.[2]

In the present work, we continue to explore the sulfonium [3,3]-sigmatropic rearrangement of propargyl silanes and vinylsulfoxides, and applied this methodology to the total synthesis of sesquiterpenoids, including the synthesis of (-)-cuparenic acid and its derivatives.[3]



■ Formation of quaternary stereocenters ■ Stereospecific rearrangement with high ees

We also developed a triflic acid-catalyzed reaction by using allenyl ketones or allenenoates for the synthesis of new highly functionalized C4-chiral cyclopentenones. The substituted cyclopentenones were directly isolated, without the need of a base-promoted aldolization step. Up to 19 examples were exemplified, with generally good yields (30% < yields < 85%) and excellent transfer of chirality from the sulfoxide substrate to the final product (92-99% ee). Diels-Alder reaction and [3+2] cycloaddition reactions can be carried out in further transformations. Additionally, these cyclopentenones showed good biological activity against HL60 cells.[4]

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[1] General reviews: (a) Smith, L. H. S.; Coote, S. C.; Sneddon, H. F.; Procter, D. J. Beyond the Pummerer Reaction: Recent Developments in Thionium Ion Chemistry. *Angew. Chem., Int. Ed.* **2010**, *49*, 5832. (b) Kaiser, D.; Klose, I.; Oost, R.; Neuhaus, J.; Maulide, N. Bond-Forming and -Breaking Reactions at Sulfur(IV): Sulfoxides, Sulfonium Salts, Sulfur Ylides, and Sulfinate Salts. *Chem. Rev*. **2019**, *119*, 8701.

[2] (a) Zhou, W.; **Huang, Y.-Q.**; Gandon, V.; Voituriez, A. Mechanistic insights into the gold(I)-catalyzed [3,3]-sigmatropic rearrangement of sulfoniums for the formation of chiral 1,4-dicarbonyls or formal α-arylation of carbonyl compounds. *Org. Chem. Front.* **2024**, *11*, 6804.

[3] **Huang, Y.-Q.** and Voituriez, A. *Unpublished work*.

[4] **Huang, Y.-Q.**; Zhou, W.; Retailleau, P.; Voituriez, A. Brønsted Acid Catalyzed Asymmetric Synthesis of Cyclopentenones with C4-Quaternary Centers Starting from Vinyl Sulfoxides and Allenyl Ketones or Allenoates *Org. Lett.* **2024**, *26*, 6637.

OC15

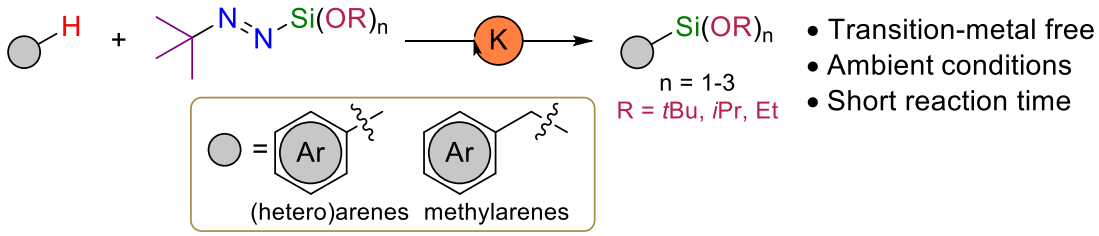
Catalytic Alkoxysilylation of C-H Bonds Using Novel Alkoxysilyldiazenes

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Arylalkoxysilanes (e.g. Ar–$SiMe_{3-n}(OR)_n$, n = 1–3) represent an important class of arylsilanes due to their widespread applications in synthetic chemistry (e.g. the Hiyama-Denmark cross-coupling) and materials science (e.g. sol/gel processes). Compared to their trialkylsilyl analogues (e.g. Ar–$SiMe_3$), these compounds offer distinct reactivity and functional advantages. However, their synthesis remains challenging due to the inherent lability of the alkoxy moiety, which can undergo redistribution, leading to undesired side products.

In this context, arylalkoxysilanes have traditionally been synthesized through stoichiometric organometallic reactions using organolithiums or Grignard reagents and orthosilicates ($SiOR_4$) or chloro(alkoxy)silanes as silicon sources. More atom economical alternatives based on the catalytic alkoxysilylation of unactivated C–H bonds have scarcely been reported as only two such reports have been disclosed. Both rely on catalytic systems based on expensive noble metals (Ir[1] and Rh[2]) as well as elaborate ligands and proceeds only under relatively harsh conditions.

Our group has recently shown that stable and readily accessible *tert*-butyl-substituted silyldiazenes (*t*Bu–N=N–SiR_3) can serve as a general platform to promote the catalytic silylation of C(sp^2)–H[3], C(sp^3)–H[4] and C(sp)–H bonds[5] under ambient and transition metal-free conditions. While this reactivity manifold had been initially exploited to the introduction of trialkylsilyl groups (e.g. $SiMe_3$), we herein demonstrate that this strategy can now be extended to the alkoxysilylation of a range of organic substrates.[6] To that end, both the synthesis and the reactivity of novel *tert*-butyl-substituted alkoxysilyldiazenes will be discussed along with some unique applications of the thus-prepared organoalkoxysilanes.



[1] Saito, H.; Shimokawa, J.; Yorimitsu, H. The Dioxasilepanyl Group as a Versatile Organometallic Unit: Studies on Stability, Reactivity, and Utility. *Chem. Sci.* **2021**, 12, 9546–9555.
[2] Som, S.; Choi, J.; Katsoulis, D.; Lee, K. L. A Direct Method to Access Various Functional Arylalkoxysilanes by Rh-Catalysed Intermolecular C-H Silylation of Alkoxysilanes. *Chem. Sci*. **2022**, 13, 10759–10764.
[3] Neil, B.; Lucien, F.; Fensterbank, L.; Chauvier, C. Transition-Metal-Free Silylation of Unactivated C(Sp^2)–H Bonds with Tert-Butyl-Substituted Silyldiazenes. *ACS Catal*. **2021**, 11, 13085–13090.
[4] Neil, B.; Saadi, L.; Fensterbank, L.; Chauvier, C. Organopotassium-Catalyzed Silylation of Benzylic C(Sp^3)–H Bonds. *Angew. Chem. Int. Ed.* **2023**, 62, e202306115.
[5] Zeng, Y.; Fensterbank, L.; Chauvier, C. Catalytic Silylation of Alkynyl C(Sp)–H Bonds with *Tert*-butyl-substituted Silyldiazenes. *ChemCatChem* **2025**, 17, e202500121.
[6] Saadi, L.; Valade, L.; Chauvier, C. Catalytic Alkoxysilylation of C–H Bonds with Tert-Butyl-Substituted Alkoxysilyldiazenes. *Chem. Sci*. **2025**, 16, 9794–9801.

OC16

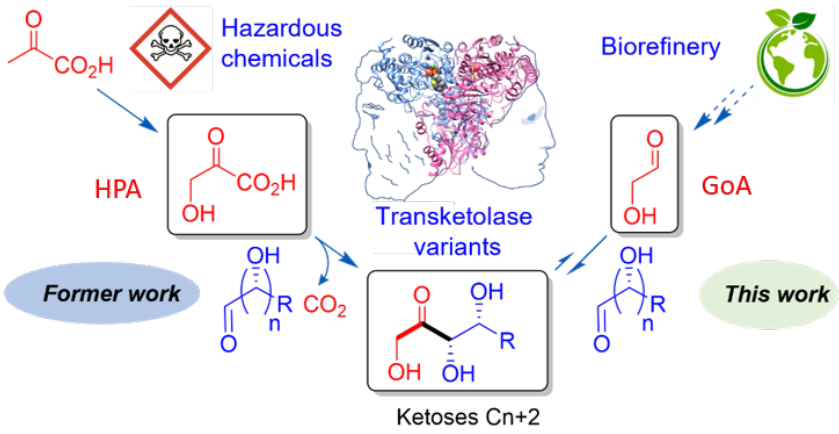
Rare Ketose Synthesis from Glycolaldehyde by C2 Elongation of Aldoses Catalyzed by Transketolase Variants

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Biocatalytic strategies involving enzymes provide access to a large scope of rare ketoses with high chemo- and regio- selectivity under mild conditions.[1] The enzyme thiamine diphosphate-dependent transketolase (TK) can efficiently catalyze the C2 elongation of aldoses electrophiles in one step, by transferring the ketol unit of β-hydroxypyruvate (HPA) as a nucleophile for the synthesis of Cn+2 ketoses by stereoselective C–C bond formation.[2] The carbon dioxide release from HPA in the TK-catalyzed reaction shifts the reaction equilibrium strongly toward the formation of the desired ketose. However, this synthetic approach is limited by the tedious and low-yielding chemical route to HPA. Recently we found that TK variants from *Geobacillus stearothermophilus* (TK_{gst})[3] showed a remarkable ability to catalyze the cross-acyloin condensation between stoichiometric amounts of aliphatic (hydroxy)aldehydes for the one-step synthesis of α-hydroxyketones.[4] Based on these results, we demonstrated that possibly biobased glycolaldehyde (GoA) can be a substitute of HPA for the synthesis of rare ketoses of biological interest by TK variant-catalyzed cross-acyloin reactions with aldoses as electrophiles. This enzymatic approach provides efficient atom economy and high yields of several rare ketoses of interest, thereby extending the enzyme toolbox for the synthesis of other α-hydroxyketones (Scheme 1).[5]



***Scheme 1**. Rare ketose synthesis from HPA or GoA by C2 elongation of aldoses catalyzed by TK variants*

[1] W. Zhang, T. Zhang, B. Jiang, W. Mu, *Biotechnol. Adv.*, **2017**, *35*, 267-274

[2] M. Lorillière, R. Dumoulin, M. L'Enfant, A. Rambourdin, V. Thery, L. Nauton, W-D Fessner, F. Charmantray, L. Hecquet, *ACS Catal.*, **2019**, *9*, 4754-4763

[3] J. Abdoul Zabar, I. Sorel, V. Hélaine, F. Charmantray, T. Devamani, D. Yi, V. de Berardinis, D. Louis, P. Marlière, W.-D. Fessner, L. Hecquet, *Adv. Synth. Catal.*, **2013**, *355*, 116-128

[4] G. Arbia, C. Gadona, H. Casajus, L. Nauton, F. Charmantray, L. Hecquet, *Green Chem.*, **2024**, *26*, 7320–7330

[5] C. Gadona, L. Royer, M. Joly, L. Hecquet, F. Charmantray, *ACS Catal.*, **2025**, *15*, 7979–7992

OC17

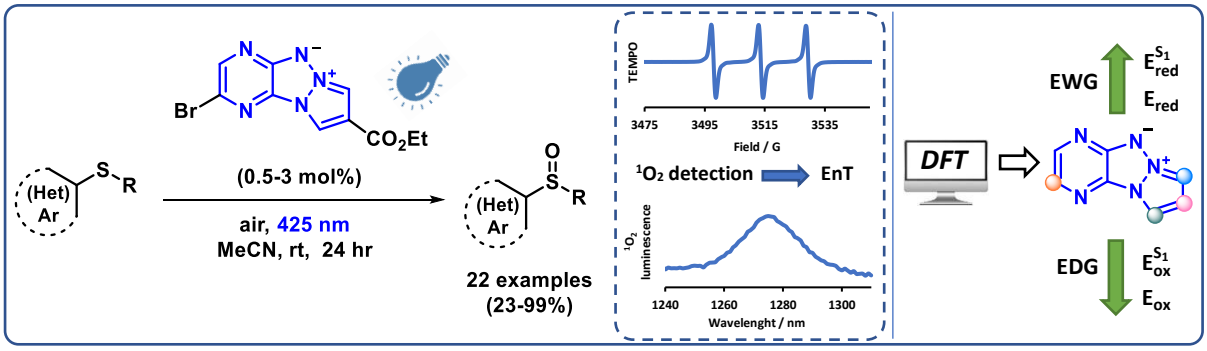
Exploring the applications of pyridazino-1,3a,6a-triazapentalenes (PyTAP) as photocatalysts

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In recent years, organic chromophores such as acridiniums, BODIPYs and thiazines have been repurposed as photocatalysts.[1,2] These have enabled systematic tailoring and environmental benignity in comparison to their more conventionally used and expensive transition-metal counterparts, whilst maintaining or even outperforming catalytic activity.[2] As this transition continues, there remains a growing interest in the development of novel photocatalytic transformations and the innovation of new and improved organo-photocatalysts.

Pyridazino-1,3a,6a-triazapentalenes (PyTAP) are a family of fused triazapentalenes that have gained interest for their fluorescence-based applications.[3] These compact 6/5/5 tricyclic scaffolds additionally offer ease of modulation, high chemical stability and good photophysical properties.[4] However, their potential application in photocatalysis has remained unexplored until now.

Herein, we report the effective use of PyTAP as a photocatalyst in the aerobic visible light oxidation of sulfides to sulfoxides. This was complemented with a series of mechanistic studies, which allowed us to identify the relevant photocatalytic mechanisms of the described sulfoxidation. In continuation, we are currently exploiting PyTAPs' modularity to design photocatalytic candidates with enhanced redox properties *via* DFT calculations.



[1] Romero, N. A.; Nicewicz, D. A. Organic Photoredox Catalysis. *Chem. Rev.* **2016**, 116 (17), 10075–10166. https://doi.org/10.1021/acs.chemrev.6b00057.
[2] Bobo, M. V.; Kuchta, J. J.; Vannucci, A. K. Recent Advancements in the Development of Molecular Organic Photocatalysts. *Org. Biomol. Chem.* **2021**, 19 (22), 4816–4834. https://doi.org/10.1039/D1OB00396H.
[3] Janczy-Cempa, E.; Mazuryk, O.; Sirbu, D.; Chopin, N.; Żarnik, M.; Zastawna, M.; Colas, C.; Hiebel, M.-A.; Suzenet, F.; Brindell, M. Nitro-Pyrazinotriazapentalene Scaffolds– Nitroreductase Quantification and in Vitro Fluorescence Imaging of Hypoxia. *Sensors and Actuators B: Chemical* **2021**, *346*, 130504. https://doi.org/10.1016/j.snb.2021.130504.
[4] Sirbu, D.; Diharce, J.; Martinić, I.; Chopin, N.; Eliseeva, S. V.; Guillaumet, G.; Petoud, S.; Bonnet, P.; Suzenet, F. An Original Class of Small Sized Molecules as Versatile Fluorescent Probes for Cellular Imaging. *Chem. Commun.* **2019**, 55 (54), 7776–7779. https://doi.org/10.1039/C9CC03765A.

OC18

Well-defined iridium complexes containing chiral cyclic (alkyl)(amino)carbenes for asymmetric hydrogenation

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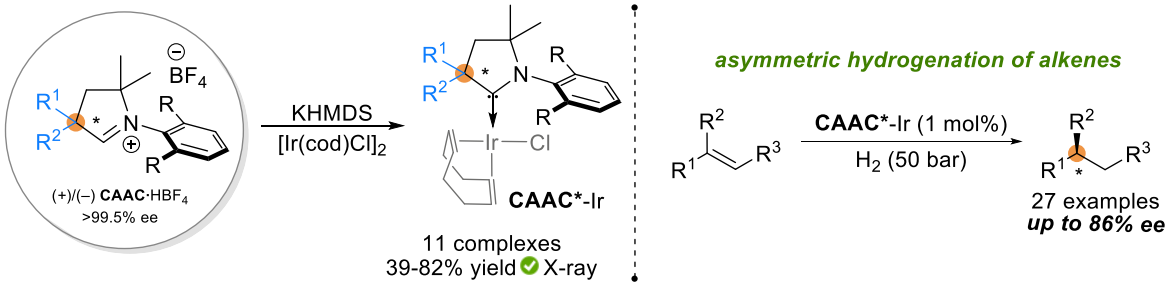
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N-heterocyclic carbene (NHC) complexes of transition metals (TM) have proven to be effective catalysts for numerous transformations, including asymmetric reactions.[1] In the specific, asymmetric hydrogenation remains a challenge, since few chiral NHC-metal complexes are capable of a significant stereoinduction.[2] In 2005, a new type of stable Cyclic (Alkyl)(Amino)Carbenes (CAACs) was discovered by Bertrand's group.[3] More recently, different routes to access chiral CAAC-TM have been developed.[4] Thanks to the efficient access to chiral CAAC precursors,[4c] we report herein the synthesis of well-defined chiral CAAC-iridium complexes and their first use in the asymmetric hydrogenation of alkenes. Encouraging results have been obtained on the hydrogenation of (*E*)-2,3-disubstituted allylic alcohols and ethers with promising enantioinductions.[5]



[1] Jayaraj, A.; Raveedran, A. V.; Latha, A. T.; Priyadarshini, D.; Swamy, P. C. A. Coordination Versatility of NHC-Metal Topologies in Asymmetric Catalysis: Synthetic Insights and Recent Trends. *Coord. Chem. Rev.* **2023**, *478*, 214922.

[2] Zhao, D.; Candish, L.; Paul, D.; Glorius, F. N-Heterocyclic Carbenes in Asymmetric Hydrogenation. *ACS Catal.* **2016**, *6*, 5978–5988.

[3] Lavallo, V.; Canac, Y.; Präsang, C.; Donnadieu, B.; Bertrand, G. Stable Cyclic (Alkyl)(Amino)Carbenes as Rigid or Flexible, Bulky, Electron-Rich Ligands for Transition-Metal Catalysts: A Quaternary Carbon Atom Makes the Difference. *Angew. Chem. Int. Ed.* **2005**, *44*, 5705–5709.

[4] Among others: (a) Morvan, J.; Vermersch, F.; Zhang, Z.; Falivene, L.; Vives, T.; Dorcet, V.; Roisnel, T.; Crévisy, C.; Cavallo, L.; Vanthuyne, N.; Bertrand, G.; Jazzar, R.; Mauduit, M. Optically Pure C1-Symmetric Cyclic(Alkyl)(Amino)Carbene Ruthenium Complexes for Asymmetric Olefin Metathesis. *J. Am. Chem. Soc.* **2020**, *142*, 19895–19901. (b) Madron du Vigné, A.; Cramer, N. Streamlined Synthetic Assembly of α-Chiral CAAC Ligands and Catalytic Performance of Their Copper and Ruthenium Complexes. *Chem. Sci.* **2024**, 13864–13871. (c) Lorkowski, J.; Yorkgitis, P.; Morvan, F.; Morvan, J.; Vanthuyne, N.; Roisnel, T.; Gembicky, M.; Bertrand, G.; Mauduit, M.; Jazzar, R. Singlet Carbenes Are Stereoinductive Main Group Ambiphiles. *J. Am. Chem. Soc.* **2025**, *147*, 14777–14784.

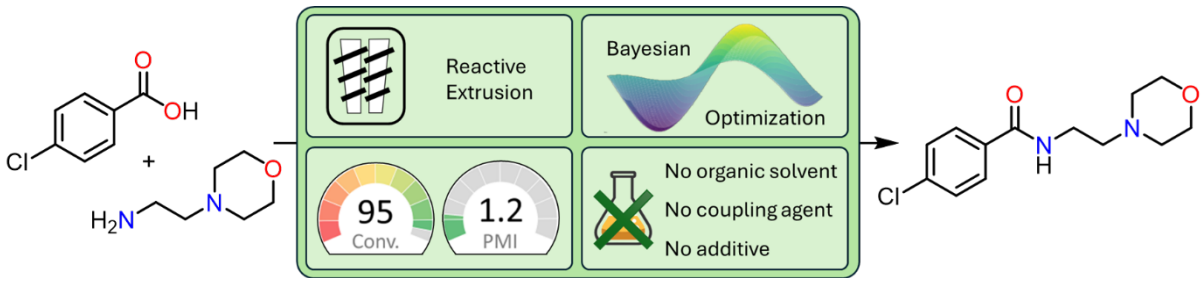
[5] Morvan, F.; Liu, M.; Vivès, T.; Roisnel, T.; Vanthuyne, N.; Jazzar, R.; Wencel-Delord, J.; Mauduit, M. Well-defined Rhodium and Iridium complexes containing chiral Cyclic(alkyl)(amino)carbenes for asymmetric hydrogenation. *ChemRxiv* **2025**.

OC19

Harnessing extrusion forces for the thermo-mechanochemical synthesis of amides through Machine Learning

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In the field of green chemistry, mechanochemistry has emerged as a powerful and sustainable approach in fine chemical synthesis, harnessing mechanical forces to drive chemical reactions.[1] Using a twin-screw extruder as a chemical reactor we explored the potential of reactive extrusion for the synthesis of amides[2] and peptides[3] in both case reducing by tenfold the amount of waste generated compared to conventional methodologies. To improve further, it was decided to form the amide bond without coupling agents or catalysts, while also leveraging Bayesian Optimization to develop tailored conditions for this thermo-mechanochemical synthesis of amides. A twin-screw extruder equipped with a recirculation valve and heating elements allows for precise control over reaction parameters such as reaction time and temperature. This accuracy was a key point in unlocking new optimization methodologies through Machine Learning, which along with a careful design of the target produces a strong tool to quickly define reaction condition that accommodate both high conversion and excellent sustainability metrics. This recent and innovative approach allowed us to develop efficient processes for the synthesis of amides free from solvents, coupling agents or any additives.[4] This solvent-less flow mechanochemistry approach aligns seamlessly with the industry's growing demand for productive and sustainable manufacturing processes.



[1] Bento, O.; Luttringer, F.; Mohy El Dine, T.; Pétry, N.; Bantreil, X.; Lamaty, F. Sustainable Mechanosynthesis of Biologically Active Molecules. *Eur. J. Org. Chem.* **2022**, *2022*, e202101516.
[2] Lavayssiere, M.; Lamaty, F. Amidation by Reactive Extrusion for the Synthesis of Active Pharmaceutical Ingredients Teriflunomide and Moclobemide. *Chem. Commun.* **2023**, *59*, 3439–3442.
[3] Mohy El-Dine, T.; Lavayssiere, M.; Adihou, H.; Subra, G.; Métro, T.-X.; Ludemann-Hombourger, O.; Lamaty, F. Synthesis of Peptides by Reactive Extrusion. Application to the Continuous and Solventless Preparation of Aspartame. *ChemistryEurope* **2024**, *2*, e202400007.
[4] Lavayssiere, M.; Bantreil, X.; Lamaty, F. Optimizing Reactions in Reactive Extrusion by a Bayesian Approach: The Case of Thermal Amidation. *ChemRxiv* **2025**. https://doi.org/10.26434/chemrxiv-2025-zgpnz.

OC20

From lignin degradation products to indanone building blocks

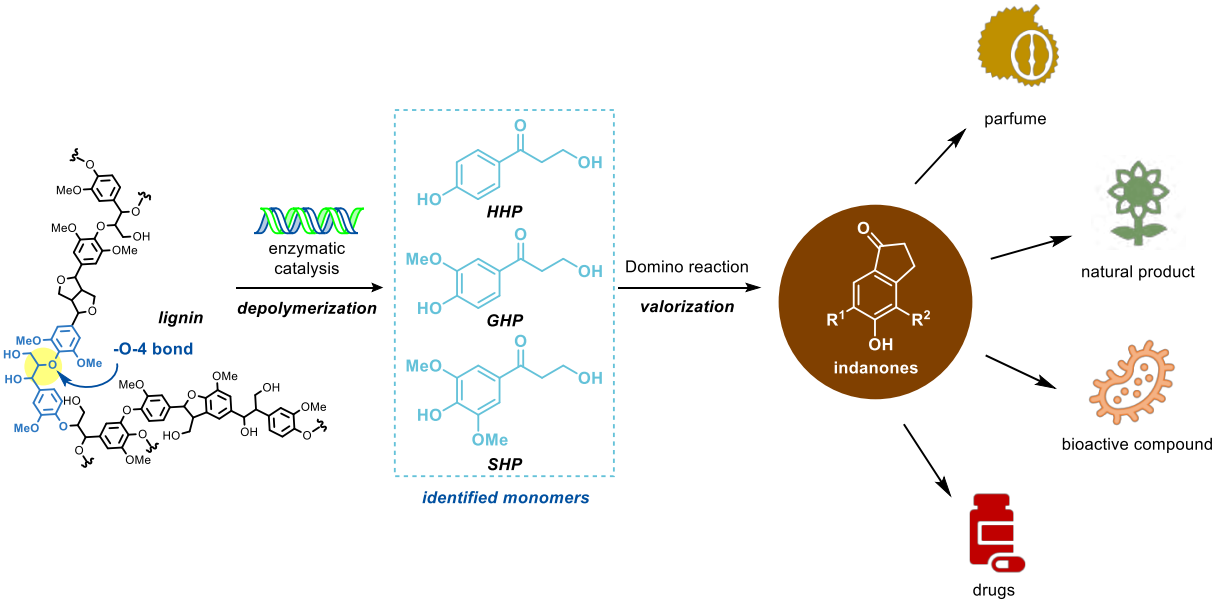
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The petrochemicals industry represents a blind spot in the effort to reduce greenhouse gas emissions, and valorization of lignocellulosic biomass could be a sustainable alternative to using petroleum as a carbon source. Especially, lignin degradation can allow access to valuable aromatic building blocks. However, the cleavage of lignin to desired structures is meeting multiple obstacles, and only a few methods exist.[1] On the one hand, chemical degradation methods are harsh and hardly controllable. On the other hand, enzymatic methods are milder, but often only feasible on a small scale. In the frame of a collaborative project with the group of Prof. A. Schallmey at TU Braunschweig, who is currently studying a scalable and preparative access to synrigyl-, guaiacyl- and *p*-hydroxyphenyl-3-hydroxypropanones (SHP, GHP, and HHP, respectively, Figure 1),[2] we developed an original domino elimination/Nazarov cyclization[3,4] sequence to obtain indanone molecular scaffolds these synthons.



[1] Gasser, C. A.; Hommes, G.; Schäffer, A.; Corvini, P. F.-X. Multi-Catalysis Reactions: New Prospects and Challenges of Biotechnology to Valorize Lignin. *Appl Microbiol Biotechnol* **2012**, *95*, 1115–1134.

[2] Husarcíková, J.; Voß, H.; Domínguez de María, P.; Schallmey, A. Microbial β-Etherases and Glutathione Lyases for Lignin Valorisation in Biorefineries: Current State and Future Perspectives. *Appl Microbiol Biotechnol* **2018**, *102*, 5391–5401.

[3] Vuong, H.; Amadou, H.; Stentzel, M. R.; Klumpp, D. A. Superelectrophilic Nazarov Cyclizations with *N*-Heterocycles. *Tetrahedron* **2020**, *76*, 131644.

[4] Suzuki, T.; Ohwada, T.; Shudo, K. Superacid-Catalyzed Electrocyclization of 1-Phenyl-2-Propen-1-Ones to 1-Indanones. Kinetic and Theoretical Studies of Electrocyclization of Oxonium−Carbenium Dications. *J. Am. Chem. Soc.* **1997**, *119*, 6774–6780.

OC21

Metal-Free Upcycling of Polyethylene into Reactive Platforms Through Direct and Selective Nitrosation and Carbonylation

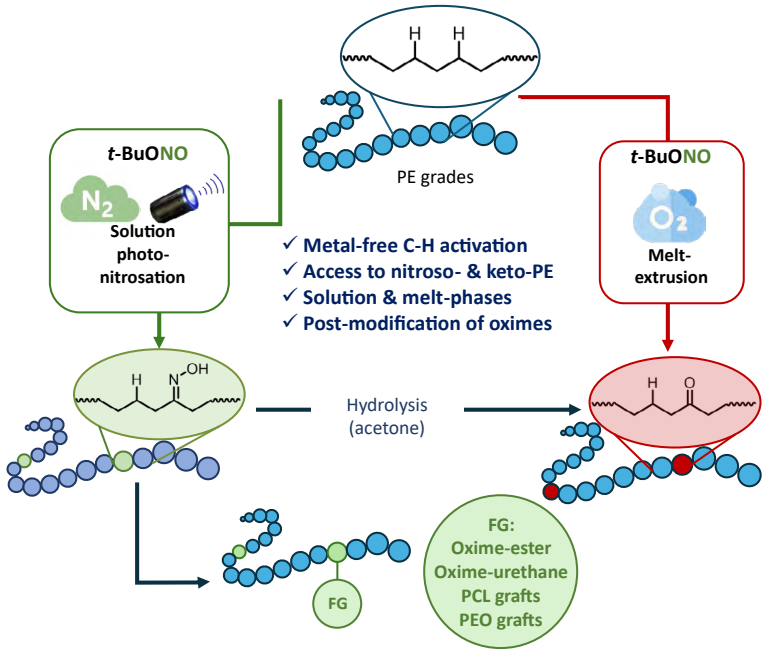
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Polyethylene (PE), the most extensively manufactured synthetic polymer worldwide, poses significant challenges for chemical modification and upcycling due to the inertness of its saturated carbon backbone.[1] We report a scalable, metal-free strategy for direct C–H functionalization of PE, enabling selective formation of oxime or carbonyl groups depending on the reaction atmosphere. This transformation operates under mild conditions, either via visible-light photosensitization in solution or thermally under reactive extrusion, making it applicable from lab to industrial scale. The method relies on tert-butyl nitrite (t-BuONO), which generates a tert-butoxy radical (t-BuO•) for hydrogen abstraction and a persistent nitrosyl radical (NO•) that installs ketoxime moieties. Mechanistic insights from quantum yield and transient absorption studies support the proposed pathway. Unlike previous methods yielding mixed functionalities, this oxygen-tunable platform delivers well-defined, functionalized PE derivatives, serving as precursors for further transformation into esters, ethers, and urethanes. This approach offers a selective and sustainable route for PE upcycling, expanding the toolbox for post-polymerization modification of this ubiquitous plastic.



[1] Cluzeau L.; Robert F.; Landais Y.; Taton D., Method for functionalizing polyolefins via the introduction of an oxime function, WO2024-FR50991, January 2025.

OC22

Extending Bioorthogonal Chemistry to Natural Oxylipins: A Tri-Functional Probe for 4-F_{4t}-Neuroprostane

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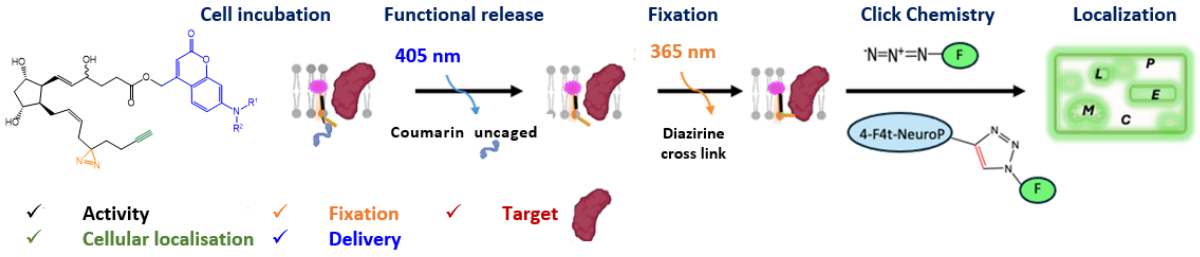
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Oxidative stress plays a crucial role in various pathological conditions, making lipid oxidation products important mediators of cellular responses. Among them, 4(RS)-4-F_{4t}-NeuroProstane (4-F_{4t}-NeuroP), a major non-enzymatic oxidation product of DHA, displays anti-arrhythmic, anti-apoptotic, and anti-inflammatory properties [1,2,3]. Yet, the molecular mechanisms underlying its activity remain largely unknown, while understanding them is crucial, as a derivative of this natural oxylipin is already in preclinical development [4,5].

In this context, we have synthesised the first tri-functional bioorthogonal clickable derivative of 4-F_{4t}-NeuroP, enabling the visualisation, target identification, and organelle-specific delivery. Here, we present the synthetic strategies and challenges associated with this unique probe, along with our first experimental results, including in-cellulo visualisation in macrophages and cardiomyocytes.

By combining click chemistry, photo-crosslinking[6] and organelle-specific delivery[7], our work extends bioorthogonal techniques to complex natural oxylipins. This strategy enables, for the first time, the visualisation and target profiling of oxylipins, providing new insights into their biological functions and therapeutic potential in oxidative stress-driven diseases.



P : Plasma membrane L : Lysosome M : Mitochondria C : Cytoplasm E : Endoplasmic reticulum F : Fluorophore

[1] Roy, J. et al. Nonenzymatic Lipid Mediators, Neuroprostanes, Exert the Antiarrhythmic Properties of Docosahexaenoic Acid. *Free Radic. Biol. Med.* **2015**, *86*, 269–278.

[2] Roy, J. et al. Non-Enzymatic Oxidized Metabolite of DHA, 4(RS)-4-F4t-Neuroprostane Protects the Heart against Reperfusion Injury. *Free Radic. Biol. Med.* **2017**, *102*, 229–239.

[3] Bosviel, R. et al. DHA-Derived Oxylipins, Neuroprostanes and Protectins, Differentially and Dose-Dependently Modulate the Inflammatory Response in Human Macrophages: Putative Mechanisms through PPAR Activation. *Free Radic. Biol. Med.* **2017**, *103*, 146–154.

[4] https://www.linkedin.com/company/occical-therapeutics

[5] Lacampagne, A et al. Novel Compounds for the Treatment of Diseases Associated with Ryanodine Receptor (RyR) Dysfunction. EP22209466.6, 2022.

[6] Gagestein, B. et al. Comparative Photoaffinity Profiling of Omega-3 Signaling Lipid Probes Reveals Prostaglandin Reductase 1 as a Metabolic Hub in Human Macrophages. *J. Am. Chem. Soc.* **2022**, *144* (41), 18938–18947.

[7] Wagner, N. et al. A Click Cage: Organelle-Specific Uncaging of Lipid Messengers. *Angew. Chem. Int. Ed.* **2018**, *57* (40), 13339–13343.

OC23

^{11}C labelling of mRNA for PET imaging of new vaccines and therapies

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RNA-based therapies have been in constant expansion in the last decades, even more so since the first COVID-19 vaccines. In the course of RNA-therapy development, the study of its biodistribution by Positron Emission Tomography (PET)-imaging could allow whole-body and direct visualization of its early spatio-temporal trafficking. The introduction of β+ emitters directly to oligonucleotides (ONs) often requires bulky chelators which may alter their structure and properties. On the contrary, smaller radionuclides such as ^{11}C are promising but challenging candidates for the labelling of RNAs.

In this project, we aim to establish direct ^{11}C-labelling of ONs *via* a Staudinger/Aza-Wittig (SAW) tandem reaction.[1] To this end, a model short RNA N_3-containing dinucleotide was successfully obtained using phosphoramidite methodology.[2] Preliminary labelling experiments have already validated the efficacy of the SAW reaction in presence of water to introduce ^{11}C on the dinucleotide with good radiochemical conversion. The synthesis of longer ONs is in progress, combining solid-phase synthesis and a chemo-enzymatic approach. ^{11}C-labelling of longer ONs will validate this methodology, and allow the labelling of poly-A fragments for mRNA imaging.

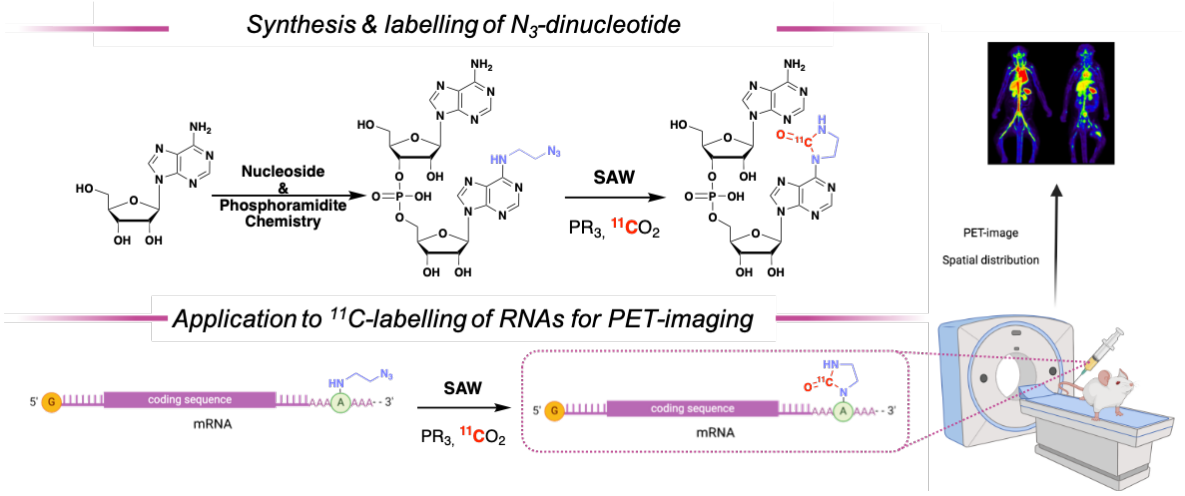


Figure. *Staudinger/Aza-Wittig (SAW) strategy for ^{11}C-labelling of oligonucleotides for PET-imaging.*

[1] Del Vecchio A., Caillé F., Chevalier A., Loreau O., Horkka K., Halldin C., Schou M., Camus N., Kessler P., Kuhnast B., Taran F., Audisio D. "Late-Stage Isotopic Carbon Labeling of Pharmaceutically Relevant Cyclic Ureas Directly from CO_2" *Angew. Chem. Int. Ed.* **2018**, *57*, 9744–9748

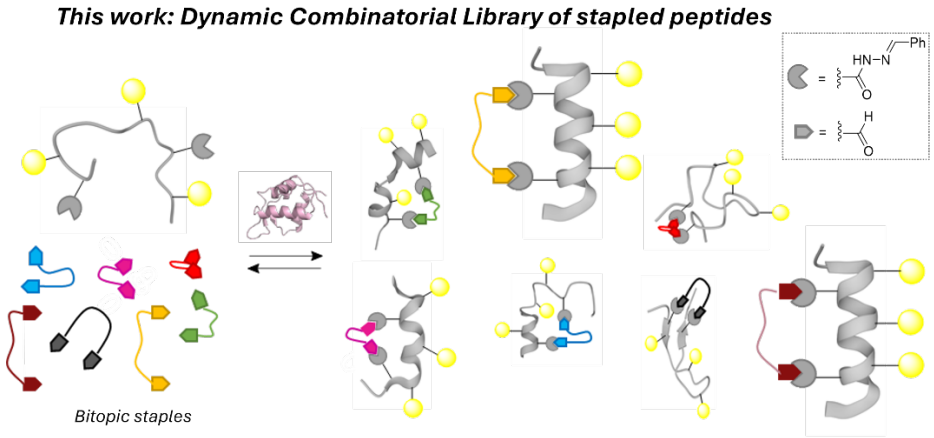
[2] Meynier V., Iannazzo L., Catala M., Oerum S., Braud E., Atdjian C., Barraud P., Fonvielle M., Tisné C., Ethève-Quelquejeu M. "Synthesis of RNA-cofactor conjugates and structural exploration of RNA recognition by an m^{6}A RNA methyltransferase" *Nucleic Acids Res.*, **2022**, *50*, 5793–5806

OC24

Dynamic Cyclic Peptides for the Inhibition of Protein-Protein Interactions

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Macrocyclic peptides are particularly attractive for challenging targets,[1] including "undruggable" protein-protein interactions (PPIs), which exhibit large and flat contact areas. Their conformational restriction gives them improved capabilities compared to linear analogs, such as higher binding affinity and specificity, proteolytic stability and improved membrane permeation. But their development has been slow down by the tremendous amount of work required for their optimization. To generate and screen large libraries of cyclic peptides, in our team, we are currently exploring Dynamic Combinatorial Chemistry toward the inhibition of p53/hDM2, a validated target in oncology.[2] Two different approaches are investigated: i) the optimization of the pharmacophore starting from a 3D structured scaffold (α-helix, β-hairpin[3,4]), or ii) the optimization of the bioactive conformation starting from a linear sequence, by dynamic intermolecular macrocyclization.[5] In this communication, focus will be given to the second approach (Fig. below).



[1] Swenson, C. S.; Mandava, G.; Thomas, D. M.; Moellering, R. E. Tackling Undruggable Targets with Designer Peptidomimetics and Synthetic Biologics. *Chem. Rev.* **2024**, *124* (22), 13020–13093.
[2] Hu, B.; Gilkes, D. M.; Chen, J. Efficient P53 Activation and Apoptosis by Simultaneous Disruption of Binding to MDM2 and MDMX. *Cancer Res.* **2007**, *67* (18), 8810–8817.
[3] Zagiel, B.; Peker, T.; Marquant, R.; Cazals, G.; Webb, G.; Miclet, E.; Bich, C.; Sachon, E.; Moumné, R. Dynamic Amino Acid Side-Chains Grafting on Folded Peptide Backbone**. *Chem. – Eur. J.* **2022**, *28* (36), e202200454.
[4] Peker, T.; Zagiel, B.; Rocard, L.; Bich, C.; Sachon, E.; Moumné, R. Analytical Tools for Dynamic Combinatorial Libraries of Cyclic Peptides. *ChemBioChem* **2023**, *24* (24), e202300688.
[5] *Unpublished results*

OC25

Synthesis and optimization of novel peptidomimetics derivatives inhibiting the efflux pumps of *Pseudomonas aeruginosa*

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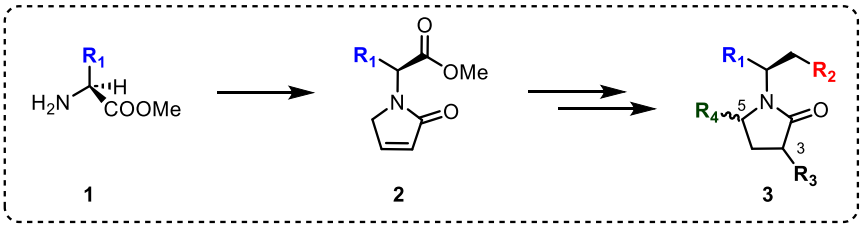
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The rise of multidrug-resistant *Pseudomonas aeruginosa* (PA) is a critical challenge in the treatment of cystic fibrosis (CF), as this pathogen is a leading cause of morbidity and mortality in patients. PA's resistance is often attributed to its efficient efflux pumps, particularly the MexAB-OprM system, which expels antibiotics out of bacteria before they can act[1]. Addressing this mechanism is crucial to overcome treatment failures and to improve patient outcomes.

In this study, funded by the French association "Vaincre la Mucoviscidose," we present an innovative approach aimed at inhibiting PA's efflux pump system. We focus on the synthesis of novel peptidomimetics **3** designed to block the MexB transporter, a key player in the recognition and expulsion of antibiotics. Unlike traditional inhibitors, our peptidomimetics are built on a γ-lactam scaffold[2] **2** (scheme), which could improve their affinity and specificity for MexB, as suggested by preliminary docking analyses and biological assays.



This strategy represents an encouraging new avenue in combating antibiotic resistance in CF patients. By targeting the efflux pump mechanism, we hope to restore the efficacy of existing antibiotics and offer a much-needed therapeutic solution for this vulnerable patient group.

[1] Glavier, M.; Puvanendran, D.; Salvador, D.; Decossas, M.; Phan, G.; Garnier, C.; Frezza, E.; Cece, Q.; Schoehn, G.; Picard, M.; Taveau, J.-C.; Daury, L.; Broutin, I.; Lambert, O. Antibiotic Export by MexB Multidrug Efflux Transporter Is Allosterically Controlled by a MexA-OprM Chaperone-like Complex. *Nat. Commun.* **2020**, *11* (1), 4948.

[2] Souquet, F.; Drici, W.; Fayssal, S. A.; Lazouni, I.; Thueillon, S.; Pérard-Viret, J. N-Acyliminium Ion Chemistry: Improving the Access to Unsaturated γ-Lactams and Their N-α-Methoxylated Derivatives: Application to an Expeditive Synthesis of (±)-Crispine A. *Synthesis* **2020**, *52*, 2970–2978.

OC26

Targeting SARS-CoV-2 Main protease: Synthesis of epoxyazepinoindole derivatives as potential inhibitors

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The Main protease (Mpro, also known as 3CLpro, NSP5) is encoded by the viral genome and is an essential protease for the SARS-CoV-2 viral replication.[1] Therefore, Mpro is a validated target to treat SARS-CoV-2 infection and the development of new Mpro inhibitors is require to provide effective and convenient treatments.

In a previous work, we have identified a hit compound from an epoxyazepino[3,4,5-c,d]indole-based chemical library that shows activity on the viral replication of the virus (EC_{50} = 6 µM) and against Mpro on cell-based luciferase assay.[2,3] In this present work, we have designed and synthesized new derivatives based on the hit compound to conduct a structure-activity relationship (SAR) study (Figure 1). The design and the synthesis of the new chemical library and the biological activity measure against the main protease and in SARS-CoV-2 viral replication will be presented.

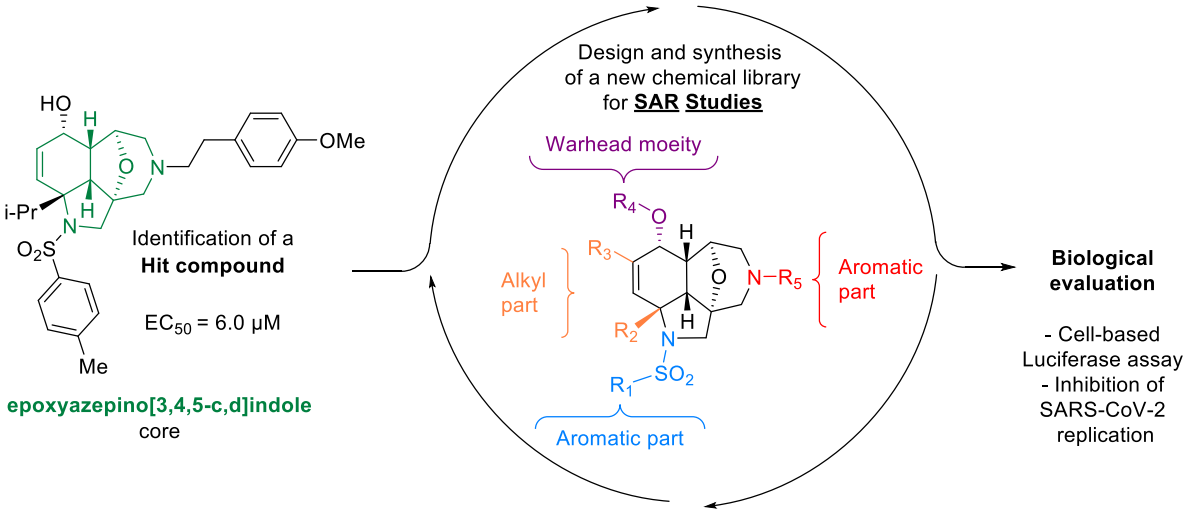


Figure 2

[1] Ullrich, S.; Nitsche, C. The SARS-CoV-2 Main Protease as Drug Target. *Bioorganic & Medicinal Chemistry Letters* **2020**, *30* (17), 127377. https://doi.org/10.1016/j.bmcl.2020.127377.

[2] Chen, K. Y.; Krischuns, T.; Varga, L. O.; Harigua-Souiai, E.; Paisant, S.; Zettor, A.; Chiaravalli, J.; Delpal, A.; Courtney, D.; O'Brien, A.; Baker, S. C.; Decroly, E.; Isel, C.; Agou, F.; Jacob, Y.; Blondel, A.; Naffakh, N. A Highly Sensitive Cell-Based Luciferase Assay for High-Throughput Automated Screening of SARS-CoV-2 Nsp5/3CLpro Inhibitors. *Antiviral Research* **2022**, *201*, 105272. https://doi.org/10.1016/j.antiviral.2022.105272.

[3] Hassan, H.; Chiavaralli, J.; Hassan, A.; Bedda, L.; Krischuns, T.; Chen, K.-Y.; Li, A. S. M.; Delpal, A.; Decroly, E., Vedadi, M.; Naffakh, N.; Agou, F.; Mallart, S.; Arafa, R. K.; Arimondo, P. B. Design and Synthesis of Naturally-Inspired SARS-CoV-2 Inhibitors. *RSC Med. Chem.* **2023**, *14* (3), 507–519. https://doi.org/10.1039/D2MD00149G.

OC27

Synthesis of acyclonucleosides fluoroalkenyl mimics

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The emergence of viral and bacterial diseases, illustrated by the recent viral pandemic and the apparition of bacterial resistance phenomena, needs to identify new biological targets and develop new drugs.[1] Modified nucleosides and their analogues represent an important class of compounds developed since many years to treat these diseases, and in particular to fight virus and bacteria. Structural modifications of naturally occurring nucleosides have been realized to improve their in vivo stability and efficacity towards a viral target. This concept of the modification of the backbone was extended to antibacterial agents, such as acyclonucleotides containing aliphatic phosphonates, controlling bacterial growth (Helicobacter pyroli, Mycobacterium tubercolosis).[2]

Despite their good activities in a biological environment, acyclonucleosides present a very high flexibility of the acyclic chain. Following these results and to reduce the number of conformers, new acyclic nucleosides with a trans-butenyl unit have been developed.[3] This motif can freeze the conformation and mimic the osidic part of the natural deoxyribose.[4] Although these compounds have good isostery with natural nucleosides, we propose to introduce a fluorine atom on the double bond to mimic the oxygen atom present in the natural nucleoside.

The present project will focus on the development of new tools to prepare acyclonucleosides analogues of the serial A and B and evaluate their biological activity to confirm the interest of presence of the fluoroalkene moiety to discover new drugs. A particular attention for the preparation of more stable analogues of antiviral agents such as HIV, COVID19.

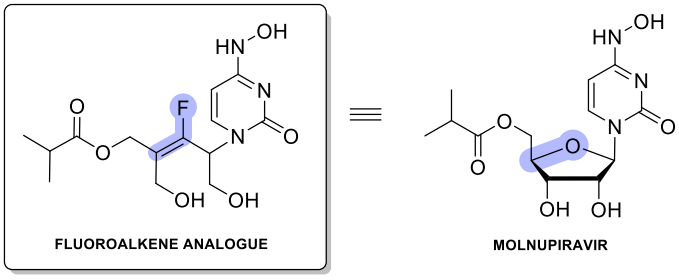


Figure 1 *Example of a fluoroalkene nucleoside analogue*

[1] Chellat, M. F.; Raguz, L.; Riedl, R. Angew. *Chem. Int. Ed.* **2016**, 55, 6600–6626.

[2] Parchina, A.; Froeyen, M.; Margamuljana, L.; Rozenski, J.; De Jonghe, S.; Briers, Y.; Lavigne, R.; Herdewijn, P.; Lescrinier, E. *ChemMedChem* **2013**, 8, 1373–1383.

[3] Sari, O.; Hamada, M.; Roy, V.; Nolan, S. P.; Agrofoglio, L. A. *Org. Lett.* **2013**, 15, 4390.

[4] Vanden Eynde, J. J.; Mangoni, A. A.; Rautio, J.; Leprince, J.; Azuma, Y.-T.; García-Sosa, T.; Agrofoglio, L. A. *Molecules.* **2020**, 25 (1), 119.

OC28

Amphiphilic photocontrolled DNA delivery systems

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Light, as an external stimulus, presents unique advantages for stimuli-responsive drug and gene delivery systems, such as spatiotemporal precision, relative safety, and minimal interference with cellular signaling pathways. It can specifically transfer energy to selected chemical entities, inducing changes in structure, conformation or polarity. Several examples of light-responsive nucleic acid therapeutic (NAT) delivery systems exist, most of which rely on photocleavable moieties incorporated into polymeric matrices.[1] However, records on the use of photoswitchable modules that impact the stability of vector-NAT nanocomplexes depending on their state are much scarcer.

Azobenzene derivatives, consisting of two phenyl rings connected by an N=N double bond that can switch between the *E* and *Z* configurations using specific light wavelengths, stand out in this field. Several approaches have been developed to exploit this capability for spatiotemporal-controlled transfection. Nevertheless, current reports are often limited to polydisperse materials, generally used in multicomponent formulation.[2] We aim at developing prototypes that are fully homogeneous at the molecular level and effective in monoformulation, which has shown to be less limited in terms of reproducibility and optimization.[3]

Building on our previous work,[3,4] we here present a covalent archetype, based on Janus-type amphiphilic molecules which integrate an azobenzene platform. Our hypothesis is that upon photoisomerization, the co-assembling properties with DNA will be altered and, consequently, the topology and transfection abilities of the nanocomplexes (Figure 1). We have synthesized and photophysically characterized a family of amphiphilic azobenzenes, which co-assembling in presence of pDNA has been fully scrutinized in terms of shape and size by different techniques. The formulation didn't show cytotoxicity and revealed *in vitro* photomodulated transfection capabilities.

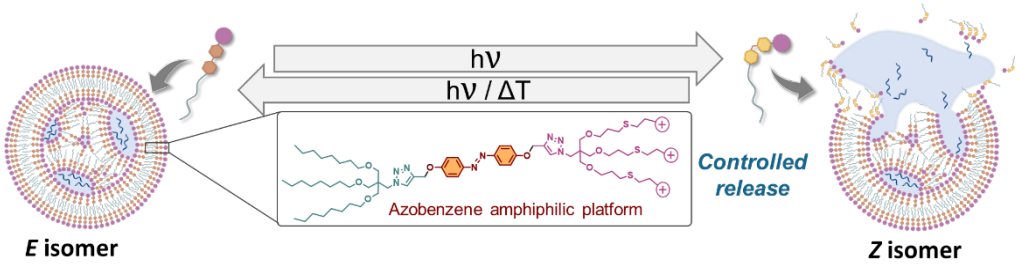


Figure 1. Scheme of the photocontrollable gene delivery systems.

[1] Kumar, R.; Chalarca, C. F. S.; Bockman, M. R.; Van Bruggen, C.; Grimme, C. J.; Dalal, R. J.; Hanson, M. G.; Hexum, J. K.; Reineke, T. M. Polymeric Delivery of Therapeutic Nucleic Acids. *Chem. Rev.* **2021**, *121*, 11527.
[2] Chittimalla, C.; Zammut-Italiano, L.; Zuber, G.; Behr, J. P. Monomolecular DNA nanoparticles for intravenous delivery of genes. *J. Am. Chem. Soc.* **2005**, *127*, 11436.
[3] Ortega-Caballero, F.; Santana-Armas, M. L.; Tros de Ilarduya, C.; Di Giorgio, C.; Tripier, R.; Le Bris, N.; Ollier, C.; Ortiz Mellet, C.; García Fernández, J. M.; Jiménez Blanco, J. L.; Mendez-Ardoy, A. Trehalose-polyamine/DNA nanocomplexes: impact of vector architecture on cell and organ transfection selectivity. *J. Mater. Chem. B.* **2024**, *12*, 3445.
[4] Rivero-Barbarroja, G.; Padilla-Pérez, M. C.; Maisonneuve, S.; García-Moreno, M. I.; Tiet, B.; Vocadlo, D. J.; Xie, J.; García Fernández, J. M.; Ortiz Mellet, C. sp^2-Iminosugar azobenzene O-glycosides: Light-sensitive glycosidase inhibitors with unprecedented tunability and switching factors. *Bioorg. Chem.* **2024**, *150*, 107555.

OC29

Towards the enzymatic labelling of oligonucleotides with triantennary *N*-acetyl galactosamine

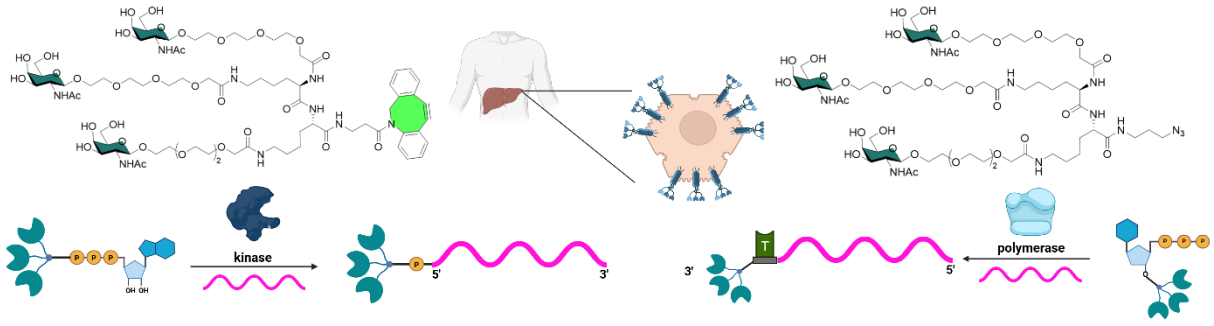
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Chemical modifications of oligonucleotides improve their resistance to nuclease-mediated degradation, enhance biological activity, and provide a degree of cellular delivery capacity. Among current delivery strategies, conjugation to triantennary *N*-acetylgalactosamine (GalNAc) ligands has proven highly effective for targeting hepatocytes. However, conventional methods for GalNAc conjugation are chemically complex, time-consuming, and require specialized equipment and/or expertise, limiting broader applicability.[1,2] To overcome these limitations, we investigated an enzymatic labeling approach to enable direct GalNAc conjugation to oligonucleotides in a sequence-independent manner. Two complementary strategies were explored. First, we synthesized a GalNAc-modified ATP by attaching the ligand to its γ-phosphate group, aiming to transfer it enzymatically to the 5′ end of oligonucleotides using kinases. Second, we designed a GalNAc-functionalized locked nucleic acid (LNA) nucleoside triphosphate, modified at the 3′ position, for incorporation at the 3′ end of oligonucleotides using template-independent polymerases.[3] Our results show that kinases exhibit poor tolerance to the bulky GalNAc modification located on ATP, preventing efficient transfer. In contrast, template-independent polymerases (such as terminal deoxynucleotidyl transferase) successfully incorporated the modified LNA nucleotide at the 3′ end of both DNA and RNA oligonucleotides without sequence constraints. This enzymatic strategy provides a promising, flexible alternative to conventional chemical conjugation methods and represents a first step toward the development of a universal, synthesis-free GalNAc-labeling platform for therapeutic oligonucleotides.[4]



[1] Engelhardt, D.; Nordberg, P.; Knerr, L.; Malins, L. R. *Angew. Chem. Int. Ed.* **2024**, *63* (49), e202409440.

[2] Tölke, A. J.; Gaisbauer, J. F.; Gärtner, Y. V.; Steigenberger, B.; Holovan, A.; Streshnev, F.; Schneider, S.; Müller, M.; Carell, T. *Angew. Chem. Int. Ed.* **2024**, *63* (25), e202405161.

[3] Bizat, P. N.; Sabat, N.; Hollenstein, M. *ChemBioChem.* **2025**, *26* (9), e202400987.

[4] Meron, E.; Bizat, P. N.; Simmons Hovorka, H.; Levi-Acobas, F.; Badji, Y.; Kitoun, C.; Sabat, N.; Hanlon, S.; Püntener, K.; Hollenstein, M. *ChemRxiv.* **2025**. DOI : 10.26434/chemrxiv-2025-808c6.

OC30

Photopharmacological tools with π-extended coumarins based on TAM kinase inhibitor UNC2025

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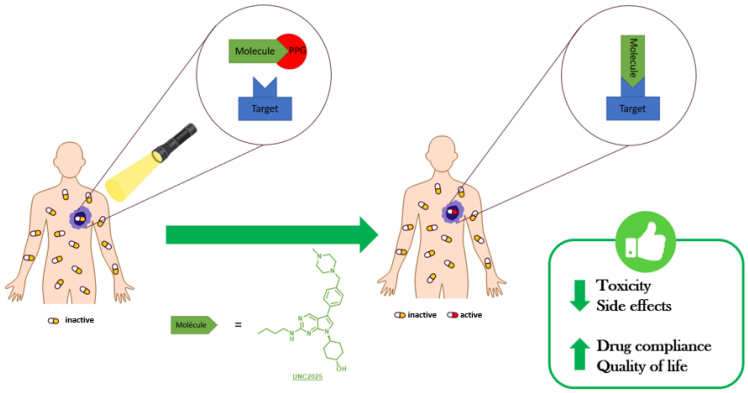
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Photopharmacology is an emerging therapeutic field that aims to control spatiotemporally drugs activity using light. Various strategies have been developed, including the photoremovable protecting groups (PPGs). This approach entails covalently attaching a photoremovable moiety to an active drug, which inactivates it. During light exposure, the PPG is cleaved, restoring the drug's initial activity. By triggering drug release through external stimuli, such processes enhance selectivity.[1] This study aims to synthesize photocleavable tyrosine kinase inhibitors as a therapeutic tool against cancer. These inhibitors target the TAM kinase family (Tyro3, Axl, and Mer), known to be overexpressed in several types of cancers. [2,3] They are based on the structure of a well-known inhibitor of this family, UNC2025.[4] To develop effective photocleavable inhibitors suitable for clinical use, the nature of PPG is crucial. Indeed, PPGs should absorb at the highest possible wavelength closest to the therapeutic window to ensure good penetration and low phototoxicity.[5] In this work, we describe the use of π-extended coumarins to afford photocleavable versions of UNC2025, which absorb in the visible light.



[1] M. Welleman, I.; et al. Photoresponsive Molecular Tools for Emerging Applications of Light in Medicine. *Chem. Sci.* **2020**, *11* (43), 11672–11691.

[2] Le Bescont, J.; et al. Photoactivatable Small-Molecule Inhibitors for Light-Controlled TAM Kinase Activity. *ChemPhotoChem* **2021**, *5* (11), 989–994.

[3] Breton-Patient, C.; et al. Light-Activatable Photocaged UNC2025 for Triggering TAM Kinase Inhibition in Bladder Cancer. *ChemBioChem* **2024**, *25* (8), e202300855.

[4] Zhang, W.; et al. UNC2025, a Potent and Orally Bioavailable MER/FLT3 Dual Inhibitor. *J. Med. Chem.* **2014**, *57* (16), 7031–7041.

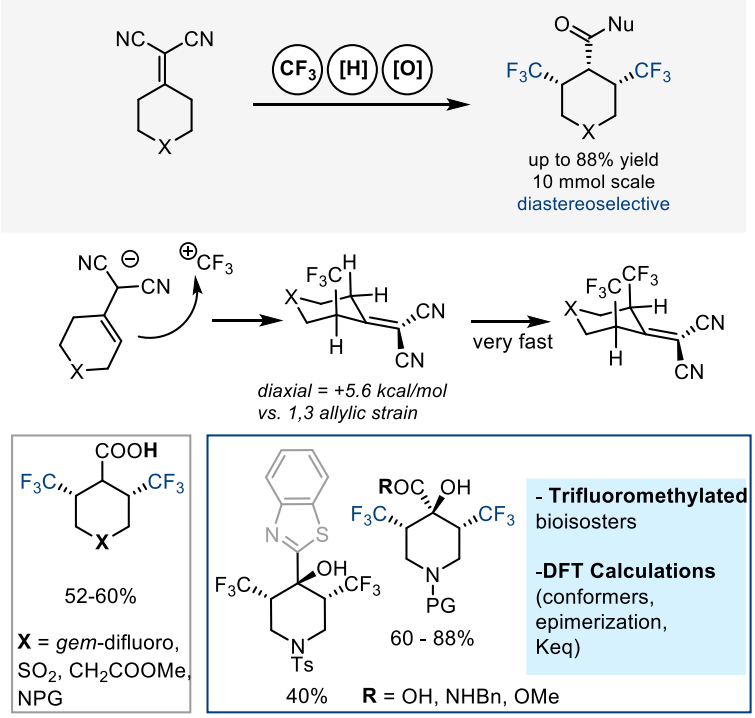
[5] Weinstain, R.; et al. Visible-to-NIR-Light Activated Release: From Small Molecules to Nanomaterials. *Chem. Rev.* **2020**, *120* (24), 13135–13272.

OC31

Synthesis of 1,3-bis-trifluoromethylated-(hetero)cyclohexane-2-carboxylates

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A syn-selective method for 1,3-bis-trifluoromethylation of (hetero)cycloalkylidene-malononitriles was scrutinized herein. The malononitrile-containing intermediate can be readily converted into carboxylates (and derivatives thereof) by oxidative decyanation. The products of this two-step sequence are 1,3-bis-trifluoromethylated, and thus physicochemically-altered, analogs of (hetero)cyclohexane-carboxylates commonly used as building blocks for drug synthesis. This study includes optimization of the bis-trifluoromethylation reaction, scope studies, synthesis of various new bis-trifluoromethylated (hetero)cycloalkane carboxylates, representative transformations relevant to pharmaceutical synthesis, mechanistic studies, and some computational analyses of the newly accessible scaffolds.[1]



[1] M. Mando, D. Smith, J.-N. Boyn, A. J. Grenning, *ChemRxiv* **2025**. 10.26434/chemrxiv-2025-bzjl4

OC32

Cycloadditions of 5-Vinyloxazolidine-2,4-diones: A Straightforward access to the (Thio)hydantoin Scaffold

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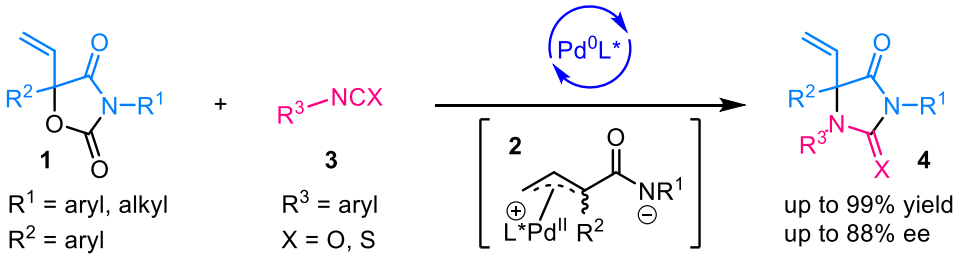
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Hydantoins are ubiquitous heterocycles in medicinal chemistry, and their imidazolidine-2,4-dione skeleton is encountered in natural products and many small-molecule drugs displaying a variety of biological activities such as mephenytoin (anticonvulsant), dantrolene (muscle relaxant), or sorbinil (aldose reductase inhibitor).[1a] Several synthetic pathways have been described for the formation of this moiety, but few strategies display the formation of enantioenriched hydantoins.[1b] Cycloaddition of transient zwitterionic π-allylpalladium^{II} complexes[2] could be a reliable strategy to access these important scaffolds.

Recently, our group and others have reported the synthetic potential of 5-vinyloxazolidine-2,4-diones (VOxD).[3] As a synthetic equivalent of the C-(C=O)-N synthon, VOxDs are a promising family of molecules to form the hydantoin skeleton. In the presence of a palladium catalyst, an oxidative addition and ring opening of VOxD **1** occurs, followed by a decarboxylation leading to the zwitterionic π-allylpalladium^{II} complex **2**, now able to react with an electrophilic cycloaddition partner. Herein, we describe a palladium-catalyzed cycloaddition between VOxD **1** and (thio)isocyanates **3** as electrophilic partner, allowing the enantioselective preparation of various hydantoin and thiohydantoin heterocycles **4**.[4]



[1] (a) Cho, S.; Kim, S.-H.; Shin, D. Recent Applications of Hydantoin and Thiohydantoin in Medicinal Chemistry. *Eur. J. Med. Chem.* **2019**, *164*, 517-545. (b) Konnert, L.; Lamaty, F.; Martinez, J.; Colacino, E. Recent Advances in the Synthesis of Hydantoins: The State of the Art of a Valuable Scaffold *Chem. Rev.* **2017**, *117*, 13757-13809.

[2] Niu, B.; Wei, Y.; Shi, M. Recent advances in annulation reactions based on zwitterionic π-allyl palladium and propargyl palladium complexes *Org. Chem. Front.* **2021**, *8*, 3475-3501.

[3] For selected publications: (a) Sculiller, A.; Casaretto, N.; Archambeau, A. Diastereo- and Enantioselective (3+2) Cycloaddition of a New Aza-π-Allylpalladium Zwitterionic Intermediate *J. Org. Chem.* **2023**, *88*, 9941-9945. (b) Roblin, A.; Casaretto, N.; Archambeau, A. Diastereo- and Enantioselective Palladium-Catalyzed Cycloadditions of 5-Vinyloxazolidine-2,4-diones with Electrophilic Imines *Org. Lett.* **2023**, *25*, 6453-6458. (c) Li, K.; Zhen, S.; Wang, W.; Du, J.; Yu, S.; Wi, Y.; Guo, H. Fungicide-inspired precursors of π-allylpalladium intermediates for palladium-catalyzed decarboxylative cycloadditions *Chem. Sci.* **2023**, *14*, 3024-3029.

[4] Busicchia, M.; Roblin, A.; Dubois, C.; Mekranter, N.; Casaretto, N.; Archambeau, A. Cycloadditions of 5-Vinyloxazolidine-2,4-diones: A Straightforward access to the (Thio)hydantoin Scaffold *J. Org. Chem.* **2024**, *89*, 12370-12377.

OC33

Light-Driven Synthesis of Diversely Substituted Indoles

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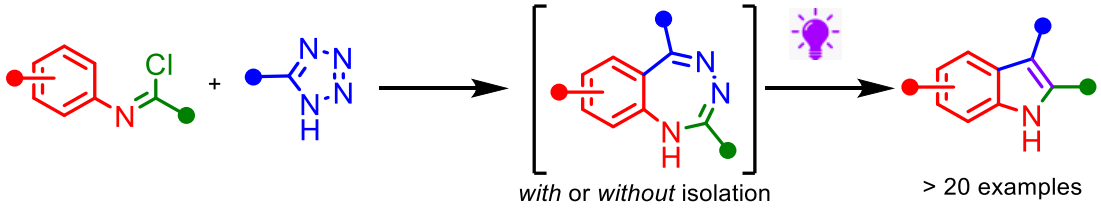
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Indoles represent one of the most important classes of heterocycles, widely present in natural products and pharmaceuticals.[1] Within this family, synthesis of 2,3-diaryl-substituted indoles remains particularly challenging. Conventional strategies often rely on transition-metal catalysis, which may suffer from regioselectivity issues, involve lengthy reaction sequences, or require complex starting materials.[2] Besides, skeletal editing has emerged as a powerful tool in organic synthesis, especially for medicinal chemistry, to access valuable architectures from existing scaffolds through single- or multi-atom deletion (ring contraction), insertion (ring expansion), or atom swapping.[3]

Inspired by recent advances in dinitrogen extrusion from organic molecules, we designed a strategy featuring a novel photochemical denitrogenative ring contraction of 1*H*-1,3,4-benzotriazepines, *in situ* generated from tetrazoles and imidoyl chloride.[4] The designed approach avoids the use of transition metals and proceeds without the need for external photosensitizers or photocatalysts.



- Simpe building blocks
- External-photosensitizer and photocatalyst-free
- Transition-metal free
- Mechanistic understanding

[1] Pravin, N. J.; Kavalapure, R. S.; Alegaon, S. G.; Gharge, S.; Ranade, S. D. Indoles as Promising Therapeutics: A Review of Recent Drug Discovery Efforts. *Bioorg. Chem.* **2025**, *154*, 108092.

[2] Neto, J. S. S.; Zeni, G. Recent Advances in the Synthesis of Indoles from Alkynes and Nitrogen Sources. *Org. Chem. Front.* **2019**, *7*, 155–210.

[3] (a) Jurczyk, J.; Woo, J.; Kim, S. F.; Dherange, B. D.; Sarpong, R.; Levin, M. D. Single-Atom Logic for Heterocycle Editing. *Nat. Synth* **2022**, 1, 352–364. (b) Sharma, R.; Arisawa, M.; Takizawa, S.; Salem, M. S. H. Remodelling Molecular Frameworks via Atom-Level Surgery: Recent Advances in Skeletal Editing of (Hetero)Cycles. *Org. Chem. Front.* **2025**, *12*, 1633–1670 and references therein.

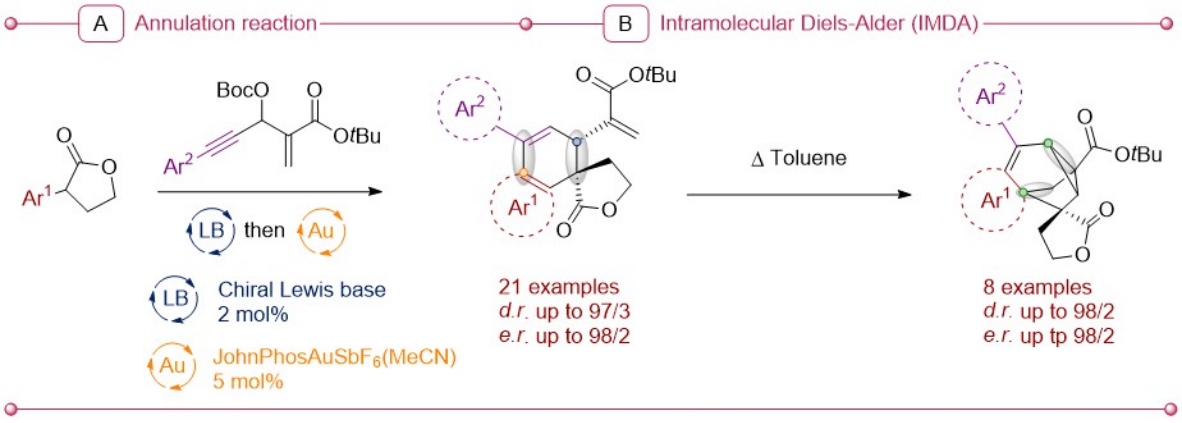
[4] Ruzhylo I.; Ferey, V.; Cruciani P.; Besset T., *unpublished results.*

OC34

Catalytic synthesis of highly functionalized chiral polycyclic compounds bearing quaternary stereocenters

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Merging organo- and gold-catalysis by sequential catalysis is a highly valuable approach for the synthesis of chiral complex molecules.[1] We will disclose a route to functionalized chiral heteroatomic polycyclic compounds leveraging these two unfriendly catalytic cycles in a one-pot sequential process. α-Heteroaromatic-γ-butyrolactones have been engaged in a highly stereoselective Lewis base asymmetric allylic alkylation with alkyne functionalized Morita-Baylis-Hillman carbonates. Gratefully to the low Lewis base catalyst loading, subsequent gold catalyzed Friedel-Crafts alkylation, entailing the formation of fused polycyclic compounds, can proceed efficiently leading to structurally complex products in high enantiomeric ratio (*Scheme 1.A*).[2]
These chiral polycyclic skeletons enable the Intramolecular Diels-Alder (IMDA) reaction, which provides a straightforward approach towards interesting tricyclo[3.2.1.0^{2,7}]octene[3] scaffolds containing five stereocenters, including two quaternary (*Scheme 1 B*).



Scheme 1. Catalytic synthesis of highly functionalized chiral polycyclic compounds bearing quaternary stereocenters.

[1] a) C. Pegu, B. Paroi, N.T. Patil. Enantioselective merged gold/organocatalysis. *Chem. Eur. J*. **2024**, *60*, 3607-3623 and references cited herein. b) C.C. J. Loh, J. Badorrek, G. Raabe, D. Enders. Merging organocatalysis and gold catalysis: enantioselective synthesis of tetracyclic indole derivatives through a sequential double Friedel-Crafts type reaction. *Chem. – Eur. J*., **2011**, 17, 13409-13414.
[2] R. Pereira, P. Locquet, A. Blanc, F. Grellepois, E. Riguet. Merging Enantioselective Lewis Base Organocatalysis and Gold(I) Catalysis: A One-Pot Access to Chiral-Fused Polycyclic Compounds. *Org. Lett.* **2025**, *90*. 3475-3479.
[3] a) M. Schneider, M. J. R. Richter, S. Krautwald, E. M. Carreira. Asymmetric Synthesis of the Tricyclooctane Core of Trachylobane Natural Products and Related Terpenoids. *Org. Lett.* **2019**, *21*, 8705-8707. b) S. N. Ng, C. M. Beaudry, D. Trauner. Intramolecular Diels-Alder reactions of 5-vinyl-1,3-cyclohexadienes. *Org. Lett.* **2003**, *5*, 1701-1704.

OC35

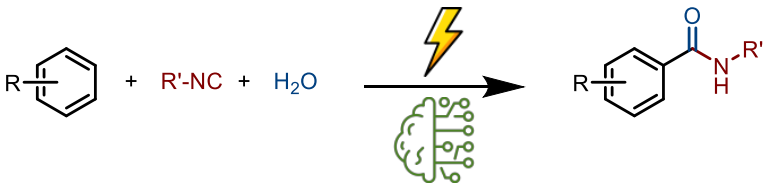
ML-guided Electrochemical Isocyanides-based Csp²-H carbamoylation of arenes

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Multicomponent reactions (MCRs) are powerful tools for constructing complex molecular scaffolds in an atom- and step-economical fashion. Among them, isocyanide-based multicomponent reactions (IMCRs) have gained prominence due to the ambiphilic nature of isocyanides.[1] In this field, we became involved in utilizing electrochemical methods to further expand the synthetic utility of IMCRs.[2,3,4]

Inspired by literature precedents,[5,6] we hypothesized that the electrochemical oxidation of arenes could generate highly reactive radical cations susceptible to be intercepted by an isocyanide. Building on this idea, we developed a novel route to aromatic amides through an electrochemical three-component C(sp²)–H carbamoylation of arenes. This electrosynthetic transformation required extensive optimization of many reaction parameters, providing an excellent platform to benchmark traditional human-led optimization against machine learning (ML)-assisted strategies.[7,8] Encouragingly, the ML-driven models not only improved reaction yield and robustness but also uncovered optimal conditions that challenged our previous understanding of electrochemical isocyanide IMCRs.

Overall, our work showcases how the synergy between electrosynthesis and AI can unlock new reactivity paradigms in multicomponent reactions, enabling the sustainable and efficient synthesis of high-value compounds. Importantly, these findings also underscore the influence of human bias in reaction optimization and highlight the potential of ML-driven strategies to transcend such limitations.



[1] For a recent reference on IMCR: Lejlogonolo, M. R.; Mabel, C. E. The vital use of isocyanide-based multicomponent reactions (MCR) in chemical synthesis. *Physical Sciences Reviews*. **2024**, *9*, 9951032.

[2] Pan, N.; Ling, J.; Zapata, R.; Pulicani, JP.; Grimaud, L.; Vitale, M. R. Electrochemical TEMPO-catalyzed multicomponent C(sp³)–H α-carbamoylation of free cyclic secondary amines *Green Chem.* **2019**, *21*, 6194−6199.

[3] Pan, N.; Xinen Lee, M.; Bunel, L.; Grimaud, L.; Vitale, M. R. Electrochemical TEMPO-Catalyzed Oxidative Ugi-Type Reaction. *ACS Org. Inorg. Au.* **2021**, *1*, 18−22.

[4] Simon, A.; Bachollet, S. P. J. T.; Pan, N.; Grimaud, L.; Vitale, M. R. Electromediated Alcohol-Based Passerini-Type Reaction. *Synlett*. **2025**, *14*, 2055−2059.

[5] Morofuji, T.; Shimizu, A.; Yoshida, JI. Electrochemical C–H Amination: Synthesis of Aromatic Primary Amines via N-Arylpyridinium Ions. *J. Am. Chem. Soc.* **2013**, *135*, 5000.

[6] Hayrapetyan, D.; Rit, R. J.; Kratz, M.; Tschulik, K.; Gooßen, L. J. Electrochemical C−H Cyanation of Electron-Rich (Hetero)Arenes *Chem. Eur. J.* **2018**, *24*, 11288.

[7] Shields, B. J.; Stevens, J.; Li, J.; Parasram, M.; Damani, F.; Martinez Alvarado, J. I.; Janey, J. M.; Adams, R. P.; Doyle, A. G. Bayesian reaction optimization as a tool for chemical synthesis. *Nature*, **2021**, 590, 89.

[8] Kastner, L.; Cuissart, B.; Lamotte, JL. BOWSA: A Contribution of Sensitivity Analysis to Improve Bayesian Optimization for Parameter Tuning. *Advances in Intelligent Data Analysis XXIII.* **2025**, 167−180.

OC36

Organocatalyzed Enantioselective Synthesis of *N* and *S*-Containing Chiral Heterocyclic Compounds

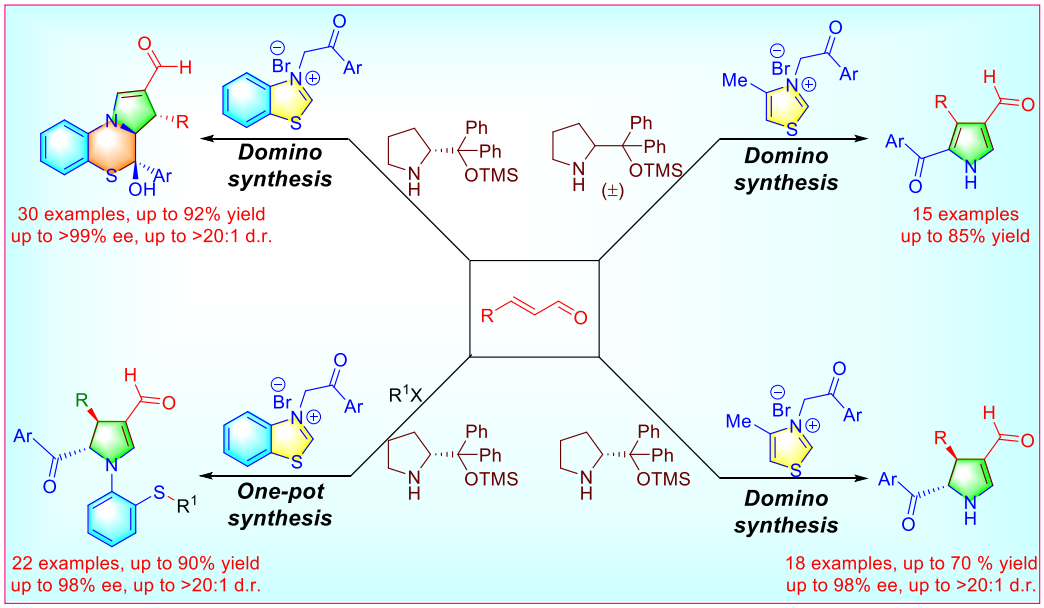
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Abstract: 1,3-Dipolar cycloaddition of azomethine ylides and dipolarophiles represents an effective approach for synthesizing diverse *N* and *S*-heterocyclic compounds.[1] Over the past decades, utilization of thiazolium and benzothiazolium azomethine ylides have been particularly prominent in the synthesis of heterocyclic compounds with multiple stereogenic centers *via* 1,3-dipolar cycloadditions in racemic form.[2] However, the enantioselective synthesis of chiral heterocyclic compounds and their derivatives are yet to be addressed with this framework. Our research endeavors to address this gap by developing a methodology for synthesizing chiral heterocyclic compounds containing multiple stereogenic centers, *via* 1,3-dipolar cycloaddition/rearrangement/ring-opening/ring-cleavage sequence. This work encompasses results including organocatalyzed (i) domino enantio- and diastereoselective synthesis of pyrrolo-thiazine-2-carbaldehydes[3]; (ii) one-pot enantioselective synthesis of tetrasubstituted dihydropyrrole-3-carbaldehydes[4]; (iii) domino synthesis of trisubstituted-1*H*-pyrrole-3-carbaldehydes; and (iv) domino enantioselective synthesis of chiral trisubstituted dihydro-1*H*-pyrrole-3-carbaldehydes[5] in Scheme 1.



Scheme 1. *Enantioselective synthesis of chiral heterocyclic compounds*

[1] Coldham, I.; Hufton, R. *Chem. Rev*. **2005**, *105*, 2765-2810.
[2] Sahoo, C. S.; Joshi, M.; Pan, S. C. *J. Org. Chem*. **2017**, *82*, 12763-12770.
[3] Pandidurai, S.; Kumar Choutipalli, V. S.; Subramanian, V.; Sekar, G. *Org. Lett*. **2024**, *26*, 2971-2975.
[4] Pandidurai, S.; Sekar, G. *Org. Biomol. Chem*. **2024**, *22*, 8119-8124.
[5] Pandidurai, S.; Chinababu, M.; Sekar, G. *Chem. Commun*. **2025**, *61,* 5806-5809.

OC37

Spirocyclisation and Subsequent Dyotropic rearrangement: A Sequential Route to the Synthesis of Exotines Scafold

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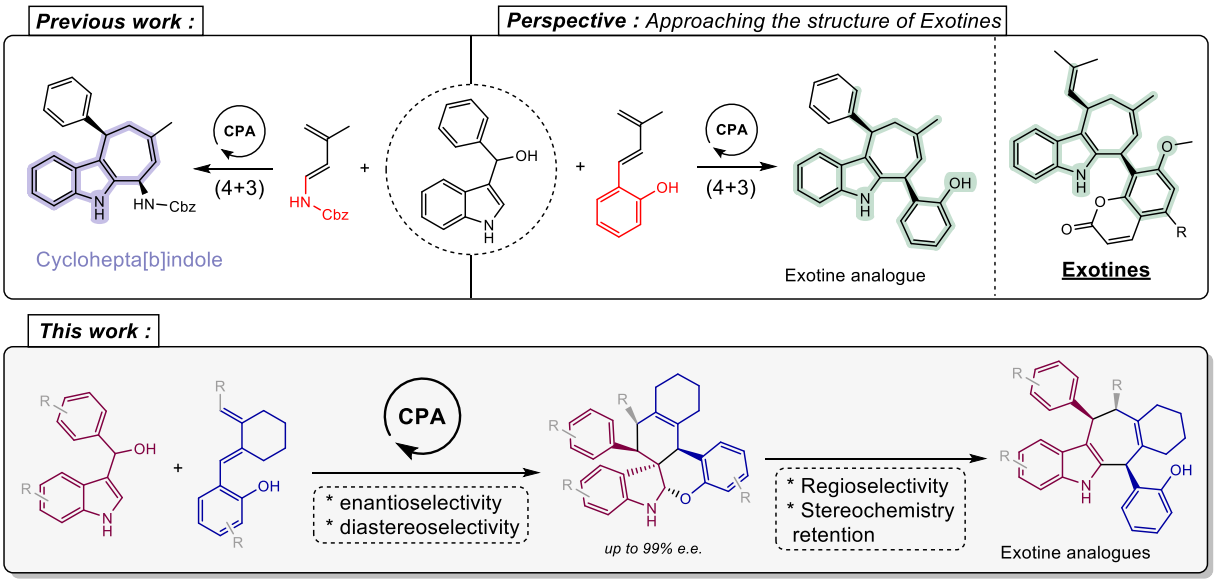
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Exotines are two natural products isolated from *Murraya exotica*, a plant native to Southeast Asia.[1] These compounds exhibit promising biological activity and feature a unique chiral cyclohepta[b]indole core, making them appealing targets for total synthesis. To date, two total syntheses have been reported, but none of them is enantioselective. [2,3]

Building on previous work from our team dealing with a chiral phosphoric acid (CPA)-catalysed asymmetric (4+3) cycloaddition of diene-carbamates to access the cyclohepta[b]indole scaffold,[4] we sought to adapt this methodology by replacing the carbamate with a phenol group to more closely mimic the natural product structure. Unexpectedly, the phenolic dienes did not undergo the anticipated (4+3) cycloaddition. Instead, they gave rise to a novel class of polycyclic compounds. Through extensive optimization, we developed an enantio- and diastereoselective version of this transformation, achieving full control over five stereogenic centers. Further investigation revealed that, under specific conditions, these polycyclic compounds could undergo a dyotropic rearrangement leading to the desired cyclohepta[b]indole core with complete regioselectivity and preservation of stereochemical information, ultimately providing access to Exotines analogues.



[1] Liu, B.-Y.; Zhang, C.; Zeng, K.-W.; Li, J.; Guo, X.-Y.; Zhao, M.-B.; Tu, P.-F.; Jiang, Y. *Org. Lett.* **2015**, *17* (17), 4380–4383.
[2] Cheng, B.; Volpin, G.; Morstein, J.; Trauner, D. *Org. Lett.* **2018**, *20* (14), 4358–4361.
[3] Lepovitz, L. T.; Martin, S. F. *J. Org. Chem.* **2021**, *86* (16), 10946–10953.
[4] Gelis, C.; Levitre, G.; Merad, J.; Retailleau, P.; Neuville, L.; Masson, G. *Angew. Chem. Int. Ed.* **2018**, *57* (37), 12121–12125.

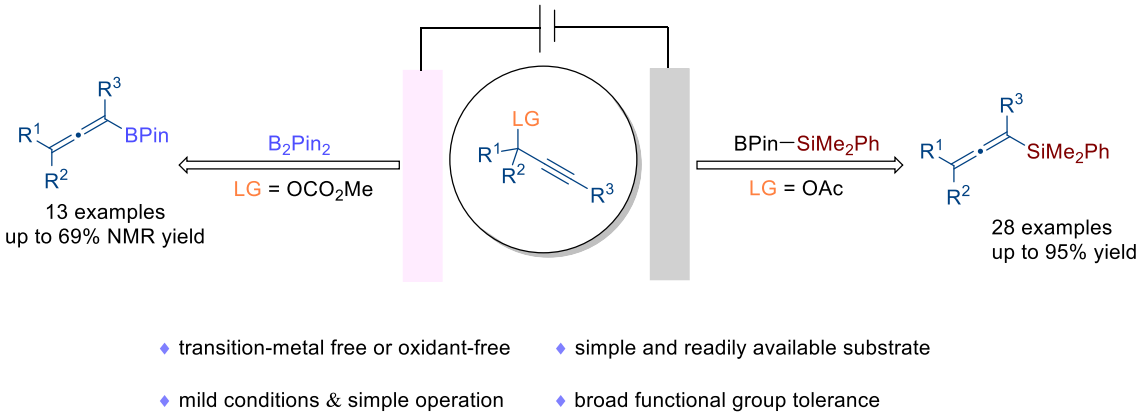
OC38

Electrochemical Synthesis of Allenyl Silanes and Allenyl Boronic Esters

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Allenyl silanes and boronates are pivotal building blocks in organic synthesis.[1,2] Nevertheless, their synthesis requires the manipulation of transition metal or highly reactive species. Hence, the development of more sustainable protocol is highly sought after. Here we show the electrochemical synthesis of allenyl silanes and allenyl boronic esters. This catalyst-free method proceeds under mild reaction conditions. The protocol for the synthesis of allenyl silanes shows an excellent efficiency and a good functional group tolerance. The allenyl silanes are isolated in good yields (28 examples, 45–95% yields) without the use of a transition metal catalyst and under mild reaction conditions. A similar protocol is developed for the synthesis of allenyl boronates, which are obtained in low to moderate yields (13 examples, 5–55% yields). Finally, a mechanism based on an oxidative generation of the silyl and boryl radicals is suggested to access these classes of allenes.

Figure 1. Electrochemical Synthesis of Allenyl Silanes and Allenyl Boronic Esters[3]



[1] Masse, C. E.; Panek, J. S. Diastereoselective reactions of chiral allyl and allenyl silanes with activated C=X bonds. *Chem. Rev*. **1995**, *95*, 1293-1316.

[2] (a) Yamashita, Y., Cui, Y., Xie, P.; Kobayashi, S. Zinc amide catalyzed regioselective allenylation and propargylation of ketones with allenyl boronate. *Org. Lett*. **2015**, *17*, 6042-6045. (b) Huang, A., Chakrabarti, N., Morita, U., Schneider, S.; Kobayashi, A. Catalytic asymmetric borono variant of Hosomi–Sakurai reactions with N,O-aminals. *Angew. Chem. Int. Ed*. **2011**, *50*, 11121-11124. (c) Wu, H., Haeffner, F.; Hoveyda, A. H. An efficient, practical, and enantioselective method for synthesis of homoallenylamides catalyzed by an aminoalcohol-derived, boron-based catalyst. *J. Am. Chem. Soc*. **2014**, *136*, 3780–3783.

[3] (a) Feng, T. T.; Biremond, T.; Jubault, P.; Poisson, T. Electrochemical synthesis of allenyl silanes and allenyl boronic esters. *Nat Commun.* **2025**, *16*, 4593; (b) Aelterman, M., Biremond, T., Jubault, P. Poisson, T. Electrochemical synthesis of *gem*-difluoro- and *γ*-fluoro-allyl boronates and silanes. *Chem. Eur. J*. **2022**, *28*, e202202194; (c) Aelterman, M., Sayes, M., Jubault, P. Poisson, T. Electrochemical hydroboration of alkynes. *Chem. Eur. J*. **2021**, *27*, 8277-8282; (d) Biremond, T., Jubault, P. Poisson, T. Electrochemical hydrosilylation of alkynes. *ACS Org. Inorg. Au*. **2022**, *2*, 148-152.

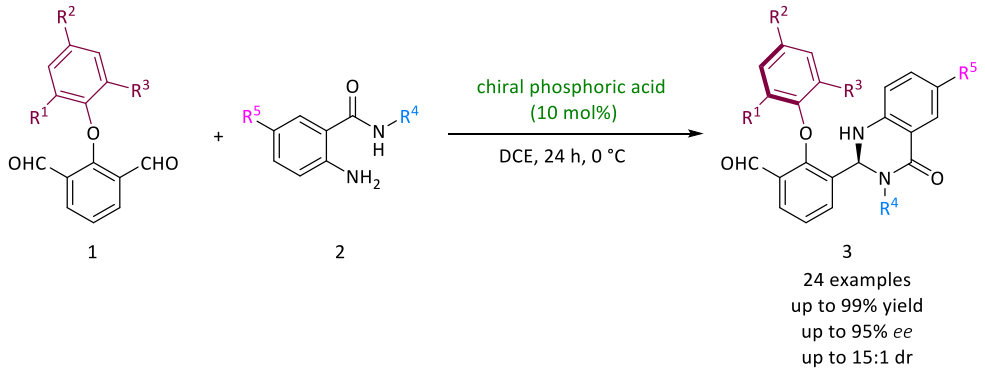
OC39

Controlling Multiple Stereogenicity in Diaryl Ethers

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Axially chiral compounds have received considerable interest from the chemical community due to their great success in the development of chiral ligands or organocatalysts for enantioselective synthesis.[1] They have also recently become increasingly prevalent in drug discovery, with many atropisomers currently undergoing clinical trials.[2] Among the various structural motifs encountered in biologically active compounds and pharmaceuticals, diaryl ethers and their related structures are particularly widespread.[3]

Recent advances in atroposelective synthesis have enabled access to diverse atropisomeric diaryl ethers with excellent control of axial chirality. However, the efficient construction of diaryl ethers bearing multiple stereogenic elements—axial-central, axial-axial, or axial-planar—remains a formidable synthetic challenge.[4] Herein, we developed an atroposelective synthesis of axially chiral diaryl ethers bearing an additional stereocenter, via an organocatalyzed condensation–cyclization of prochiral 2-phenoxyisophthalaldehyde derivatives with 2-aminobenzamides, enabled by a chiral phosphoric acid catalyst.[5] This strategy affords a series of diaryl ethers with good stereocontrol of axial–central chirality.



1 2 3

Scheme 1: Enantio- and diastereoselective synthesis of configurationally stable diaryl ethers

[1] Cheng, J. K.; Xiang, S.-H.; Li, S.; Ye, L.; Tan, B. Recent Advances in Catalytic Asymmetric Construction of Atropisomers. *Chem. Rev.* **2021**, *121*, 4805–4902.
[2] Basilaia, M.; Chen, M. H.; Secka, J.; Gustafson, J. L. Atropisomerism in the Pharmaceutically Relevant Realm. *Acc. Chem. Res.* **2022**, *55*, 2904–2919.
[3] Shee, S.; Shree Ranganathappa, S.; Gadhave, M. S.; Gogoi, R.; Biju, A. T. Enantioselective Synthesis of C−O Axially Chiral Diaryl Ethers by NHC-Catalyzed Atroposelective Desymmetrization. *Angew. Chem. Int. Ed.* **2023**, *62*, e202311709.
[4] Naghim, A.; Rodriguez, J.; Chuzel, O.; Chouraqui, G.; Bonne, D. Enantioselective Synthesis of Heteroatom-Linked Non-Biaryl Atropisomers. *Angew. Chem. Int. Ed.* **2024**, *63*, e202407767.
[5] Controlling Multiple Stereogenicity in Diaryl Ethers, A. Naghim, P. Solai, J.-V. Naubron, S. Chentouf, J. Rodriguez, O. Chuzel, G. Chouraqui, D. Bonne, *Submitted*.

OC40

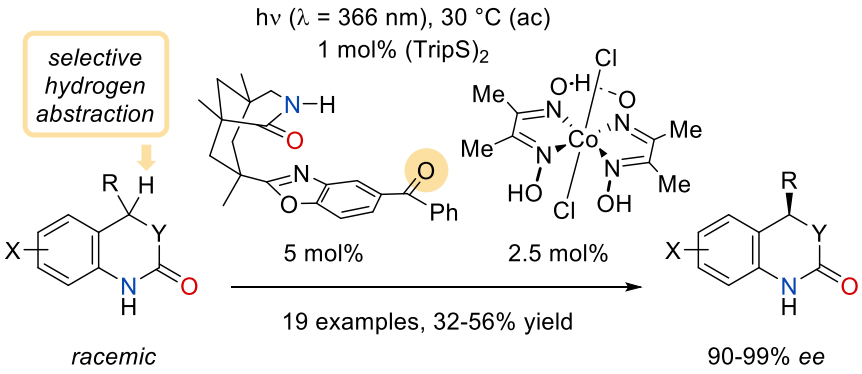
Kinetic Resolution of Heterocyclic Lactams by a Photocatalytic Cobalt-Catalyzed Dehydrogenation

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Chiral heterocyclic lactams have been kinetically resolved in a photochemical process that involves selective hydrogen abstraction by a chiral benzophenone catalyst.[1] Recognition of one enantiomer is achieved by a two-point hydrogen bonding interaction that directs the reactive carbonyl group of the photocatalyst to the C–H bond at the stereogenic center within the lactam.[2] The generated radical is converted to an oxidized product in a cobaloxime-catalyzed dehydrogenation reaction.[3] The unreactive enantiomer is retained and isolated in enantiomerically enriched form (21 examples, 31–56% yield, 90–99% ee). This dual-catalytic platform integrates asymmetric photochemistry with transition-metal catalysis, offering a novel pathway for the selective functionalization of challenging substrates. The combination of detailed mechanistic elucidation with demonstrated synthetic applications highlights the broad potential and academic significance of this methodology in organic synthesis.



[1] Zhou, C.; Bach, T. Kinetic Resolution of Heterocyclic Lactams by a Photocatalytic Cobalt-Catalyzed Dehydrogenation. *J. Am. Chem. Soc.* **2025**, *147*, 25148–25152.

[2] Großkopf, J.;Bach, T. Catalytic Photochemical Deracemization via Short-Lived Intermediates. *Angew. Chem., Int. Ed.* **2023**, *62*, e202308241

[3] Zhou, M.-J.; Zhang, L.; Liu, G.; Xu, C.; Huang, Z. Site-Selective Acceptorless Dehydrogenation of Aliphatics Enabled by Organophotoredox/Cobalt Dual Catalysis. *J. Am. Chem. Soc.* **2021**, *143*, 16470–16485

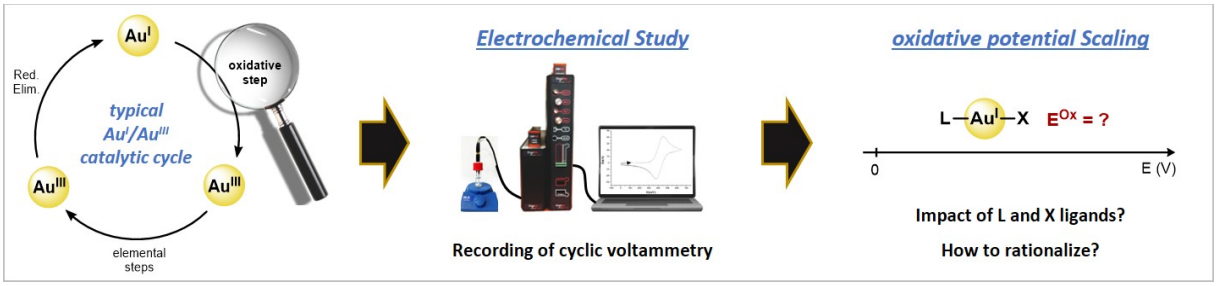
OC41

An Electrochemical Study of Catalytically Relevant Gold Complexes

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Gold catalysis has long been dominated by the ability of gold(I) to activate unsaturated systems as a carbophilic Lewis acid.[1] However, recent advances have highlighted the significance of Au(I)/Au(III) redox transitions, unlocking new catalytic pathways.[2] Among the strategies facilitating these oxidative processes, electrochemical anodic oxidation has emerged as a powerful tool.[3] Despite its potential, the electrochemical properties of key gold complexes remain largely underexplored. In this study, we prepared a series of gold complexes and systematically investigate their oxidative behavior using cyclic voltammetry. We thus established key trends based on the nature of the ligands involved. These findings provide fundamental insights into the redox properties of gold complexes, offering valuable guidelines for the design of new gold-catalyzed transformations.[4]



[1] a) Zhang, L.; Sun, J.; Kozmin, S. A.; *Adv. Synth. Catal.* **2006**, *348*, 2271-2296; b) Hashmi, A. S. K. *Top. Organomet. Chem.* **2013**, *44*, 143-164; c) Toste, F. D.; Michelet, V. *Gold Catalysis*, Vol. 13, Imperial College Press, 2014; d) Dorel, R.; Echavarren, A. M. *Chem. Rev.* **2015**, *115*, 9028-9072; e) Reyes, R. L.; Iwai, T.; Sawamura, M. *Chem. Rev.* **2021**, *121*, 8926-894.

[2] a) Huang, B.; Hu, M.; Toste, F. D. *Trends Chem.* **2020**, *2*, 707-720; b) Fricke, C.; Reid, W. B.; Schoenebeck, F. *Eur. J. Org. Chem.* **2020**, *2020*, 7119-7130; c) Bhoyare, V. W.; Tathe, A. G.; Das, A.; Chintawar, C. C.; Patil, N. T. *Chem. Soc. Rev.* **2021**, *50*, 10422-10450; d) Font, P.; Valdés, H.; Ribas, X. *Angew. Chem. Int. Ed.* **2024**, *63*, e202405824.

[3] Kumar, A.; Bhattacharya, N.; Patil, N. T. *ChemCatChem* **2024**, *16*, e202401112.

[4] Baubiat, E.; Vo, N. H. H.; Olivero, S.; Michelet V.; Melot R. *Angew. Chem. Int. Ed.* **2025**, *64*, e202509683

OC42

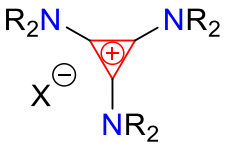
Towards New Organic Posolytes Based on Imidazolium Cores

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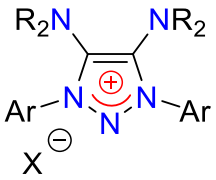
Redox-flow batteries (RFBs) are promising technologies for large-scale energy storage, but their deployment remains hindered by the lack of efficient high-potential posolytes. In aqueous media, the narrow electrochemical window limits the accessible cell voltage, while in non-aqueous solvents, the design of stable, soluble, and reversible redox-active electrolytes (posolytes) above +0.8 V vs Fc/Fc^+ is still a major challenge.[1]

To address this limitation, cationic cycles have recently emerged as a powerful strategy to raise oxidation potentials while stabilizing the corresponding radical dications through charge delocalization. Notably, triaminocyclopropenium salts (**A**) have demonstrated reversible oxidation above +0.8 V vs Fc/Fc^+,[2] while more recent nitrenium derivatives (**B**) have showcased bipolar redox behavior,[3] enabling symmetric cells with voltages up to 3.5 V. These pioneering results highlight the potential of conjugated cationic scaffolds as next-generation posolytes.

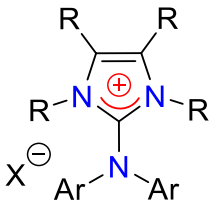
In this communication, we present our ongoing work on 2-(diarylamino)imidazolium-derived cationic frameworks (**C**).[4] Their modular design offers wide structural diversity, allowing us to probe how steric and electronic effects influence redox behavior and radical stabilization. Preliminary electrochemical investigations already point to promising reversible oxidations at high potential, positioning these scaffolds as potential candidates for next-generation posolytes in non-aqueous RFBs.



(**A**)



(**B**)



(**C**)

[1] Shoaib, M.; Vallayil, P.; Jaiswal, N.; Iyapazham Vaigunda Suba, P.; Sankararaman, S.; Ramanujam, K.; Thangadurai, V. Advances in Redox Flow Batteries – A Comprehensive Review on Inorganic and Organic Electrolytes and Engineering Perspectives. *Adv. Energy Mater.* **2024**, *14* (32), 2400721.
[2] Sevov, C. S.; Samaroo, S. K.; Sanford, M. S. Cyclopropenium Salts as Cyclable, High-Potential Catholytes in Nonaqueous Media. *Adv. Energy Mater.* **2017**, *7* (5), 1602027.
[3] Varenikov, A.; Gandelman, M.; Sigman, M. S. Development of Modular Nitrenium Bipolar Electrolytes for Possible Applications in Symmetric Redox Flow Batteries. *J. Am. Chem. Soc.* **2024**, *146* (28), 19474–19488.
[4] Manuscript under preparation.

OC43

Development of Pyrroloquinolone-Based Push-Pull Fluorescent Dyes

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Keywords: Donor-π-Acceptor architecture, pyrroloquinolone, internal charge transfer

Summary: In a Donor-π-Acceptor molecular architecture, often abbreviated **D-π-A**, a donor moiety **D** is linked to an acceptor moiety **A** via an intermediate **π**-conjugated bridge. This arrangement can promote the phenomenon of internal charge transfer (**ICT**), the flow of electrons from a donor moiety (**D**) to an acceptor moiety (**A**) through the conjugated bridge.[1]

By adjusting the properties of the donor and acceptor units, the molecule's photophysical characteristics can be optimized for various applications. Donor-acceptor dyes are relevant structures for preparing fluorescent compounds with large Stokes shifts, preventing effects like self-absorption. A key challenge in this field is designing fluorescent molecules with zero overlap between their absorption and emission spectra.[2] In our project, pyrroloquinolone was chosen as the central aromatic motif linking the D and A units.

The synthesis of these molecular architectures (D-π-A), their photophysical properties, and the time-dependent density functional theory (TD-DFT) calculations will be presented in this communication.

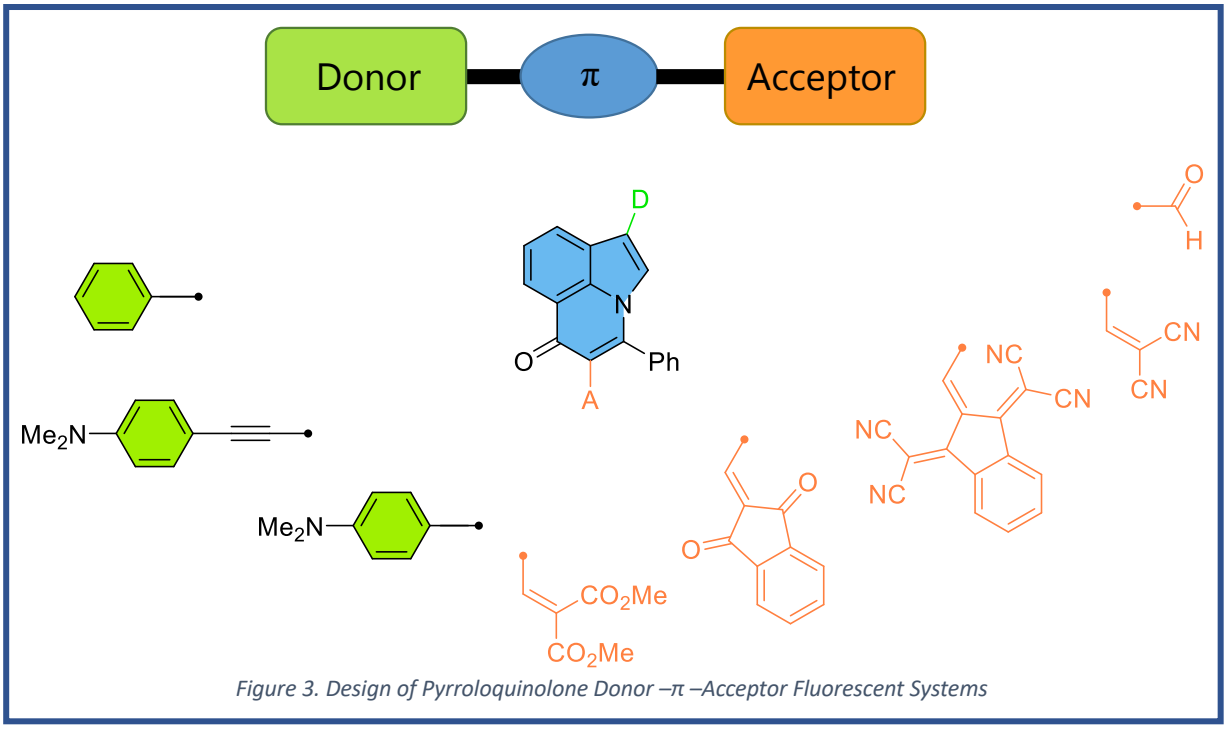


Figure 3. Design of Pyrroloquinolone Donor –π –Acceptor Fluorescent Systems

[1] Rational Design of Push–Pull Fluorene Dyes: Synthesis and Structure–Photophysics Relationship. *Chem. – Eur. J.* **2016**, *22* (30), 10627–10637.

[2] Zero-Overlap Fluorophores for Fluorescent Studies at Any Concentration. *J. Am. Chem. Soc.* **2020**, *142* (28), 12167–12180

OC44

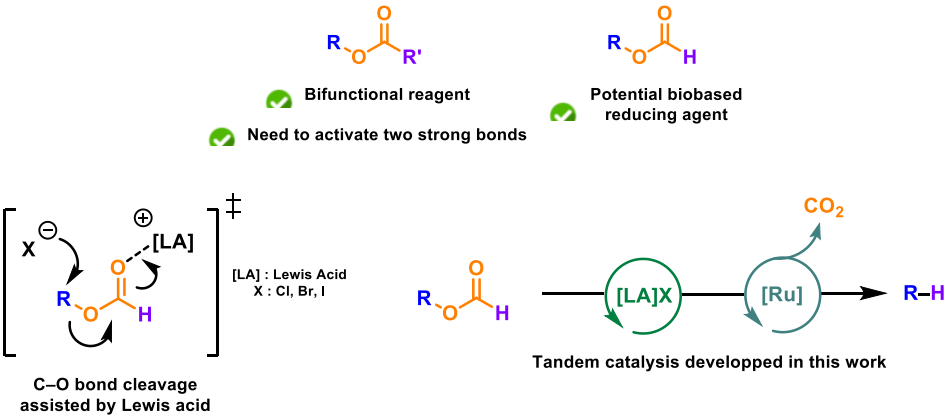
σ C–O bond cleavage and protodecarboxylation of formates

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The mitigation of climate change and the transition from petroleum feedstock to biorenewable carbon sources are challenging for academia and industry. This is partly because of the oxidation state, due to the high number of O atoms, and functionalization differences in petroleum and bio-based carbon. Thus, to accomplish this change of paradigm, chemists need to find new catalytic systems able to cleave σ C–O bonds and defunctionalize biomass to unlock its use as a starting material.[1,2]

Esters can be readily available or synthesized from biomass. From a reactivity point of view, they are interesting compounds as they can be considered, upon CO_2 extrusion, as bifunctional reagents with both a nucleophilic and an electrophilic moiety.[3] However, such use is currently restricted to allyl and benzyl esters bearing an activated C–O bond.[4,5,6]

To expand the scope of this strategy to alkyl esters, the activation of their strong σ C–O bond is critical. In this work, we demonstrate that catalytic Lewis acidic salts enable this strategic cleavage and are compatible with organometallic catalysts, able to perform the subsequent decarboxylation. This tandem catalysis unlocks the decarboxylative recombination of formate esters, thereby providing a deoxygenation pathway of alcohols to alkanes, using formic acid as a reducing agent.



[1] Das Neves Gomes, C., Jacquet, O., Villiers, C., Thuéry, P., Ephritikhine, M., Cantat, T., A Diagonal Approach to Chemical Recycling of Carbon Dioxide: Organocatalytic Transformation for the Reductive Functionalization of CO_2. *Angew. Chem. Int. Ed*., **2012** (51), 187-190. https://doi.org/10.1002/anie.201105516

[2] Bender, T.A., Dabrowski, J.A., Gagné, M.R. Homogeneous catalysis for the production of low-volume, high-value chemicals from biomass. *Nat Rev Chem*, **2018**, 35–46, https://doi.org/10.1038/s41570-018-0005-y

[3] Huang, HM., Bellotti, P., Ma, J., Dalton T., Glorius F., Bifunctional reagents in organic synthesis. *Nat Rev Chem, **2021*** (5), 301–321. https://doi.org/10.1038/s41570-021-00266-5

[4] Weaver JD, Recio A 3rd, Grenning AJ, Tunge JA. Transition metal-catalyzed decarboxylative allylation and benzylation reactions. *Chem Rev*. **2011** (111), 1846-913. https://doi.org/10.1021/cr1002744

[5] Shang, R., Liu, L. Transition metal-catalyzed decarboxylative cross-coupling reactions. *Sci. China Chem.,* **2011** (54), 1670–1687. https://doi.org/10.1007/s11426-011-4381-0

[6] E. Crochet, L. Anthore-Dalion, T. Cantat, Alkyl Formates as Transfer Hydroalkylation Reagents and Their Use in the Catalytic Conversion of Imines to Alkylamine, *Angew. Chem. Int. Ed.* **2023** (62), e202214069. https://doi.org/10.1002/anie.202214069

OC45

Silicon-Assisted Sustainable Gold(I)-Catalysis

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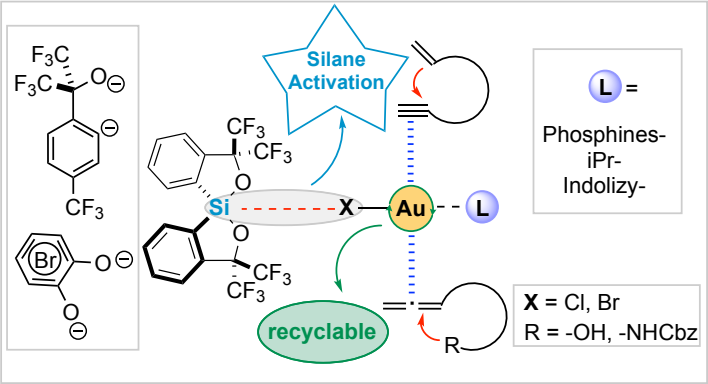
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Undoubtedly, π-activation of C–C double and triple bonds by noble metals[1] especially cationic gold(I) catalysts[2] has enabled numerous valuable transformations, with applications spanning complex natural product synthesis,[3] asymmetric catalysis,[4] and materials science.[5] This work shows that spirosilane Lewis acids can replace silver salts to activate gold precatalysts, enabling a broad range of cyclization, cycloisomerization, and intermolecular reactions. NMR and computational studies reveal activation via Si···Cl interaction rather than full cationization, which preserves the Au–Cl bond and allows catalyst recovery. The close silane - gold proximity not only enhances asymmetric induction but also supports more sustainable gold catalysis, positioning silicon-based Lewis acids as versatile cooperative agents in organometallic chemistry.



[1] Fürstner, A.; Davies, P. W. Catalytic Carbophilic Activation: Catalysis by Platinum and Gold π Acids. *Angew. Chem. Int. Ed.* **2007**, *46*, 3410-3449.

[2] (a) Michelet, V.; Toste, F. D., Eds. *Homogenous Gold Catalysis*; Imperial College Press: London, **2014**. (b) Hashmi, A. S. K.; Toste, F. D., Eds. *Modern Gold Catalysis: Synthesis*; Wiley: Hoboken, **2012**. (c) Fensterbank, L.; Malacria, M. Molecular Complexity from Polyunsaturated Substrates: The Gold Catalysis Approach. *Acc. Chem. Res.* **2014**, *47*, 953–965. (d) Dorel, R.; Echavarren, A. M. Gold(I)-Catalyzed Activation of Alkynes for the Construction of Molecular Complexity. *Chem. Rev.* **2015**, *115*, 9028–9072. (e) Campeau, D.; León Rayo, D. F.; Mansour, A.; Muratov, K.; Gagosz, F. Gold-Catalyzed Reactions of Specially Activated Alkynes, Allenes, and Alkenes. *Chem. Rev.* **2021**, *121*, 8756–8867. (f) Chintawar, C. C.; Yadav, A. K.; Kumar, A.; Sancheti, S. P.; Patil, N. T. Divergent Gold Catalysis: Unlocking Molecular Diversity through Catalyst Control *Chem. Rev.* **2021**, *121*, 8478–8558.

[3] Pflästerer, D.; Hashmi, A. S. K. Gold Catalysis in Total Synthesis – Recent Achievements. *Chem. Soc. Rev.* **2016**, *45*, 1331–1367.

[4] Zi, W.; Toste, F. D. Recent Advances in Enantioselective Gold Catalysis. *Chem. Soc. Rev.* **2016**, *45*, 4567–4589.

[5] (a) Nzulu, F.; Bontemps, A.; Robert, J.; Barbazanges, M.; Fensterbank, L.; Goddard, J.-P.; Malacria, M.; Ollivier, C.; Petit, M.; Rieger, J.; Stoffelbach, F. Gold-Catalyzed Polymerization Based on Carbene Polycyclopropanation. *Macromolecules* **2014**, *47*, 6652–6656. (b) Hendrich, C. M.; Sekine, K.; Koshikawa, T.; Tanaka, K.; Hashmi, A. S. K. Homogeneous and Heterogeneous Gold Catalysis for Materials Science. *Chem. Rev.* **2021**, *121*, 9113–9163.

OC46

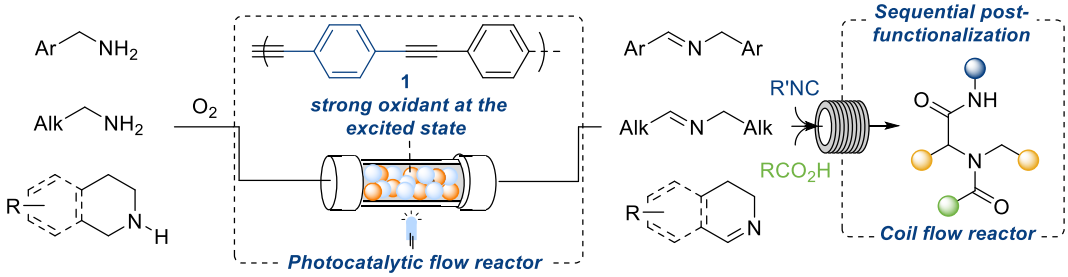
Heterogeneous Photocatalysis in Flow for Applications in Organic Synthesis

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Over the last two decades, photoredox catalysis has become a powerful and versatile synthetic tool that provides chemists with a milder way to do radical chemistry. What with the sky-high costs and poor recyclability of the commonly-used Ru and Ir-based homogeneous photocatalysts,[1] there is a growing need to find more sustainable replacements.

Developing easily recyclable organic heterogeneous photocatalysts could be a promising solution. However, heterogeneous catalysts being mostly opaque, their activity as photoactive species can be drastically limited. Today, the most elegant solution to deal with this problem is to use solid-state semiconductors as heterogeneous photocatalysts. Under light irradiation, appropriately designed semiconductors can reach an electronically excited state that triggers redox events throughout the whole solid-state species.[2] Despite these promising properties, such heterogeneous photocatalysts are often shunned by organic chemists because of the absence of commercial availability and, crucially, the lack of rational behind their reactivity.

Trying to address these issues, this presentation will focus on the synthesis, characterization and use of a simple linear conjugated polymer, poly-(*p*-phenyleneethynelene) (**1**), which displays strong single-electron oxidative properties at the excited state. This reactivity will be showcased in the aerobic oxidation of amines into imines in batch and flow reactors.[3] Finally, in-line post-functionalizations that access bioactive compounds via a telescoped 3-CR Ugi process[4] will be presented.[5]



[1] a) Nicewicz, D. A.; MacMillan, D. W. C. Merging Photoredox Catalysis with Organocatalysis: The Direct Asymmetric Alkylation of Aldehydes. *Science* **2008**, *322*, 77-80. b) Ischay, M. A.; Anzovino, M. E.; Du, J.; Yoon, T. P. Efficient Visible Light Photocatalysis of [2+2] Enone Cycloadditions. *J. Am. Chem. Soc.* **2008**, *130*, 12886-12887.
[2] Savateev, A.; Antonietti M. Heterogeneous Organocatalysis for Photoredox Chemistry. *ACS Catalysis* **2018**, *8*, 9790-9808.
[3] Beatty, J. W.; Stephenson, C. R. J. Amine Functionalization via Oxidative Photoredox Catalysis: Methodology Development and Complex Molecule Synthesis. *Acc. Chem. Res.* **2015**, *48*, 1474-1484.
[4] Ngouansavanh, T.; Zhu, J. IBX-Mediated Oxidative Ugi-Type Multicomponent Reactions: Application to the N and C1 Functionalization of Tetrahydroisoquinoline. *Angew. Chem. Int. Ed.* **2007**, *46*, 5775-5578.
[5] Weyl, B.; Goujon, G.; Raggio, L.; Demey, E.; Vinh, E.; d'Espinose de Lacaillerie, J.-B.; Krafft, J.-M.; Laroche, B. Visible Light Excitation of Poly-(*para*-Phenylene Ethynylene) Enables Heterogeneous Photocatalytic Oxidations of Amines in Flow. *Angew. Chem. Int. Ed.* **2025**, *64*, e202419169.

OC47

B_2pin_2-mediated Ligand Deprotonation Enables Selective Iridium-catalyzed C-H Borylations Revealed by Click Ligands

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Iridium-catalyzed C-H bond borylation reactions have revolutionized the way of conceiving chemical synthesis by providing step- and atom-economy methodologies using bench stable boron precursors such as bis(pinacolato)diboron(B_2pin_2).[1] Indeed, the access to boron-containing building blocks is highly attractive since straightforward post-modifications can lead to new carbon-carbon and carbon-heteroatom bond formations. Iridium-catalyzed C-H borylation of aromatics have been developed and the regioselectivity is controlled by the steric and electronic nature of the substrate as pioneered by Hartwig.[2] To bypass the inherent reactivity of iridium at sterically accessible sites, catalyst-to-substrate coordination appears as a promising strategy.[3] For that, well-defined, and typically sensitive, anionic ligands have been developed in order to form catalytically active iridium species allowing substrate-coordination towards proximal selectivity.[4] Herein, we present a fundamentally new approach in which the anionic ligand forms *in situ* upon reaction of the iridium pre-catalyst with the boron reagent B_2pin_2. This new action mode has been exploited to control the regioselectivity in unbiased substrates that impose selectivity issues when using standard iridium catalysts. As such, these results disclose the manifold role of B_2pin_2 and rises questions about previous, postulated action modes[5] in which the ligand could eventually *in situ* switch from neutral to anionic during the catalysis.

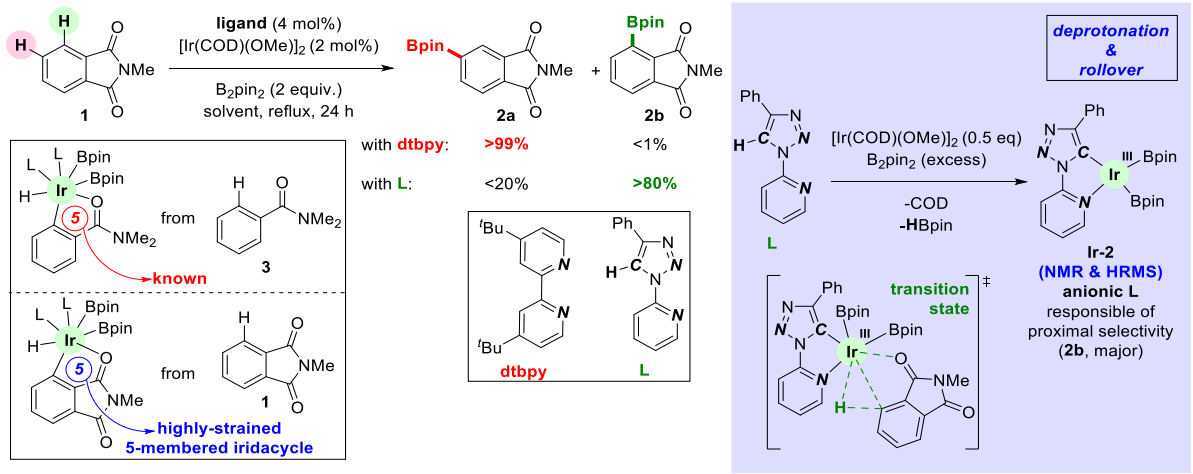


Figure 1 *Click ligands enabling proximal C-H bond borylation selectivity via a unique action mechanism mediated by B_2pin_2*

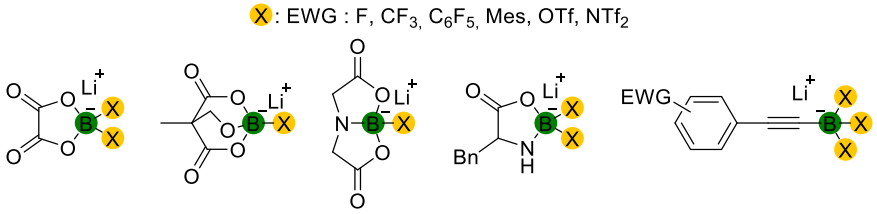
[1] R. Bisht, C. Haldar, M. M. M. Hassan, E. M. Hoque, J. Chaturvedi, B. Chattopadhyay, *Chem. Soc. Rev.* **2022**, *51*, 5042.
[2] R. J. Oeschger, M. A. Larsen, A. Bismuto, J. F. Hartwig, J. Am. Chem. Soc. 2019, 141, 16479.
[3] E. Hoque, M. M. M. Hassan, B. Chattopadhyay, J. Am. Chem. Soc. 2021, 143, 5022.
[4] G. Wang, L. Liu, H. Wang, Y.-S. Ding, J. Zhou, S. Mao, P. Li, J. Am. Chem. Soc. 2017, 139, 91.
[5] D. Marcos-Atanes, C. Vidal, C. D. Navo, F. Peccati, G. Jiménez-Osés, J. L. Mascareñas, Angew. Chem. Int. Ed. 2023, 62, e202214510.

OC48

Toward fluorine-free weakly coordinating borate anions for lithium-ion batteries, ionic liquids and catalysis

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Borate anions are increasingly used for the development of ionic liquids used as green solvents in organic synthesis, for the design of new electrolyte for lithium ions batteries, as well as in the context of the identification, isolation and stabilization of very strong electrophiles and superelectrophiles.[1] While the current tendency is to increase the number of fluorine atoms to design new anions, our goal is to develop non-fluorinated anions with good properties for these different applications.
In this presentation, the challenges in the synthesis and characterization of novel boronated salts will be discussed. Comprehensive solution and solid-state characterizations by NMR spectroscopy and XRD analysis combined with quantum chemical calculations will help to discover the optimal structures, while electrochemical and stability tests will enable to compare the new anions to well-known anions such as BF_4^- and $B(C_6F_5)_4^-$.[2,3]



Overview of interesting non-coordinating lithium borate ion

We will particularly focus on the synthesis of completely new or almost unexplored families of anions, such as amino acid–borate derivatives. Remarkably, we report the first X-ray crystal structure of an amino acid–BF_2 borate anion, providing key structural insight into this class of compounds. The photochemical generation of other cyclic borate anions containing a boron atom constrained in small heterocycles (three to four membered rings) is under investigation, and we will study variations in redox potentials as a function of cycle size and of the counter-ion (Li^+, Na^+, K^+ and Mg^{2+}).[4] Complementary NMR studies for the borate lithium salt obtention by deprotonation will further elucidate their reactivity and stability.
In parallel, theoretical calculations (thanks to a collaboration with the LCMFM team) suggest that five- versus six-membered ring motifs could play a decisive role in ion transport and stability, providing a rational design basis for accessing new class of performant fluorine-free anions. Overall, this work aims to develop non-coordinating non-fluorinated borate anions of interest in several fields of chemistry ranging from ionic liquids, electrolytes and organic catalysis.

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[1] Nobel prize in chemistry: A. Fernholm, the Royal Swedish Academy of Sciences, 2019.
[2] Zuo, X.; Fan, C.; Xiao, X.; Liu, J.; Nan, J. High-Voltage Performance of LiCoO2/Graphite Batteries with Methylene Methanedisulfonate as Electrolyte Additive. *Journal of Power Sources* **2012**, *219*, 94–99.
[3] Kong, X.; Zhou, R.; Wang, J.; Zhao, J. An Effective Electrolyte Strategy To Improve the High-Voltage Performance of $LiCoO_2$ Cathode Materials. *ACS Appl. Energy Mater.* **2019**, *2*, 4683–4691.
[4] Kropp, M. A.; Schuster, G. B. 1,1,2,3-Tetraphenylboratirene: First Isolation and Characterization of a Boratirene. *J. Am. Chem. Soc.* **1989**, *111* (6), 2316–2317.

OC49

Dication disulfuranes as photoactivatable sources of radical organocatalysts

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Covalent radical catalysis (CoRC) harnesses organic open-shell species to activate unsaturated bonds, providing powerful opportunities for synthetic chemistry.[1] Its broader development, however, has been hampered by difficulties in generating catalytic species *in situ* and sustaining efficient turnover. Sulfur-centered radicals, for instance, display remarkable reactivity but are prone to rapid deactivation and typically require UV irradiation or specialized charge-transfer complexes for their formation.[2-4] To address this, our group previously developed a relay dual catalytic system in which photoredox oxidation of a thiourea precatalyst generates isothiouronium radical catalysts.[5] While highly versatile, this strategy is limited by incompatibility with redox-active reagents that interfere with the photocatalytic cycle, leaving the need for a more general approach to access isothiouronium radicals. In this context, we have now designed bench-stable dicationic disulfuranes that undergo direct homolysis under visible-light irradiation to furnish active radical catalysts, thereby unlocking new synthetic opportunities.[6]

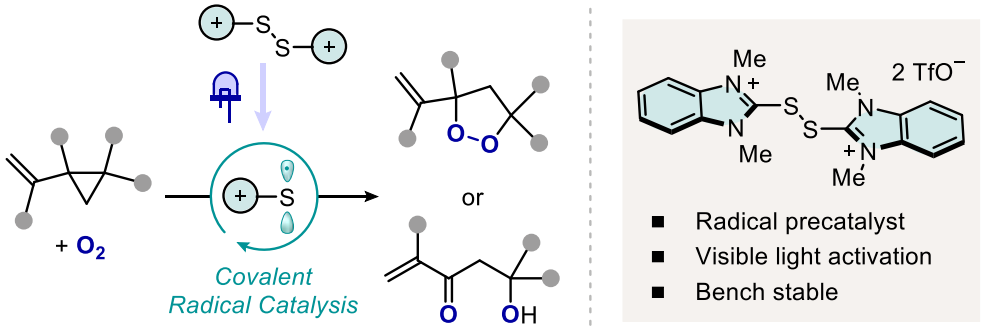


Figure 1. *Dicationic disulfuranes catalyze (3+2) cycloaddition of VCPs and O_2*

[1] Archer, G.; Song, K.; Médebielle, M.; Merad, J. *ChemPhotoChem.* **2023**, *7*, e202300096.
[2] Dénès, F.; Pichowicz, M.; Povie, G.; Renaud, P. *Chem.Rev.* **2014**, *114*, 2587.
[3] Lynch, D. M.; Scanlan, E. M. *Molecules* **2020**, *25*, 3094.
[4] Patehebieke, Y. *Beilstein J. Org. Chem.* **2020**, *16*, 1418.
[5] Archer, G.; Cavalère, P.; Médebielle, M.; Merad, J. *Angew. Chem. Int. Ed.*, **2022**, *61*, e202205596.
[6] Song, K.; Meyrelles, R.; Pilet, G.; Maryasin, B.; Médebielle, M.; Merad, J., *Angew. Chem. Int. Ed.* **2025**, *64*, e202419751.

OC50

Low-coordinate Iron(II)-Complex for Catalytic Alkene Isomerization via Two-state Reactivity

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Metal-catalyzed isomerization of alkenes is a strategic route, providing value-added alkene-containing compounds from more readily available analogues.[1] Major challenges associated with the development of such a method are the control of the carbon-carbon double bond relocation over the carbon scaffold and/or the configurational geometry of the re-formed alkene. For decades, precious metals dominated efforts to overcome selectivity challenges and expand reaction applications.[2] However, economic and environmental concerns, as well as the prospect of complementary reactivity, have spurred interest in employing earth-abundant 3d transition metals such as Co, Ni, and more recently, Fe and Mn, as catalysts for selective alkene isomerization.[3] In line with our ongoing efforts,[4] we have achieved, through a mechanistically driven approach combining extensive experimental and computational studies, a highly selective method for alkene transposition using a novel low-coordinate Fe(II) complex. This latter features a unique behavior to catalyze both positional and geometrical isomerization via two state reactivity (Figure 4). Our methodology has been directly applied to a range of alkenes, including industrially and synthetically relevant targets and can be further expanded to perform controllable regiodivergent or regio- and stereoconvegent isomerization.

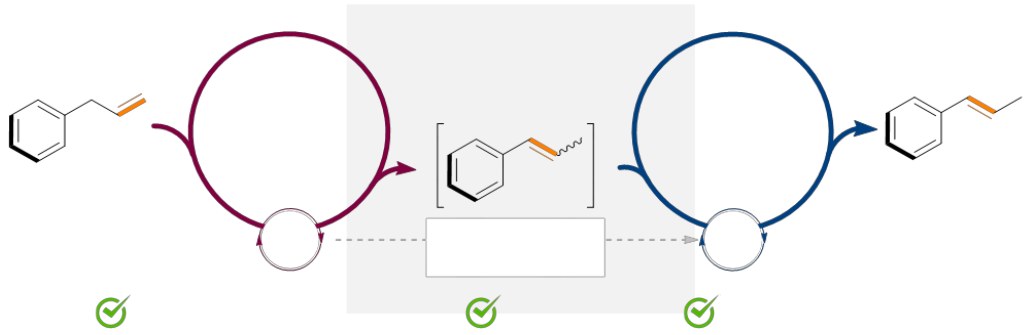


Figure 4. *Overview of iron(II)-catalyzed isomerization of allylbenzene via auto-tandem process*

[1] a) Molloy, J. J.; Morack, T.; Gilmour, R. Positional and Geometrical Isomerisation of Alkenes: The Pinnacle of Atom Economy. *Angew. Chem., Int. Ed*. **2019**, *58*, 13654−13664; b) Hilt, G. Double Bond Isomerisation and Migration–New Playgrounds for Transition Metal-Catalysis. *ChemCatChem*. **2014**, *6*, 2484−2485.

[2] a) Larionov, E.; Li, H.; Mazet, C. Well-defined transition metal hydrides in catalytic isomerizations. *Chem. Commun.* **2014**, *50*, 9816-9826; b) Massad, I.; Marek, I. Alkene Isomerization through Allylmetals as a Strategic Tool in Stereoselective Synthesis. *ACS Catal*. **2020**, *10*, 5793-5804.

[3] a) Liu, X.; Li, B.; Liu, Q. Base-Metal-Catalyzed Olefin Isomerization Reactions. *Synthesis* **2019**, *51*, 1293–1310; b) Zhang, S.; Findlater, M. Cobalt-Catalyzed Isomerization of Alkenes. *Synthesis* **2021**, *53*, 2787–2797; c) Obeid, A. -H.; Hannedouche, J. Iron-Catalyzed Positional and Geometrical Isomerization of Alkenes. *Adv. Synth. Catal.* **2023**, *365*, 1100-1111.

[4] Chen, C.; Lepori, C.; Guillot, R.; Gil, R.; Bezzenine, S.; Hannedouche, J. A Rationally Designed Iron(II) Catalyst for C(sp3)–C(sp2) and C(sp3)–C(sp3) Suzuki–Miyaura Cross-Coupling. *Angew. Chem., Int. Ed.* **2024**, *63*, e202408419.

OC51

Total Synthesis and Analysis of Phenolic Phytoprostanes

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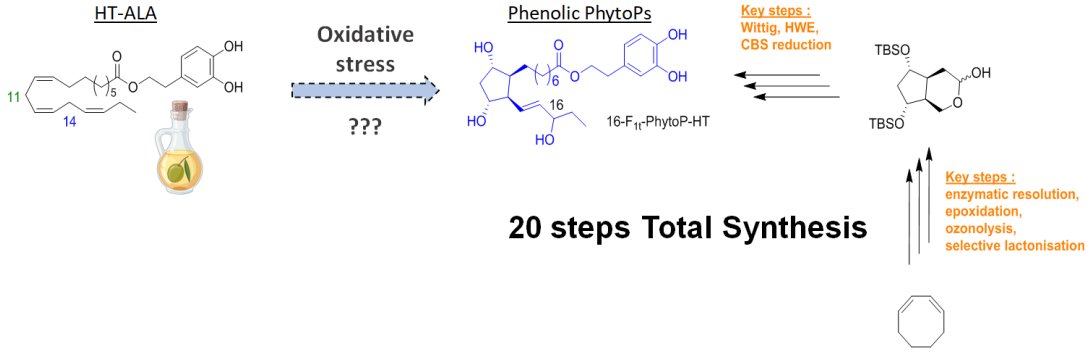
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Lipophenols, or phenolipids, are polyphenolic compounds acylated by fatty acids, enhancing lipophilicity, cell penetration, and bioavailability. In the last 20 years they have been identified in some food matrices naturally rich in both polyphenols and fatty acids. Studying their biosynthesis, sources, pharmacological actions, and metabolization then appears crucial for understanding their dietary role.

In 2016, we identified hydroxytyrosol (HT) lipophenols linked to three unsaturated fatty acids e.g. oleic acid (OA, C18:1 n-9), linoleic acid (LA, C18:2 n-6), and α-linolenic acid (ALA, C18:3 n-3) in extra virgin olive oil (EVOO).[1] A UHPLC-MS/MS study examined lipophenol concentration variations in EVOO over 12 months under room temperature and improper storage conditions. Results highlighted HT-OA as a relevant marker for oil quality, while HT-ALA exhibited a distinct behaviour, suggesting different metabolization patterns based on fatty acid unsaturation.[2]

To investigate HT lipophenol metabolization, we focused on phytoprostanes (PhytoPs), oxidized ALA metabolites. These non-enzymatic lipid peroxidation products are oxidative stress biomarkers in plants and signalling molecules with pharmacological properties. Literature reports the presence of PhytoPs from ALA in various vegetable oils, suggesting that **phenolic-PhytoPs** arising from HT-ALA oxidation could follow a similar pathway. To investigate this, we performed the first stereoselective total synthesis of four PhytoPs-HT in 20 steps from commercially available 1,3-cyclooctadiene. The lactol key intermediate was synthesized in 11 steps with controlled stereochemistry, which then allowed the introduction of the two side chains using Wittig and HWE reactions. The synthesized analytical standards enabled the identification of these molecules by UHPLC-MS/MS in oxidized HT-ALA samples, confirming them as potential natural metabolites in lipophenol-rich food matrices or in vivo metabolization products of HT lipophenols.



[1] Lee, Y. Y.; Crauste, C.; Wang, H.; Leung, H. H.; Vercauteren, J.; Galano, J.-M.; Oger, C.; Durand, T.; Wan, J. M.-F.; Lee, J. C.-Y. Extra Virgin Olive Oil Reduced Polyunsaturated Fatty Acid and Cholesterol Oxidation in Rodent Liver: Is This Accounted for Hydroxytyrosol-Fatty Acid Conjugation? *Chem. Res. Toxicol.* **2016**, *29* (10), 1689–1698

[2] Medina, S.; Auñón, D.; Lehoux, J.; Durand, T.; Crauste, C.; Gil-Izquierdo, Á. Hydroxytyrosol Fatty Acid Esters as New Candidate Markers for Detecting Olive Oil Inadequate Storage Conditions by UHPLC-QqQ-MS/MS. *Microchem. J.* **2022**, *181*, 107656.

OC52

Not going back: Unidirectional movement by intramolecular one-way ratcheting of functionalized cyclodextrin

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Molecular motion is vital for life, driving essential processes at the nanoscale within living cells. This is made possible by biomolecular motors, which can perform unidirectional motion. For example, kinesin motor proteins transport cargos along microtubules.[1] Such directional movement arises from biasing Brownian motion through chemically fueled Brownian ratcheting mechanisms.[2] Natural systems have inspired scientists to design artificial molecular motors.[3] While unidirectional motion has been achieved using information ratchet mechanisms in rotaxanes and catenanes,[4,5] exploiting the intrinsic asymmetry of a three-dimensional macrocycle to drive motion via ratcheting remains unexplored.

In this work, we present an information ratchet that exploits the inherent asymmetry of cyclodextrin's cone-shaped macrocycle to achieve directional motion in a rotaxane. By selectively functionalizing the cyclodextrin small rim, we enable a mechanospecific deprotection of temporary stoppers positioned on the rotaxane axle in front of the CD. As a result, under chemical fueling, the CD moves autonomously in a single direction by opening the stoppering gates exclusively one way, and subsequently favoring their closure[6] once it has passed through. This system demonstrates a synergistic, double-gated, one-way ratchet mechanism driven by the unique asymmetrical structure of the cyclodextrin paving the way toward long-range linear molecular motors (Figure 1).[7]

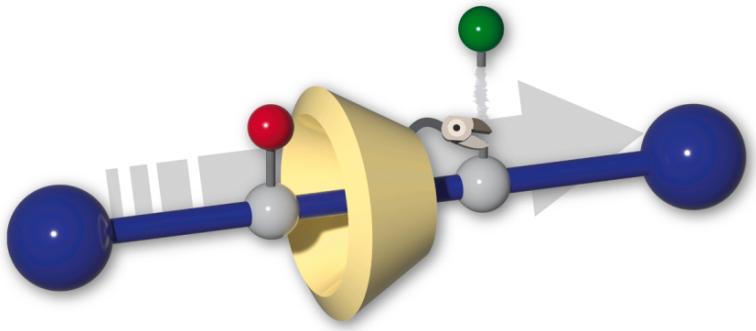


Figure 5. Schematic representaion of the double-gated one-way ratcheted system.[7]

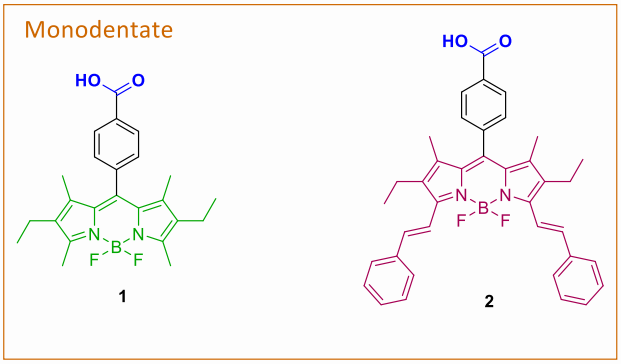
[1] Hirokawa, N.; Noda, Y.; Tanaka, Y.; Niwa, S. Kinesin Superfamily Motor Proteins and Intracellular Transport. *Nat. Rev. Mol. Cell Biol.* **2009**, *10*, 682–696.
[2] Schliwa, M.; Woehlke, G. Molecular Motors. *Nature* **2003**, *422*, 759–765.
[3] Erbas-Cakmak, S.; Leigh, D. A.; McTernan, C. T.; Nussbaumer, A. L. Artificial Molecular Machines. *Chem. Rev.* **2015**, *115*, 10081–10206.
[4] Ren, Y.; Jamagne, R.; Tetlow, D. J.; Leigh, D. A. A Tape-Reading Molecular Ratchet. *Nature* **2022**, *612*, 78–82.
[5] Wilson, M. R.; Solà, J.; Carlone, A.; Goldup, S. M.; Lebrasseur, N.; Leigh, D. A. An Autonomous Chemically Fuelled Small-Molecule Motor. *Nature* **2016**, *534*, 235–240.
[6] Liu, E.; Cherraben, S.; Boulo, L.; Troufflard, C.; Hasenknopf, B.; Vives, G.; Sollogoub, M. A Molecular Information Ratchet Using a Cone-Shaped Macrocycle. *Chem* **2023**, *9*, 1147–1163.
[7] Liu, E.; Daou, D.; Hasenknopf, B.; Vives, G.; Sollogoub, M. Not Going Back: Unidirectional Movement by Intramolecular One-Way Ratcheting of Functionalized Cyclodextrin. *Chem* **2025**, 102623.

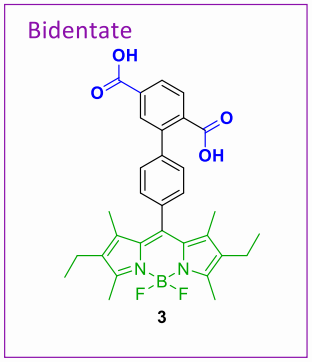
OC53

Functionalization of the BODIPYs allowing integration into MOFs by different pathways

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BODIPYs are organic fluorophores that can be modified by functionalization at several specific positions, called α, β, meso, in particular by complexing functions, such as carboxylic acid. This would enable to dope MOFs (Metal-Organic Frameworks), porous hybrid materials belonging to the family of coordination polymers, composed of metal clusters linked by organic ligands (linkers). This could solve the problem of *Aggregation-Caused Quenching* (ACQ) phenomenon, which strongly reduces photoluminescence of the BODIPYs in the solid state.
To achieve this, different ways of integration have been designed. The first one, a monodentate pathway (see scheme), by functionalizing a BODIPY with one complexing function by a simple and rapid synthetic sequence. This pathway suffers from limitations as a monodentate BODIPY would replace a bidentate linker of the MOF (limited integration, reduced stability of the material). The second one, insertion by a bidentate pathway, by connecting in the meso position of the BODIPY a moiety identical to a MOF linker to integrate it efficiently into the MOF. This technique would allow to maintain a better stability of the MOF, but requires more synthetic steps. For both approaches, there is also a challenge of finding MOF synthetic conditions (typically, high temperatures and strong acidity) compatible with BODIPYs.
Various tests have been developed to find the best compromise to integrate BODIPY into MOFs. In the first tests carried out, a BODIPY carrying a carboxylate group in meso **1** was first synthesized, [1] for the monodentate route, using a classical condensation of pyrrole on an aldehyde. This same BODIPY was also functionalized by phenyls thanks to a Knoevenagel condensation **2.** [1] Then, another BODIPY functionalized by a terephthalic acid **3** was synthesized, to try a bidentate approach, this time through a Suzuki synthesis in order to functionalize the acid with an aldehyde, and then again performed a condensation of a pyrrole on the aldehyde. These syntheses will be described in this communication as well as results on the integration of such BODIPYs into MOFs by mild synthesis.





[1] Tran, A.; Leroux, M.; Michelin, C.; Réveret, F.; Boyer, D.; Cisnetti, F. Carboxylate BODIPY Integrated in MOF-5: Easy Preparation and Solid-State Luminescence. *J Mater Chem C Mater* **2023**, *11* (42), 14896–14905. https://doi.org/10.1039/d3tc02581k.

OC54

Total synthesis of latrunculin B photoswitches and their application in actin chemical biology

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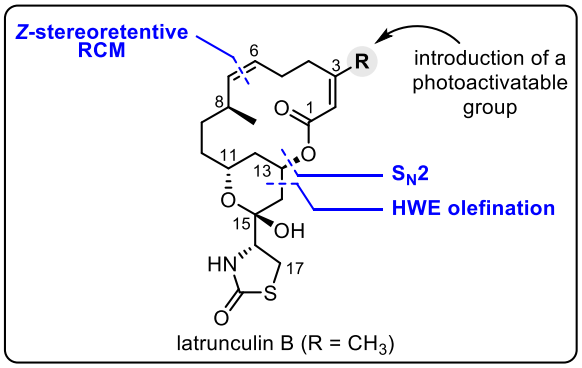
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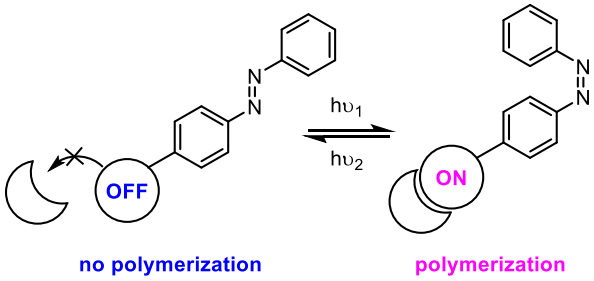
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The marine toxin latrunculin B was isolated in 1980 and demonstrated the ability to disrupt the actin cytoskeleton by sequestrating actin monomers.[1,2] To advance these applications and enable reversible spatiotemporal control of cell migration, we envisioned the development of a photoswitchable latrunculin B derivative with a photopharmacological approach involving the incorporation of a light-responsive azobenzene unit. During this presentation, the total synthesis of photoswitchable latrunculin B and their biological evaluations will be disclosed.[3] Our highly convergent and modular synthetic strategy, mixing new methodologies and optimization of literature approaches, includes an original *Z*-stereoretentive ring-closing metathesis.[4,5,6] This strategy allowed the synthesis of new analogues, exhibiting remarkable photoreversible properties and excellent efficiency in controlling *in vitro* actin polymerization and cell migration by light.





[1] Kashman, Y.; Groweiss, A.; Shmueli, U. Latrunculin, a New 2-Thiazolidinone Macrolide from the Marine Sponge Latrunculia Magnifica. *Tetrahedron Lett.* **1980**, *21* (37), 3629–3632.

[2] Spector, I.; Shochet, N. R.; Kashman, Y.; Groweiss, A. Latrunculins: Novel Marine Toxins That Disrupt Microfilament Organization in Cultured Cells. *Science* **1983**, *219*, 493–495.

[3] Gamet, A.; Ciss, I.; Courtois, A.; Joyeux, B.; Gautreau, A.M.; Romero, S.; Le Clainche, C.; Nay, B. Total Synthesis of Photoswitchable Latrunculin B Enables Reversible Inhibition of Actin Polymerization and Cell Migration. *ChemRxiv* **2025**, Preprint.

[4] Fürstner, A.; Turet, L. Concise and Practical Synthesis of Latrunculin A by Ring-Closing Enyne–Yne Metathesis. *Angew. Chem. Int. Ed.* **2005**, *44* (22), 3462–3466.

[5] Khan, R. K. M.; Torker, S.; Hoveyda, A. H. Readily Accessible and Easily Modifiable Ru-Based Catalysts for Efficient and *Z* -Selective Ring-Opening Metathesis Polymerization and Ring-Opening/Cross-Metathesis. *J. Am. Chem. Soc.* **2013**, *135* (28), 10258–10261.

[6] Müller, D. S.; Curbet, I.; Raoul, Y.; Le Nôtre, J.; Baslé, O.; Mauduit, M. Stereoretentive Olefin Metathesis Made Easy: In Situ Generation of Highly Selective Ruthenium Catalysts from Commercial Starting Materials. *Org. Lett.* **2018**, *20* (21), 6822–6826.

OC55

Intramolecular Mechanics with Motors: Coupling Rotation to Selective Helicene Inversion

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An overcrowded alkene-based molecular motor comprising an extended dibenzo[*c,g*]fluorene moiety has been previously synthesized and studied by our group.[1] This compound displays a bathochromic shift of the excitation wavelength allowing for visible-light driving of the rotation. DFT calculations showed that each step in the rotary cycle induced an inversion of the helicity of the dibenzo[*c,g*]fluorene, giving rise to a coupled paddling motion along with the rotation of the motor.[2] This phenomenon could unfortunately not be studied experimentally due to the very low racemization barrier of the dibenzo[*c,g*]fluorene lower part. Such coupled motions are unusual phenomena of high interest for the design of new molecular systems displaying higher levels of functionality[3] and open the way to a range of new applications.
We thus designed new derivatives allowing to control this paddling motion by tuning the racemization barrier of the lower half, allowing to study this phenomenon and use it for applications ranging from new helicity driven molecular motors to chiroptical switches performing remote helicity inversions upon photoactuation. The newly developed compounds, associated synthetic routes and photophysical studies will be presented.[4]

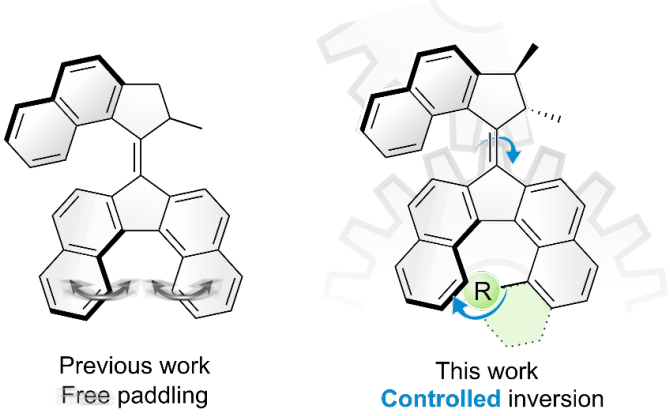


Figure 1. Second-generation molecular motors featuring a helical dibenzofluorene bottom-half.

[1] van Leeuwen, T.; Pol, J.; Roke, D.; Wezenberg, S. J.; Feringa, B. L. Visible-Light Excitation of a Molecular Motor with an Extended Aromatic Core. *Org. Lett.* **2017**, *19* (6), 1402–1405.
[2] Costil, R.; Holzheimer, M.; Crespi, S.; Simeth, N. A.; Feringa, B. L. Directing Coupled Motion with Light: A Key Step toward Machine-like Function. *Chem. Rev.* **2021**, *121* (21), 13213–13237.
[3] Štacko, P.; Kistemaker, J. C. M.; van Leeuwen, T.; Chang, M.-C.; Otten, E.; Feringa, B. L. Locked Synchronous Rotor Motion in a Molecular Motor. *Science* **2017**, *356* (6341), 964–968.
[4] Gisbert, Y.; Ovalle, M.; Stindt, C. N.; Costil, R.; Feringa, B. L. Coupling Rotary Motion to Helicene Inversion within a Molecular Motor. *Angew. Chem. Int. Ed Engl.* **2025**, *64* (4), e202416097.

OC56

Tuning of photophysical and chiroptical properties by encapsulation inside a hydrogen-bonded cavity

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The properties of coordination metal complexes traditionally depend on the nature of the metal cation and the complexed ligands. An original strategy to tune these properties is to play with the environment around the complex by a **supramolecular** approach[1].

This work reports on the encapsulation of **Cu(I) bisdiimine complexes** inside a **self-assembled hexameric resorcin[4]arene-based capsule**[2]. The confinement leads to the modification of their photophysical and chiroptical properties, namely: (1) an **Encapsulation-Induced Emission Enhancement** (*Figure 1*), (2) an **enantiomeric excess induction** on the encapsulated complex from an enantiopure chiral capsule, (3) an enantiomeric excess induction on both the capsule and the encapsulated complex using an enantiopure counter anion, (4) the generation of **Circularly Polarized Luminescence** emission[3]. This supramolecular chirality induction could be harvested subsequently to achieve enantioselective reactions.

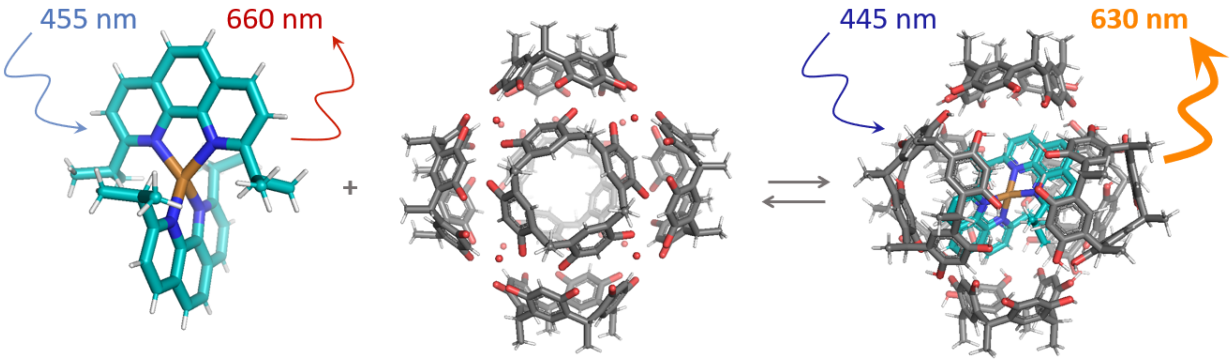


***Figure 1**. Tuning of photophysical properties in a copper(I) complex by its encapsulation.*

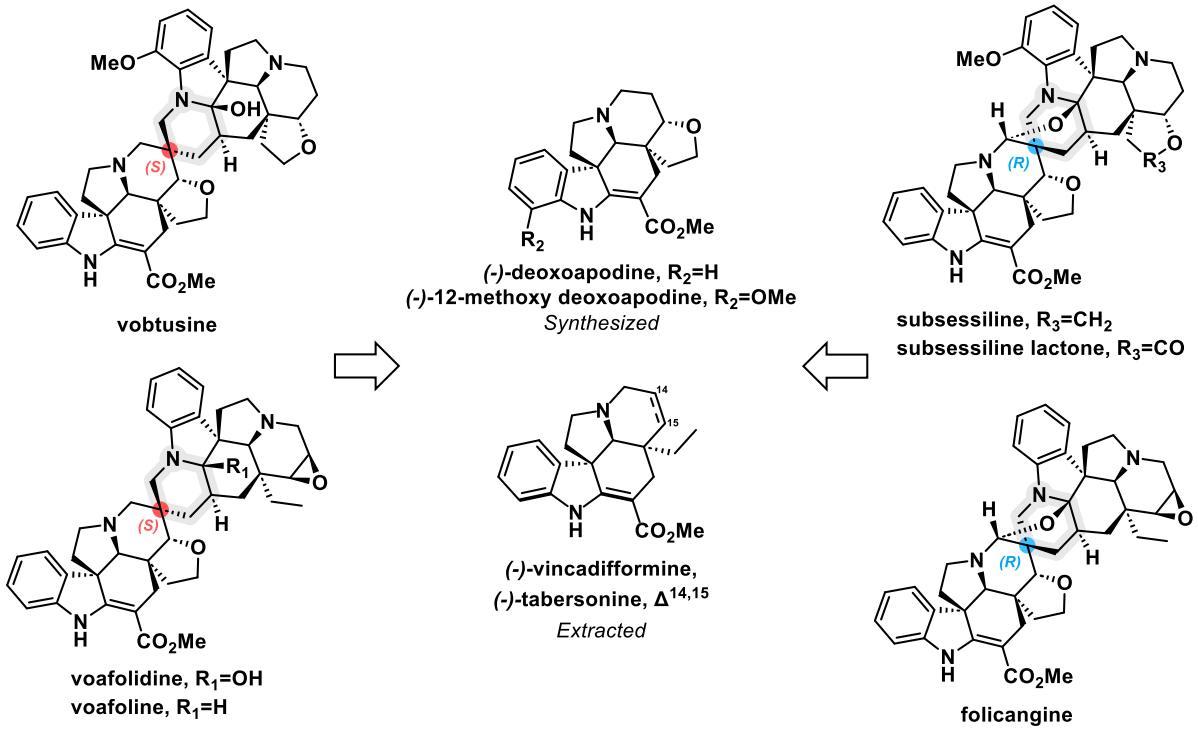
[1] Horiuchi, S.; Hayashi, M.; Umakoshi, K. Noncovalent tailoring of coordination complexes by resorcin[4]arene-based supramolecular hosts. *Dalton Transactions* **2023**, 52 (20), 6604-6618.
[2] Atwood, J. L. A chiral spherical molecular assembly held together by 60 hydrogen bonds. *Nature* **1997**, *389* (6650), 469-472.
[3] Leherte, L.; Pellegrin, Y.; Sliwa, M.; Jiménez Gallego, J. R.; Višnjevac, A.; Doistau, B.; Colasson, B. *Manuscript in preparation.*

OC57

Bioinspired Total Syntheses of Indole Alkaloids: Spirocyclic Assembly of Pseudo-Dimeric Oligomers

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Monoterpene indole alkaloids (MIA) constitute a fascinating group of natural substances displaying high degree of complexity and diversity. They tend to self-assemble, in many cases, spontaneously in Nature to yield bis-indolic oligomers of important biological relevance. Vobtusine[1], voafoline, voafolidine[2] and callichiline[3] are pseudo-dimeric natural products arising from pseudo-monomers displaying the polycyclic *aspidosperma* skeleton and bearing a challenging spirocyclic central motif, making them an attractive target for organic chemists. Although isolated fifty years ago by Poisson and co-workers at Châtenay-Malabry from two *voacanga* species, no total syntheses of these natural products have yet been reported. Investigating the assembly of such compounds, will allow us to develop efficient and straightforward synthetic sequences inspired by nature to increment structural complexity starting from simple chemical building blocks. We have already obtained advanced dimeric intermediates towards these natural products.



[1] A. Gorman, V. Agwada, M. Hesse, U. Renner, H. Schmid, Zur Chemie des Beninins und des Vobtusins, *Helv. Chim. Acta* **1966**, 49 (7), 2072.. HCA, 49: 2072-2098. https://doi.org/10.1002/hlca.660490714.
[2] Y. Rolland, G. Croquelois, N. Kunesch, P. Boiteau, M. Debray, J. Pecher, J.Poisson, Alcaloïdes des feuilles de Voacanga thouarsii. *Phytochemistry* **1973**, 12 (8), 2039. https://doi.org/10.1016/S0031-9422(00)91531-0.
[3] A. T. McPhail, E. W. Hagaman, N. Kunesch, E. Wenkert, J. Poisson, The structure of callichiline. *Tetrahedron* **1983**, 39 (22), 3629–3637. https://doi.org/10.1016/S0040-4020(01)88601-4.

OC58

Synthesis and optoelectronic properties of original pyrano-carbazole based chiral structures

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Organic open-shell molecules are increasingly explored for their potential in next-generation optoelectronic applications.[1] However, their practical use remains largely restricted by intrinsic issues of chemical and configurational stability. Recently, research in this area has focused on a specific class of open-shell systems, showing an energetic inversion of the singly occupied molecular orbital (SOMO) and the highest doubly occupied molecular orbital (HOMO) level (Fig. 1), named SOMO-HOMO inversion (SHI) radicals. Our group contributes to this domain of research and has described original carbazole-based chiral open-shell systems showing SHI. Interestingly, this peculiar electronic configuration seems to be associated with enhanced configurational (Fig. 1b) and chemical (photo-)stability, while representing a strategy to afford high-spin diradicals (Fig. 1a).[2,3] While these compounds represent an important step forward, their stability remains modest, highlighting the necessity to establish deeper structure–property relationships in order to enhance both chemical robustness and configurational stability through the SHI approach, while controlling the interactions between the generated organic spins.

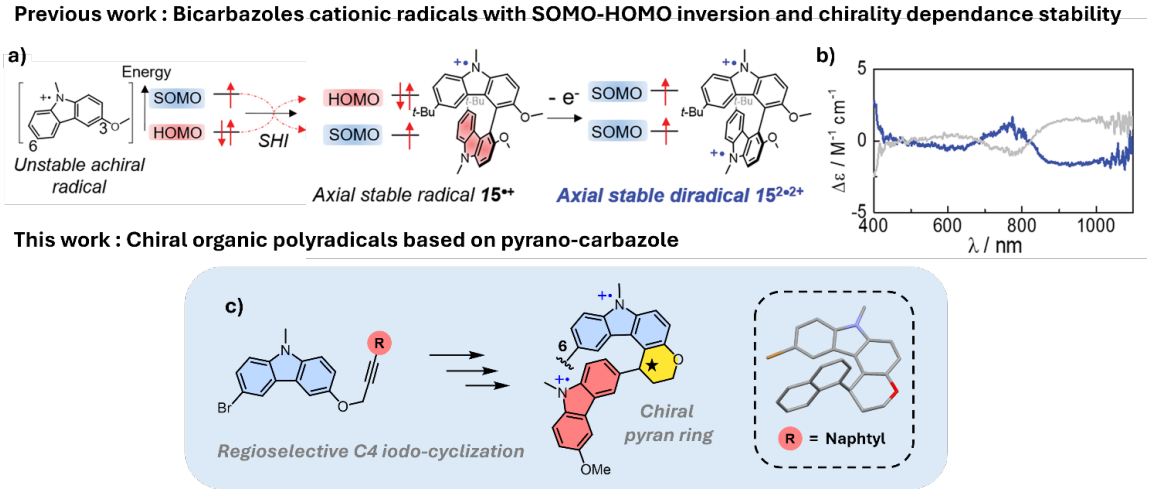


*Figure 6 : a) SOMO-HOMO inversion in a configurationally stable carbazole open-shell system, b) ECD spectra of axial stable diradical carbazole **15**$^{2,2+}$ in acetonitrile, c) Example of an original chiral pyrano-carbazole-based system presented in this work.*

To address these issues, we present here a new design of chiral organic compounds based on pyrano-carbazole molecular architectures with various C6 functionalization (Fig. 1c). Our structure-property relationship study show that these original scaffold can generate stable mono- and diradicals because of the controlled carbazole units interactions thanks to the rigid conformation of the 6-membered-ring. Optical and electrochemical characterizations of these new systems are reported, together with the most recent results on the characterization of their open-shell states.

[1] X. Hu, W. Wang, D. Wang, Y. Zheng, *J. Mater. Chem. C*. **2018**, 6, 11232-11242.
[2] S. Kasemthaveechok, L. Abella, M. Jean, M. Cordier, N. Vanthuyne, T. Guizouarn, O. Cador, J. Autschbach, J. Crassous, L. Favereau, *J. Am. Chem. Soc.* **2022**, 144, 7253-7263.
[3] S. Kasemthaveechok, L. Abella, M. Jean, M. Cordier, T. Roisnel, N. Vanthuyne, T. Guizouarn, O. Cador, J. Autschbach, J. Crassous, L. Favereau, *J. Am. Chem. Soc*. **2020**, 142, 20409-20418.

OC59

Harnessing Conformational Dynamics to Tune π-Magnetism in Flexible Macrocycle

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Organic molecules with open-shell electronic structures, characterised by unpaired electrons in their ground or low-lying states, exhibit unusual electronic, optical, and magnetic properties.[1] Among them, diradicaloids stand out for their behaviour intermediate between closed-shell singlets and pure diradicals, offering opportunities in **next-generation organic semiconductors**, **spintronic materials**, and **magnetic switches**. Controlling such behaviour in a molecular framework requires balancing extended/global π-conjugation with localised aromatic stabilisation, a principle historically exemplified by **Thiele's hydrocarbon**, where resonance between phenyl (open-shell, owing to Clar's sextet) and quinoidal (closed-shell) motifs generates a singlet–triplet equilibrium (Figure 1a). Here, we extend this concept to more complex macrocyclic π-architectures to lower the singlet–triplet energy gap ($\Delta E_{S\text{-}T}$) and stabilise diradicaloid states.[2] We developed a *para*-phenylene embedded macrocyclic framework (Figure 1b) in which cyclophane-like geometry integrates benzene and quinoidal motifs within a flexible skeleton, yielding stimuli-responsive dynamic behaviour and an equilibrium between closed-shell singlet & open-shell singlet/triplet states. Spectroscopic, structural, and theoretical analyses reveal that the diradicaloid contribution is modulated by the dihedral angle between *para*-phenylenes, where torsional distortion suppresses global diatropic π-conjugation and enhances open-shell stabilisation. By linking conformational dynamics to electronic flexibility, this work establishes a strategy for engineering π-conjugated macrocycles with switchable electronic states. Such systems not only provide new insights into resonance and aromaticity control in organic frameworks but also pave the way toward adaptive **SMART** organic materials with tunable conductivity, spin states, and magnetic responses.

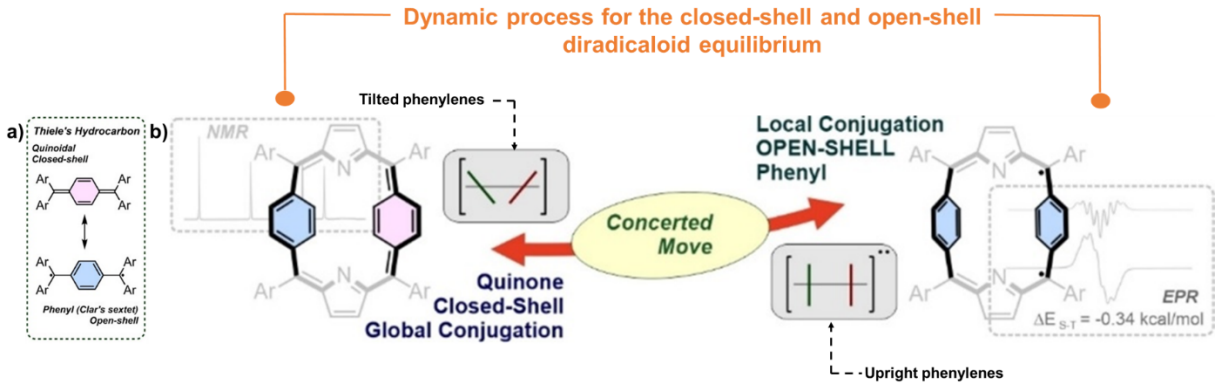


***Figure 1**. (a) Thiele's hydrocarbon and (b) tuning of π-magnetism in flexible macrocycle.*

[1] Abe, M. Diradicals. *Chem. Rev*. **2013**, *113*, 7011–7088.
[2] Banachowicz, P., Das, M.; Kruczała, K.; Siczek, M.; Sojka, Z.; Kijewska, M.; Pawlicki, M. Breaking Global Diatropic Current to Tame Diradicaloid Character: Thiele's Hydrocarbon Under Macrocyclic Constraints. *Angew. Chem. Int. Ed*. **2024**, e202400780.

OC60

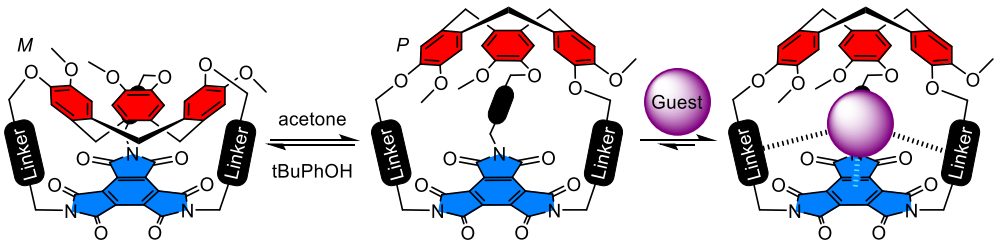
Electron Deficient Hemicryptophanes: From Anion-π Interactions to Functional Receptors

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Hemicryptophanes are covalent molecular cages based on a cyclotriveratrylene (CTV) unit and an additional C_3 symmetrical moiety. Such architectures allow the recognition of anions, cations and zwitterions thanks to their ditopic character.[1] In order to increase the affinity of hemicryptophanes for negatively charged species, anion-π interactions are highly promising while still being underrecognized. Anion-π interactions are electrostatic interactions between an anion and an aromatic electron deficient surface with a high quadrupolar moment. Several units have been used to introduce these weak interactions into functional systems such as naphthalene diimides[2] or benzene triimides (BTI). The latter has a strong positive quadrupolar moment and a C_3 symmetry axis matching the topography of CTVs which makes them good candidates to endow hemicryptophanes with strong anion-π interactions.[3] In addition, the presence of an electron rich north part, together with an electron deficient south part can induce intramolecular donor acceptor interactions, that can be used to control the CTV configuration. This chiral switch triggers a dramatic change of the hemicryptophane topography, going from an open to a fully inverted cage. Hereby, we will describe the synthesis and characterization of receptors with either electron rich or electron poor linkers between CTV and BTI units, which modulate the affinity for charged guests[4] and demonstrate the configurational equilibrium of a hemicryptophane that can be displaced by achiral solvents.[5]



[1] Zhang, D.; Martinez, A.; Dutasta, J.-P. Emergence of Hemicryptophanes: From Synthesis to Applications for Recognition, Molecular Machines, and Supramolecular Catalysis**.** *Chem. Rev.* **2017**, *117*, 4900–4942.

[2] Zhao, Y.; Cotelle, Y.; Liu, L.; López-Andarias, J.; Bornhof, A.-B.; Akamatsu, M.; Sakai, N.; Matile, S. The Emergence of Anion−π Catalysis. *Acc. Chem. Res*. **2018**, *51*, 2255-2263.

[3] Tuo, D.-H.; Ao, Y.-F.; Wang, Q.-Q.; Wang, D.-X. Benzene Triimide Cage as a Selective Container of Azide. *Org. Lett.* **2019**, *21*, 7158-7162.

[4] Miton, L.; Dupin, P.-A.; Antonetti, E.; Jean, M.; Nava, P.; Martinez, A.; Cotelle, Y. Electron-deficient hemicryptophanes for the recognition of anions through anion–π interactions. *Org. Biomol. Chem.* **2025**, *23*, 4360-4364.

[5] Miton, L.; Antonetti, E.; García-López, D.; Nava, P.; Robert, V.; Albalat, M.; Vanthuyne, N.; Martinez, A.; Cotelle, Y. A Cyclotriveratrylene Solvent-Dependent Chiral Switch. *Chem. Eur. J.* **2024**, *30*, e202303294.

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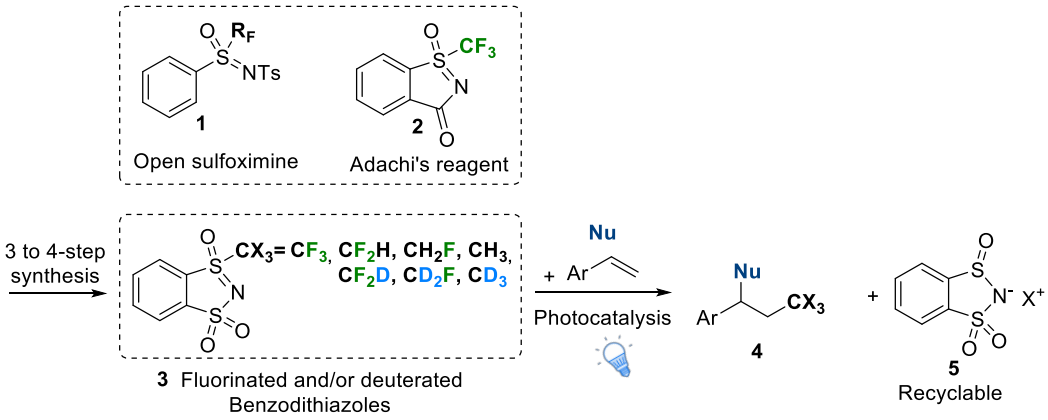
P A001

A New Sulfoximine Scaffold for the Generation of Diverse Fluorinated Radicals in Photoredox Catalysis

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Fluoromethyl groups are of high interest for modifying electronic properties of molecules, and are especially relevant for improving drug efficacy. Insertion of -CF_3 group is well described in the literature, and a lot of FDA-approved drugs today contain this motif. Recognizing the importance of fluorine in medicinal chemistry but hampered by the recent controversy surrounding PFAS, reactions for the insertion of non-PFAS fluorinated motifs have emerged, such as the -CF_2H moiety. N-tosylated sulfoximines have demonstrated their effectiveness in these reactions **1**,[1-3] though little research has been conducted on monofluoromethylation, or on combining fluorine and deuterium chemistry in novel functional groups.

Inspired by the cyclic sulfoximine **2** described by Adachi and Ishihara,[4] we are presenting herein the multi-gram scale synthesis of a new cyclic sulfoximine scaffold **3** capable of generating in photoredox catalysis **4** all of the fluorinated methyl radicals (from •CF_3 to •CH_2F) with an improved reactivity compared to linear sulfoximines. This scaffold also has the critical advantage to be able to generate the scarcely described •CH_3 radical, to be usable in flow chemistry and recyclable after use **5**.[5] Moreover, easy deuteration of these benzodithiazoles enables them to also react as •CF_xD_y donors, forming unique functional groups.



[1] Zhang, W.; Wang, F.; Hu, J. N-Tosyl-S-difluoromethyl-S-phenylsulfoximine: A New Difluoromethylation Reagent for S-, N-, and C-Nucleophiles. *Org. Lett*. **2009**, *11*, (10), 2109-2112.
[2] Noto, N.; Koike, T.; Akita, M. Visible-Light-Triggered Monofluoromethylation of Alkenes by Strongly Reducing 1,4-Bis(diphenylamino)naphthalene Photoredox Catalysis. *ACS Catal*. **2019**, *9*, (5), 4382-4387.
[3] Pégot, B.; Urban, C.; Bourne, A.; Le, T. N.; Bouet, S.; Marrot, J.; Diter, P.; Magnier, E. Difluoromethyl and Chlorofluoromethyl Sulfoximines: Synthesis and Evaluation as Electrophilic Perfluoroalkylating Reagents. *Eur. J. Org. Chem*. **2015**, 3069.
[4] Adachi, K., Ishihara, S. *Japan Tokkyo Kokai Patent*, **2005,** 145917.
[5] Wu, P., Goujon, G., Pan, S., Tuccio, B., Pégot, B., Dagousset, G., Anselmi, E., Magnier, E., Bolm, C. Cyclic Sulfoximines as Methyl and Perdeuteromethyl Transfer Agents and Their Applications in Photoredox Catalysis. *Adv. Synth.Catal.* **2023**, 365, 2392-2399.

P A002

Regio- and stereoselective azidation of activated *N*-allenamides: an entry to α, β, γ and δ-amido-azides

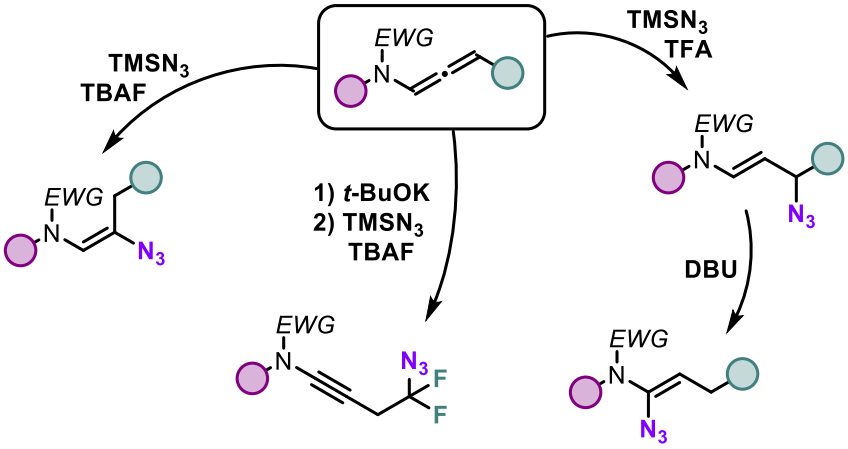
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Organic azides are versatile synthetic intermediates. Among them, the unique features of vinyl-azides have turned these compounds into critical building blocks for the construction of *N*-heterocycles. The remarkable properties of the azide group connected to an alkene moiety allow this functional group to act as an electrophile, an enamine-type nucleophile or a radical acceptor.[1] The multifaced reactivity of these highly versatile synthons have generated a great inspiring variety of intermediates such as iminodiazonium ions, nitrilium ions, iminyl radicals and metal enaminyl radicals upon heating-, metal-or light-induced processes.[2] Following our interest in the preparation of nitrogen-containing building blocks, we envisioned that *N*-allenamides would be ideal candidates to generate vinyl azides.

A totally controlled regiodivergent azidation of activated *N*-allenamides is presented. Using $TMSN_3$/TBAF, β-azidation of *N*-allenamides occurred exclusively, yielding vinyl azides. Conversely, employing a TFA/$TMSN_3$ mixture resulted solely in the formation of γ-azides. A subsequent azide shift of the latter with DBU produced α-amido vinyl azides. Additionally, δ-difluorinated azides featuring an ynamide were selectively synthesized from ene-ynamides.[3]



[1] Fu, J.; Zanoni, G.; Anderson, E. A.; Bi, X. α-Substituted Vinyl Azides: An Emerging Functionalized Alkene. Chem. Soc. Rev. 2017, 46 (23), 7208–7228. https://doi.org/10.1039/C7CS00017K.

[2] Gholami, F.; Yousefnejad, F.; Larijani, B.; Mahdavi, M. Vinyl Azides in Organic Synthesis: An Overview. RSC Adv. 2023, 13 (2), 990–1018. https://doi.org/10.1039/D2RA06726A.

[3] Schutz, D.; Hourtoule, M.; Miesch, L. Regio- and Stereoselective Azidation of Activated N-Allenamides: An Entry to α, β, γ and δ-Amido-Azides. Org. Chem. Front. 2025, 12 (1), 185–191. https://doi.org/10.1039/D4QO01802H.

P A003

A simple hydrogen cyanide-based access to piperazin-2-ones

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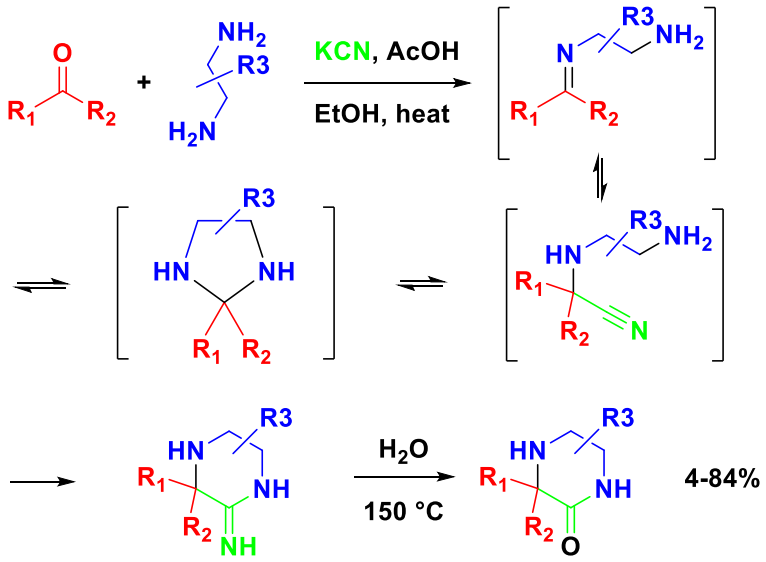
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We have studied and improved the scope of a simple access to piperazin-2-ones from carbonyls, hydrogen cyanide (generated *in situ* from acetic acid and potassium cyanide) and ethylenediamine as well as N- or C- substituted alkyl 1,2-diamines. [1234]

As depicted, the synthesis proceeds via the occurrence of imines and/or imidazolines intermediates and, upon an addition of hydrogen cyanide, to α,δ-diaminonitriles. Their ensuing cyclisation leads to piperazin-2-imines which then require a hydrolysis step to generate the piperazin-2-ones.

Although the reaction proceeds sometimes in very modest yields (ranging from 4 to 84% - 73 cases were studied), its rather large scope as well as the many commercially available starting material do provide a one-pot alternative to prepare original libraries of chemicals featuring a piperazin-2-one component.



In a way, this work removes another “chemical blind spot” and should lead to a far greater availability of piperazin-2-one-bearing derivatives for any biological evaluations.

[1] Strong, J. S.; Graig, W. E.; Elkind, V. T. Preparation of ketopiperazines. US 2700668, 1955.

[2] Masuzawa, K.; Masaki, M.; Ohta, M. Syntheses and reactions of nitrogen and sulfur-analogs of 2-piperazinone. Bull. Chem. Soc. Jpn. 1968, 41, 702-707.

[3] Sut, A.; Podesta, M.; Lattes, M. A. N-Monoalkylation of some 2-oxo- and 2,5-dioxopiperazines. Chimica Therapeutica 1969, 4, 167-173.

[4] Ito, N.; Sasaki, H.; Tai, K.; Shinohara, T. Heterocyclic compounds for treating or preventing disorders caused by reduced neurotransmission of serotonin, norepinephrine or dopamine. WO 2012036253, 2012.

P A004

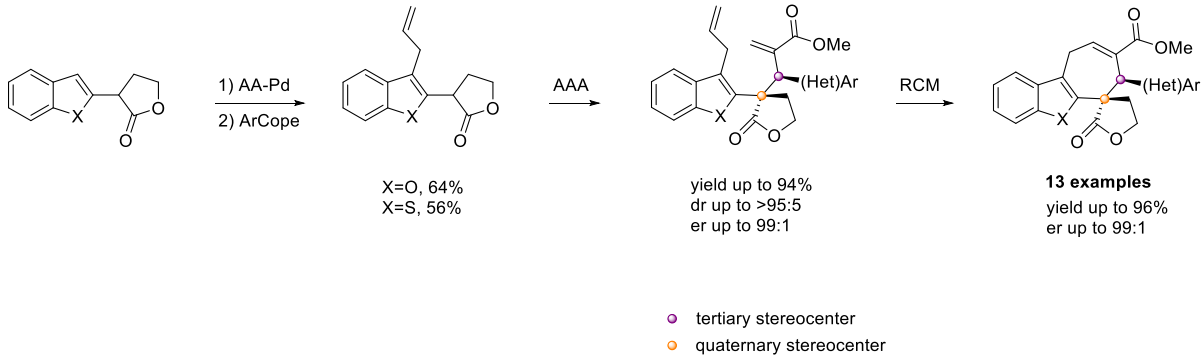
Enantioselective synthesis of polycyclic compound bearing vicinal tertiary and quaternary stereocenters

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One of the great challenge of organic chemists is to form carbon-carbon bonds leading to the creation of a stereogenic center in a controlled manner. This type of transformation enables the construction of three-dimensional structures and thus provide useful tools and methods for the synthesis of biologically active molecules.[1] This exploitation of space is at the heart of the latest studies carried out by our laboratory. One of our recent objectives is to develop the synthesis of chiral compounds containing two heteroaromatic heterocycles, one of which being fused with a 7-membered ring, forming a structural pattern present in natural products such as Frondozin.
The formation of the 7-membered ring was achieved through a ring closing metathesis reaction involving an electron-rich and an electron-poor alkene. The introduction of the two unsaturated chains was thus the key steps of this strategy. The allyl group on the heteroaromatic ring was introduced through a sequence involving a Tsuji-Trost allylic alkylation reaction followed by an aromatic Cope rearrangement,[2,3] while the chiral chain containing the α,β-unsaturated ester was introduced through an organocatalyzed asymmetric allylic alkylation of the lactone.[4]



[1] Lovering, F.; Bikker, J.; Humblet, C. Escape from Flatland: Increasing Saturation as an Approach to Improving Clinical Success. *J. Med. Chem*. **2009**, *52* (21), 6752-6756. https://doi.org/10.1021/jm901241e.

[2] Tomiczek, B. M.; Greening, A. J. Aromatic Cope Rearrangements. *Org. Biomol. Chem.* **2021**, *19* (11), 2385-2398. https://doi.org/10.1039/D1OB00094B.

[3] Mando, M.; Grellepois, F.; Blanc, A.; Hénon, E.; Riguet, E. Toward Efficient and Stereoselective Aromatic and Dearomative Cope Rearrangements: Experimental and Theoretical Investigations of α-Allyl-α'-Aromatic γ-Lactone Derivatives. *Chem. – Eur. J.* **2024**, *30* (21), e202304138. https://doi.org/10.1002/chem.202304138.

[4] Mando, M.; Fares, M.; Kowandy, C.; Grellepois, F.; Riguet, E. Organocatalyzed Asymmetric Allylic Alkylation Enables Synthesis of Chiral γ-Lactones Bearing Vicinal Tertiary and Quaternary Stereocenters. *Org. Lett*. **2022**, *24* (29), 5351-5355. https://doi.org/10.1021/acs.orglett.2c02001.

P A005

Development of novel Liver X Receptor modulators for prostate cancer therapy

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Background: Nuclear receptors LXRα (NR1H3) and LXRβ (NR1H2) are pivotal in managing physiological functions such as cell growth, immune response and apoptosis. They can be activated by oxysterols—oxidized cholesterol derivatives. They are potential pharmacological targets for treating metabolic disorders and cancers[1]. However, clinical progress in developing LXR-targeting drugs is hindered by the high sequence similarity between LXRα and LXRβ, leading to challenges in achieving receptor specificity and side effects like hypertriglyceridemia and neurological issues[2,3].

Methods: In our research, we employ a dual approach to discover selective LXRβ modulators derived from natural flavonoids. First, we use molecular modelling to map the LXRβ receptor binding pocket. This analysis allows to identify the crucial interactions to establish between our synthetic molecules and the active site in order to activate selectively LXRβ isoform. Second, we test these new synthetic molecules *in vitro* using HeLa cells transfected with the LXRα or LXRβ receptor. Following the biological results on LXRβ activity and on isoform selectivity a SAR study is established to optimize the molecular model and synthetic ligands.

Results: 3 series of 2nd generation molecules were designed *in silico* and synthesized using a convergent synthesis pathway. The compounds were tested *in vitro* on HeLa cells transfected with LXRα or LXRβ. We have identified 2 LXRβ selective and 1 LXRα selective modulators. The ongoing development of the 3rd generation molecules aims to improve the binding affinity with LXRβ receptor.

Conclusions: The molecular modelling allowed us to identify the Liver X receptor agonist pharmacophore and lead us to a conception of 1st and 2nd generation compounds. Zones of interaction responsible for LXRα or LXRβ selectivity were identified through the optimized second-generation compounds. Ligands with improved binding affinity for LXRβ receptor will next be optimized and evaluated in *in vivo* studies.

[1] Buñay, J.; Fouache, A.; Trousson, A.; Joussineau, C.; Bouchareb, E.; Zhu, Z.; Kocer, A.; Morel, L.; Baron, S.; Lobaccaro, J. A. Screening for Liver X Receptor Modulators: Where Are We and for What Use? *Br J Pharmacol* **2021**, *178* (16), 3277–3293. https://doi.org/10.1111/bph.15286.

[2] Schultz, J. R.; Tu, H.; Luk, A.; Repa, J. J.; Medina, J. C.; Li, L.; Schwendner, S.; Wang, S.; Thoolen, M.; Mangelsdorf, D. J.; Lustig, K. D.; Shan, B. Role of LXRs in Control of Lipogenesis. *Genes Dev.* **2000**, *14* (22), 2831–2838. https://doi.org/10.1101/gad.850400.

[3] Wrobel, J.; Steffan, R.; Bowen, S. M.; Magolda, R.; Matelan, E.; Unwalla, R.; Basso, M.; Clerin, V.; Gardell, S. J.; Nambi, P.; Quinet, E.; Reminick, J. I.; Vlasuk, G. P.; Wang, S.; Feingold, I.; Huselton, C.; Bonn, T.; Farnegardh, M.; Hansson, T.; Nilsson, A. G.; Wilhelmsson, A.; Zamaratski, E.; Evans, M. J. Indazole-Based Liver X Receptor (LXR) Modulators with Maintained Atherosclerotic Lesion Reduction Activity but Diminished Stimulation of Hepatic Triglyceride Synthesis. J. Med. Chem. 2008, 51 (22), 7161–7168. https://doi.org/10.1021/jm800799q.

P A006

Oxidation of Dihydrotetrazine Triggered by Near Infrared Photocatalysis for Photoclick Chemistry

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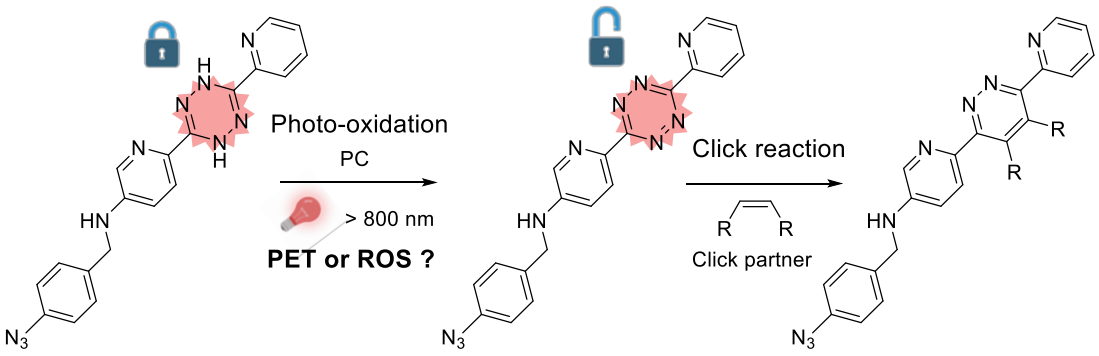
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Synthetic chemists aspire to control each parameter involved in organic transformations, such as efficiency, selectivity (chemo-, regio-, enantio-selectivity), and kinetics. The next level of control needed for applications is the reaction's temporal and spatial trigger. This is particularly required for biological/pharmaceutical applications such as drug delivery or medical diagnostics.[1] Governing the reaction through a simple switcher is appealing, and the photo-click concept is a wonderful tool for achieving this goal. Thus the click reaction, which has many advantages (kinetic, selectivity…), and is triggered by light.[2] Until now, the photoclick concept has been developed from UV to visible light. However, near-infrared light presents many advantages, such as light penetration, biocompatibility and low energy. [3]

Based on our previous works on NIR-photocatalysis driven by cyanines and squaraines[4,5], we tackle the challenge of NIR-Photoclick. Herein, the NIR-photooxidation of dihydrotetrazine to deliver the clickable tetrazine is presented. This study includes photocatalyst design, optimization, and mechanistic discussion. The last point is crucial to reach the best photocontrol. Does the reaction proceed through a photoinduced electron transfer, reactive species of O_2 or both?



Scheme 1: Near-Infrared Light triggred click reaction

[1] R. Weinstain, T. Slanina, D. Kand, P. Klán. *Chem. Rev.* **2020**, *120*, 13135–13272.
[2] C. Wang, H. Zhang, T. Zhang, X. Zou, H. Wang, J.-E. Rosenberger, R. Vannam, W. S. Trout, J. B. Grimm, L. D. Lavis, C. Thorpe, X. Jia, Z. Li, J. M. Fox. *J. Am. Chem. Soc.* **2021**, *143*, 10793–10803.
[3] N. Sellet, M. Cormier, J.-P. Goddard. *Org. Chem. Front*. **2021**, *8*, 6783-6790.
[4] A. R. Obah Kosso, N. Sellet, A. Baralle, M. Cormier, J.-P. Goddard. *Chem. Sci.* **2021**, *12*, 6964–6968.
[5] N. Sellet, M. Sebbat, M. Elhabiri, M. Cormier, J.-P. Goddard. *Chem. Commun.* **2022**, *58*, 13759–13762.

P A007

Bis-Zirconocenes Generated from Weinreb allylaminoacetamides as Key Intermediates for a Diastereoselective Approach to polysubstituted-piperidines

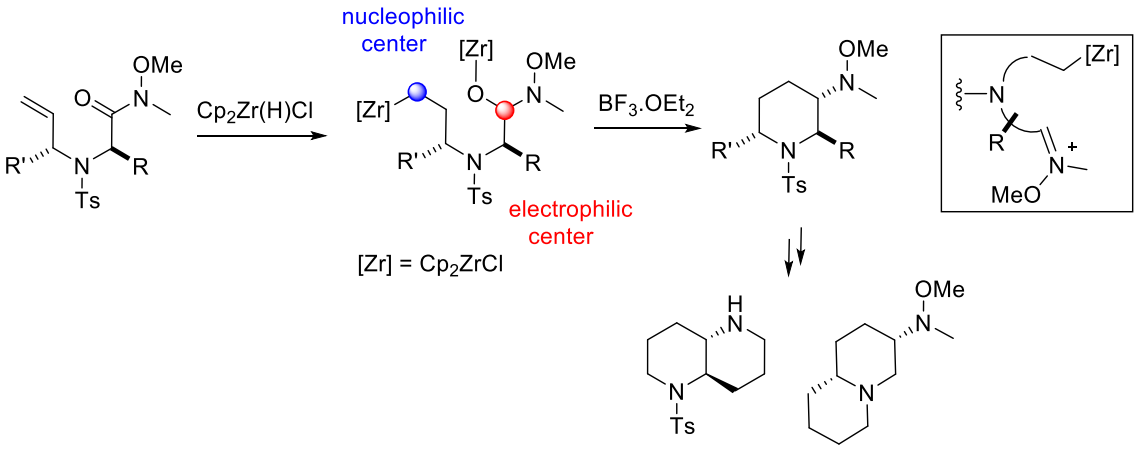
Mohamed El Gharbi,[1] Emilie Bianchi,[1] Aurélien Coelho,[1] Christelle Kowandy,[1] Jean-Bernard Behr,[1] Jean-Luc Vasse[1]

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Structurally common to many biologically active molecules, nitrogen-containing heterocycles constitute valuable synthetic entities. While the preparation aza-cycles through C-N bond-forming approaches is largely reported, cyclizations through C-C bond formation, alternative to metathesis, remain much less developed.

This presentation describes the access to 3-amino-piperidines derivatives through C-C bond forming cyclization from bis-zirconocenes generated from amines containing a vinylic chain and a Weinreb amide. Based on the simultaneous generation of both the nucleophilic and the electrophilic sites involved in the Lewis acid-promoted cyclization, this approach, was proven to be highly diastereoselective, and can be applied to diversely substituted unsaturated Weinreb amides, thus opening the way to the synthesis of bicyclic heterocycles[1,2].



[1] El Gharbi, M.; Bianchi, E.; Coelho, A.; Kowandy, C.; Behr, J.-B.; Vasse, J.-L. Bis-Zirconocenes Generated from Weinreb 2-Allylaminoacetamides as Key Intermediates for a Diastereoselective Approach to 2- and 6-Substituted-3-Aminopiperidines. *J. Org. Chem.* **2025**, *90* (12), 4134–4139.

[2] Coelho, A.; Souvenir Zafindrajaona, M.; Vallée, A.; Behr, J.; Vasse, J. Dual Activation of Unsaturated Amides with Schwartz's Reagent: A Diastereoselective Access to Cyclopentanols and N,O Dimethylcyclopentylhydroxylamines. *Chemistry A European J.* **2022**, *28* (3), e202103789.

P A008

Bis-Meisenheimer Azacalixarene: Exploration of an Unprecedented Dissipative System

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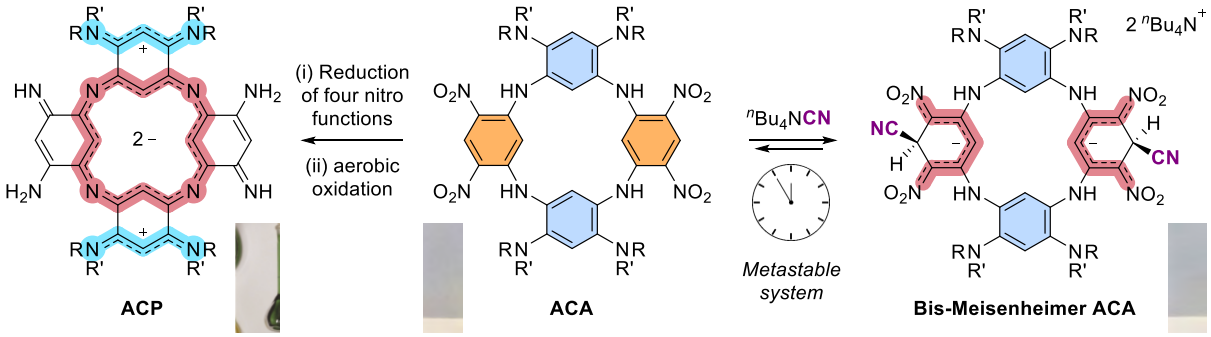
[2] *CINaM, UMR 7325 CNRS Aix-Marseille Univ, 13288 Marseille, France*

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Among heterocalixarenes, azacalixarenes (ACA) are of particular interest due to the presence of nitrogen bridges, which significantly impact their physicochemical properties. This makes them valuable scaffolds for applications ranging from ion sensing[1] to the development of porous covalent organic frameworks for dialysis and depollution.[2] ACAs also serve as versatile precursors to design near-infrared absorbing dyes such as azacalixphyrins (ACP), which are employed as photoinitiators for polymerization and photoacoustic contrast agents.[3]



We recently designed an electron-deficient ACA that captures cyanide via nucleophilic aromatic substitution, forming a metastable dianionic macrocycle bearing two Meisenheimer units. Stabilized by intramolecular hydrogen bonding and solid-state interactions, this bis-adduct spontaneously dissociates under mild conditions to regenerate the parent macrocycle. The reversible, fuel-driven process establishes a rare example of a dissipative system, tunable by counterion, concentration, solvent, and temperature.[4]

[1] Canard, G.; Edzang, J. A.; Chen, Z.; Chessé, M.; Elhabiri, M.; Giorgi, M.; Siri, O. 1,3-Alternate Tetraamido-Azacalix[4]Arenes as Selective Anion Receptors. *Chem. Eur. J.* **2016**, *22* (16), 5756–5766.

[2] a) Skorjanc, T.; Shetty, D.; Gándara, F.; Pascal, S.; Naleem, N.; Abubakar, S.; Ali, L.; Mohammed, A. K.; Raya, J.; Kirmizialtin, S.; Siri, O.; Trabolsi, A. Covalent Organic Framework Based on Azacalix[4]Arene for the Efficient Capture of Dialysis Waste Products. *ACS Appl. Mater. Interfaces* **2022**, *14* (34), 39293–39298; b) Elmerhi, N.; Al-Maqdi, K.; Athamneh, K.; Mohammed, A. K.; Skorjanc, T.; Gándara, F.; Raya, J.; Pascal, S.; Siri, O.; Trabolsi, A.; Shah, I.; Shetty, D.; Ashraf, S. S. Enzyme-Immobilized Hierarchically Porous Covalent Organic Framework Biocomposite for Catalytic Degradation of Broad-Range Emerging Pollutants in Water. *J. Hazard. Mater.* **2023**, *459*, 132261.

[3] For a recent review on these dyes, see: Mourot, B.; Jacquemin, D.; Siri, O.; Pascal, S. Coupled Polymethine Dyes: Six Decades of Discoveries. *Chem. Rec.* **2024**, *24* (12), e202400183.

[4] Pascal, S.; Torres Ruiz, A.; Baker, A. E.; Vander Griend, D. A.; Giorgi, M.; Planchat, A.; Jacquemin, D.; Siri, O. Metastable Macrocyclic Bis-Meisenheimer Adduct. *Angew. Chem. Int. Ed.* **2025**, DOI: 10.1002/anie.202511037.

P A009

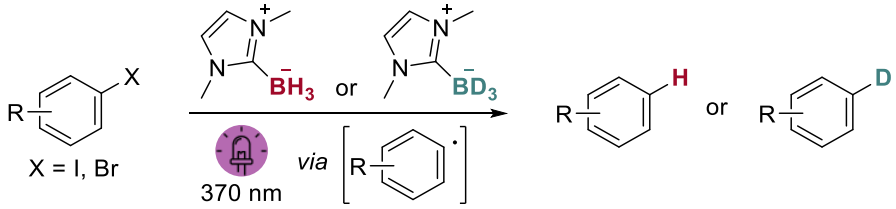
Photoinduced radical reduction and deuteration of aryl halides with NHC-boranes

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The radical chemistry of NHC-boranes has evolved rapidly over the past two decades, unlocking new opportunities for the synthesis of functionalized organic molecules.[1] While most of the reported transformations typically rely on the use of a radical initiator or a photoredox catalyst to proceed effectively, an alternative approach using only light has been described in the hydroalkylation of electron poor alkenes.[2] However, these methods were restricted to the generation of silyldifluoromethyl and alkyl radicals.

In comparison, aryl radicals are more challenging to generate. Thus, we wondered if this simple, yet underexplored method could be applied to the reduction of aryl halides through the formation of aryl radicals.

Herein, we report an operationally simple photoinduced generation and reduction of aryl radicals using NHC-boranes (Scheme 1). This method is compatible with various functional groups and tolerant to both water and oxygen, providing a valuable tool for synthesis and isotopic labeling.



Scheme 1 : Radical photoreduction of aryl halides

[1] (a) Taniguchi, T. Advances in Chemistry of N-Heterocyclic Carbene Boryl Radicals. *Chem. Soc. Rev.* **2021**, *50* (16), 8995–9021. https://doi.org/10.1039/D1CS00385B.
(b) Juliá, F.; Constantin, T.; Leonori, D. Applications of Halogen-Atom Transfer (XAT) for the Generation of Carbon Radicals in Synthetic Photochemistry and Photocatalysis. *Chem. Rev.* **2022**, *122* (2), 2292–2352. https://doi.org/10.1021/acs.chemrev.1c00558.
(c) Wan, T.; Capaldo, L.; Ravelli, D.; Vitullo, W.; De Zwart, F. J.; De Bruin, B.; Noël, T. Photoinduced Halogen-Atom Transfer by *N* -Heterocyclic Carbene-Ligated Boryl Radicals for C(Sp^3)–C(Sp^3) Bond Formation. *J. Am. Chem. Soc.* **2023**, *145* (2), 991–999. https://doi.org/10.1021/jacs.2c10444.
(d) Capaldo, L.; Wan, T.; Mulder, R.; Djossou, J.; Noël, T. Visible Light-Induced Halogen-Atom Transfer by N-Heterocyclic Carbene-Ligated Boryl Radicals for Diastereoselective C(Sp^3)–C(Sp^2) Bond Formation. *Chem. Sci.* **2024**, *15* (36), 14844–14850. https://doi.org/10.1039/D4SC02962C.
[2] (a) Wan, T.; Ciszewski, Ł. W.; Ravelli, D.; Capaldo, L. Photoinduced Intermolecular Radical Hydroalkylation of Olefins via Ligated Boryl Radicals-Mediated Halogen Atom Transfer. *Org. Lett.* **2024**, *26* (27), 5839–5843. https://doi.org/10.1021/acs.orglett.4c02034.
(b) Supranovich, V. I.; Levin, V. V.; Struchkova, M. I.; Korlyukov, A. A.; Dilman, A. D. Radical Silyldifluoromethylation of Electron-Deficient Alkenes. *Org. Lett.* **2017**, *19* (12), 3215–3218. https://doi.org/10.1021/acs.orglett.7b01334.

P A010

Sustainable electrocatalytic carboxylation of benzyl halides with CO_2 without reducing metals

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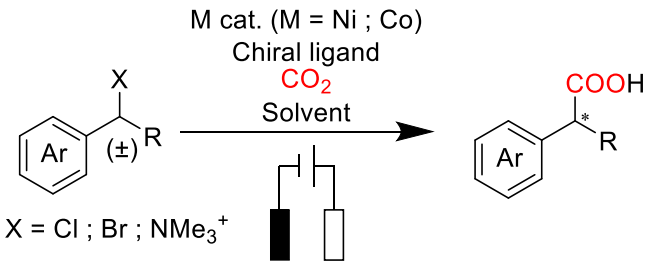
Carbon dioxide has a major impact on global warming ; it is responsible for approximately 26% of the greenhouse effect occurring in the Earth's atmosphere. The increase in its concentration is the primary driver of climate change observed on a global scale since the last decades of the 20th century.

CO_2 can be used as a raw material and a "reagent" through various techniques. Its valorization allows the production of chemical compounds or even pharmaceuticals, such as ibuprofen, which contains a carboxylic acid function on a chiral benzylic position.

Several studies on the carboxylation of benzylic positions have been published, but they rely on the use of excessive amounts of reducing metals, raising environmental concerns.

The group of R. Martin [1] investigated a carboxylation reaction of benzyl halides with CO_2, catalyzed by an achiral Ni complex; however, this reaction requires a large excess of zinc as a reducing agent. The same reactivity was explored by the group of P. Li [2] , using a chiral Ni complex, which enables the formation of enantioenriched products. Nonetheless, an excess of manganese as a reducing agent is still necessary. An electrocatalytic system for the carboxylation of chlorinated derivatives was developed by the group of G. Silvestri [3] in 1984. This system allows the synthesis of carboxylic acids using CO_2, but several challenges remain, particularly regarding enantioselectivity. In 2014, the group of J.-X. Lu [4] demonstrated the possibility of synthesizing a chiral carboxylic acid at the benzylic position from CO_2 using an electro-catalytic system catalyzed by an enantiopure Co-Salen complex, a reaction limited to only one substrate, a low yield and an enantioselectivity value that can be improved.

We thus aim to develop an electro-catalytic system for the synthesis of enantioenriched benzylic carboxylic acids from CO_2, without the use of reducing metals.



A detailed overview of the optimizations performed on the electrocatalytic system, including electrode materials, applied potential, current intensity, and supporting electrolyte, as well as on the reaction conditions such as substrate scope, concentration, temperature, and reaction time, will be here presented.

[1] León, T. ; Correa, A. ; Martin, R. *J. Am. Chem. Soc.* **2013**, *135* (4), 1221–1224.
[2] Wang, L. ; Li, T. ; Perveen, S. ; Zhang, S. ; Wang, X. ; Ouyang, Y. ; Li, P. *Angew. Chem., Int. Ed*. **2022**, *61*, e202213943.
[3] Silvestri, G. ; Gambino, S. ; Filardo, G. ; Gulotta, A. *Angew. Chem., Int. Ed*. **1984**, *23*, 979–980.
[4] Chen, B.-L. ; Zhu, H.-W. ; Xiao, Y. ; Sun, Q.-L. ; Wang, H. ; Lu, J.-X. *Electrochem. Commun*. **2014**, *42*, 55–59.

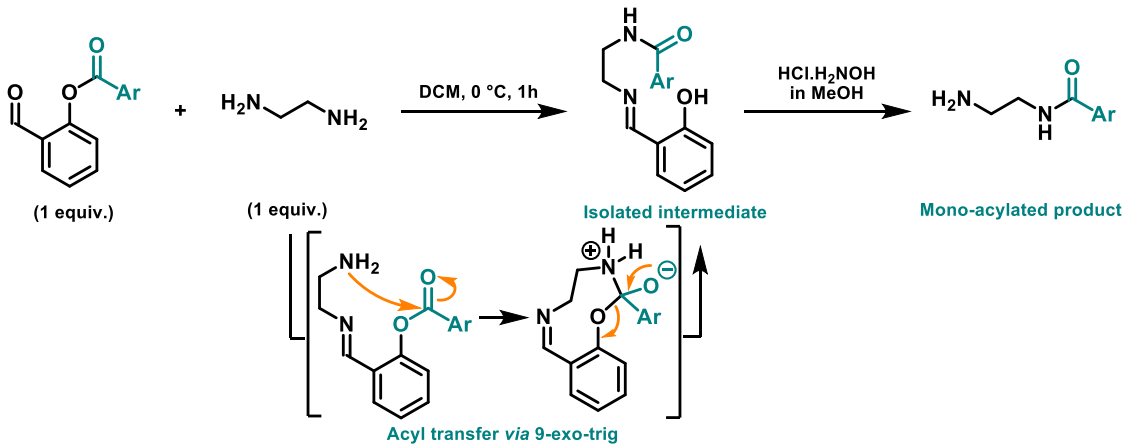
P A011

Selective transformation of diamines using a bifunctional reagent

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Diamines are widely present in many biologically active pharmaceutical products[1] and natural compounds.[2] They are also a commonly found scaffold in ligands/catalysts for organic synthesis.[3] The selective mono-functionalization of bifunctional compounds is highly interesting to access such valuable compounds. However, it remains challenging, especially for this type of diamines in which the two amine functions are both highly nucleophilic and difficult to discriminate, thus leading to complex mixtures of mono- and poly-functionalized products.[4] This type of transformation usually requires a passage through protection/deprotection steps, the use of strong acids[5]/bases,[6] *ie* overall drastic conditions.[7]

We propose a new approach for the challenging mono-*N*-acylation of diamines which takes advantage of an original bifunctional reagent. The latter allows the temporary protection of one amine moiety through the formation of an imine, subsequently leading to the intramolecular transfer of a carbonyl group on the remaining amine moiety. Then, after a simple cleavage of the imine, we can obtain the desired mono-acylated product **(Scheme 1).** After a thorough optimisation study of the reaction conditions and tuning of the bifunctional reagent, excellent selectivities were obtained towards the desired monoacylated product, under mild conditions without the observation of any di-acylated product. We succeeded in synthesising new acylating agents and started to explore the chemoselectivity of our reaction.



Scheme 1. *New approach for the selective monofunctionalisation of diamines*

[1] Lauridsen, J. M. V.; Poderyte, M.; Lee, J. W. *Green Chem*. **2023**, *25*, 1332-1338.
[2] Long, O.; Zhou, W.; Zhou, H.; Tang, Y.; Chen, W.; Liu, Q.; Bian, X. *Nat. Prod. Rep.* **2023**, *41*, 525-564.
[3] France, S; Guerin, D. J.; Miller, S. J.; Lectka, T. *Chem. Rev.* **2003**, *103*, 2985-3012.
[4] Dörwald, F. Z. *Side Reactions in Organic Synthesis*; Wiley-VCH: Weinheim, **2006**.
[5] Dhawan, B.; Southwick, P. L. *Org. Prep. Proced. Int.* **1975**, *7*, 85–88.
[6] Wang, T.; Zhang, Z.; Meanwell, N. A. *J. Org. Chem.* **1999**, *64*, 7661–7662.
[7] Jacobson, A. R.; Makris, A. N.; Sayre, L. M. *J. Org. Chem.* **1987**, *52*, 2592–2594.

P A012

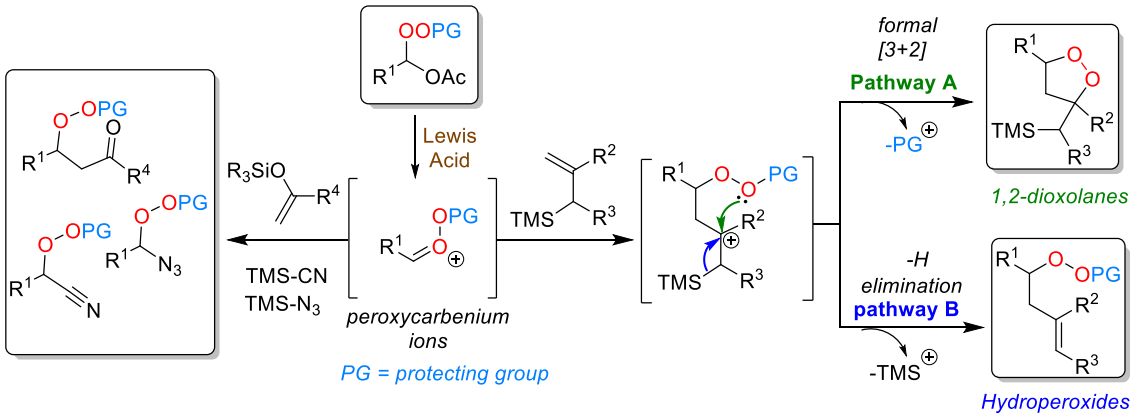
Using Acyclic Peroxyacetals in Organic Synthesis: Divergent Access to Hydroperoxides or Endoperoxides

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Peroxides are common motifs in natural products, valued for their diverse biological activities such as anti-inflammatory, antimalarial, and antitumor effects.[1] In synthetic chemistry, peroxy-ketals and -acetals derived from these structures offer promising opportunities, particularly through the formation of peroxycarbenium ions that enable nucleophilic additions, facilitating the construction of complex oxygenated frameworks and expanding the methods for endoperoxide functionalization.

Cyclic peroxyacetals have proven to be effective intermediates for the functionalization of endoperoxides, [2-4] while studies on their acyclic counterparts remain limited, and have primarily focused on more stabilized disubstituted ketal systems. Thus, the pioneering work by Dussault[5] and Woerpel,[6] described the use of acyclic peroxyketals in Sakurai or ene reactions leading directly to 1,2-dioxolanes via a formal [3+2] cycloaddition.

Based on our experience in endoperoxide chemistry, our first aim was to explore the reactivity and the formation of acyclic peroxyacetals bearing acetate functions. Acetates proved to be excellent leaving groups to generate peroxycarbenium ions on cyclic systems, and we expected a similar behavior on acyclic peroxyacetals. In the next steps, these acetoxy-peroxyacetals were employed in alkylation reactions to access a wide range of derivatives. Our goal was to perform selective transformation on a such system. Thus, a divergent reactivity was studied depending on the protecting group, allowing to obtain with allylsilanes either a [3+2] formal cycloaddition reaction, which leads to 1,2-dioxolanes (Pathway A), or either a Hosomi-Sakurai type reaction, which provides protected hydroperoxides functions (Pathway B. The other silylated nucleophiles (enolate, cyanide, azide, etc…) were also investigated, allowing a high degree of functionalization.



[1] Liu, D.-Z.; Liu, J.-K. *Nat. Prod. Bioprospect.* **2013**, *3*, 161–206.
[2] Pinet, A.; Figadère, B.; Ferrié, L. *Adv. Synth. Catal.* **2020**, *362*, 1190–1194.
[3] López, M. M.; Jamey, N.; Pinet, A.; Figadère, B.; Ferrié, L *Org. Lett.* **2021**, *23*, 1626–1631.
[4] Champciaux, B., Jamey, N., Figadère, B. & Ferrié, L *J. Am. Chem. Soc.* **2025**, 147, 3353–3359.
[5] Dussault, P.; Lee, I. Q.; Lee, H.-J.; Niu, Q. J.; Schultz, J. A.; Zope, U. R. *J. Org. Chem.* **2000**, *65*, 8407–8414.
[6] Ramirez, A.; Woerpel, K. A. *Org. Lett*. **2005**, *7*, 4617–4620.

P A013

Non-usual cyclopropane reorganisation under superacidic-activation

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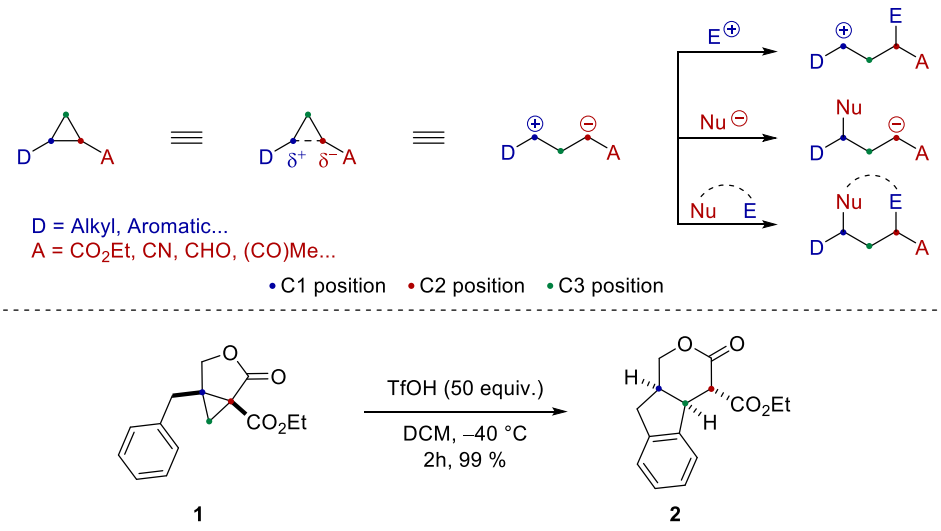
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Cyclopropanes are highly reactive species due to their inherent ring strain and unique geometry. Those specificities lead to distinctive orbital configuration and make them valuable for molecular diversity. When cyclopropanes are substituted with both electron-donating and withdrawing groups, substitution occurs at **C1** or **C2** position.[1]

Here, we report a new activation of donor-acceptor cyclopropanes unlocking new opportunities for stereoselective molecular synthesis by combining organocatalysis and superacid chemistry.[2] Indeed, an unusual cyclopropane reactivity, that implies the functionalization of less reported **C3** position, is going to be discussed. Starting from easily accessible lactone **1**,[3] polycyclic complex molecules **2** were attained in high selectivities and yields. Details on the reaction development and mechanistic studies,[4] that allowed us to propose a plausible mechanistic model consistent with the experimental observations, will be presented.



[1] Pirenne, V.; Muriel, B.; Waser, J. Catalytic Enantioselective Ring-Opening Reactions of Cyclopropanes. *Chem. Rev.* **2021**, *121* (1), 227–263.

[2] In collaboration with S. Thibaudeau Superacid group at IC2MP, Poitiers (Superacid chemistry)

[3] Terrasson, V.; van der Lee, A.; Marcia de Figueiredo, R.; Campagne, J. M. Organocatalyzed Cyclopropanation of α-Substituted α,β-Unsaturated Aldehydes: Enantioselective Synthesis of Cyclopropanes Bearing a Chiral Quaternary Center. *Chemistry – A European Journal* **2010**, *16* (26), 7875–7880.

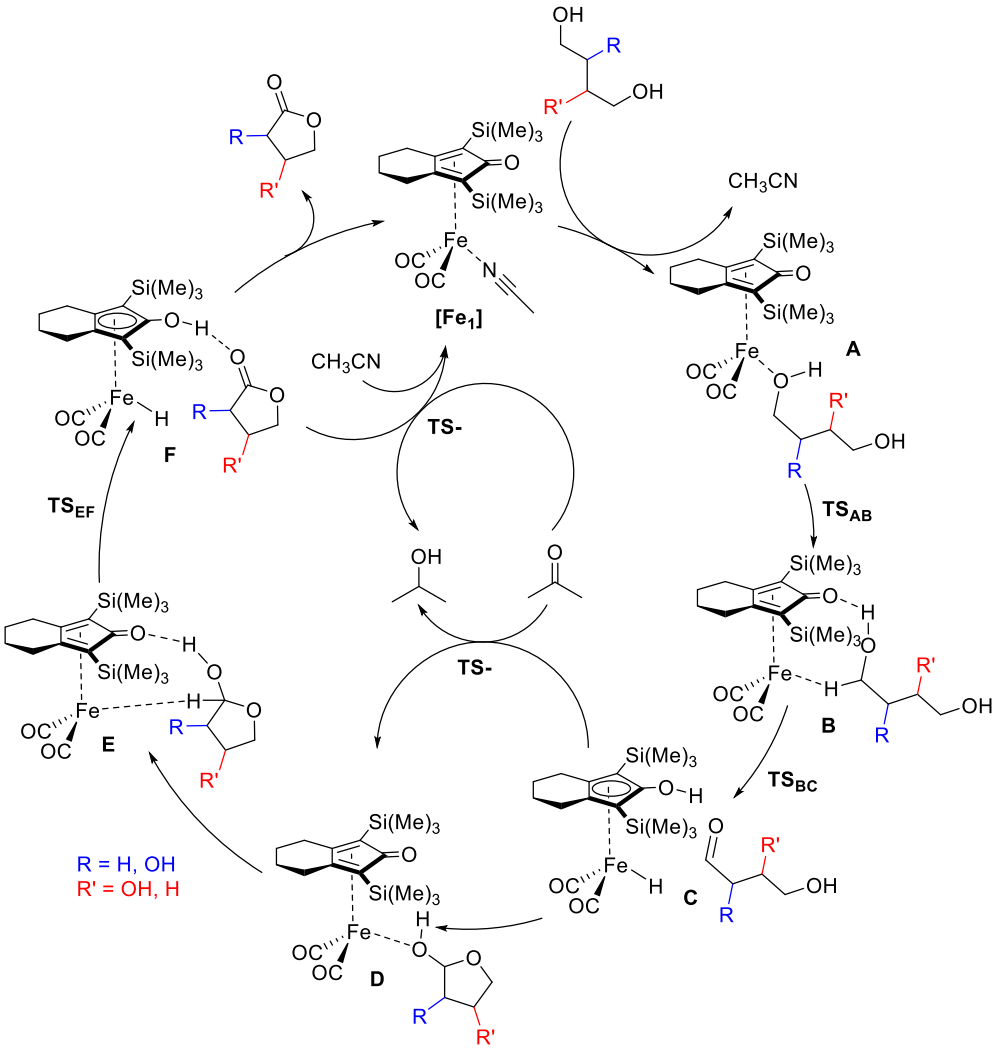
[4] In collaboration with E.Clot at ICGM, Montpellier (DFT calculation)

P A014

Iron-Catalyzed oxidation of triol containing vicinal diols into hydroxy lactones: A DFT Study

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A combined experimental and theoretical study on the iron-catalyzed oxidation of unprotected triols incorporating vicinal diols, into hydroxy-lactones is presented using the Knölker catalyst. Focused on triols as mimics for complex polyols derived from sugars, this report rationalizes the difference in reactivity and selectivity observed between vicinal and non-vicinal primary alcohols in transfer hydrogenation. Moreover, DFT calculations performed on a model substrate allowed us to elucidate the key steps of the sequence highlighting that the final oxidation step determines the selectivity of the whole process. Interestingly, the final product distribution was unexpectedly governed by the contribution of entropy to Gibbs free energy and more particularly by the vibrational contribution in the last transition state.



P A015

Developments of new polyfunctionalized heterocycles from original metallocatalyzed processes

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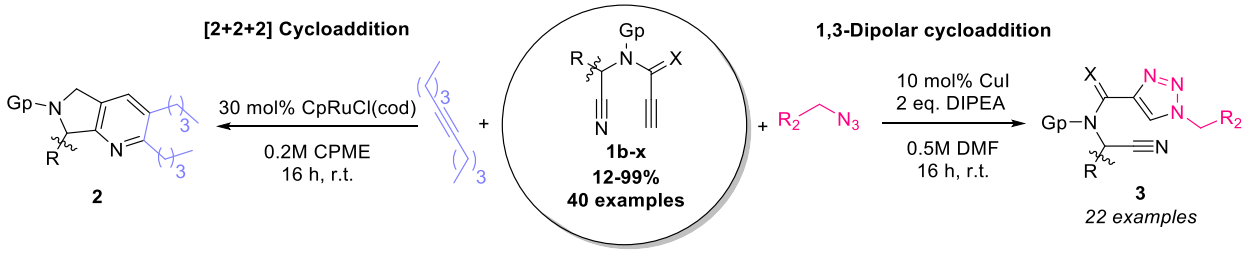
[1] *Université Le Havre Normandie, Normandie Univ, URCOM UR 3221, F-76600 Le Havre, France*

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This project aims to develop new synthetic approaches to access a novel class of aza-spirocyclic compounds.[1] In this context, we explored metallocatalyzed multi-component reactions. Preliminary work has identified molecules capable of strongly inhibiting farnesyltransferase (FTase), a metalloenzyme involved in certain cancers [2](CI = 1 469 and 1,900 nM).[3] Encouraged by these results, we continued the pharmacomodulation around the spiroisoindole nuclei. Thus, a new series of type **1b-x** acetatamids was designed from ynamide-nitriles or alkylcyanamides, via an Ugi reaction catalyzed by Fe(III). These compounds were then transformed into **2** derivatives (**Scheme 1**) by ruthenium-catalyzed [2+2+2] cycloaddition,[4] or by 1,3-dipolar cycloaddition[5] with an azide to obtain novel 1,2,3-triazoles **3**.



Scheme 1: Synthesis oof new polyfunctionalized heterocycles

[1] Pesquet, A.; Othman, M. *Tetrahedron Lett.* **2013**, *54*, 5227.

[2] Saranya, S.; Aneeja, T.; Neetha, M.; Anilkumar, G. *Appl. Organomet. Chem.* **2020**, *34*.

[3] (a) Pesquet, A.; Merzag, H.; Knorr, M.; Strohmann, C.; Lawson, A. M.; Ghinet, A.; Dubois, J.; Farce, A.; Daïch, A.; Othman, M. *Org. Biomol. Chem.* **2019**, *17*, 2798. (b) Chortani, S.; Othman, M.; Lawson, A. M.; Romdhane, A.; Ben Jannet, H.; Knorr, M.; Brieger, L.; Strohmann, C.; Daïch. A. *New J. Chem.* **2021**, *45*, 2393.

[4] Foster R. W., Tame C. J., Hailes H. C., Sheppard T. D. *Adv. Synth. Catal.* **2013**, *355*, 2353.

[5] Kwon M., Jang Y., Yoon S., Yang D., Jeon H. B., *Tetrahedon Letters*, *53*, 1606.

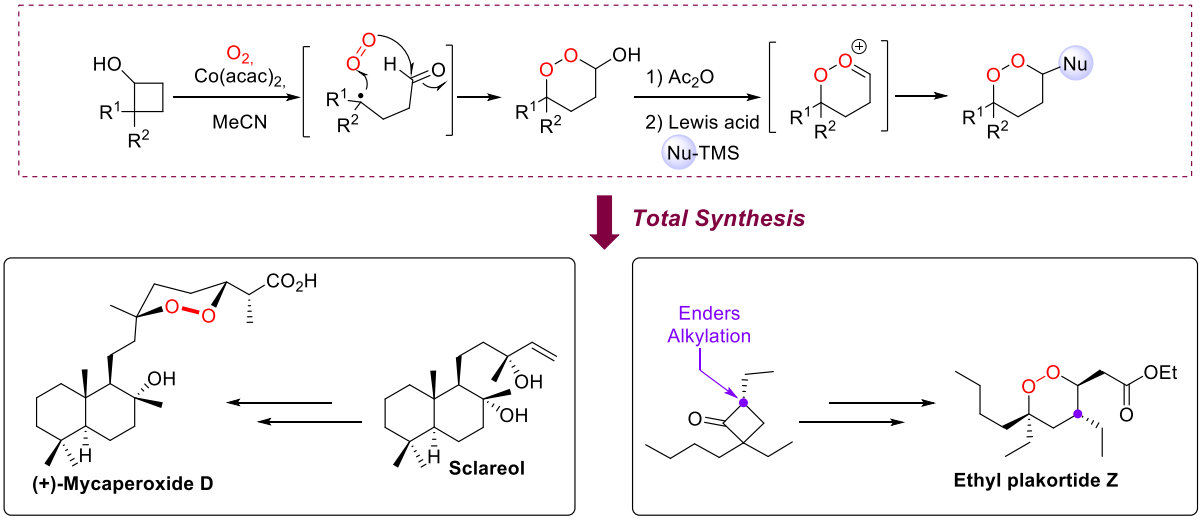
P A016

Total Synthesis of Marine Endoperoxides: Mycaperoxides B, C, D and G, and Ethyl Plakortide Z

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Marine endoperoxides are compounds produced mainly by sponges or tunicates, and likely play a role as anti-fouling agents, enabling these organisms to remain clean. Their biological activity is diverse, with properties that are mainly cytotoxic, antiviral, antibacterial, or antiparasitic.[1] In recent years, our team has developed methods for accessing endoperoxides based on the insertion of molecular oxygen into constrained cycloalkanols, followed by the activation of an endoperoxyacetal function to introduce various silylated nucleophiles.[2,3,4] Here we illustrate the application of these different methods to the total synthesis of several marine endoperoxides. Mycaperoxides B, C, D, and G were synthesized from sclareol, allowing the introduction of decalin via a divergent strategy.[5] We also focused on the total synthesis of ethyl plakortide Z, an endoperoxide with the distinctive feature of having an ethyl group on the 1,2-dioxane motif, which was introduced by an Enders alkylation.[6,4]



[1] Ferrié, L. Chapter Two - Advances in the Synthesis of 1,2-Dioxolanes and 1,2-Dioxanes. In *Adv. Heterocycl. Chem.* **2021**; Vol. 135, pp 57–146. 10.1016/bs.aihch.2021.03.001.

[2] Pinet, A.; Figadère, B.; Ferrié, L. Access to Functionalized 3,5-Disubstituted 1,2-Dioxolanes under Mild Conditions through Indium(III) Chloride/Trimethylsilyl Chloride or Scandium(III) Triflate Catalysis. *Advanced Synthesis & Catalysis* **2020**, *362* (5), 1190–1194. 10.1002/adsc.201901145.

[3] López, M. M.; Jamey, N.; Pinet, A.; Figadère, B.; Ferrié, L. Oxidative Ring Expansion of Cyclobutanols: Access to Functionalized 1,2-Dioxanes. *Org. Lett.* **2021**, *23* (5), 1626–1631. 10.1021/acs.orglett.1c00070.

[4] Champciaux, B.; Jamey, N.; Figadère, B.; Ferrié, L. Peroxycarbenium-Mediated Asymmetric Synthesis of 1,2-Dioxanes and 1,2-Dioxolanes. *J. Am. Chem. Soc.* **2025**, *147* (4), 3353–3359. 10.1021/jacs.4c13899.

[5] Kerim, M. D.; Evanno, L.; Ferrié, L. Stereodivergent Total Syntheses of (+)-Mycaperoxides C, D, G Methyl Ester and (−)-Mycaperoxide B. *Chem. Eur. J.* **2023**, *29* (6), e202203004. 10.1002/chem.202203004.

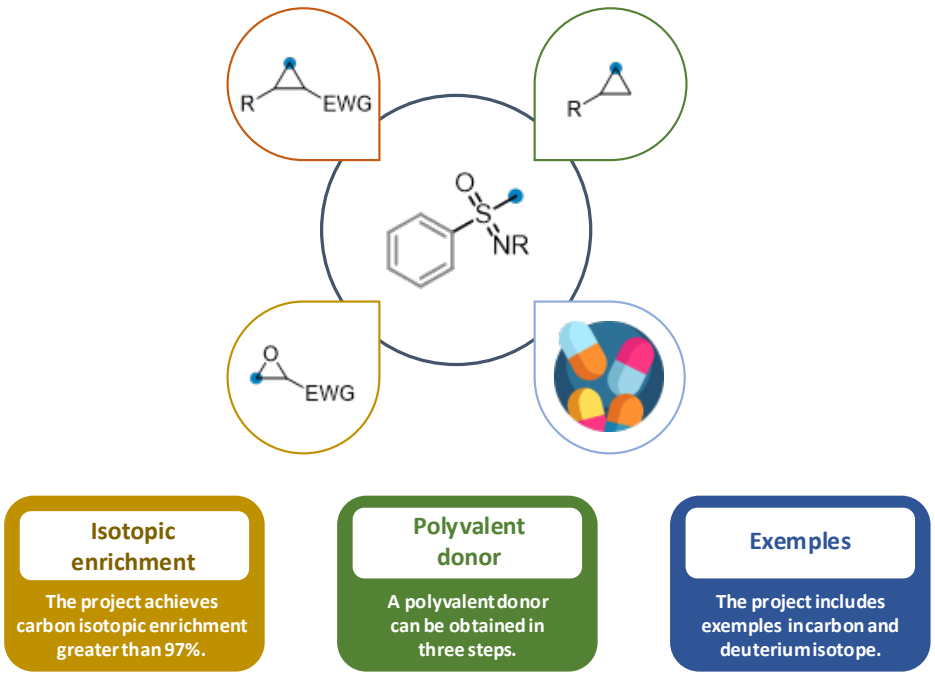
[6] Jamey, N.; Ferrié, L. Stereodivergent Total Synthesis of Ethyl Plakortide Z. *Org. Lett.* **2024**, *26* (27), 5741–5745. 10.1021/acs.orglett.4c01893.

P A017

Development of sulfoximines as carbon-labelled donor

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Sulfoximines, monoaza analogues of sulfones have a unique structure, thus enabling a fine tuning of their electronic properties thanks to N-functionalization.[1] These versatile reagents can act as electrophiles, nucleophiles, or radical methyl donors, making them highly valuable in synthetic chemistry.[2] On the other hand, radioactive labelling is essential when comes the study of Absorption, Distribution, Metabolism and Excretion (ADME) of drug candidates.[3] Currently, emerging pharmacophores such as cyclopropanes can only be prepared in a multistep fashion, leading to the generation of high amounts of radioactive and difficult to treat wastes.[4,5] Herein, we report the development of a sulfoximine-based carbon donor for cyclopropanation in carbon and deuterium isotopic labeling, which can be synthesized in just three steps and enables the late-stage functionalization of complex scaffolds.



[1] Mäder, P.; Kattner, L. *J. Med. Chem.* **2020**, *63*, 14243–14275.
[2] Shen, X.; Hu, J. *Eur. J. Org. Chem.* **2014**, *2014*, 4437–4451.
[3] Babin, V.; Taran, F.; Audisio, D. *JACS Au* **2022**, *2*, 1234–1251.
[4] Kanamaru, H.; Kawahara, K.; Okuno, M.; Yoshitake, A.; Nakatsuka, I. *J. Label. Compd. Radiopharm.* **1987**, *24*, 409–422.
[5] Sardana, M.; Mühlfenzl, K. S.; Wenker, S. T. M.; Åkesson, C.; Hayes, M. A.; Elmore, C. S.; Pithani, S. *J. Label. Compd. Radiopharm.* **2022**, *65*, 86–100.

P A018

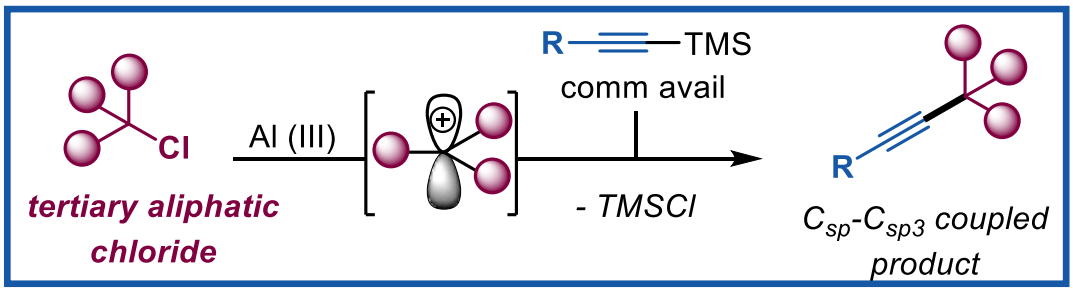
Al(III)-Promoted Formation of All-Carbon Quaternary Centers from Aliphatic Tertiary Chlorides and Alkynyl Silanes

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Despite the accessibility of numerous alkynes through coupling or substitution reactions, the synthesis of trialkyl-substituted alkynes is still a major challenge. Within this context, we reexplored the electrophilic alkynyl substitution between tertiary aliphatic chlorides and silylated alkynes. We were able to demonstrate that this approach is significantly more general than originally demonstrated by Capozzi[1] and even tolerates various functional groups. Intriguingly, our study revealed remarkable high diastereoselectivities for substrates with substitution in the α position.[2,3] Additionally, we made an unexpected discovery: an intriguing C-H activation of a cyclooctane ring furnishing a cyclooctane-fused cyclobutene. These findings not only extend the utility of Capozzi's original concept but also underscore the potential of highly reactive cations in modern organic C-H activation reactions.



[1] One-step synthesis of tertiary alkyl-substituted acetylenes from silylacetylenes. Capozzi, G.; Romeo, G.; Marcuzzi, F. *J. Chem. Soc., Chem. Commun.* **1982**, 959−960.

[2] Al(III)-Promoted Formation of All-Carbon Quaternary Centers from Aliphatic Tertiary Chlorides and Alkynyl Silanes. P. Charki, D.S. Müller *J. Org. Chem.* **2024**, *10*, 7324–73293.

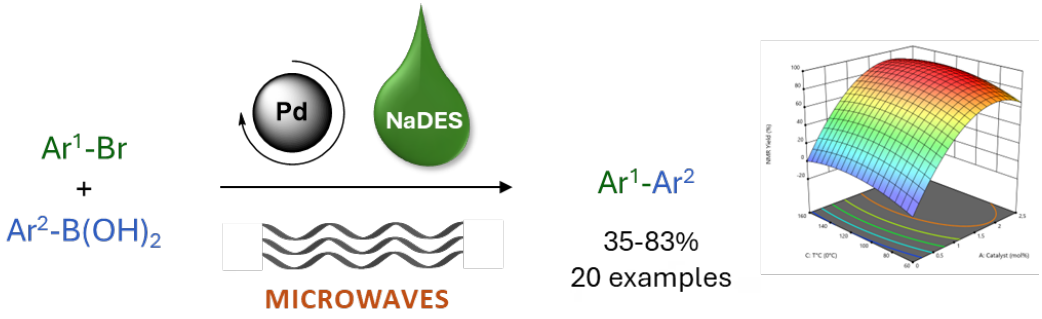
[3] Reactions of Tertiary Aliphatic Cations with Silylated Alkynes: Substitution, Cyclization and Unexpected C−H Activation Products. P. Charki, M, Cordier, K. E. O. Ylijoki, D. S. Müller, *Chem. Eur. J.* **2025,** *31*, e202403979.

P A019

Simple and Rapid Microwave-Assisted Suzuki–Miyaura Cross-coupling in Betaine/Glycerol Natural Eutectic Solvent

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The twelve principles of green chemistry proposed by Anastas *et al.* aim to minimise the risks and environmental impact of chemical processes. They guide researchers in the development of more sustainable methodologies. Reaction solvents significantly influence the environmental impact, cost and health and safety issues of chemical processes. In particular, principle 5 focused on the replacement of conventional organic solvents with safer and more sustainable alternatives.
Since the 2000s, deep eutectic solvents (DES), especially when of natural origin (NaDES), have been considered an alternative to conventional organic solvents and ionic liquids. Their non-volatility, non-flammability, biodegradability and low toxicity meet green chemistry criteria.
Although DES are used in many synthetic reactions today, few references reported their use in microwave-assisted reactions. To explore their potential and diversify their applications, Suzuki-Miyaura coupling was studied in NaDES under microwave irradiation.
After optimization using a design of experiment based on response surface methodology, the most efficient conditions were found to be betaine:glycerol (1:4, mol/mol) as eutectic solvent, $PdCl_2dppf.CH_2Cl_2$ as catalyst, Na_2CO_3 as base, and microwave heating at 129°C for 15 minutes. The results showed an increase in reactivity with very rapid reaction kinetics. Under these conditions, 20 compounds, including two of therapeutic interest, were isolated in yields ranging from 35 to 82%. Furthermore, the catalyst in the eutectic solvent was recycled, and a gram-scale reaction was performed as an example.[1]
The results of this study demonstrate that the combination of NaDES with eco-compatible activation techniques such as microwaves can contribute to the synthesis of molecules of interest through green processes for sustainable chemistry.



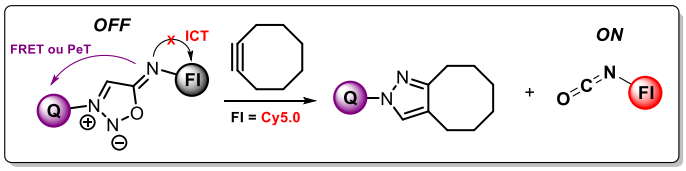
[1] C. Salami, L. Boudesocque-Delaye, P-O. Delaye, E. Thiery, *ChemistryOpen* **2025**, e202500138.

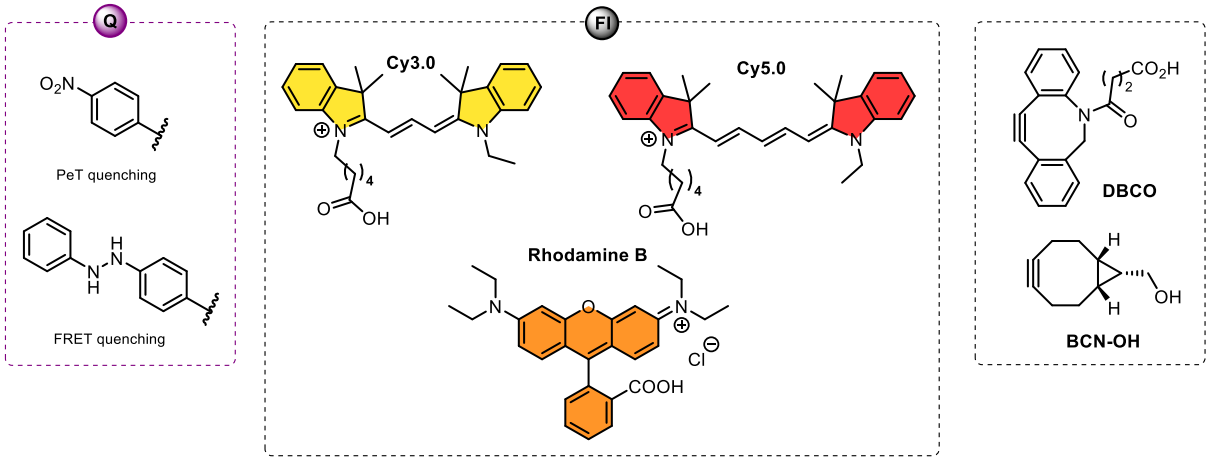
P A020

Sydnonimine probes for biorthogonal cycloadditions with cyclooctynes

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Abstract: Sydnonimines are a class of mesoionic dipoles that can undergo bioorthogonal cycloadditions with cyclooctynes, releasing reactive electrophiles (isocyanates). This unique reactivity positions them as promising tools for fluorogenic scavenging of endogenous cellular nucleophiles, including protein thiols and amines residues.[1] The aim of this projet is therefore to develop, synthetize and use highly reactive sydnonimine-based probes for irreversible protein labeling in living cells. Among the possible applications of this strategy, we intend to explore permanent fluorescence labeling for advanced cell imaging.





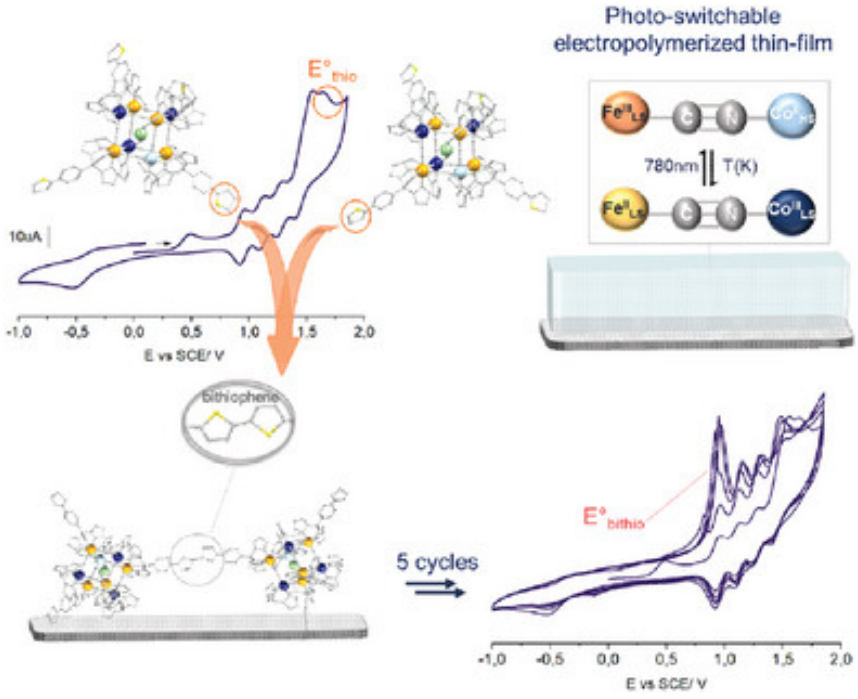
[1] Fast and Bioorthogonal Release of Isocyanates in Living Cells from Iminosydnones and Cycloalkynes. *J. Am. Chem. Soc.* **2023**, *145*, 2219−2229

P A021

Design of photomagnetic ultra-thin films by electro-deposition of switchable cyanide-bridged Fe_4Co_4 complexes

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Preparing thin-films of molecular polymetallic materials remains one of the current limitations in the implementation of polymetallic complexes into devices.[1-8] The hurdle was tackled here using an electrochemical route for depositing the cyanido-bridged polymetallic complex {Tl^{I}[Fe^{II}(2-TPhTp)(CN)3]4[Co^{III}(Tp)]3[Co^{II}(Tp)]}(1) (where 2-TPhTp = [4-(2-thienyl)Phenyl] tris(pyrazol-1-yl)borate ; and Tp = tris(pyrazol-1-yl)borate), functionalized with thiophene groups, on conductive surface (Pt/mica).**[9]** Cyclic voltammograms show that the electrochemical pattern of the cubic units is maintained in the electropolymerized film, notably with four quasi reversible successive Fe^{III}/Fe^{II} redox events. Assessing the morphology and the chemical composition of the resulting thin-film by Atomic Force Microscopy (AFM) and X-ray Photoelectron Spectroscopy (XPS) experiments respectively, reveal a homogenous deposition (thickness of ca. 20 nm) showing the expected metallic ratio. More importantly, X-ray Absorption Spectroscopy (XAS) and X-ray Magnetic Circular Dichroism (XMCD) measurements demonstrate that the photo-induced metal-metal electron transfer is preserved in the film. XMCD signals of Fe and Co atoms at their L2,3 absorption edges both indicate an equivalent conversion of Fe^{II}-CN-Co^{III} diamagnetic pairs into Fe^{III}-CN-Co^{II} paramagnetic ones under laser light irradiation below 62 K. As for the photo-magnetic complex, this behavior is reversible: metastable Fe^{III}-CN-Co^{II} paramagnetic pairs thermally relax to the diamagnetic ground state upon heating to room temperature.



[1] Yao *et al.,* Adv. Funct. Mat. 2024, 34, 2313938.
[2] R. Sánchez-de-Armas *et al.,* Nanoscale 2021, 13, 18702.
[3] N. A. M. Amin *et al.,* Inorg. Chim. Acta 2023, 544, 121168.
[4] G. Molnár *et al.,* Adv. Mat. 2018, 30, 1703862.
[5] M. Gruber *et al.,* Magnetochemistry 2020, 6, 35.
[6] M. Zerdane *et al.,* Faraday Discuss. 2022, 237, 224–236.
[7] M. Cammarata *et al.,* Nat. Chem. 2021, 13, 10–14.
[8] M. Pénicaud *et al.,* J. Maer. Chem. C 2023, 11, 11518–11528.
[9] A. Benchohra *et al.,* Small, 2025, ⟨10.1002/smll.202408917⟩.

P A022

Nickel-Catalyzed Electroreductive Intramolecular Hydrosilylation of Alkenes and Alkynes

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Developing new accesses to heterocyclic compounds is a constant challenge in synthetic chemistry. While heterocyclic motifs are abundant in natural products, new methodologies have recently been developed in our laboratory, enabling the heterocyclization of variously functionalized acetylenic compounds.[1] In parallel, our group has embarked on a research program devoted to accessing silylated or germylated heterocycles *via* cyclization reactions,[2] the presence of silicon/germanium atoms being known to increase the lipophilicity of the corresponding molecules.[3] A common method for accessing silylated compounds is the hydrosilylation reaction. This reaction involves the addition of an Si–H bond to an sp^2 or sp carbon. Typically, hydrosilylation reactions use expensive noble metals such as rhodium or platinum.[4] In this study, we have developed a simple and effective method for synthesizing new silylated heterocycles without the need for these noble metals. Our approach uses a stable and inexpensive pre-catalyst, $NiBr_2$bipy, which is electrochemically reduced to Ni(0) to facilitate an intramolecular hydrosilylation reaction on alkenes and alkynes (Fig. 1).[5] This methodology is fully regio- and stereoselective, and allows moderate to very good yields to be achieved.

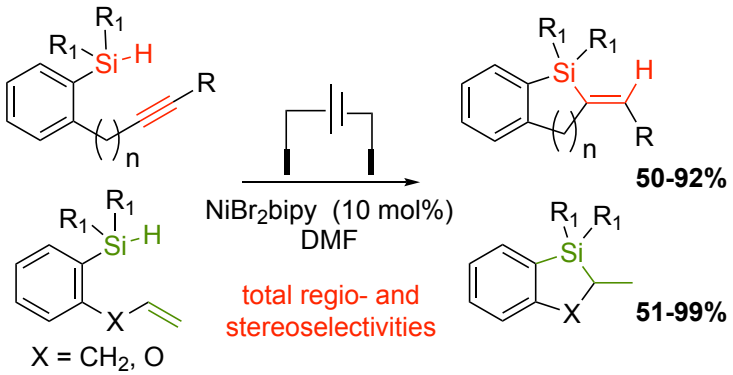


Figure 1

[1] (a) Fressigné, C.; Girard, A-L.; Durandetti, M.; Maddaluno J. *Angew. Chem. Int. Ed.* **2008**, *47*, 891–893. (b) Lhermet, R.; Ahmad, M.; Fressigné, C.; Silvi, B.; Durandetti, M.; Maddaluno J. *Chem. Eur. J.* **2014**, *20*, 10249–10254.
[2] (a) Boddaert, T.; François, C.; Mistico, L.; Querolle, O.; Meerpoel, L.; Angibaud, P.; Durandetti, M.; Maddaluno J. *Chem. Eur. J.* **2014**, *20*, 10131–10139. (b) Ahmad, M.; Gaumont, A.-C.; Durandetti, M.; Maddaluno J. *Angew. Chem. Int. Ed.* **2017**, *56*, 2464–2468.
[3] (a) Friedrich, J.; Dörrich, S.; Berkefeld, A.; Kraft, P.; Tacke, R. *Organometallics* **2014**, *33*, 796–803. (b) Egawa, T.; Koide, Y.; Hanaoka, K.; Komatsu, T.; Terai, T.; Negano, T. *Chem. Commun.*, **2011**, *47*, 4162–4164. (c) Fu, M.; Xiao, Y.; Qian, X.; Zhao, D.; Xu, Y. *Chem. Commun*. **2008**, 1780–1782. (d) Franz, A.K.; Wilson, S.O.J. *Med. Chem*. **2013**, 56, 388–405.
[4] (a) Matsuda, T.; Kadowaki, S.; Murakami, M. *Chem. Commun.*, **2007**, 2627–2629. (b) Trost, B.M.; Ball, Z.T. *J. Am. Chem. Soc*. **2003**, *125*, 30–31. (c) Kinoshita, H.; Uemura, R.; Fukuda, D.; Miura, K. *Org. Lett*, **2013**, *15*, 5538–5541.
[5] Reboli, M.; Kassamba, S.; Durandetti, M. *Chem. Eur. J.*, **2024**, *30*, e202400440.

P A023

Design, synthesis and photophysical studies of tripodal proligands for photoactive iron complexes

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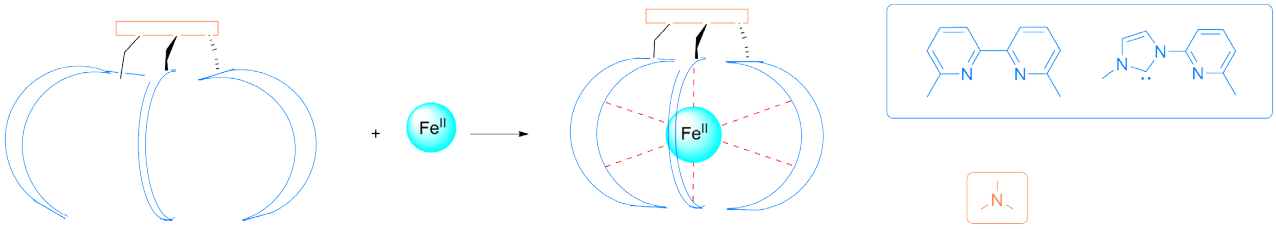
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The growing demand for sustainable photoactive materials has driven the exploration of transition metal complexes based on earth-abundant elements. Within this context, this work focuses on developing novel supramolecular assemblies (hemicages and cages) constructed from tripodal ligands bearing pyridine-NHC or bipyridine motifs. These systems aim to optimize metal-to-ligand charge transfer (MLCT) states, particularly in iron(II) complexes, by enhancing structural rigidity and destabilizing undesired metal-centered (MC) deactivation pathways.[1]

In this work, two original tripodal ligands and proligands were synthesized via multistep pathways. The chelating units are linked to a central amine platform. The pyridine-NHC-based ligand, synthesized in four steps, showed promising features for complexation. Parallel efforts led to the synthesis of a bipyridine-based hemicage and its corresponding Fe(II) complex.[2,3]

This work highlights the potential of rigid tripodal ligand platforms to stabilize photoactive iron complexes toward more efficient and sustainable applications in photodynamic therapy and solar energy conversion.



[1] Magra, K.; Domenichini, E.; Francés-Monerris, A.; Cebrián, C.; Beley, M.; Darari, M.; Pastore, M.; Monari, A.; Assfeld, X.; Haacke, S.; Gros, P. C. Impact of the Fac/Mer Isomerism on the Excited-State Dynamics of Pyridyl-Carbene Fe(II) Complexes. *Inorg. Chem.* **2019**, 58 (8), 5069–5081.

[2] Hussein, H.; Varbanov, M.; Fournier, B.; Dumarçay-Charbonnier, F. Towards the Design, Synthesis and Preliminary Biological Evaluation of Potential Corono and Clipcarbenes: Novel Bis-Imidazolium-Bis-Heterocycle Macrocyclic Ligands. *Tetrahedron Letters* **2021**, 79, 153288.

[3] Hussein, H.; Wang, M.; Kunstek, H.; Hergot, T.; Philippot, S.; Risler, A.; Frochot, C.; Arnoux, P.; Fournier, B.; Varbanov, M.; Dumarçay-Charbonnier F. New corono asymmetrical N-bis-heterocyclic bis-imidazolium macrocycle salt, preliminary physicochemical studies, X-Ray structures and biological evaluation. *J. Heterocycl. Chem.* **2025**, Accepted and in press.

P A024

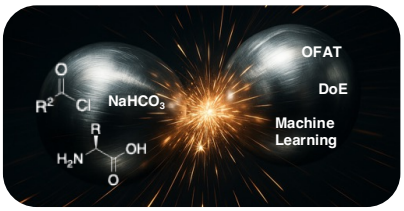
A journey through optimization: Applying OFAT, DoE and machine learning to sustainable amidation

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Amide bond formation has been broadly investigated in organic chemistry due to its particular relevance in many fields such as medicinal chemistry. Starting from a carboxylic acid and an amine, this reaction is greatly facilitated when coupling agents are employed to activate the acid. Another possibility is to use an activated carboxylic acid such as an acyl chloride. These approaches, combined with mechanochemistry, have found many developments, since our pioneering works in amidation[1] and peptide synthesis,[2] conducted in a ball-mill, to identify more sustainable ways to form amide bonds.

The optimization of reaction conditions is part of every development of a new synthetic pathway. However, depending on which method is used, the number of experiments to carry out can exponentially increase. The well-known “one factor at a time” method (OFAT) is the perfect example: tens or hundreds of experiments can be necessary to find the best conditions, depending on how many variables are considered. Performing such number of experiments can question the sustainability of the method. As an alternative, statistical approaches have been developed such as Design of Experiment (DoE)[3] or Bayesian-based machine learning optimization (BO).[4]



Inspired by all these recent advances, we herein disclose the optimization of a very simple amidation reaction in a ball-mill, by reacting an amino acid and an acyl chloride, using various available optimization methods. Moreover, to align with the 12 principles of green chemistry, the optimization process was implemented for each molecule within a given scope in a fast and straightforward manner. Such compounds can then be further functionalized to lead to more complex molecules.[5]

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[1] Métro, T.-X.; Bonnamour, J.; Reidon, T.; Sarpoulet, J.; Martinez, J.; Lamaty, F., Mechanosynthesis of amides in the total absence of organic solvent from reaction to product recovery. *Chem. Commun.* **2012,** *48* (96), 11781-11783.

[2] Declerck, V.; Nun, P.; Martinez, J.; Lamaty, F., Solvent-Free Synthesis of Peptides. *Angew. Chem. Int. Ed.* **2009,** *48* (49), 9318-9321.

[3] Murray, P. M.; Bellany, F.; Benhamou, L.; Bucar, D. K.; Tabor, A. B.; Sheppard, T. D., The application of design of experiments (DoE) reaction optimisation and solvent selection in the development of new synthetic chemistry. *Org Biomol Chem* **2016,** *14* (8), 2373-84.

[4] Lavayssiere M, Bantreil X, Lamaty F. Optimizing Reactions in Reactive Extrusion by a Bayesian Approach: the Case of Thermal Amidation. ChemRxiv. 2025; doi:10.26434/chemrxiv-2025-zgpnz

[5] Burton, T. F.; Garisoain, Z.; Chaix, C.; Aassine, J.; Virapin, E.; Voronova, A.; Pinaud, J.; Giani, O., An Optimized and Universal Protocol for the Synthesis of Morpholine-2,5-Diones from Natural Hydrophobic Amino Acids and Their Mixture. *ACS Omega* **2024,** *9* (26), 28583-28593.

P A025

Development of Pyrroloquinolone-Based Push-Pull Fluorescent Dyes

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Keywords: Donor-π-Acceptor architecture, pyrroloquinolone, internal charge transfer

Summary: In a Donor-π-Acceptor molecular architecture, often abbreviated **D-π-A**, a donor moiety **D** is linked to an acceptor moiety **A** via an intermediate **π**-conjugated bridge. This arrangement can promote the phenomenon of internal charge transfer (**ICT**), the flow of electrons from a donor moiety (**D**) to an acceptor moiety (**A**) through the conjugated bridge.[1]

By adjusting the properties of the donor and acceptor units, the molecule's photophysical characteristics can be optimized for various applications. Donor-acceptor dyes are relevant structures for preparing fluorescent compounds with large Stokes shifts, preventing effects like self-absorption. A key challenge in this field is designing fluorescent molecules with zero overlap between their absorption and emission spectra.[2] In our project, pyrroloquinolone was chosen as the central aromatic motif linking the D and A units.

The synthesis of these molecular architectures (D-π-A), their photophysical properties, and the time-dependent density functional theory (TD-DFT) calculations will be presented in this communication.

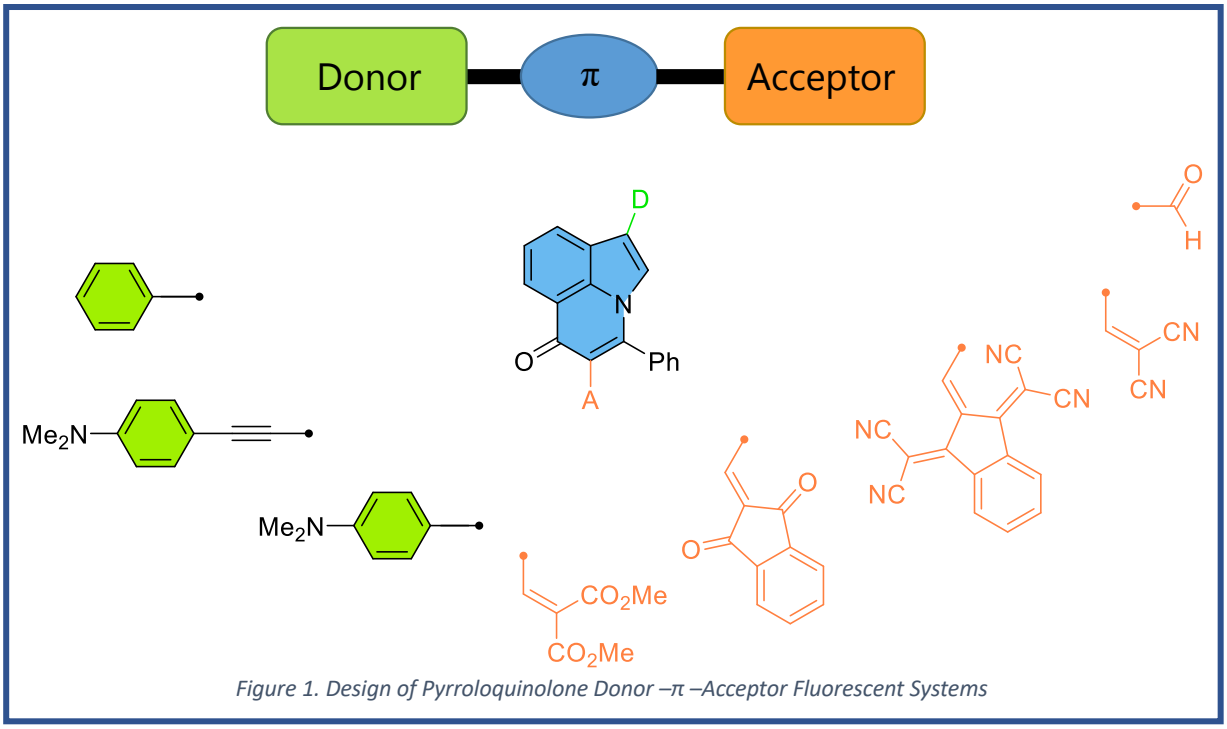


Figure 1. Design of Pyrroloquinolone Donor –π –Acceptor Fluorescent Systems

[1] Rational Design of Push–Pull Fluorene Dyes: Synthesis and Structure–Photophysics Relationship. *Chem. – Eur. J.* **2016**, *22* (30), 10627–10637.

[2] Zero-Overlap Fluorophores for Fluorescent Studies at Any Concentration. *J. Am. Chem. Soc.* **2020**, *142* (28), 12167–12180

P A026

Synthesis and structural studies of heterocyclic benzoxazine analogues of α-amino acid for pseudopeptides' elaboration

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Peptides play an essential role in numerous physiological and biochemical processes including hormone regulation, neurotransmission, immune response or metabolic regulation. Since the first half of the 20th century, more than 80 peptide-based drugs have been approved by the FDA (*Food and Drug Administration*), accounting for about 6% of all authorized pharmaceuticals.[1] This low percentage can be explained by several inherent limitations associated with peptides as drugs[1-2]: high and rapid biodegradability of peptides by proteases, excessive conformational flexibility, which can negatively impact binding affinity and specificity and low lipophilicity which limits the ability of peptides to cross physiological barriers (*i.e,* gastrointestinal or blood-brain barrier).

To overcome these defects, an approach has emerged which consists of introducing chemical modifications on the peptide backbone while maintaining or increasing biological activity and selectivity. These molecules are called pseudopeptides. A common strategy frequently used in the design of these pseudopeptides involves the incorporation of heterocycles as part of amino acid analogues. Among these heterocycles, 3,4-dihydro-2*H*-1,4-benzoxazine is of considerable interest due to its wide range of pharmacological applications.[3]

In this context, our work investigates the synthesis of pseudo mono-, di- or tripeptides incorporating a 1,4-benzoxazine scaffold as an analogue of β-amino acid (**Figure**). The rigid heterocyclic core acts as a conformational constraint and can be bonded to other natural amino acids to mimic secondary structural motifs such as γ-, β-, or α-turns. Their conformational preferences in solution and solid states are studied using a combination of spectroscopic analyses (IR, NMR) and X-ray diffraction. The final objective of this work is to engage the most interesting new synthesised pseudopeptides in a program to study their potential biological properties.

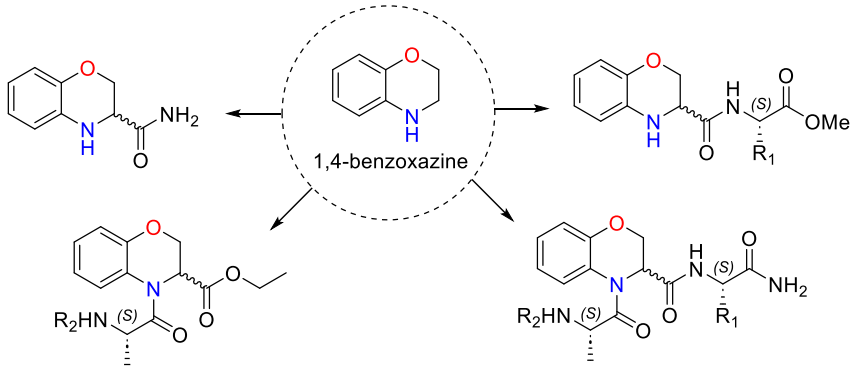


***Figure**: Chemical structures of pseudopeptides incorporating 1,4-benzoxazine as analogue amino acid (R_1 = Me, Phe ; R_2 = Fmoc, H)*

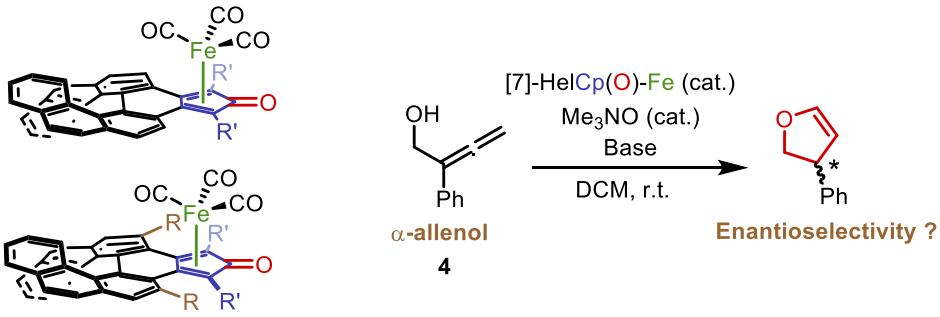
[1] Komal Sharma *et al. Drug Discov. Today*, **2023**, *28 (2)*, 103464
[2] David J. Craik *et al. Chem. Biol. Drug Des*. **2012**, *81 (1)*, 136-147
[3] Zilong Tang *et al. Curr. Med. Chem.*, **2023**, *30*, 372-389

P A027

Synthesis of a new class of cyclopentadienone ligands with helical chirality towards application to iron^0 catalyzed cycloisomerization of α-allenols

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Chemical catalysis plays a central role in the production of over 80% of all modern manufactured goods. In the pharmaceutical industry, catalytic processes must be as safe as possible, favoring the use of low-toxicity metals while maintaining the required reactivity. Furthermore, to obtain the desired biologically active enantiomer, catalytic systems must exhibit high enantioselectivity, thus avoiding costly and environmentally unfriendly racemic resolution steps. Dihydrofurans are important molecular scaffolds found in a variety of bioactive natural products, such as clerodin and reductiomycin. Among the numerous synthetic strategies reported for constructing this motif, one notable method developed by Bäckvall enables the formation of 2,3-dihydrofurans *via* the cycloisomerization of α-allenols. However, this transformation has so far only been demonstrated in a racemic manner. The objective of this work is to develop an enantioselective version of this reaction. To achieve this, the reactive fragment of Bäckvall's catalyst, an iron-cyclopentadienone (Fe–Cp(O)) system was incorporated onto a chiral helical framework. This report first presents the synthesis of a simplified Fe–Cp(O) complex and α-allenol. It then details the multistep synthesis of a helicene-based chiral catalyst. Finally, efforts to perform *peri*-functionalization of the helicene core are described, with the aim of incorporating enantioselectivity by influencing the proposed enantiodetermining step.



Guðmundsson, A.; Gustafson, K. P. J.; Mai, B. K.; Yang, B.; Himo, F.; Bäckvall, J.-E. Efficient Formation of 2,3-Dihydrofurans via Iron-Catalyzed Cycloisomerization of α-Allenols. *ACS Catal.* **2018**, *8*, 12–16.
Quintard, A.; Rodriguez, J. Iron Cyclopentadienone Complexes: Discovery, Properties, and Catalytic Reactivity. *Angew. Chem. Int. Ed.* **2014**, *53*, 4044–4055.
Mavrynsky, D. *et al*., Cyclopenta[l]Phenanthrenyl and Cyclopenta[a]Acenaphthylenyl Half-Sandwich Complexes of Ruthenium as Racemization Catalysts for Secondary Alcohols. *Organometallics* **2009**, *28*, 598–605.
Lehnherr, D. *et al*. Discovery of a Photoinduced Dark Catalytic Cycle Using in Situ LED-NMR Spectroscopy. *J. Am. Chem. Soc.* **2018**, *140*, 13843–13853.

P A028

Synthesis and evaluation of cyanine-7 derivatives for NIR imaging and photothermal therapy

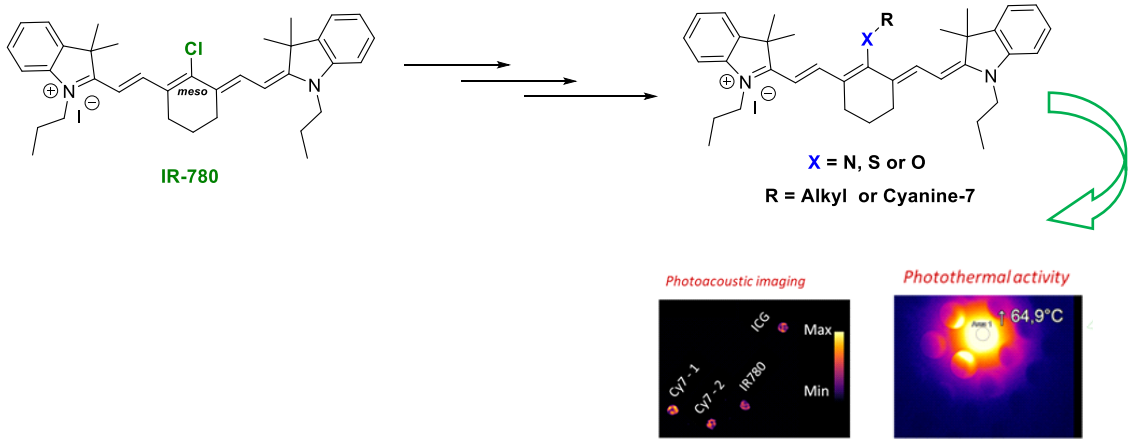
Khaoula Cherkani El Hassani,[1] Kamal Jouad,[1] Naomi Illi,[1] Tioga Gulon,[1] Mathilde Bouché,[1] Katalin Selmeczi,[1] Sandrine Lamandé-Langle,[1] Nadia Pellegrini Moïse[1]

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Heptamethine cyanine-7 dyes exhibit interesting photophysical properties.[1] These compounds are capable of absorbing light in the near-infrared (NIR) region and re-emitting it as fluorescence or a photoacoustic signal. Thanks to their efficient light-to-heat conversion ability, they also show promising applications in photothermal therapy. These properties provide complementary information, contributing to improved diagnostic accuracy and therapeutic monitoring.

In this context, we focused on the synthesis and functionalization of cyanine-7 dyes, starting from the commercial compound IR-780, known for its good stability and specific reactivity at the meso position of the cyclohexene ring. This stability and the photophysical properties can also be further optimized through structural modifications, in particular by varying the nature of the heteroatom introduced at the meso position, leading to *N*-, *S*-and *O*-alkylated derivatives. To go further, cyanine-7 dimers with various linkers and heteroatoms introduced on meso position are also developed. Optical and photothermal evaluation of these cyanine-7 derivatives show their potential as theranostic agents for image-guided phototherapy.[2]



[1] Feng, L.; Chen, W.; Ma, X.; Liu, S. H.; Yin, J. Near-Infrared Heptamethine Cyanines (Cy7): From Structure, Property to Application. *Org. Biomol. Chem.* **2020**, *18* (46), 9385–9397.

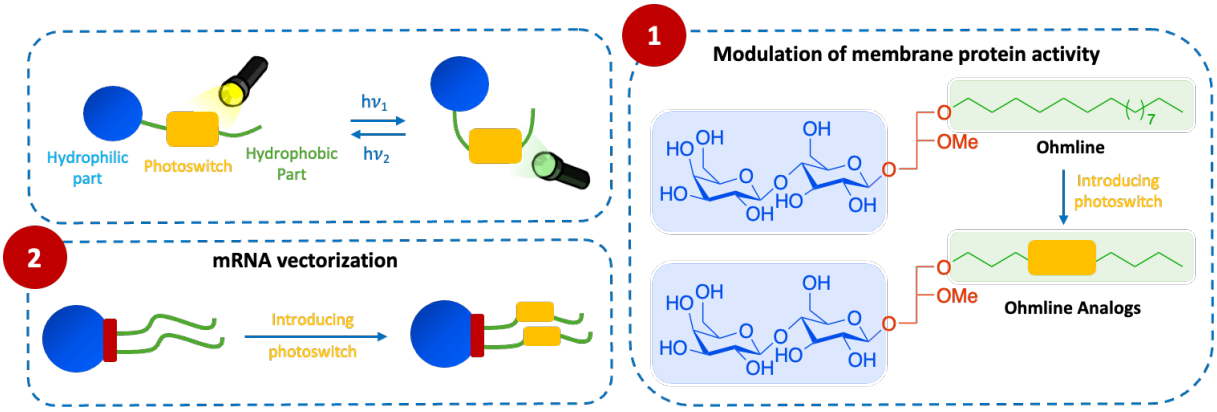
[2] Jouad, K.; Mengel, E.; Selmeczi, K.; Bouché, M.; Collet-Defossez, C.; Pellegrini Moïse, N.; Lamandé-Langle, S. Multimodal PET/PAI/FLI Imaging Probe Based on Meso-O-Alkyl Heptamethine Cyanine: Synthesis, [18F]F-Radiolabelling and Photophysical Characterizations. *Dyes Pigm.* **2024**, *223*, 111995.

P A029

Synthesis of Photoisomerizable Amphiphilic Molecules for Medical Applications

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Amphiphilic molecules play a central role in biomedicine, particularly in the modulation of membrane proteins and the delivery of messenger RNA (mRNA). Incorporating photoswitchable groups into these systems enables precise spatiotemporal control of biological activity upon light irradiation. Ohmline, a glycoglycerolipid amphiphile, has demonstrated selective modulation of membrane proteins (Ion channels SK3) involved in cancer metastasis without inducing cytotoxicity.[1] However, its non-specific biodistribution limits its therapeutic potential. Regarding mRNA delivery,[2] the limitation of the endosomal escape remains a major obstacle to effective cytosolic release.[3] To overcome these limitations, we designed new amphiphiles incorporating photoisomerizable units into their lipid tails. In the context of protein modulation, light activation aims to trigger the localization of the amphiphile into a biomembrane which is a first step towards a biological activity. For mRNA delivery, light-induced destabilization of lipid nanoparticle (LNP) membranes may promote efficient intracellular release. Several analogues have been synthesized for these two applications. These compounds have been structurally characterized and will undergo comprehensive physicochemical and biological evaluation to assess their effectiveness in targeted, light-activated therapeutic strategies.



[1] A. Chantôme, M. Potier-Cartereau, L. Clarysse, G. Fromont, S. Marionneau-Lambot, M. Guéguinou, J.C. Pagès, C. Collin, T. Oullier, A. Girault, F. Arbion, J.P. Haelters, P.A. Jaffrès, M. Pinault, P. Besson, V. Joulin, P. Bougnoux, C. Vandier, Pivotal role of the lipid raft SK3-Orai1 complex in human cancer cell migration and bone metastases. *Cancer Research*, **2013**, *73*, 4852-61. DOI: 10.1158/0008-5472.CAN-12-4572.

[2] B. Kopilovic, N. Laroui, M. Berchel, P.A. Jaffrès, P. Midoux, M.G. Freire, C. Pichon, Maltodextrin-modified lipoplexes for enhanced mucosal penetration and efficient mRNA delivery, *Materials Today Bio*, **2025**, *33*, 101975. DOI: 10.1016/j.mtbio.2025.101975

[3] M. Grau, E. Wagner, Strategies and mechanisms for endosomal escape of therapeutic nucleic acids, *Curr. Opinion Chem Biol*., **2024**, *81*, 102506. DOI: 10.1016/j.cbpa.2024.102506

P A030

Synthetic phospholipids for nucleic acid delivery

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Nucleic acids (e.g. mRNA, pDNA) are now considered for new therapeutic approaches to address a multitude of pathologies or as a prophylactic strategy as illustrated with SARS-CoV-2 vaccines[1]. Viral and synthetic carriers were developed and currently synthetic carriers, formulated for instance as Lipid Nanoparticles (LNPs), appeared to be the most promising approach[2]. However, it is still needed to improve nucleic acid delivery in order to extend applications to other pathologies or to reduce the administrated doses needed to get therapeutic benefice. For this purpose, one approach consists in modulating the structure of the major lipid components of the LNP, the ionizable amphiphiles. Our group works on the development of synthetic phospholipids inspired from natural compounds that feature an amphiphilic structure. The optimization of these structures is necessary to influence the multi-step process of transfection, from cell internalization to cargo release into the cytosol. In this communication, the synthesis of new ionizable amphiphiles and the lipid nanoparticle formulation stage will be presented, as well as *in vivo* RNA reporter transport and gene editing assays.[3]

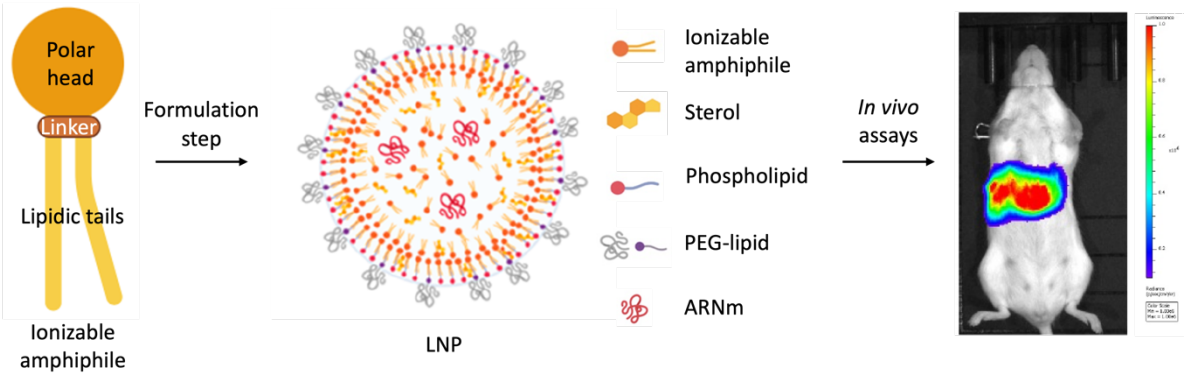


Figure 2 : scheme of an ionizable amphiphile used in the formulation of lipid nanoparticles for nucleic acid delivery

[1] Suzuki, Y.; Ishihara, H. Difference in the Lipid Nanoparticle Technology Employed in Three Approved siRNA (Patisiran) and mRNA (COVID-19 Vaccine) Drugs. *Drug Metabolism and Pharmacokinetics* **2021**, *41*, 100424. DOI: 10.1016/j.dmpk.2021.100424.

[2] Eygeris, Y.; Gupta, M.; Kim, J.; Sahay, G. Chemistry of Lipid Nanoparticles for RNA Delivery. *Acc. Chem. Res.* **2022**, *55* (1), 2–12. DOI: 10.1021/acs.accounts.1c00544.

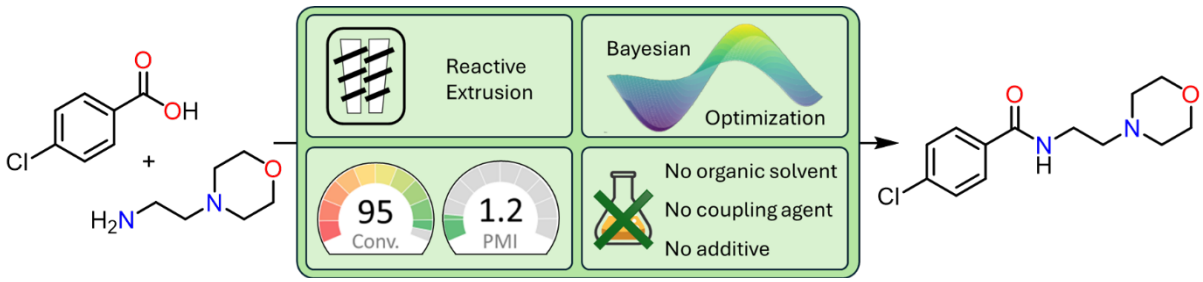
[3] Jozić, A.; Le Roux, C.; Kim, J.; Berchel, M.; Bodi, E. K.; Palumbo, M.; Murthy, N.T.V.; Sahel, D.K.; Eygeris, Y.; Vasudevan, A.; Gautam, M.; Bloom, E.; Barnes, A. P.; Jaffrès, P.A.; Sahay, G. Submitted (under review).

P A031

Harnessing extrusion forces for the thermo-mechanochemical synthesis of amides through Machine Learning

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In the field of green chemistry, mechanochemistry has emerged as a powerful and sustainable approach in fine chemical synthesis, harnessing mechanical forces to drive chemical reactions.[1] Using a twin-screw extruder as a chemical reactor we explored the potential of reactive extrusion for the synthesis of amides[2] and peptides[3] in both case reducing by tenfold the amount of waste generated compared to conventional methodologies. To improve further, it was decided to form the amide bond without coupling agents or catalysts, while also leveraging Bayesian Optimization to develop tailored conditions for this thermo-mechanochemical synthesis of amides. A twin-screw extruder equipped with a recirculation valve and heating elements allows for precise control over reaction parameters such as reaction time and temperature. This accuracy was a key point in unlocking new optimization methodologies through Machine Learning, which along with a careful design of the target produces a strong tool to quickly define reaction condition that accommodate both high conversion and excellent sustainability metrics. This recent and innovative approach allowed us to develop efficient processes for the synthesis of amides free from solvents, coupling agents or any additives.[4] This solvent-less flow mechanochemistry approach aligns seamlessly with the industry's growing demand for productive and sustainable manufacturing processes.



[1] Bento, O.; Luttringer, F.; Mohy El Dine, T.; Pétry, N.; Bantreil, X.; Lamaty, F. Sustainable Mechanosynthesis of Biologically Active Molecules. *Eur. J. Org. Chem.* **2022**, *2022*, e202101516.
[2] Lavayssiere, M.; Lamaty, F. Amidation by Reactive Extrusion for the Synthesis of Active Pharmaceutical Ingredients Teriflunomide and Moclobemide. *Chem. Commun.* **2023**, *59*, 3439–3442.
[3] Mohy El-Dine, T.; Lavayssiere, M.; Adihou, H.; Subra, G.; Métro, T.-X.; Ludemann-Hombourger, O.; Lamaty, F. Synthesis of Peptides by Reactive Extrusion. Application to the Continuous and Solventless Preparation of Aspartame. *ChemistryEurope* **2024**, *2*, e202400007.
[4] Lavayssiere, M.; Bantreil, X.; Lamaty, F. Optimizing Reactions in Reactive Extrusion by a Bayesian Approach: The Case of Thermal Amidation. *ChemRxiv* **2025**. https://doi.org/10.26434/chemrxiv-2025-zgpnz.

P A032

Merging organo- and organometallic catalysts for cooperative asymmetric multicatalysis

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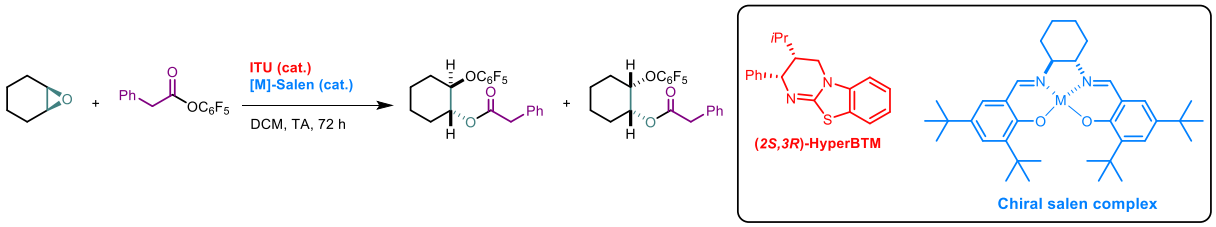
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The fine chemicals sector dedicated to health applications increasingly requires new and sustainable methods to synthesize enantioenriched, functionalized molecules. Although asymmetric catalysis has already provided effective solutions, the growing demand for molecular complexity poses new challenges. In this context, the development of highly stereoselective reactions involving multiple catalysts promoting the same transformation—referred to dual asymmetric multicatalysis—emerges as a promising strategy.

A number of new organic transformations have been developed through cooperative/synergistic organo/organometallic catalysis.[1] The discovery of efficient isothiourea/transition metal (ITU/TM) cooperative catalytic systems to access chiral molecules continues to attract the attention of organic chemists, and many achievements have been accomplished. [2,3,4]

Herein we propose cooperative multicatalysis for the opening of strained cycles, particularly epoxides, in a reaction between cyclohexene oxide and an activated ester. An interesting reactivity arises from the cooperative use of isothiourea and [M]-Salen complexes to promote the ring opening of epoxides, as described in the reaction below.



Ongoing efforts are aimed at optimizing reaction conditions, varying the scope of substrates, analyzing different double catalytic systems with particular reference to match and mismatch effects, and selecting the best conditions for controlling diastereo- and enantioselectivity to enable a mechanism to be proposed.

[1] J. A. Kalow, A. G. Doyle, *J. Am. Chem. Soc.* **2010**, 132, 3268-3269

[2] Schwarz, K. J., Amos, J. L., Klein, J. C., Do, D. T., Snaddon, T. N. *J. Am. Chem. Soc.* **2016**, 138, 5214−5217

[3] Q. Wang, T. Fan, J. Song, *Org. Lett.* **2023**, 25, 1246-1251

[4] T. Fan, Z. Shi, Q.-W. Gong, J. Song, L.-J. Gong, *Org. Lett.* **2024**, 26, 1421-1425

P A033

Access to a photoswitchable probe for the control of peptide conformation

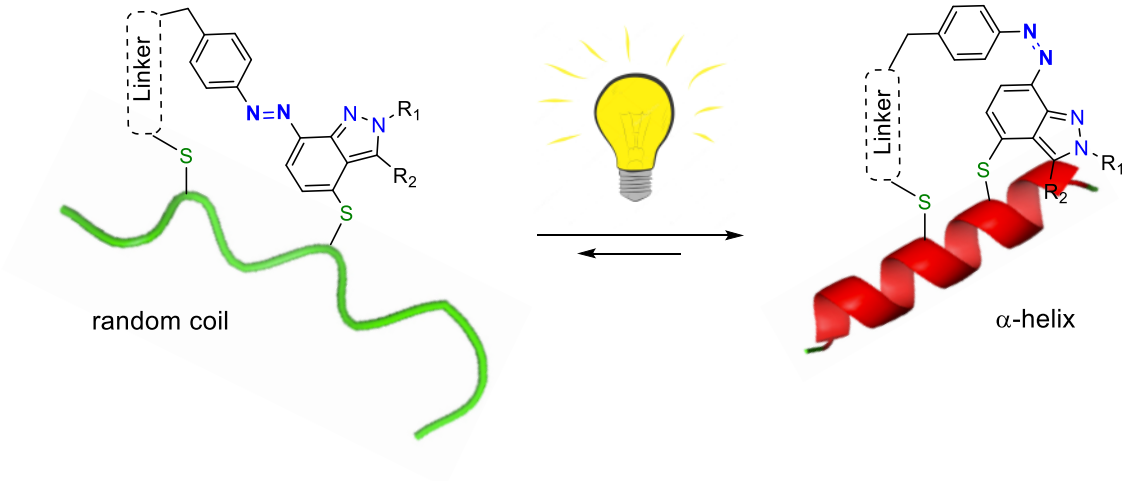
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Nicotinic acetylcholine receptors (nAChRs) are pentameric ligand-gated ion channels involved in key neural processes. As central players in synaptic transmission, they are promising therapeutic targets for neurological disorders such as Alzheimer's and Parkinson's diseases, as well as nicotine addiction. While nAChRs exhibit multiple functionally relevant conformational states, the molecular details of their transitions remain elusive due to limited high-resolution structural data.[1]

To overcome these limitations, we are developing photoswitchable and potentially fluorescent molecular tools that enable light-mediated control over nAChRs conformation, with the ultimate goal of modulating nAChRs activity.

This poster highlights the design and synthesis of a novel photoswitchable probe incorporating an azobenzene and a fluorescent indazole scaffold. This dual-functional probe allows for both optical control of conformation and real-time fluorescent tracking.

We will present the synthetic route, characterize its photochromic behavior, and describe peptide conjugation strategies for targeting model systems.



[1] Cecchini, M.; Corringer, P.-J.; Changeux J.-P. The Nicotinic Acetylcholine Receptor and its pentameric homologs : Toward an Allosteric Mechanism of Signal Transduction at the Atomic Level. *Annu. Rev. Biochem.* **2024**, *93*, 339-366.

P A034

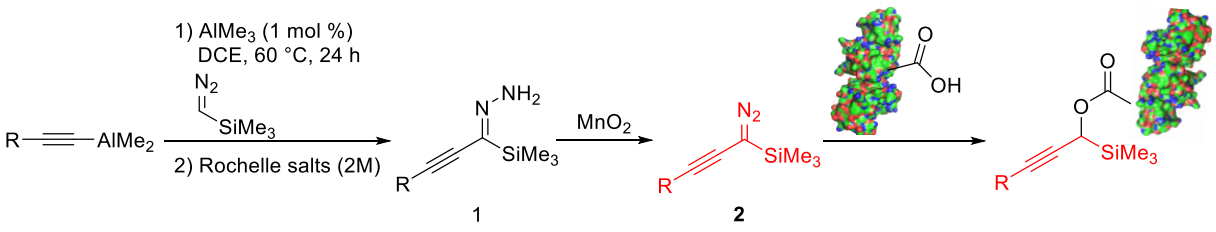
A Journey from Alkynylalanes to Bioconjugation of Biomolecules

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Organoaluminum compounds are an intriguing class of organometallics, characterized by unique selectivity and reactivity arising from the strong Lewis acidity of aluminum and the non-ionic character of the C–Al bond.[1] Within this class, we are particularly interested in studying the reactivity of dimethylalkynylalanes. Traditionally, these compounds are prepared via transmetallation of the corresponding lithium or magnesium derivatives in ethereal solvents.[2] However, this method often reduces their reactivity due to the formation of Lewis acid-base adducts. To overcome this limitation, building on earlier work by Binger[3], a base-catalyzed direct metalation of terminal alkynes has been developed to generate dimethylalkynylalanes in toluene or heptane.[4]

Since no ethereal solvents are used in this process, the resulting compounds exhibit entirely new reactivity, which we have investigated in our group. Notably, we discovered an unprecedented reaction with trimethylsilyldiazomethane, leading to the formation of hydrazone **1**, a compound that cannot be prepared by other means.[5] This hydrazone serves as a valuable intermediate for synthesizing alkynyldiazosilane **2** via oxidation with MnO_2.

We will demonstrate how this new class of diazo compounds, accessible only through alkynylalanes, can be applied in the bioconjugation of biomolecules.[6]



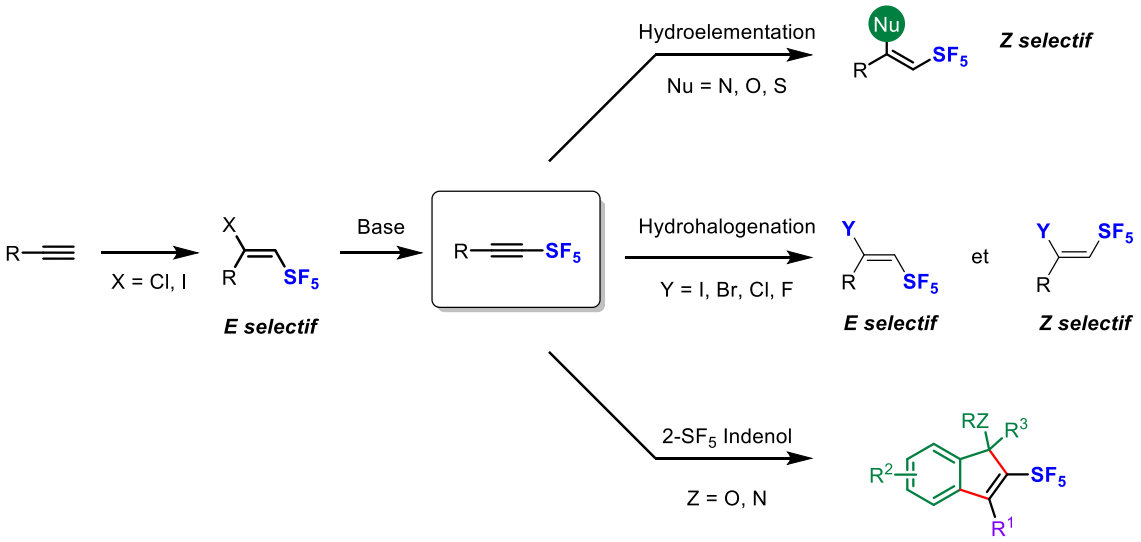
[1] *The chemistry of Organoaluminum Compounds*, in *PATAI'S Chemistry of Functional Groups* (Eds.: Micouin, L.; Marek, I.; Rappoport, Z.), John Wiley & Sons, Ltd, **2017**, ISBN: 978-1-119-02146-9.
[2] Starowieyski, K. B.; Chwojnowski, A.; Kusmierek, Z. *J. Organomet. Chem.* **1980**, *192*, 147-154
[3] Binger, P. *Angew. Chem., Int. Ed. Engl.* **1963**, *2*, 686.
[4] a) Feuvrie, C.; Blanchet, J.; Bonin, M.; Micouin, L. *Org. Lett.* **2004**, *6*, 2333-2336; b) Zhou, Y.; Lecourt, T.; Micouin, L. *Adv. Synth. Catal.* **2009**, *351*, 2595-2598.
[5] Kumar, R.; Turcaud, S.; Micouin, L. *Org. Lett.* **2014**, *16*, 6192–6195.
[6] Zhao, T.; Sachon, E.; Micouin, L.; Piccardi, R. *Chem. Eur. J.* **2024**, *30*, e202302807.

P A035

Recent breakthrough in SF_5 alkyne chemistry: Versatile building blocks to access molecular complexity

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Over the last few years, our team has developed new synthetic methodologies to access pentafluorosulfanyled (SF_5) compounds with high level of regio- and stereocontrol in order to access more complex structures. This emerging fluorinated group is mainly obtained by oxidative fluorination of thiols or sulfur derivatives, or by direct introduction of the SF_5 motif using fluorinated gases (SF_5Cl or SF_6). SF_5-Alkynes are readily accessible from the corresponding terminal alkynes via a two-step synthesis that we recently improved.[1,2] This versatile and highly polarized building block is used to perform highly chemo-, regio- and stereoselective reactions, such as hydroelementation,[3] hydrohalogenation,[4] as well as the synthesis of 2-SF_5 indenols.[5]



[1] Nguyen, T. M.; Legault, C. Y.; Blanchard, N.; Bizet, V.; Cahard, D., Tracking SF_5I in the Iodopentafluorosulfanylation of Alkynes. *Chem. Eur. J.* **2023,** *29* (67), e202302914.
[2] Nguyen, T. M.; Popek, L.; Matchavariani, D.; Blanchard, N.; Bizet, V.; Cahard, D., Expanding Radical Chloropentafluorosulfanylation of Alkynes. *Org. Lett.* **2024,** *26* (1), 365-369.
[3] Popek, L.; Cabrera-Trujillo, J. J.; Debrauwer, V.; Blanchard, N.; Miqueu, K.; Bizet, V., Regio- and Stereoselective Hydroelementation of SF_5-Alkynes and Further Functionalizations. *Angew. Chem. Int. Ed.* **2023,** *62* (19), e202300685.
[4] Matchavariani, D.; Popek, L.; Cabrera-Trujillo, J. J.; Nguyen, T. M.; Blanchard, N.; Miqueu, K.; Cahard, D.; Bizet, V., Ambiphilic Reactivity of SF_5-Alkynes Applied to Regioselective and Stereodivergent Halogenation Reactions: An Experimental and Theoretical Case Study. *Adv. Synth. Catal.* **2024,** *366* (16), 3481-3493.
[5] Popek, L.; Cihan, M.; Blanchard, N.; Bizet, V., Palladium-Catalyzed Regioselective Synthesis of 2-SF_5-Indenols and Further Derivatizations. *Angew. Chem. Int. Ed.* **2024,** *63* (7), e202315909.

P A036

Green Suzuki-Miyaura cross-couplings in aqueous media involving O-electrophiles and air-stable nickel precatalysts

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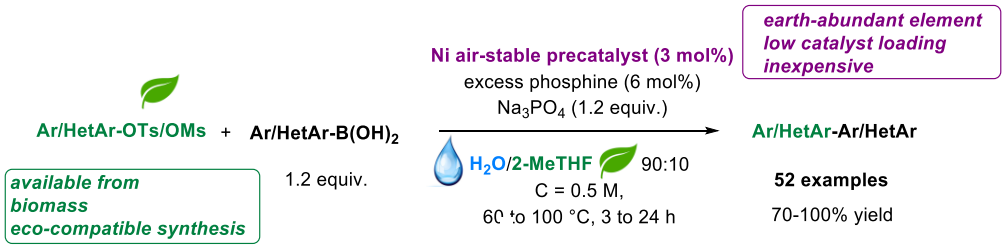
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In the context of the sustainability-focused development plan outlined by the United Nations in 2015, the need for green and sustainable chemistry and engineering has been clearly identified as a major challenge. However, the lack of "green" manufacturing processes is an unsolved problem in major areas especially in organometallic catalysis. Hence, despite their exponential development, cross-coupling (C-C) reactions remain highly polluting by associating toxic organic halides to over-exploited low-abundant palladium (0.015 mg/kg earth crust) and organic solvents, which represent over 80% of the chemical waste of the chemical industry.[1] Although significant advances have been made in the field thanks to micellar systems, these works only focus on organic halides and none of them concern eco-compatible O-based electrophiles.[2]

For this reason, we have developed an eco-compatible Suzuki-Miyaura cross-coupling[3] which allows access to biaryl as well as heteroaryl compounds. The process combines a non-noble metal complex and sustainable O-based electrophiles in a green media composed of 90% water. In details, the association we have targeted gathers the use of:

- Aryl/heteroaryl tosylates and mesylates, which represent a sustainable alternative to corresponding halides since they are readily available from biomass (phenols) and chemically stable and they can be synthesized in an eco-compatible manner.[4]
- An air-stable catalyst issued from "non-noble" abundant and inexpensive nickel (84 mg/kg earth crust). A catalyst loading as low as 3 mol% was employed, and further reduction to 1 mol% was feasible by extending the reaction time to 12 hours, without significant loss in yield. The protocol was also amenable to gram-scale synthesis, delivering the coupling product in consistently high yield.
- Aqueous reaction media composed of 90% water and 10% of a biosourced organic solvent (methyl tetrahydrofurane) for solubility issues, allowing a significant reduction of chemical wastes (Scheme 1).



Scheme 1

[1] Shaughnessy, K. H.; De Vasher, R. B. *Curr. Org. Chem*. **2005**, *9*, 585–604.

[2] a) Handa, S.; Slack, E. D.; Lipshutz, B. H. *Angew. Chem. Int. Ed.* **2015**, *54*, 11994-11998.; b) Guo, X. ; Dang, H.; Wisniewski, R. Simmons, E. M. *Organometallics*, **2022**, *41*, 1269-1274.

[3] Unpublished results.

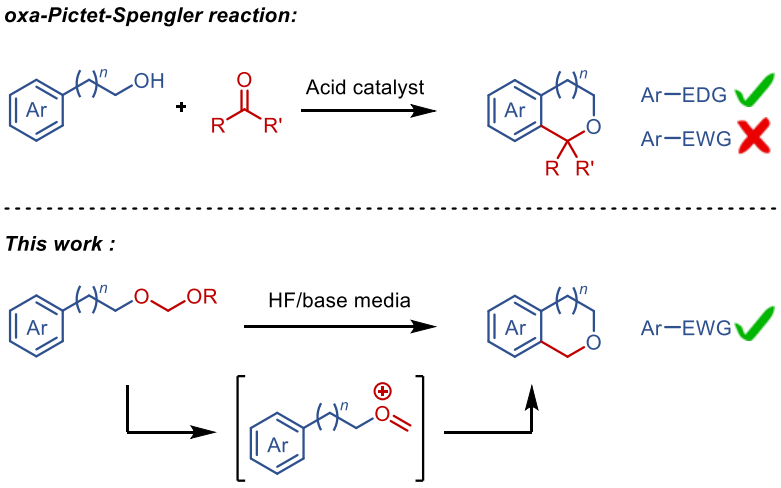
[4] Lei, X.; Jalla, A.; Shama, M. A. A.; Stafford, J. M.; Cao, B. *Synthesis*, **2015**, 2578–2585.

P A037

Oxa-Pictet-Spengler reaction of deactivated arenes in strongly acidic HF/base media

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Oxocarbenium ions are an important class of intermediates in organic chemistry and are implicated in many textbook reactions. A notable example is the oxa-Pictet-Spengler reaction which originally involved the transformation of 2-phenylethanal in the presence of paraformaldehyde and hydrochloric acid.[1] Since then, the reaction has undergone significant development to offer different methods of generating the key oxocarbenium intermediate, thereby extending its field of application.[2] However, this reaction is still limited to electron-rich aromatic rings.[3] Recently, our group has shown that the use of strongly acidic HF/pyridine solutions[4] allows the formation of primary oxocarbenium ions which can be trapped with deactivated styrenes in a Prins-type reaction.[5] Here we show that the high reactivity of oxocarbenium ions in HF/base media allows to extend the oxa-Pictet-Spengler reaction to deactivated arenes, affording high-valued (homo)isochromanes.



[1] Buschmann, H.; Michel, R.; German Patent, 614461, **1935**, [*Chem. Abstr.* **1935**, *29*, 5861].
[2] Larghi, E. L.; Kaufman, T. S. Synthesis of Oxacycles Employing the Oxa-Pictet–Spengler Reaction: Recent Developments and New Prospects. *Eur. J. Org. Chem.* **2011**, *2011*, 5195.
[3] (a) Muller, C.; Horký, F.; Vayer, M.; Golushko, A.; Lebœuf, D.; Moran, J. Synthesis of Functionalised Isochromans: Epoxides as Aldehyde Surrogates in Hexafluoroisopropanol. *Chem. Sci.* **2023**, *14*, 2983. (b) Sarkar, S.; Sultana, S.; Indukuri, K.; Unnava, R.; Saikia, A. K. Synthesis of Isochroman Derivatives via Oxa-Pictet–Spengler Reaction of Vinylogous Esters. *Synthesis* **2016**, *48*, 1727. (c) Saeed, A. Oxa-Pictet–Spengler Reaction in Water. Synthesis of Some (±)-1-Aryl-6,7-Dimethoxyisochromans. *Chin. Chem. Lett.* **2010**, *21*, 261.
[4] Longuet, M.; Vitse, K.; Martin-Mingot, A.; Michelet, B.; Guégan, F.; Thibaudeau, S. Determination of the Hammett Acidity of HF/Base Reagents. *J. Am. Chem. Soc*. **2024**, *146*, 12167.
5 Longuet, M.; Naullet, F.; Pérochon, A.; Martin-Mingot, A.; Guégan, F.; Michelet, B.; Thibaudeau, S. Regulating the Acidity of HF/Pyridine Media to Control the Chemodivergent Fluoro- and Hydro-heteroalkylation of Olefins. *J. Am. Chem. Soc*. **2025**, doi: 10.1021/jacs.5c07526.

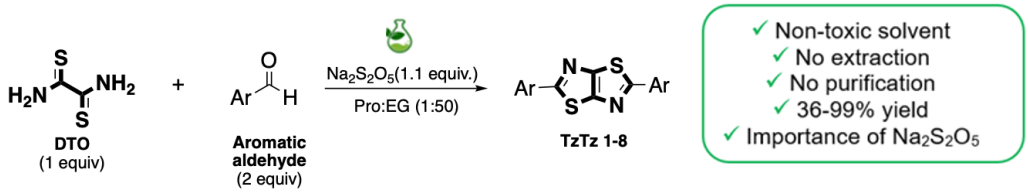
P A038

Eco-Friendly Synthesis of Thiazolo[5,4-*D*]Thiazoles and Their Derivatives Bearing Azoles Units

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Thiazolo[5,4-*d*]thiazoles (TzTz) are a class of heteroaromatic compounds that have attracted increasing interest in the fields of organic synthesis, electronics, and biology, due to their π-conjugated systems and their rigid planar backbones. [1] To date, most synthetic routes toward TzTz derivatives are still based on the classical method developed by Ketcham *et al* [2], which involves a double condensation between dithiooxamide and suitable aldehydes and then oxidation of the intermediate product. However, this approach usually requires harsh reaction conditions, toxic solvents, and troublesome isolation and purification steps.[3]

This study aims to develop a greener and more environmentally friendly synthetic protocol using deep eutectic solvents (DES) to enable a straightforward access to TzTz derivatives without further purification. By optimizing the reaction parameters by modifying the nature and ratio of DES components, changing the activation method, and adding auxiliary oxidants, eight TzTz derivatives were synthesized in equal or better yields compared to the reported protocols (ranging from 20% to 75%) under mild and eco-friendly conditions, in L-proline and ethylene glycol (1:50) mixture, with the presence of sodium metabisulfite as oxidant, at 130 °C for one hour.[4]



In a further effort to enhance π-conjugation and introduce new functionalities, this work also explored the functionalization of the TzTz scaffold at the 2,5-positions with azole units such as imidazole, benzimidazole, and triazole via two different synthetic strategies. Among them, nucleophilic aromatic substitution (S_NAr) between azole amines and bis(4-fluorophenyl)-substituted TzTz emerged as a promising method to diversify the TzTz core. Preliminary photophysical characterizations revealed that these TzTz bearing azoles derivatives exhibit notable absorption and fluorescence behavior, underlining their potential as building blocks for organic optoelectronic application.

[1] Reginato, G.; Mordini, A.; Zani, L.; Massimo Calamante; Alessio Dessì. Photoactive Compounds Based on the Thiazolo[5,4-*D*]Thiazole Core and Their Application in Organic and Hybrid Photovoltaics. *European journal of organic chemistry* **2015**, *2016* (2), 233–251. DOI: 10.1002/ejoc.201501237.
[2] Johnson, J. R.; Ketcham, R. Thiazolothiazoles. I. The Reaction of Aromatic Aldehydes with Dithioöxamide[1]. *Journal of the American Chemical Society* **1960**, *82* (11), 2719–2724. DOI: 10.1021/ja01496a017.
[3] Bevk, D.; Marin, L.; Lutsen, L.; Vanderzande, D.; Maes, W. Thiazolo[5,4-*d*]Thiazoles – Promising Building Blocks in the Synthesis of Semiconductors for Plastic Electronics. *RSC Advances* **2013**, *3* (29), 11418. DOI: 10.1039/c3ra40851e.
[4] Nguyễn, T.T.T.; Longevial, J.-F.; Hesse, S. Synthesis of Thiazolo[5,4-*d*]Thiazoles in an Eco-Friendly L-Proline–Ethylene Glycol Mixture. *Molecules* **2025**, *30* (4), 938–938. DOI: 10.3390/molecules30040938.

P A039

Design of a universal and selective radiolabelable agent for PET imaging and targeted internal radiotherapy (TRT)

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Molecular imaging, particularly positron emission tomography (PET) scans using β^+ emitting radionuclides, has become a key tool for diagnosing a wide range of diseases, including cancer. This non-invasive technique stands out for its ability to generate detailed 3D images of the body after injection of a radiotracer allowing for precise visualization and quantification of disease-specific molecular targets. Beyond diagnosis, radiotracers play also a key role in **targeted radionuclide therapy (TRT)**, where they deliver therapeutic radiation doses (α, β^-, or Auger electrons) directly to cancer cells. Each radiotracer is designed to include a cancer-targeting vector (e.g., a peptide), associated with a bifunctional chelating agents (BFCAs) to complex the radionuclide of interest.

Recently, a new radiolabeling technique based on fluorine-18 complexation chemistry, specifically the formation of the aluminum-fluoride-18 complex, has emerged as a method of choice for developing new radiotracers for PET imaging. Fluorine-18 (^{18}F) and gallium-68 (^{68}Ga) are the preferred β^+ emitting radionuclides for PET, while lutetium-177 (^{177}Lu) is a β^- emitter commonly used in TRT. However, these three radionuclides exhibit different complexation properties requiring specific BFCA to optimize the radiolabelling.

Based on previous research realized[1],the goal of our research is to optimize the chemical structure of novel BFCAs by developing a hybrid cyclic/acyclic chelators based on a hydrazine scaffold allowing to adapt the number of coordination sites and the type of chelator by: inserting a spacer between the hydrazine and the chelating cage, bringing the additional chelating arm closer, replacing the hydrazide carbonyl with a methylene group, and adding a second additional chelating arm . Theses chelators should be (i) capable of radiolabeling with Al-^{18}F, ^{68}Ga, and ^{177}Lu *via* complexation chemistry, and (ii) conjugatable to targeting peptides through selective thiol–maleimide click bioconjugation. The objective is to generate "peptide–chelator" conjugates suitable for both PET imaging and TRT, as part of a radiotheranostic approach (*i.e.*, therapy and diagnosis in nuclear medicine) within a personalized medicine framework.

[1] Laurène, W.; Raúl, L.; Katalin, S.; Céline, F.; Gilles, K.; Antonio, M.; Charlotte, C.; Samir, A. Design and Synthesis of a New Bifunctional Chelating Agent: Application for Al 18F/177Lu Complexation. *Journal of Inorganic Biochemistry* **2023**, *246*, 112267.

P A040

Synthesis of non-symmetric *ortho*-functionalized azoarenes through arylation of arylazo sulfones

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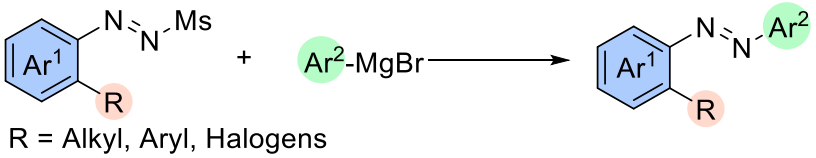
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Azoarenes represent an important class of organic compounds with a wide range of applications, including molecular photoswitches,[1] functional materials,[2] biomedical agents,[3] organic dyes[4] and food additives,[5] among other uses. Here we report the synthesis of unsymmetrical *ortho*-functionalized azoarenes through the arylation of arylazo-sulfones using organomagnesium reagents. These stable arylazo-sulfones, which serve as masked electrophilic diazonium sources, were successfully arylated with good to excellent isolated yields. The method accommodates a broad scope of substrates and demonstrates high tolerance to various functional groups. Additionally, DFT calculations were performed to explore the reaction mechanism and explain the observed regioselectivity.



R = Alkyl, Aryl, Halogens

High Yields | Broad substrate scope | Mechanism investigation

[1] Jerca, F. A.; Jerca, V. V.; Hoogenboom, R. Advances and Opportunities in the Exciting World of Azobenzenes. *Nat Rev Chem.* **2021**, *6* (1), 51–69.

[2] Baroncini, M.; Bergamini, GAzobenzene in Molecular and Supramolecular Devices and Machines. *In Discovering the Future of Molecular Sciences*; Wiley, **2014**; pp 379–397.

[3] Alsantali, R. I.; Raja, Q. A.; Alzahrani, A. Y. A.; Sadiq, A.; Naeem, N.; Mughal, E. U.; Al-Rooqi, M. M.; El Guesmi, N.; Moussa, Z.; Ahmed, S. A. Miscellaneous Azo Dyes: A Comprehensive Review on Recent Advancements in Biological and Industrial Applications. *Dyes Pigm*. **2022**, *199*, 110050.

[4] Bafana, A.; Devi, S. S.; Chakrabarti, T. Azo Dyes: Past, Present and the Future. *Environ. Rev.* **2011**, *19*, 350–371.

[5] Barciela, P.; Perez-Vazquez, A.; Prieto, M. A. Azo Dyes in the Food Industry: Features, Classification, Toxicity, Alternatives, and Regulation. *Food Chem. Toxicol.* **2023**, *178*, 113935.

P A041

Alkyne Metathesis: Towards the Synthesis of Polyynes

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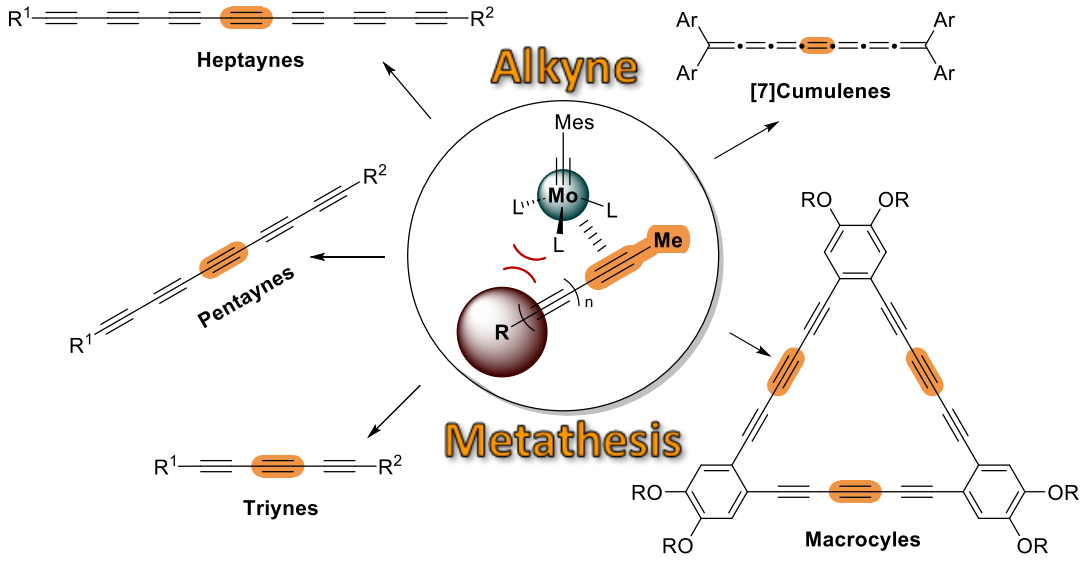
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Oligoynes are molecules which contain two or more conjugated C–C triple bonds. Such molecules can be found in nature as well as in the interstellar media.[1] These compounds have fascinated researchers for decades and several methods such as the Glaser/Eglington/Hay coupling or the Fritsch-Buttenberg-Wiechell rearrangement have been developed with the aim to synthesize the longest possible oligoynes, carbyne – a polymer of infinite conjugated C–C triple bonds – being the ultimate goal.[2] These methods mostly allow to access oligoynes containing an even number of conjugated C–C triple bonds. However, the more challenging synthesis of oligoynes containing an odd number of conjugated C–C triple bonds is very scarce in literature reports. Alkyne metathesis has emerged as a new reliable method for accessing oligoynes of this type such as triynes as recently demonstrated by our group.[3] In this talk, our recent development of alkyne metathesis towards the synthesis of oligoynes containing an odd number of conjugated C–C triple bonds up to a heptayne will be discussed. Thanks to these advances, the synthesis of difficult-to-access [7]cumulenes as well as triangle-shaped macrocycles containing multiple triyne units in their core will also be highlighted.[4]



[1] *Synthesis of Naturally Occurring Polyynes.* Shi Shun, A. L. K.; Tykwinski, R. R. *Angew. Chem. Int. Ed.* **2006**, *45*, 1034–1057; *Census of Interstellar, Circumstellar, Extragalactic, Protoplanetary Disk, and Exoplanetary Molecules.* McGuire, B. A. *Astrophys. J. Suppl. S* **2018**, *239*, 17.

[2] *Synthetic Strategies for Oligoynes.* Jevric, M.; Nielsen, M. B. *Asian J. Org. Chem.* **2015**, *4*, 286–295.

[3] *Expedient Synthesis of Triynes via Alkyne Metathesis.* Curbet, I.; Colombel-Rouen, S.; Manguin, R.; Clermont, A.; Quelhas, A.; Müller, D. S.; Roisnel, T.; Baslé, O.; Trolez T.; Mauduit, M. *Chem. Sci.* **2020**, *11*, 4934–4938.

[4] *Synthesis of Conjugated Linear and Cyclic Polyynes by Alkyne Metathesis*. Escudero, J.; Long, J.; Bouëtard, D.; Morvan J.; Kooghard M.; Neitzel A.; Bockfeld, D.; Nwachukwu, S.; Roisnel, T.; Tykwinski, R. R.; Tamm, M.; Mauduit, M.; Trolez, Y. *ChemRxiv*. **2025**; doi:10.26434/chemrxiv-2025-lm8cw-v2

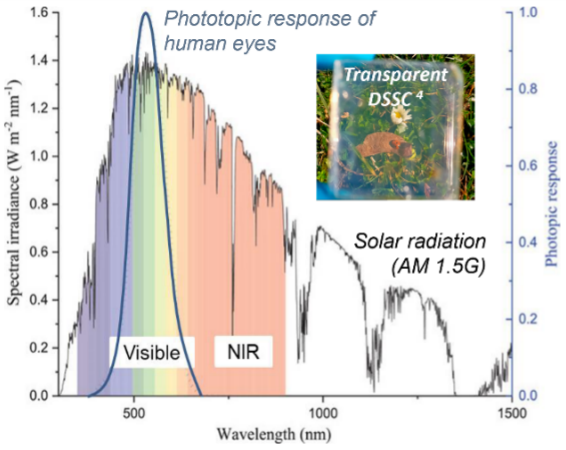
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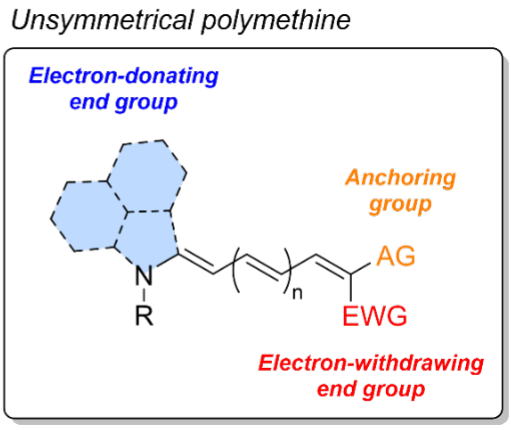
Synthesis of Unsymmetrical Near-Infrared Polymetines for Transparent Dye-Sensitized Solar Cells

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To resolve the ever-growing concerns about energy production, dye-sensitized solar cells (DSSC) bring several advantages such as their low-cost production and relatively easy integration (e.g., portative devices, buildings). In addition, the possibility to modify the organic dye to selectively absorb in the near-infrared (NIR) paves the way to design a new generation of transparent and colourless solar panel.[1]

Among NIR-absorbing dyes, the polymethine family stands out by its ease of synthesis and exceptional optical properties.[2,3] In this context, the objective of our project is to optimise the polymethine structure using simple and straightforward synthetic strategies, introducing tailored electron-donating and electron-withdrawing end groups to enhance their performances in transparent and colourless NIR-selective DSSC.





[1] Grifoni, F.; Bonomo, M.; Naim, W.; Barbero, N.; Alnasser, T.; Dzeba, I.; Giordano, M.; Tsaturyan, A.; Urbani, M.; Torres, T.; Barolo, C.; Sauvage, F. Toward Sustainable, Colorless, and Transparent Photovoltaics: State of the Art and Perspectives for the Development of Selective Near-Infrared Dye-Sensitized Solar Cells. *Adv. Energy Mater.* **2021**, *11* (43), 2101598.

[2] Saccone, D.; Galliano, S.; Barbero, N.; Quagliotto, P.; Viscardi, G.; Barolo, C. Polymethine Dyes in Hybrid Photovoltaics: Structure–Properties Relationships. *Eur. J. Org. Chem.* **2016**, *2016* (13), 2244–2259.

[3] Pascal, S.; Getmanenko, Y. A.; Zhang, Y.; Davydenko, I.; Ngo, M. H.; Pilet, G.; Redon, S.; Bretonnière, Y.; Maury, O.; Ledoux-Rak, I.; Barlow, S.; Marder, S. R.; Andraud, C. Design of Near-Infrared-Absorbing Unsymmetrical Polymethine Dyes with Large Quadratic Hyperpolarizabilities. *Chem. Mater.* **2018**, *30* (10), 3410–3418.

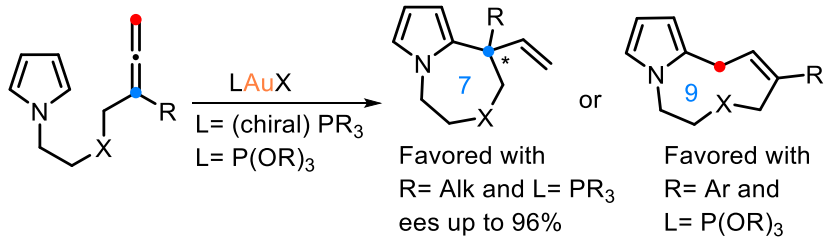
[4] Naim, W.; Novelli, V.; Nikolinakos, I.; Barbero, N.; Dzeba, I.; Grifoni, F.; Ren, Y.; Alnasser, T.; Velardo, A.; Borrelli, R.; Haacke, S.; Zakeeruddin, S. M.; Graetzel, M.; Barolo, C.; Sauvage, F. Transparent and Colorless Dye-Sensitized Solar Cells Exceeding 75% Average Visible Transmittance. *JACS Au* **2021**, *1* (4), 409–426.

P A043

Au(I)-Catalyzed Regiodivergent Hydroarylation of Allenes for the Synthesis of Tetrahydrodiazepines or Tetrahydrodiazonines

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The unique structural diversity of natural products is a source of inspiration to fasten the discovery of druggable, biologically active molecules.[1a] Particularly nitrogen-containing heterocycles are utmost important.[1b] Furthermore, in 2014, Chan reported that 95% of a large set of 1297 marketed drugs possess a ring.[1c] Most of these rings are 5- and 6-membered ones. 7-Membered ring-sized compounds are far less represented, along with higher order 8-11 ring-sized ones, also known as medium-sized heterocycles. This under-representation is mainly due to the lack of efficient synthetic methods, which suffer from unfavorable enthalpic and entropic factors.[2] This study presents an Au(I)-catalyzed hydroarylation of allenes[3] tethered to pyrroles, leading to tetrahydrodiazepines or tetrahydrodiazonines.



The regioselectivity of the reaction is governed by both the substitution pattern of the allene and the nature of the Au(I) ligand. Hence, alkyl *gem*-disubstituted allenes preferentially lead to tetrahydrodiazepines *via* 7-*exo*- cyclizations, while aryl-substituted allenes preferentially lead to tetrahydrodiazonines *via* 9-*endo* cyclization when a phosphite ligand is used. Enantioselective reactions have been developed with the SEGPHOS chiral ligand, leading to chiral heterocycles with high enantioselectivity (up to 96% ee). In addition, DFT calculations have streamlined the regioselectivity (7-*exo* vs 9-*endo*) of these gold(I)-catalyzed cyclizations.[4]
This work offers a versatile strategy for the synthesis of relevant medicinal heterocycles and advances the mechanistic understanding of Au(I)-catalyzed cyclizations.

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[1] (a) Atanasov, A. G. *et al*. Natural products in drug discovery: advances and opportunities. *Nat. Rev. Drug Discov.* **2021**, *20*, 200; (b) Heravi M. M.; Zadsirjan, V. Prescribed drugs containing nitrogen heterocycles: an overview. *RSC Adv.* **2020**, *10*, 44247; (c) Aldeghi, M.; Malhotra, S.; Selwood D. L.; Chan, A. W. E. Two- and Three-dimensional Rings in Drugs. *Chem. Biol. Drug Des.* **2014**, *83*, 450.
[2] (a) Clarke A. K.; Unsworth, W. P. A happy medium: the synthesis of medicinally important medium-sized rings via ring expansion. *Chem. Sci*. **2020**, *11*, 2876; (b) Huber, T.; Wildermuth R. E.; Magauer, T. 9-Membered Carbocycles: Strategies and Tactics for their Synthesis. *Chem. Eur. J*. **2018**, *24*, 12107.
[3] Campeau, D.; León Rayo, D. F.; Mansour, A.; Muratov, K.; Gagosz, F. Gold-Catalyzed Reactions of Specially Activated Alkynes, Allenes, and Alkenes. *Chem. Rev.* **2021**, *121*, 8756.
[4] Zhou, P.; Retailleau, P.; Gandon, V.; Voituriez, A.; Guinchard, X. Au(I)-Catalyzed Regiodivergent Hydroarylation of Allenes for the Synthesis of Tetrahydrodiazepines or Tetrahydrodiazonines. *Adv. Synth. Catal.* **2025**, *367*, e202401541.

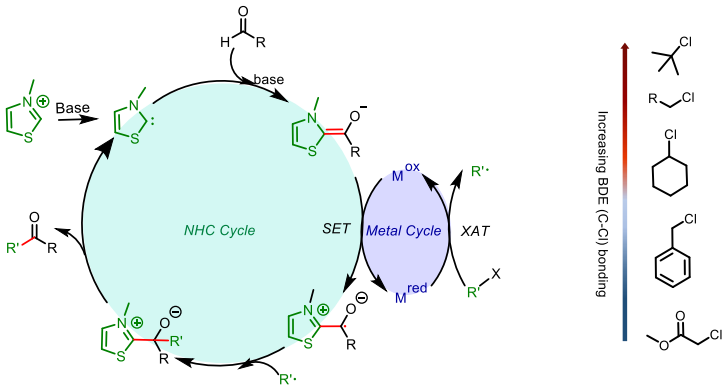
P A044

Cooperative *N*-heterocyclic carbene/transition metal redox catalysis

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N-Heterocyclic carbenes (NHCs)[1]are well known organocatalysts. They are known for their umpolung reaction with aldehydes to produce Breslow intermediates.[2] These enols are then utilized in the formation of ketones by coupling with other electrophiles. There are two pathways for this reaction: anionic and radical. The reducing power of enolates are limited to redox accessible substrates (E > -2 V vs SCE).[3] NHCs can reduce alkyl halides such as primary and secondary alkyl iodides and bromides through both radical and ionic pathway, which are considered challenging substrate to activate.[4,5,6]However this method is still not possible in activating alkyl chloride and tertiary alkyl bromide and iodide.

A possible strategy to activate redox inaccessible substrates is to run cooperative catalysis. Our group showed that tertiary alkyl iodides can be activated by NHC/Ni cooperative catalysis, via SET events.[7] The reduced [$NiBr_2$(Xantphos)] shows a (E°Ni(0)/Ni(I) = −0.9 V vs SCE), this potential enables acylation between tertiary alkyl iodides and aldehydes to form ketone.[7] Our approach involves starting with *N*-heterocyclic carbene (NHC) in conjunction with cobalt salen to facilitate the activation of alkyl chlorides, beginning with benzyl chloride as the model alkyl chloride.[8]
In future aim to synthesize metal complexes capable of activating more challenging alkyl chlorides.



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[1] Arduengo, A.; Bertrand, G. *Chem. Rev.* **2009**, *109*, 3209−3210.
[2] Enders, D.; Niemeier, O.; Henseler, A. *Chem. Rev.* **2007**, *107*, 5606−5655.
[3] Delfau, L.; Nichilo, S.; Molton, F.; Broggi, J.; Tomás-Mendivil, E.; Martin, D. *Angew. Chem. Int. Ed.* **2021**, *60*, 26783.
[4] Padmanaban, M.; Biju, A. T.; Glorius, F. *Org. Lett.* **2011**, *13*, 98−101.
[5] Li, Q.; Zeng, R.; Xu, P.; Jin, X.; Xie, C.; Yang, Q.; Zhang, X.; Li, J. *Angew. Chem. Int. Ed.* **2023**, *135*, *40*, e202309572.
[6] Liu, C.; Zhang, Z.; Zhao, L.-L.; Bertrand, G.; Yan, X. *Angew. Chem. Int. Ed.* **2023**, *62*, e202303478.
[7] Delfau, L.; Mauro, E.; Pecaut, J.; Martin, D.; Tomás-Mendivil, E. *ACS Catal.* **2024**, *14*, 7149−7156.
[8] Wu, X.; Hao, W.; Ye, K.-Y.; Jiang, B.; Pombar, G.; Song, Z.; Lin, S. *J. Am. Chem. Soc.* **2018**, *140*, 14836−14843.

P A045

Synthesis of 2-Trifluoromethyl)Azetidines by Strain-Release Reactions of 2-(Trifluoromethyl)-1-Azabicyclo[1.1.0]Butanes

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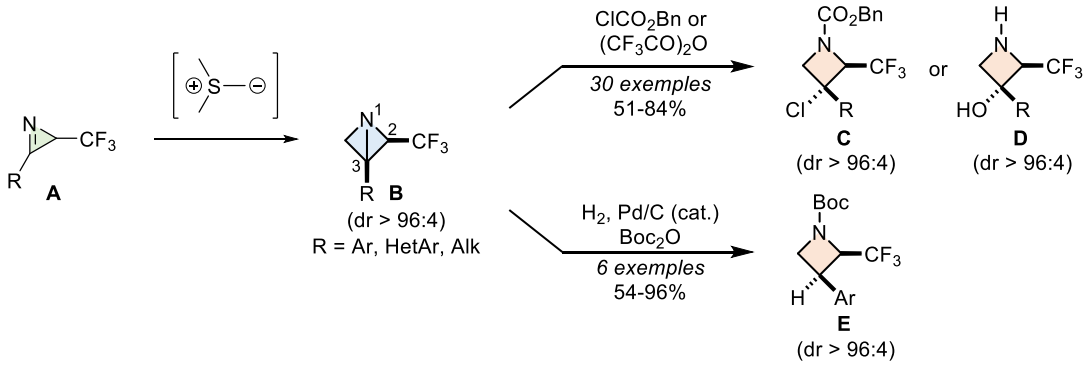
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Substituted azetidines are privileged *N*-heterocyclic scaffolds in medicinal chemistry and have become synthetic targets of high interest in recent years.[1] With the goal of developing a new access to azetidines incorporating the pharmaceutically relevant trifluoromethyl group,[2] the reactivity of 2-(trifluoromethyl)-1-azabicylo[1.1.0]butanes **B**, readily available from the corresponding 2-(trifluoromethyl)-2*H*-azirines **A** by Corey-Chaykovsky cyclopropanation, was investigated in polar strain-release reactions.[3]

By using benzyl chloroformate or trifluoroacetic anhydride as electrophilic reacting partners, diversely substituted 3-chloroazetidines **C** and azetidin-3-ols **D**, bearing a trifluoromethyl at C2 position, could be readily synthesized with high diastereoselectivities (dr>96:4). In addition, this new family of azabicyclobutanes provided an efficient entry to *cis*-3-aryl-2-trifluoromethyl azetidines **E** by diastereoselective palladium-catalyzed hydrogenolysis reactions.[4]



[1] (a) Bauer, M. R.; Di Fruscia, P.; Lucas, S. C. C.; Michaelides, I. N.; Nelson, J. E.; Storer, R. I.; Whitehurst, B. C. *RSC Med. Chem.* **2021**, *12*, 448-471. (b) Parmar, D. R.; Soni, J. Y.; Guduru, R.; Rayani, R. H.; Kusukar, R. V.; Vala, A. G. *Arch. Pharm.* **2021**, DOI : 10.1001/ardp.202100062. (c) Mughal, H.; Szostak, M. *Org. Biomol. Chem*. **2021**, *19*, 3274-3286.

[2] (a) Meyer, F. *Chem. Commun*. **2016**, *52*, 3077-3094. (b) H. D. Thi, T. Van Nguyen, M. D'hooghe, *Monatsh. Chem.* **2018**, *149*, 687-700.

[3] For selected examples of strain-release reactions of aza-bicyclobutanes see : (a) Andresini, M.; Degennaro, L.; Luisi, R. *Org. Biomol. Chem*. **2020**, *18*, 5798-5810. (b) Turkowska, J.; Durka, J.; Gryko, D. *Chem. Commun.* **2020**, *56,* 5718-5734. (c) Tyler, J. L.; Noble, A.; Aggarwal, V. K. *Angew. Chem. Int. Ed.* **2021**, *60*, 11824-11829. (d) Tyler, J. L.; Noble, A.; Aggarwal, V. K. *Angew. Chem. Int. Ed.* **2022**, *61*, e202114235. (e) Zanini, M.; Noble, A.; Aggarwal, V. K. *Angew. Chem. Int. Ed.* **2024**, *63*, e202410207.

[4] Sculiller, A.; Dupas, A.; Lefebvre G.; Bouriche, N.; Chédotal, H.; Guillamot, G.; Cossy, J.; Meyer, C. *Chem. Eur. J.* **2025**, *31*, e202500590.

P A046

Programmable Construction of Supramolecular Polymers

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Supramolecular polymers (SP) have become ubiquitous objects as they play central roles in living organisms and have found many applications in artificial systems.[1] SP are defined as 1D materials resulting from the self-assembly of small molecules, the monomers, through a combination of weak non-covalent interactions such as, Hydrogen bonding, Halogen bonding, dispersive interactions etc… Originally thought to be under thermodynamic control, recent discoveries in the field highlighted the possibility to grow aggregates with shape and size differing from the thermodynamic state.[2] In this presentation, I will depict our recent efforts[3] to create and stabilize such kinetic aggregate using the Toluene Bis-Amide (TBA) monomers. I will also show how minute changes of the monomeric scaffold (Toluene Urea – Amide, TUA) dramatically impact the supramolecular polymerization event and how spectroscopy can be helpful to decipher supramolecular packings.[4]

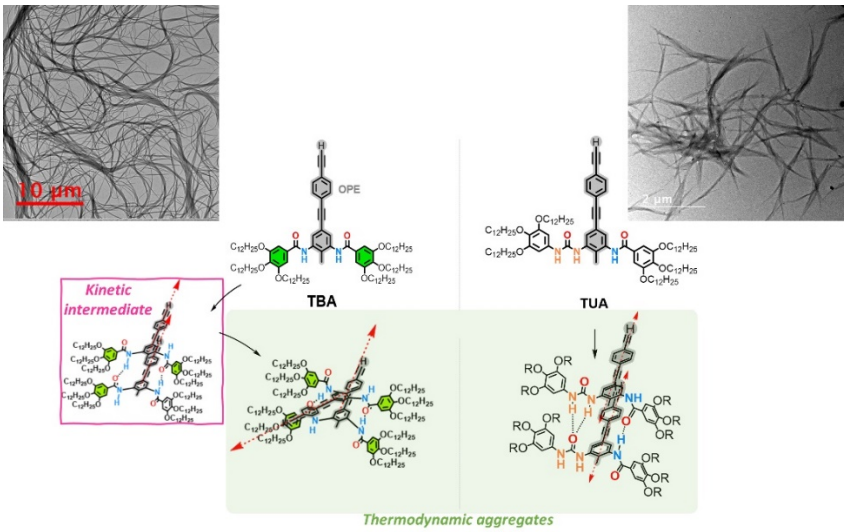


Figure 1 Structures of the two monomers TBA and TUA and their respective supramolecular aggregation.

[1] De Greef T. F. A.; Wolffs M.; Schenning A. P. H. J.; Sijbesma R. P.; Meijer E. W. Supramolecular Polymerization. *Chem. Rev.* **2009**, *109*, 5687.
[2] Korevaar P. A. ; de Greef T. F. A. ; Meijer E. W. Pathway Complexity in π-Conjugated Materials. *Chem. Mater.* **2013**, *1*, 576.
[3] Gallonde W. T.; Poidevin C.; Houard F.; Caytan E.; Dorcet V.; Fihey A.; Bernot K.; Rigaut S.; Galangau O. Kinetic Delay in Cooperative Supramolecular Polymerization by Redefining the Trade-Off Relationship between H-Bonds and Van der Waals/pi-pi Stacking Interactions. *Angew. Chem. Int. Ed.* **2023**, e202313696.
[4] Gallonde W. T. ; Shekar M. ; Rigaut S. ; Galangau O. Supramolecular Polymerization of Monomers Containing Both Urea and Amide Groups: Evidence for Narcissistic Hydrogen Bond Self-Sorting. *Chem. Eur. J.* **2025**, e202500443.

P A047

Synthesis and study of multivalent glycoclusters by dynamic combinatorial chemistry

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Pseudomonas aeruginosa is an opportunistic Gram-negative bacterium that mainly affects immunocompromised patients and is involved in nosocomial infections such as lung infections critical in cystic fibrosis patients. The World Health Organization listed *Pseudomonas aeruginosa* as a high-priority bacterial pathogen due to its multiple resistance to antibiotics.[1] In order to counteract this resistance, anti-biofilm and anti-adhesive approaches are being explored. The adhesion of *Pseudomonas aeruginosa* to host cells is mediated by two soluble lectins (LecA and LecB).[2] Several multivalent glycoclusters have been synthesized and have shown potential therapeutic applications as anti-infective agents.[3]

To move away from a classicals methods for lectin ligand design, dynamic combinatorial chemistry (DCC) has been investigated for the generation of a library of potential multivalent glycoclusters through thermodynamically controlled reversible covalent bonds.[4]

A first generation of multivalent glycoclusters, composed of a 1,4-dithiophenol aromatic core displaying glycosylated arms, synthesized using DCC, have shown promising results. Various divalent building blocks in the mannose, galactose, and fucose series were synthesized and equilibrated in the presence of lectins. The study demonstrated the predominant formation of macrocycles X_3 and X_4, linked by disulfide bridges. The glycoclusters were evaluated by ITC and showed an affinity in the nanomolar range.[5]

With the aim of obtaining greater diversity, monovalent building blocks were synthesized using the same method.[5] Preliminary studies have shown the formation of larger macrocycles up to hexamers and amplification of tetramers by the lectin ConA (Figure 1).

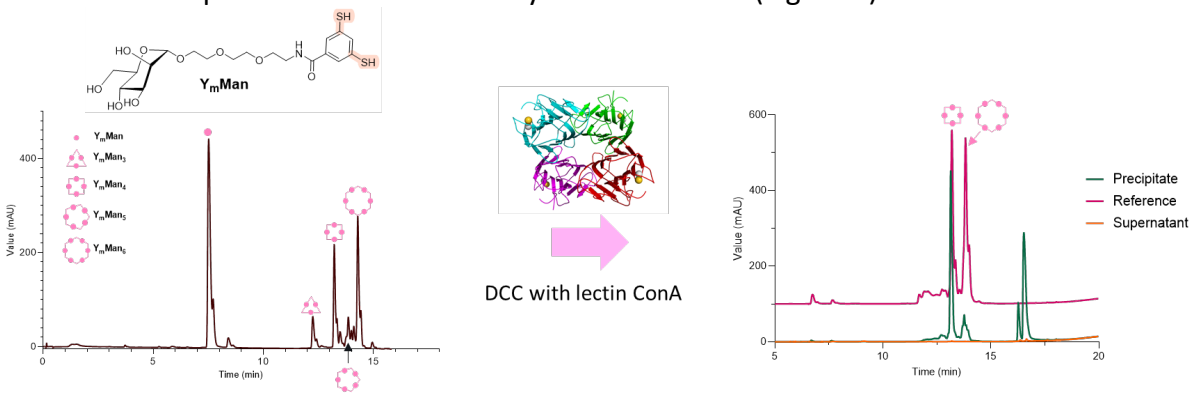


Figure 1 : *Equilibration of the monovalent 3,5-dithiophenol building block* ***Y*** *and DDC with ConA*

[1] *WHO updates list of drug-resistant bacteria most threatening to human health*. https://www.who.int/news/item/17-05-2024-who-updates-list-of-drug-resistant-bacteria-most-threatening-to-human-health (accessed 2024-07-31).

[2] Imberty, A.; Wimmerová, M.; Mitchell, E. P.; Gilboa-Garber, N. *Microbes Infect.* **2004**, *6* (2), 221–228. https://doi.org/10.1016/j.micinf.2003.10.016.

[3] Cecioni, S.; Imberty, A.; Vidal, S. *Chem. Rev.* **2015**, *115* (1), 525–561. https://doi.org/10.1021/cr500303t.

[4] Otto, S.; Furlan, R. L. E.; Sanders, J. K. M. *Drug Discov. Today* **2002**, *7* (2), 117-125.

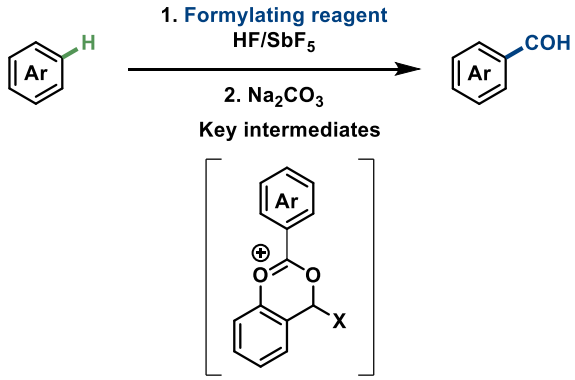
[5] Demontrond, F.; Pascal, Y.; Donnier-Maréchal, M.; Raillon, C.; Luton, B.; De La Tramblais, C.; Vial, L.; Gueyrard, D.; Galia, W.; Berger, E.; Géloën, A.; Cournoyer, B.; Leclaire, J.; Vidal, S. Chem. Eur. J. in press.

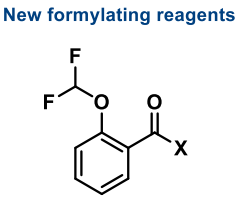
P A048

Direct formylation of aromatics under superacid activation

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The pharmaceutical and agrochemical industries are constantly looking for new molecules, motivating strong need for the development of efficient methods to functionalize complex structures.[1] Direct formylation of aromatic compounds is a synthetic approach that enables the introduction of an aldehyde directly onto the aromatic core without requiring a previous activation of the substrate.[2] Among the carbonyl functions, the formyl group is one of the most reactive, it results to the simplification of synthetic pathways, reducing the number of steps needed to synthesise complex molecules.[3] However, the already known formylation methods are facing several limits, particularly in terms of selectivity control, reactivity and tolerance to various functional groups.[4] Under superacidic conditions (HF/SbF_5),[5] organic molecules, especially functionalized aromatic compounds, can be polyprotonated, facilitating functionalization at positions that are often difficult to modify using conventional methods. Thanks to this unique reactivity, we were able to develop late-stage functionalization strategies to directly diversify complex molecules.[6] In this context, a novel method of aromatic formylation has been developed, using the superelectrophilic activation [7] of specially designed and easily accessible formylation reagents.





[1] (a) N.J.Castellino, A.P. Montgomery, J.J. Danon and M. Kassiou, *Chem. Rev*., **2023**, 123, 13, 8127-8153 ;(b). J. Börgel, T.Ritter, *Chem*, **2020**, 6(8), 1877-1887.; (c) L. Zhang, T.Ritter, *J. Am. Chem. Soc*., **2022**, 144, 2399-2414.
[2] I. Yadav, D. Dhiman and M. Sankar, *Chem.Commun*., **2024**, 60, 13456-13467.
[3] (a)N. H. Jabarullah, K. Jermsittiparsert, P. A. Melkinov, A. Maseleno, A. Hosseinian and E. Vessally, *J. Sulfur Chem*., **2020**, 41(1), 96-115. ; (b) G. Bosica, R. Abdilla, *Catalysts*, **2022**, 12(7), 725.; (c) A. Kherudkar, A. Bhattacharjee, A. Nawkhare, S. Mukherjee, S. Pramanick, J. K. Laha, *Chem. Rec*., **2023**, *23*, e202300063
[4] (a) O. *Meth-Cohn; SP. Stanforth, Compr. Org. Synth, **1991**, 2, 777–794.* ; (b) L. N.Ferguson, *Chem. Rev*. **1946**, *38, 2*, 227–254. ; (c) G. A. Olah, F. Pelizza, S. Kobayashi, J. A. Olah, *J. Am. Chem. Soc*. **1976**, *98, 1*, 296–297.
[5] G. A. Olah, K. S. Prakash, A. Moln ar, J. Sommer, Superacid chemistry , 2009, 2nd Edition John Wiley and Sons ; New York.
[6] (a) M. Artault, K .Vitse, A. Martin-Mingot, S. Thibaudeau, *Chem. Eur. J*. **2022**, *28*, e202103926. ; (b) LJC. Bonazaba Milandou, H. Carreyre, S. Alazet, G. Greco, A. Martin-Mingot, C. Nkounkou Loumpangou, JM. Ouamba, F. Bouazza, T. Billard, S. Thibaudeau, Angew. *Chem. Int. Ed*. **2017**, *56*, 169-172. ; (c) A. Mamontov, A. Martin-Mingot, B. Métayer, O. Karam, F. Zunino, F. Bouazza, S. Thibaudeau, *Chem. Eur. J*. **2020**, *46*, 10411-10416. ; (d) P. Bourbon, K. Vitse, A. Marti-Mingot, H. Geindre, F. Guégan, B. Michelet and S. Thibaudeau, *Nat. Commun*. **2024**, 15, 7435.
[7] G. A. Olah, D. A. Klump, Superelectrophiles and their chemistry, 2008, John Wiley and Sons, Inc., Hoboken, New Jersey.

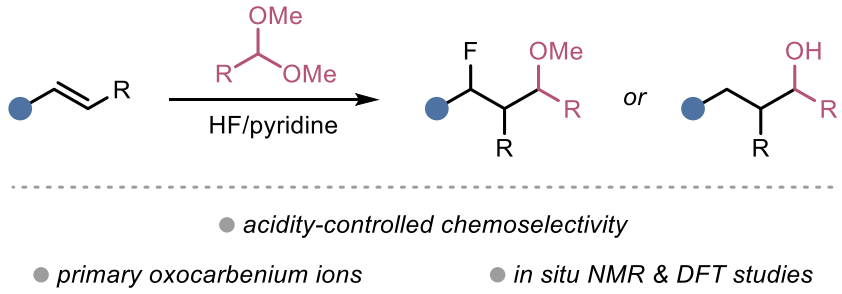
P A049

Regulating the acidity of HF/pyridine media to control the chemodivergent fluoro- and hydro-heteroalkylation of olefins

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Although anhydrous hydrogen fluoride (HF) itself is only rarely exploited in academic research for the development of new transformations, it is employed at an industrial scale for the preparation of high-value synthons (such as fluoroarenes, trifluoromethylarenes, etc.).[1] More commonly, HF is used in combination with an organic base (e.g., HF/pyridine, HF/Et_3N)[2] as a nucleophilic fluorinating reagent, particularly for the fluoro-functionalization of unsaturated substrates. The crucial influence of the acidity of these HF/base systems on the efficiency and selectivity of such transformations has been underscored by several research groups over the last years.[3] Recently, our group has developed a method to quantify, for the first time, the acidity of these media on the Hammett acidity scale (H_0).[4] In this context, investigating the reactivity of alkenes in the presence of electrophiles derived from dimethoxymethane in HF/pyridine media has revealed the pivotal role of acidity in governing the chemoselectivity of this transformation.[5]



[1] Harsanyi, A.; Sandford, G. Organofluorine chemistry : applications, sources and sustainability. *Green. Chem*. **2015**, *17*, 2081–2068.
[2] Yoneda, N. The combination of hydrogen fluoride with organic bases as fluorination agents*, Tetrahedron* **1991**, *47*, 5329–5365.
[3] (a) Scheidt, F.; Schafer, M.; Sarie, J. C.; Daniliuc, C. G.; Molloy, J. J.; Gilmour, R. Enantioselective, catalytic vicinal difluorination of alkenes. *Angew. Chem. Int. Ed*. **2018**, *57*, 16431–16435. (b) Haj, M. K.; Banik, S. M.; Jacobsen, E. N. Catalytic, enantioselective 1,2-difluorination of cinnamamides. *Org. Lett*. **2019**, *21*, 4919–4923. (c) Wang, Q.; Lübcke, M.; Biosca, M.; Hedberg, M.; Eriksson, L.; Himo, F.; Szabó, K. J. Enantioselective construction of tertiary fluoride stereocenters by organocatalytic fluorocyclization. *J. Am. Chem. Soc*. **2020**, *142*, 20048–20057.
[4] Longuet, M.; Vitse, K.; Martin-Mingot, A.; Michelet, B.; Guégan, F.; Thibaudeau, S. Determination of the Hammett Acidity of HF/Base Reagents*. J. Am. Chem. Soc*. **2024**, *146*, 12167–12173.
[5] Longuet, M.; Naullet, F.; Pérochon, A.; Martin-Mingot, A.; Guégan, F.; Michelet, B.; Thibaudeau, S. Regulating the Acidity of HF/Pyridine Media to Control the Chemodivergent Fluoro- and Hydro-heteroalkylation of Olefins*. J. Am. Chem. Soc*. **2025**, *in press*. doi.org/10.1021/jacs.5c07526

P A050

Discovery and small molecule targeting of a regulatory pseudoknot in ABL1 mRNA

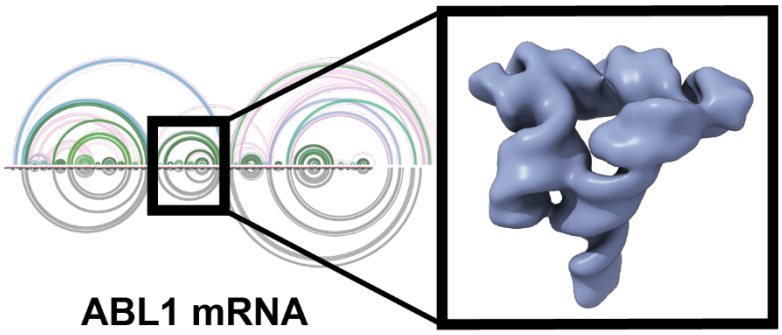
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RNA structures within coding sequences are increasingly recognized as regulators of translation, yet structurally and functionally validated examples in human mRNAs remain limited.[1] Here, we combined in-cell discovery of RNA tertiary structures by chemical probing with 3D modeling to discover a pseudoknot within the coding region of human *ABL1* mRNA.[2] Machine learning-based modeling,[3] validated by cryo-electron microscopy,[4] confirmed the existence of a stable, compact pseudoknot. A synonymous mutation that disrupted the pseudoknot led to increased *ABL1* protein levels, establishing its role as a translational repressor. We further identified a small-molecule fragment that binds the pseudoknot with mid-micromolar affinity and resolved its precise binding site in the pseudoknot.[5] Ongoing experiments focus on the mechanisms by which mutations and ligand binding influence *ABL1* expression and oncogenicity. Our findings identify a structured RNA regulatory element within a human oncogene and underscore the potential of coding-region mRNA structures as targets for small-molecule therapeutics.



Tertiary RNA Structure found in the ABL1 Coding Sequence

[1] Cao, X.; Zhang, Y.; Ding, Y.; Wan, Y. Identification of RNA Structures and Their Roles in RNA Functions. *Nat Rev Mol Cell Biol* **2024**, 25 (10), 784–801.

[2] Wang, J. Y. J. The Capable ABL: What Is Its Biological Function? *Molecular and Cellular Biology* **2014**, 34 (7), 1188–1197.

[3] Wang, W.; Feng, C.; Han, R.; Wang, Z.; Ye, L.; Du, Z.; Wei, H.; Zhang, F.; Peng, Z.; Yang, J. trRosettaRNA: Automated Prediction of RNA 3D Structure with Transformer Network. *Nat Commun* **2023**, 14 (1), 7266.

[4] Haack, D. B.; Rudolfs, B.; Jin, S.; Khitun, A.; Weeks, K. M.; Toor, N. Scaffold-Enabled High-Resolution Cryo-EM Structure Determination of RNA. *Nat Commun* **2025**, 16 (1), 880.

[5] Veenbaas, S. D.; Koehn, J. T.; Irving, P. S.; Lama, N. N.; Weeks, K. M. Ligand-Binding Pockets in RNA and Where to Find Them. *Proceedings of the National Academy of Sciences* **2025**, 122 (17), e2422346122.

P A051

Asymmetric [3,3]-Sigmatropic Rearrangement for the Synthesis of Quaternary Center-Containing 1,4-Diketones and Application to the Total Synthesis of (-)-Sinoracutine

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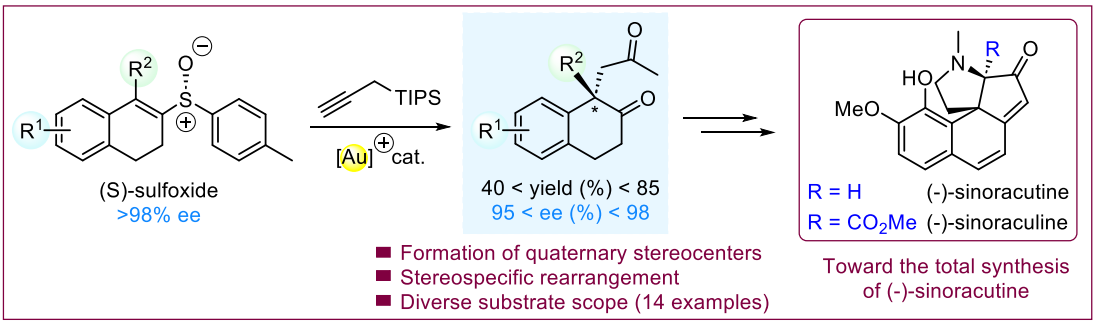
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In recent decades, gold(I)-catalyzed reactions have been widely applied to access complex molecular frameworks. Indeed, gold catalysis has emerged as a powerful method in organic synthesis due to the unique ability of cationic gold complexes to activate unsaturated bonds such as allenes or alkynes.

Recently, we have synthesized acyclic and polycyclic cyclopentenones with C4-quaternary stereocenters through a stereospecific gold-catalyzed [3,3]-sigmatropic rearrangement of acyclic and cyclic vinyl sulfoxides. The application of this simple asymmetric methodology allowed the total synthesis of six natural sesquiterpenoids, including hitoyopodin A, lagopodin A, enokipodin A and B and a natural partially aromatic steroid, the myrmenaphthol A.[1,2]

In this present work, we have developed a methodology for the transformation of cyclic vinyl sulfoxides into complex chiral polycylic 1,4-diketones. The synthesis of 1,4-diketones bearing either aromatic, bicyclic or heterocyclic frameworks with quaternary centers was achieved in good yields (40-85%) and excellent enantioselectivities (95-98% ee).

The establishment of this asymmetric transformation allowed us to consider the synthesis of hasubanan alkaloids, especially the (-)-sinoracutine and (-)-sinoraculine, isolated from Sinomenium acutum in 2009 and from *Stephania cepharantha* in 2012, respectively.[3] The total synthesis of these natural products is currently underway and will be reported soon.



[1] (a) Zhou, W.; Voituriez, A. Gold(I)-Catalyzed Synthesis of Highly Substituted 1,4-Dicarbonyl Derivatives via Sulfonium [3,3]-Sigmatropic Rearrangement. *Org. Lett.* **2021**, *23,* 247; (b) Zhou, W.; Voituriez, A. Synthesis of Cyclopentenones with C4-Quaternary Stereocenters via Stereospecific [3,3]-Sigmatropic Rearrangement and Applications in Total Synthesis of Sesquiterpenoids. *J. Am. Chem. Soc.* **2021**, *143,* 17348.

[2] Zhou, W.; Huynh, G. H.; Voituriez, A. Asymmetric [3,3]-Sigmatropic Rearrangement for the Synthesis of Quaternary Center-Containing Polycyclic Molecules: Application to the Total Synthesis of Myrmenaphthol A **2025**, *Submitted article.*

[3] (a) Bao, G. H., Wang, X. L., Tang, X. C., Chiu, P., Qin, G. W. Sinoracutine, a novel skeletal alkaloid with cell-protective effects from *Sinomenium acutum*. *Tetrahedron Lett.* **2009**, *50,* 4375; (b) He, L., Deng, L. L., Mu, S. Z., Sun, Q. Y., Hao, X. J., Zhang, Y. H., Sinoraculine, the Precursor of the Novel Alkaloid Sinoracutine from Stephania cepharantha Hayata. *Helv. Chim. Acta* **2012**, *95,* 1198.

P A052

Synthesis and anti-cancer biological activities of new bimetallic (*N*-Heterocyclic Carbene)-Amine-Pt(II) complexes

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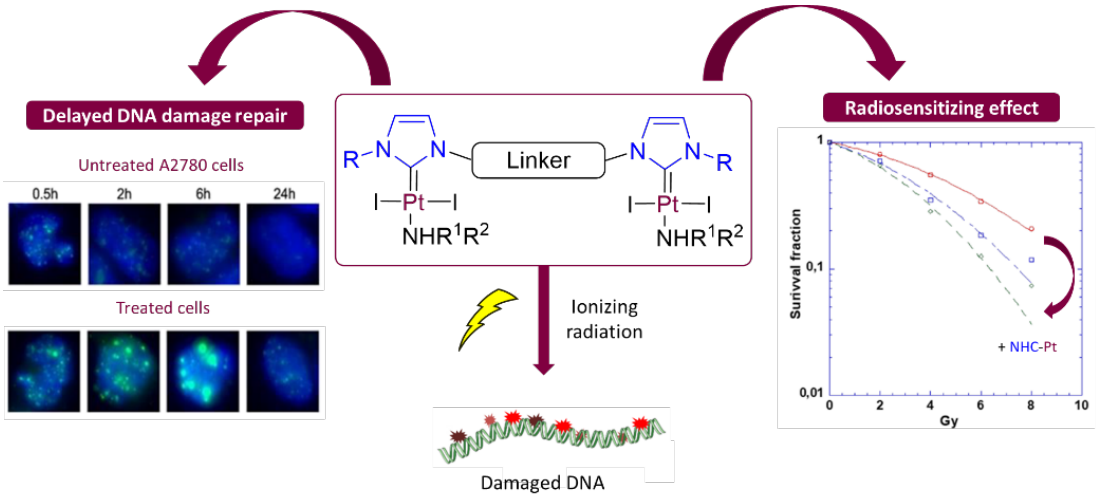
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Bioactive *N*-heterocyclic carbene (NHC) transition metal complexes have shown great potential as anti-cancer agents.[1,2] However, their application as radiosensitizers agents remains largely unexplored. In this study, we will describe the synthesis of a new series of (bis-NHC)[trans-$Pt(RNH_2)I_2]_2$ bimetallic platinum(II) complexes, elaborated by a simple and efficient two-step procedure from their imidazolium salts.[3] These complexes exhibit micromolar cytotoxicity on various tumor cell lines. They accumulate significantly and interact with genomic DNA, leading to DNA damage. In particular, these bimetallic species induce a marked radiosensitizers effect on A2780 ovarian carcinoma cells and H1299 non-small cell lung carcinoma cells. Further investigations have shown that these complexes inhibit DNA repair mechanisms, prolonging the persistence of radiation-induced lesions. This is corroborated by an increased and long-lasting accumulation of γ-H2AX and 53BP1 foci after exposure to ionizing radiation in the presence of NHC-Pt complexes. Overall, this work provides the first *in vitro* demonstration of the radiosensitizers potential of platinum-based NHC complexes, highlighting their interest in the context of therapeutic strategies combining chemotherapy and radiotherapy.



[1] Zhao, S.; Yang, Z.; Jiang, G.; Huang, S.; Bian, M.; Lu, Y.; Liu, W. An Overview of Anticancer Platinum N-Heterocyclic Carbene Complexes. *Coord. Chem. Rev.* **2021**, *449*, 214217.

[2] Bellemin-Laponnaz, S. N-Heterocyclic Carbene Platinum Complexes: A Big Step Forward for Effective Antitumor Compounds. *Eur. J. Inorg. Chem.* **2020**, *2020* (1), 10–20.

[3] Jia, T.; Diane, O.; Ghosh, D.; Skander, M.; Fontaine, G.; Retailleau, P.; Poupon, J.; Bignon, J.; Moulai Siasia, Y. M.; Servajean, V.; Hue, N.; Betzer, J.-F.; Marinetti, A.; Bombard, S. Anti-Cancer and Radio-Sensitizing Properties of New Bimetallic (*N*-Heterocyclic Carbene)-Amine-Pt(II) Complexes. *J. Med. Chem.* **2023**, *66* (10), 6836–6848.

P A053

Synthesis and study at the micro / nano scale of Poly (Diiododiacetylenes): on the road to carbyne

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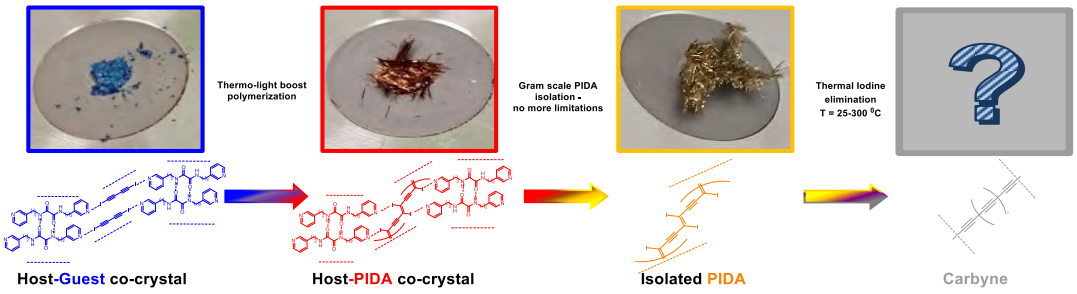
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Conjugated polymers have recently garnered significant interest due to their exceptional electrical, optical, and sensing properties. Among these, poly(diiododiacetylene) (PIDA)—a one-dimensional (1D) conjugated polymer featuring a carbon chain substituted solely with iodine atoms—remains understudied despite its potential[1]. Isolated PIDA demonstrates diverse applications, including radiosensitization enhancement[2], therapeutic effects in inflammatory bowel disease[3], and serving as a precursor for carbon-rich materials, including carbyne – infinitely long polyyne molecule [–C≡C–]n[4,5]. Despite over two decades of research into PIDA synthesis[1,4,6], no standardized protocol exists. In this work, we present an optimized gram-scale procedure for isolating PIDA, enabling unrestricted access for further scientific exploration. Additionally, motivated by theoretical predictions of carbyne's high conductivity[5], we employ a four-probe method to measure the electrical properties of pristine PIDA crystals and their iodine-eliminated derivatives, probing the potential emergence of superconductivity in this new material system.



[1] Sun, A.; Lauher, J. W.; Goroff, N. S. Preparation of Poly (Diiododiacetylene), an Ordered Conjugated Polymer of Carbon and Iodine. Science **2006**, 312 (5776), 1030–1034. https://doi.org/10.1126/science.1124621.

[2] Yin, M.; Yuan, Y.; Huang, Y.; Liu, X.; Meng, F.; Luo, L.; Tian, S.; Liu, B. Carbon–Iodine Polydiacetylene Nanofibers for Image-Guided Radiotherapy and Tumor-Microenvironment-Enhanced Radiosensitization. *ACS Nano* **2024**, *18* (11), 8325–8336. https://doi.org/10.1021/acsnano.3c12623.

[3] Yin, M.; Chen, Y.; Liu, X.; Tian, S.; Zhao, L.; Bai, Y.; Wang, H.; Lin, J.; Jiang, D.; Lei, Z.; Meng, F.; Tian, D.; Luo, L. Targeted Computed Tomography Visualization and Healing of Inflammatory Bowel Disease by Orally Delivered Bacterial-Flagella-Inspired Polydiiododiacetylene Nanofibers. *ACS Nano* **2023**, *17* (4), 3873–3888. https://doi.org/10.1021/acsnano.2c12154.

[4] Luo, L.; Wilhelm, C.; Sun, A.; Grey, C. P.; Lauher, J. W.; Goroff, N. S. Poly(Diiododiacetylene): Preparation, Isolation, and Full Characterization of a Very Simple Poly(Diacetylene). *J. Am. Chem. Soc.* **2008**, *130* (24), 7702–7709. https://doi.org/10.1021/ja8011403.

[5] Yang, G. Synthesis, Properties, and Applications of Carbyne Nanocrystals. *Materials Science and Engineering: R: Reports* **2022**, *151*, 100692. https://doi.org/10.1016/j.mser.2022.100692.

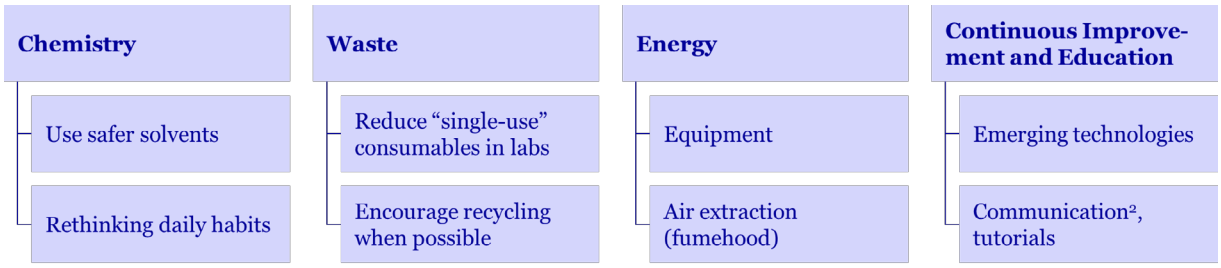
[6] Yin, M.; Liu, X.; Lei, Z.; Gao, Y.; Liu, J.; Tian, S.; Liang, Z.; Wang, Y.; Meng, F.; Luo, L. Precisely Translating Computed Tomography Diagnosis Accuracy into Therapeutic Intervention by a Carbon-Iodine Conjugated Polymer. *Nat Commun* **2022**, *13* (1), 2625. https://doi.org/10.1038/s41467-022-30263-1.

P A054

Driving Sustainability in Drug Discovery: A Focus on Greener Solvent Strategies at Evotec

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At Evotec – a globally recognized leader in R&D partnerships – we are deeply committed to embracing and advancing new technologies. In our pursuit to remain at the forefront of scientific innovation and deliver cutting-edge solutions, we have established several dedicated working groups actively engaged in key areas such as photochemistry, electrochemistry, flow chemistry, biocatalysis... As part of this strategy, the "Green Chemistry" working group focuses on designing chemical products and processes that minimize or eliminate the use and generation of hazardous substances. We continuously strive to implement safer, cleaner, and more sustainable methodologies that align with the principles of green chemistry,[1] which apply throughout a chemical product's entire life cycle – from design and manufacturing to use and disposal. Additionally, we are committed to reducing energy consumption to help lower the company's overall carbon footprint. Our sustainability initiatives and commitment to green chemistry are pursued without compromising our high standards of excellence in drug discovery. To support these goals, we have identified four key areas for improvement:



This presentation will be focused on the first pillar of improvement and more especially on solvent replacement. Evotec places a strong emphasis on the use of safer solvents, with a particular focus on those derived from bio-based & renewable sources, in order to reduce dependence on CMR and/or chlorinated solvents known for their environmental and health risks. As part of this commitment, Evotec has successfully substituted conventional hazardous solvents such as DMF, DCM, and Dioxane/THF with greener alternatives like Me-THF, DMC, CPME and dimethyl isosorbide (DMIso),[3] achieving comparable or even improved reaction yields while significantly lowering toxicity and minimizing environmental impact.

[1] Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press: New York, **1998**, 30, By permission of Oxford University Press
[2] Green Chemistry at Evotec: Pioneering Sustainable Drug Discovery - Evotec
[3] a) Coby J. Clarke, Wei-Chien Tu, Oliver Levers, Andreas Bröhl, and Jason P. Hallett *Chemical Reviews* **2018**, 118, 747 b) Pace, V., Hoyos, P., Castoldi, L., Domínguez de María, P. and Alcántara, A.R. *ChemSusChem* **2012**, 5, 1369 c) Andrew Jordan, Callum G. J. Hall, Lee R. Thorp, and Helen F. Sneddon *Chemical Reviews* **2022**, 122, 6749 d) Aricò, F.; Tundo, P. Beilstein *J. Org. Chem.* 2016, 12, 2256 e) F. Aricò, A. S. Aldoshin, P. Tundo, *ChemSusChem* **2017**, 10, 53 f) Russo F., Galiano F., Pedace F., Aricò F., and Figoli A. CS *Sustainable Chem. Eng.* **2020**, 8, 1, 659 g) Pin, F., Picard, J., Dhulut, S. Org. Process Res. Dev. **2025**, 29, 1715

P A055

The application of MOC (memory of chirality) to asymmetric 1,3-dipolar cycloaddition of azomethine ylides

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Memory of Chirality (MOC)[1] is an original method belonging to asymmetric synthesis from chiral pool. In MOC reactions, the only source of chirality is the starting reagent which possesses a single stereogenic center (e.g. an α-amino acid) and whose stereogenic center is temporarily trigonalized/destroyed during the key step, but still leads to an enantioenriched product. During this process, the initial chirality is therefore "memorized" in a global chiral conformation of the molecule. In previous results, in our group, MOC has been successfully used for alkylation[2], aldol reaction[3] and radical oxydative coupling of enolates[4]. Our goal is to develop new original methods of asymmetric cycloadditions, based on MOC concept. The adopted strategy relies on dynamic axial chirality of tertiary aromatic amides. We synthesized some imines with axial chirality from alanine, valine, leucine, isoleucine, methionine, phenylglycine and phenylalanine. The overall yield are 18-54%, without racemization. We then performed cycloaddition reactions with imines and some nitroalkenes or other dipolarophiles. With nitrostyrene, we obtained the expected cycloaddition product in 50% yield and 77% ee. We will present our latest results in this field and our attempts to completely remove the protection of the carboxylic acid to obtain proline derivatives.

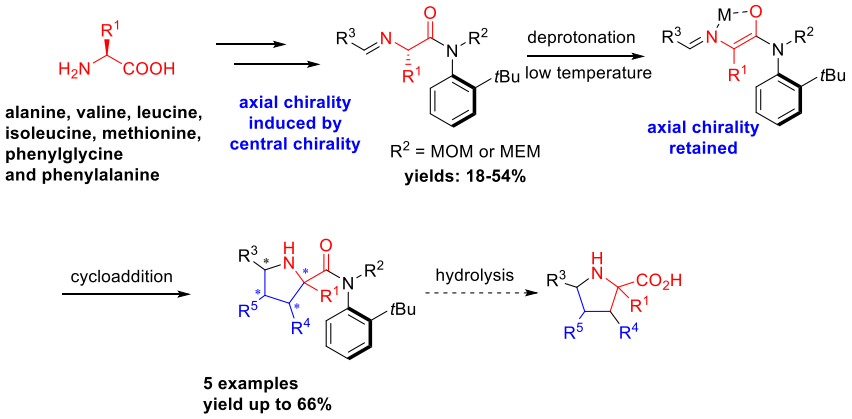


Figure 1. Synthesis of proline derivatives

[1] Alezra V.; Kawabata T. *Synthesis* **2016**, *48*, 2997.

[2] For selected examples on alkylation of MOC: (a) Branca M.; Pena S.; Guillot R.; Gori D.; Alezra V.; Kouklovsky C. *J. Am. Chem. Soc.* **2009**, *131*, 10711. (b) Branca M.; Gori D.; Guillot R.; Alezra V.; Kouklovsky C. *J. Am. Chem. Soc.* **2008**, *130*, 5864. (c) Branca M.; Alezra V.; Kouklovsky C.; Archirel P. *Tetrahedron* **2008**, *64*, 1743.

[3] Viswambhaaran B.; Gori D.; Guillot R.; Kouklovsky C.; Alezra V. *Org. Lett*. **2014**, *16*, 788.

[4] Mambrini A.; Gori D.; Guillot R.; Kouklovsky C.; Alezra V. *Chem. Commun.* **2018**, *54*, 12742.

P A056

Allene Function Enables Intermolecular Reductive-Heck, Making Propa-1,2-diene an Isopropenylation Reagent for C(sp²) Halides

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The Heck coupling reaction is a broadly used and popular organic synthesis tool accommodating a wide range of C(sp²) halides or pseudo-halides substrates, which can be paired with diverse alkene coupling partners, mostly through palladium catalysis.[1]Its reductive counterpart[2] is also of paramount importance in the field of palladium-catalyzed reactions.

In this study, the reactivity of the allene function is harnessed to develop an efficient intermolecular variant of the reductive Heck reaction. Using propa-1,2-diene and inexpensive sodium formate, a Pd-catalyzed hydrocarbation delivers isopropenyl-substituted aromatic and aliphatic compounds from readily available or commercially accessible C(sp²) halides. This method features broad substrate scope, high functional group tolerance, and delivers good to excellent yields.

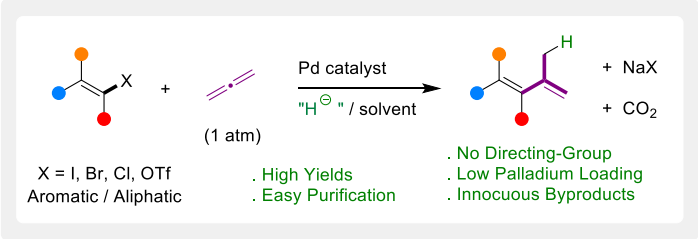


Figure 3 Reductive Heck Reaction on Propa-1,2-diene

Notably, this methodology extends beyond propa-1,2-diene to encompass O-, N-, Si-, and C-substituted allenes[3,4], demonstrating remarkable versatility. Over 40 examples are reported, with palladium loadings as low as 0.10 mol% remaining effective under optimized conditions. The protocol also grants straightforward access to deuterated analogues using DCO_2Na. Operationally simple, this reaction produces only innocuous by-products (CO_2 and sodium halides), and in most cases, the pure products are readily isolated by simple water/ether extraction.

[1] a) I. Beletskaya and A. Cheprakov. The Heck Reaction as a Sharpening Stone of Palladium Catalysis. *Chem. Rev.* 2000, 100 (8), 3009-3066. b) Nicolaou, K.C., Bulger, P.G. and Sarlah, D. Palladium-Catalyzed Cross-Coupling Reactions in Total Synthesis *Angew. Chem., Int. Ed.* 2002, 44: 4442-4489.

[2] S. Cacchi and A. Arcadi. Palladium-catalyzed conjugate addition reaction of aryl iodides with .alpha.,.beta.-unsaturated ketones. *J. Org. Chem.* 1983, 48, 23, 4236–4240

[3] S.B Mohite, P.S Bera, Y.K Mirza, V. Ntuli, Y. Soorni, R. Karpoormath and M. Bera. Hydrogen-Bonding Network-Enabled Terminal Selective Heteroarylation of Allenamides in Hexafluoroisopropanol. *Org. Lett.* 2025, 27, 9, 2053–2059

[4] Song, G., Wang, B., Nishiura, M. and Hou, Z. Catalytic C-H Bond Addition of Pyridines to Allenes by a Rare-Earth Catalyst. *Chem. Eur. J.* 2015, 21: 8394-8398.

P A057

Triaryl-Heptazines Photocatalysts for the Oxidation of C–H and C–C bonds in Nitrogen-Containing Molecules

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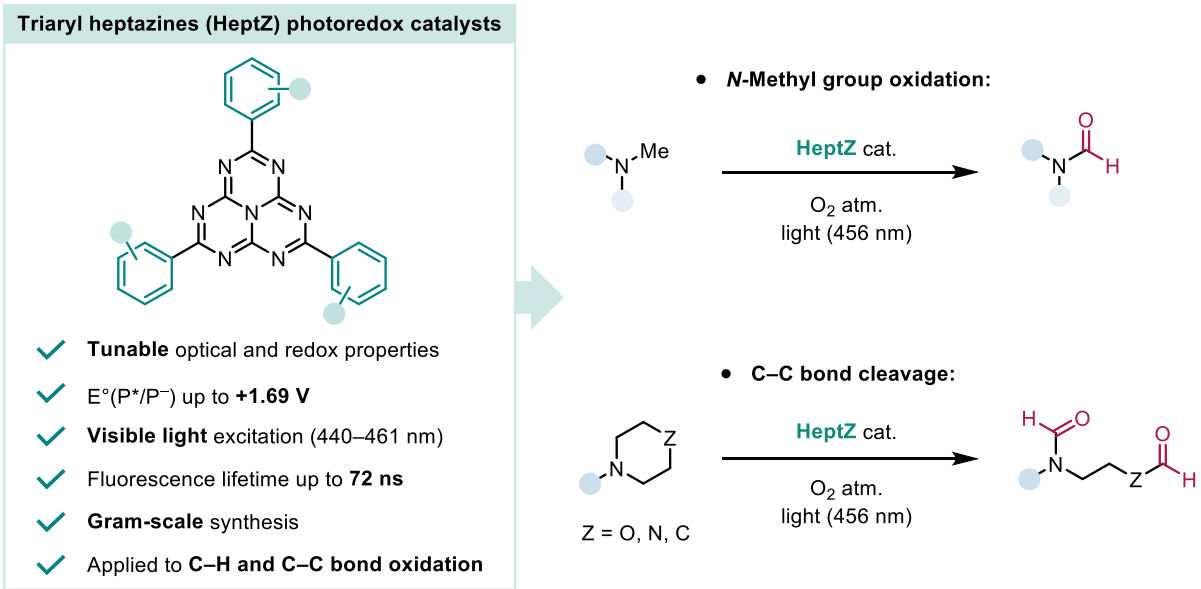
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Over the past decade, open-shell intermediates have attracted renewed attention, positioning photoredox chemistry —and therefore the development of new photoredox catalysts— as a key topic of research.[1] More specifically, organic photoredox catalysts (e.g., acridiniums or pyryliums) are potent oxidants under light irradiation and enabled otherwise challenging oxidations.[2] However, their short excited-state lifetime can hamper reactions by reducing the likelihood of productive collisions.

We developed a new family of organic photoredox catalysts based on a triaryl heptazine scaffold which are activable by visible light, and display high redox potentials as well as long excited-state lifetimes.[3] Furthermore, the substitution pattern on the peripheral aromatic rings can be modified, allowing for modulation of their photoredox properties.

We then applied these new photocatalysts to challenging C–H and C–C bond oxidations in nitrogen-containing molecules.[4] They demonstrated excellent synthetic performance, notably in terms of scope and selectivity. Moreover, mechanistic studies provided a clear picture of the behavior of these new heptazines under photoredox conditions.



[1] (a) Tucker, J. W.; Stephenson, C. R. J. *J. Org. Chem.* **2012**, *77* (4), 1617–1622; (b) Shaw, M. H.; Twilton, J.; MacMillan, D. W. C. *J. Org. Chem.* **2016**, *81* (16), 6898–6926.

[2] Romero, N. A.; Nicewicz, D. A. *Chem. Rev.* **2016**, *116* (17), 10075–10166.

[3] Le, T.; Galmiche, L.; Masson, G.; Allain, C.; Audebert, P. *Chem. Commun.* **2020**, *56* (73), 10742–10745.

[4] Yu, X.-Y.; Chen, J.-R.; Xiao, W.-J. *Chem. Rev.* **2021**, *121* (1), 506–561.

P A058

Gold-catalyzed synthesis of heterospirocycles for molecular diversity

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Spirocycles are defined by a fully-substituted central carbon atom (Csp^3) that can easily be a source of chirality. This specific arrangement gives a pseudo-rigid and well-organized 3D structure and brings interesting physico-chemical properties. Creating new synthetic methodology for the preparation of these compounds represents an opportunity to explore new chemical[1] and biological space. Previous work in our laboratory has led to the discovery of a quick and very efficient way to obtain heterospirocycles from alkynes via gold(I)-catalysis[2,3]. Now, we wish to develop a small library of *N*-protected spirocycles from alkynes with orthogonal protecting groups for application in different medicinal chemistry projects in our laboratory. The resulting molecules possess a double-bond that can be selectively reduced via an asymmetric hydrogenation[4] (Figure 1).

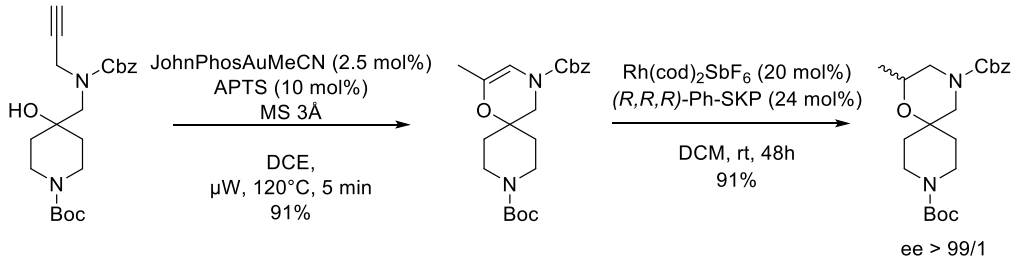


Figure 4 : Spirocyclization and asymmetric reduction.

Encouraging results obtained after optimization led to us to pursue this work with di-substituted alkynes in order to increase molecular diversity. Several *N*-protected spirocycles have been synthetized and are currently undergoing the reduction step in our laboratory.

[1] Lovering, F.; Bikker, J.; Humblet, C., Escape from Flatland : Increasing Saturation as an Approach to Improving Clincial Success, *J.Med.Chem.* **2009**, *52*, 6752.
[2] Soklou, K. E.; Marzag, H.; Vallée, B.; Routier, S.; Plé, K., Synthesis of Heterospirocycles through Gold-(I) Catalysis: Useful Building Blocks for Medicinal Chemistry, *Adv. Synth. Catal.* **2022**, *364*, 218
[3] Soklou, K. E.; Marzag, H.; Bouillon, J-P.; Marchivie, M.; Routier, S.; Plé, K., Gold-Catalyzed Intramolecular Hydroamination and hydroalkoxylation of Alkynes: Access to Original Heterospirocycles, *Org. Lett.* **2020**, *22*, 5973.
[4] Li, M.; Zhang, J.; Zou, Y.; Zhou, F.; Zhang, Z.; Zhang, W., Asymmetric hydrogenation for the synthesis of 2-substituted chiral morpholines, *Chem.Sci.* **2021**,*12*, 15061.

P A059

Enantioselective, Intermolecular [π2+σ2] Photocycloaddition Reactions of 2(1H)-Quinolones and Bicyclo[1.1.0]butanes

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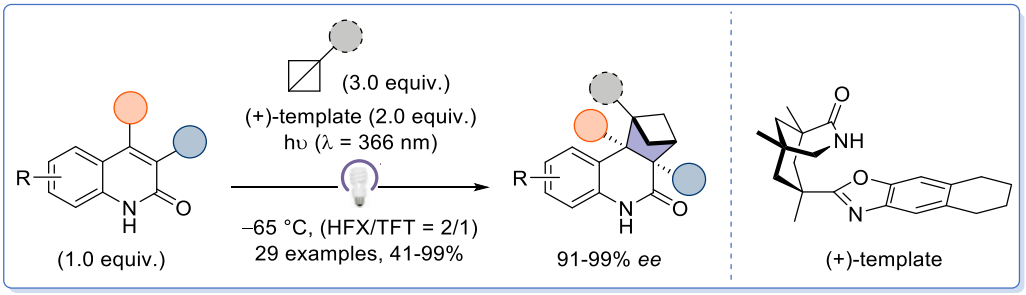
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[2+2] Photocycloadditions are efficient organic transformations to establish C–C bonds. In most cases, the reaction occurs between two π-bonds which are converted into two new σ-bonds. Typically, this leads to the formation of cyclobutane rings. Previously, a racemic intermolecular [2π+2σ] photocycloaddition on coumarins, using bicyclo[1.1.0]butanes (BCBs) and thioxanthone as triplet sensitizer with irradiation at 405 nm, has been described.[1] However, furnishing the product in an enantioselective fashion would be highly desirable.

Herein, we focus on the first enantioselective [2π+2σ] intermolecular photocycloaddition on quinolone substrates, using BCBs as 2σ-electron reagents (*Scheme 2*).[2] In our approach, the racemic products are obtained by direct irradiation of the quinolone at 366 nm in the presence of the BCBs, and without sensitizer. Afterwards, control of enantioselectivity can be achieved in the presence of a chiral lactam complexing agent (template). The 1:1 complex with fixed geometry between the substrate and the template, generated by two-point hydrogen bonding, induces excellent enantioselective attack of the BCB thanks to the effective antiface differentiation of the quinolone double bond. Moreover, the template facilitates the solubility of substrates in a mixture of nonpolar solvents at low temperatures. The reaction leads to the formation of chiral bicyclo[2.1.1]hexanes in good yields and high enantiomeric excesses. Furthermore, the template can be recovered almost quantitatively (97%) and used in the same photoreaction, to achieve similar results.



Scheme 2 Enantioselective [π2+σ2] photocycloaddition of 2(1H)-Quinolones and Bicyclo[1.1.0]butanes mediated by chiral template

[1] R. Kleinmans, T. Pinkert, S. Dutta, A. O. Paulisch, H. Keum, C. G. Daniliuc, F. Glorius. Intermolecular [2π+2σ]-photocycloaddition enabled by triplet energy transfer. *Nature* **2022**, *605*, 477–482.

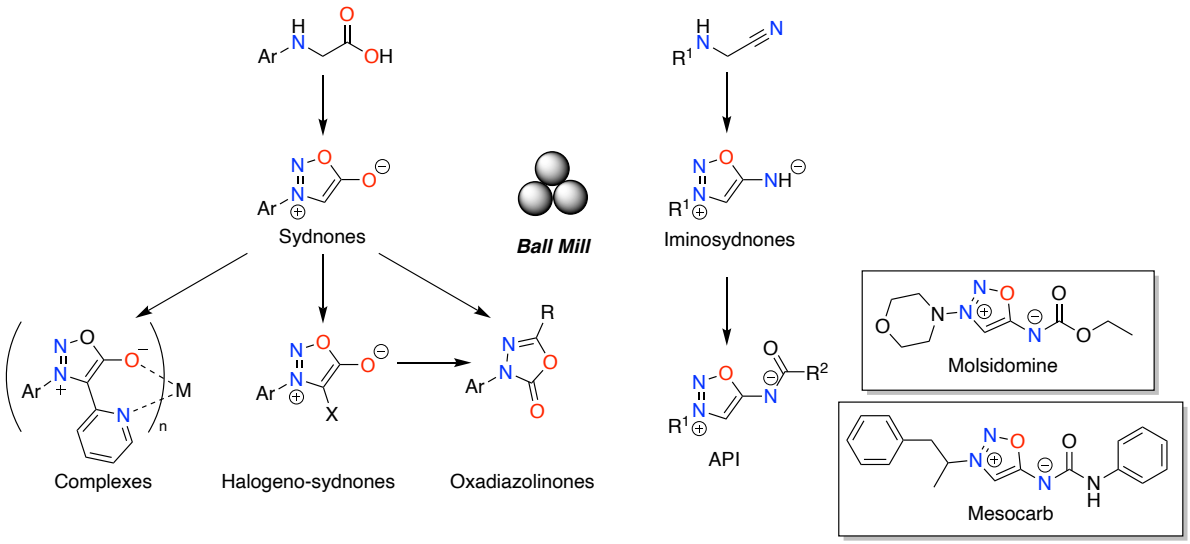
[2] M.de Robichon, T. Kratz, F. Beyer, J. Zuber, C. Merten, T. Bach. Enantioselective, Intermolecular [π2+σ2] Photocycloaddition Reactions of 2(1H)-Quinolones and Bicyclo[1.1.0]butanes. *J. Am. Chem. Soc.* **2023**, *145*, 24466–24470.

P A060

The mechanochemical story of the sydnone family: from APIs to coordination complexes

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Sydnones and iminosydnones are the most representative members of mesoionic compounds, a family of molecules intensively studied for more than 60 years for their unusual chemical structures and properties.[1] These dipolar heterocycles, besides their remarkable biological properties, recently proved to be valuable molecular platforms for different applications, notably in the field of biorthogonal chemistry.[2] In our will to provide innovative and sustainable methods for organic synthesis, we undertook to develop an eco-friendly and efficient access to mesoionic compounds. By drawing on our expertise in mechanochemistry, we designed first a solventless synthesis of sydnones, iminosydnones and of their precursors (arylglycine and aminoacetonitrile) thanks to ball-milling techniques.[3] Subsequent studies allowed us to derivatize our initial building-blocks into unprecedented coordination complexes[4] and iminosydnone-based Active Pharmaceutical Ingredients (APIs).[5] Moreover, careful tuning of mechanochemical conditions during the halogenation of sydnones allowed us to demonstrate an original molecular rearrangement leading to 1,3,4-oxadiazolin-2-ones.[6]
Thus, in this communication, we will give an overview of our works on the mechanochemistry of mesoionic compounds.



[1] Cherepanov, I. y. A.; Moiseev, S. K. In *Advances in Heterocyclic Chemistry*, Scriven, E. F. V., Ramsden, C. A. Eds.; Academic Press, **2020**, Vol. 131, 49-164.
[2] Porte, K.; Riomet, M.; Figliola, C.; Audisio, D.; Taran, F. *Chem. Rev.* **2021**, *121* (12), 6718-6743.
[3] Pétry, N.; Luttringer, F.; Bantreil, X.; Lamaty, F. *Faraday Discuss.* **2023**, *241*, 114-127.
[4] Pétry, N.; Vanderbeeken, T.; Malher, A.; Bringer, Y.; Retailleau, P.; Bantreil, X.; Lamaty, F. *Chem. Commun.* **2019**, *55* (64), 9495-9498.
[5] Pétry, N.; Bantreil, X.; Lamaty, F. *Eur. J. Org. Chem.* **2024**, *27* (28), e202400387.
[6] Luttringer, F.; Pétry, N.; Clot, E.; Bantreil, X.; Lamaty, F. *ChemistryEurope* **2025**, *3* (1), e202400054.

P A061

Red-Light Induced Thiol-ene and Thiol-yne Reaction. Application to Bioconjugation.

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Visible-light photocatalysis is a blossoming research area. Among all the synthetic applications, selective modification of biomolecules via bioconjugation is an attractive method, allowing precise functionalization without disrupting native protein function.[1] Due to its low abundance, cysteine stands out as an interesting target for selective protein modification. In this context, the functionalization involving a thiol-ene or thiol-yne reaction has been among the most commonly explored strategy.[2] However, applications of such strategy for protein bioconjugation under photochemical conditions are still rather limited. Indeed, photochemical radical thiol-ene processes have relied mainly on UV radiation or radical initiators.[3] High-energy blue-light photocatalyzed thiol-ene reactions have been reported recently,[4] albeit sensitive protein can be denaturated or damaged in these conditions.[5] In this presentation, we will present our work on photocatalyzed thiol-ene and thiol-yne reaction under low-energy red-light irradiation combining mild reaction conditions, efficiency and biorthogonality.[6]

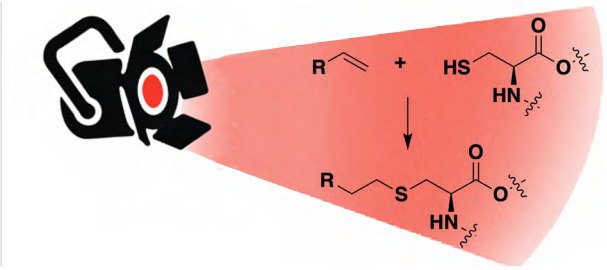


Figure 1. *Thiol-ene reaction under red-light irradiation*

[1] Gunnoo, S. B.; Madder, A. Chemical Protein Modification through Cysteine. *ChemBioChem* **2016**, *17*, 529.
[2] Nolan, M. D.; Scanlan, E. M. Applications of Thiol-Ene Chemistry for Peptide Science. *Front. Chem.* **2020**, *8*, 583272.
[3] Xiao, Q.; Tong, Q.-X.; Zhong, J.-J. Recent Advances in Visible-Light Photoredox Catalysis for the Thiol-Ene/Yne Reactions. *Molecules* **2022**, *27*, 619.
[4] Choi, H.; Kim, M.; Jang, J.; Hong, S. Visible-Light-Induced Cysteine-Specific Bioconjugation: Biocompatible Thiol–Ene Click Chemistry. *Angew. Chem. Int. Ed.* **2020**, *59*, 22514 and references cited therein.
[5] Toh, K.; Nishio, K.; Nakagawa, R.; Egoshi, S.; Abo, M.; Perron, A.; Sato, S.; Okumura, N.; Koizumi, N.; Dodo, K.; Sodeoka, M.; Uesugi, M. Chemoproteomic Identification of Blue-Light-Damaged Proteins. *J. Am. Chem. Soc.* **2022**, *144*, 20171.
[6] Manuscript in preparation.

P A062

Synthesis of Enantioenriched Fluorinated Heterocyclic and Acyclic Alcohols through Rh and Ru-Catalyzed Asymmetric Transfer Hydrogenation

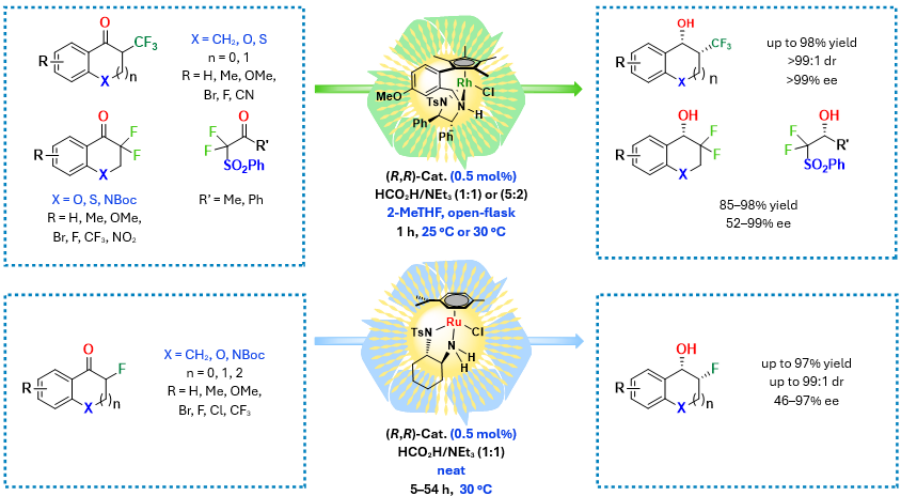
Lucas Bacheley,[1] Ricardo Molina-Betancourt,[1] Anzhela Karapetyan,[1] Rathies Ravindra,[1] Gérard Guillamot,[2] Phannarath Phansavath,[1] Virginie Vidal[1]

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The introduction of a fluorine-containing group on a compound improves considerably the physicochemical properties of the molecule giving access to pharmaceutical building blocks.[1] The highly valuable characteristics of fluorinated groups inspired us to prepare a range of enantioenriched novel fluorinated alcohols by using Rh(III) catalysts[2] developed in the group through asymmetric transfer hydrogenation (ATH)[3] of α-trifluoromethyl ketones[4] or *gem*-difluorinated heterocyclic and non-cyclic derivatives[5] under mild conditions. The reaction was performed in the green solvent 2-MeTHF with HCO_2H/Et_3N as the hydrogen donor with up to 98% yield, >99:1 dr and >99% ee. The ATH of α-trifluoromethyl ketones is based on a dynamic kinetic resolution (DKR)[6] process. Likewise, a Ru-catalyzed ATH/DKR of carbocyclic and heterocyclic ketones under neat conditions led to the *cis*-monofluorinated alcohols with up to 97% yield, 99 :1 dr and 97% ee.[7]



[1] a) Inoue, M.; Sumii, Y.; Shibata, N. *ACS Omega* **2020**, *5*, 10633. b) Caron, S. *Org. Process Res. Dev*. **2020**, *24*, 470. [2] a) Echeverria, P.-G.; Férard, F.; Phansavath, P.; Vidal, V. *Catal. Commun*. **2015**, *62*, 95. b) Zheng, L.-S.; Llopis, Q.; Echeverria, P.-G.; Férard, C.; Guillamot, G.; Phansavath, P.; Ratovelomanana- Vidal, V. *J. Org. Chem.* **2017**, *82*, 5607. c) Echeverria, P.-G.; Zheng, L.-S.; Llopis, Q.; He, B.; Westermeyer, A.; Molina Betancourt, R.; Phansavath, P.; Vidal, V. *SynOpen* **2022**, *6*, 75. [3] a) Bacheley, L.; Guillamot, G.; Phansavath, P.; Ratovelomanana-Vidal, V. *Tetrahedron* **2024**, *15,* 133781. d) Kosiuha, M.; Karapetyan, A.; Charon, O.; Meyer, C.; Phansavath, P.; Ratovelomanana-Vidal, V. *Synthesis* **2025** (accepted) and cited references. [4] Molina Betancourt, R.; Bacheley, L.; Karapetyan, A.; Guillamot, G.; Phansavath, P.; Ratovelomanana-Vidal, V. *ChemCatChem*. **2022**, *14*, e202200595. [5] Bacheley, L.; Ravindra, R.; Guillamot, G.; Phansavath, P.; Ratovelomanana-Vidal, V. *Adv. Synth. Catal*. **2024**, 366, 1019. [6] Noyori, R.; Tokunaga, M.; Kitamura, M. *Bull. Chem. Soc. Jpn*. **1995**, *68,* 36. [7] a) Molina Betancourt, R.; Phansavath, P.; Vidal, V. *Molecules* **2022**, *27*, 995. b) Bacheley, L.; Molina Betancourt, R.; Ravindra, R.; Guillamot, G.; Phansavath, P.; Ratovelomanana-Vidal, V. *Eur. J. Org. Chem.* **2023**, *26*, e202300383 (VIP).

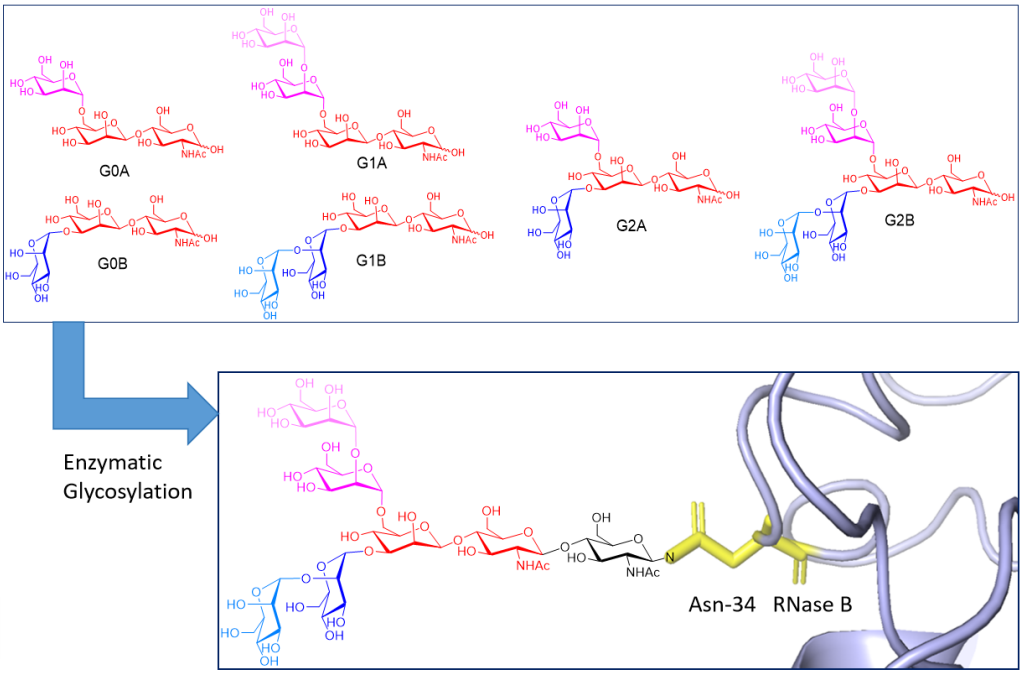
P A063

Synthesis of Oligomannosides for Neoglycoprotein-Based Vaccine Development

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Tuberculosis (TB), caused by *Mycobacterium tuberculosis*, continues to be a major global health threat. Surface-expressed oligomannosides play a critical role in host–pathogen interactions and represent attractive candidates for the development of next-generation vaccines.[1] The oligomannoside chains found in pathogenic glycoconjugates are highly adaptable,[2] undergoing frequent structural modifications in response to environmental changes, which results in substantial heterogeneity.[3] Studying homogeneous, structurally defined oligosaccharides is key to understand their structure-activity relationship, to develop vaccines *via* conjugation to carrier proteins.[4]

In this presentation, we report the design and synthesis of a selection of nine mannoside structures using convergent glycosylation approach and orthogonal protecting group strategies. The compounds include both linear and branched α-linked oligomannosides, ranging from trisaccharides to hexasaccharides. This study establishes a robust chemical platform for the precise and reproducible synthesis of mannose glycans intended as key components for the development of neoglycoprotein-based immunogens targeting *Mycobacterium tuberculosis* after grafting on RNase B protein.



[1] Sedaghat, B.; Stephenson, R.; Toth, I. *Curr. Med. Chem* **2014**, *21*, 3405–3418.
[2] Reily, C.; Stewart, T. J.; Renfrow, M. B.; Novak, J. *Nat Rev Nephrol* **2019**, *15*, 346–366.
[3] Cummings, R. D. *Glycoconj J* **2019**, *36*, 241–257.
[4] Wang, H.; Terreni, M.; Sollogoub, M.; Zhang, Y. *Curr. Med. Chem* **2025,** 32, 6153–6182.

P A064

Rhodium Catalyzed Carbon Isotope Exchange of Aldehydes

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Carbon isotope labeling plays a critical role in the development of pharmaceuticals and agrochemicals by enabling precise tracing of bioactive molecules in complex media such as living organisms and environmental systems.[1,2] However, incorporating carbon isotopes —particularly carbon-14— remains a synthetic challenge due to the limited availability of precursors, which all ultimately originate from CO_2, and the resulting need for lengthy, costly, and often harsh synthetic procedures. An elegant response to these limitations is the emerging Carbon Isotope Exchange (CIE).[3] While demonstrating great value for late-stage labeling, its application has thus far been largely limited to nitriles and carboxylic acids.[4] In this work, we present a rhodium-catalyzed CIE method for the direct $^{13/14}C$ labeling of aldehydes—versatile motifs found in drugs, fragrances, and synthetic intermediates. The approach enables efficient and selective carbon isotope incorporation starting from CO_2 under mild conditions, without the need for tailored route redesign. Applicability was demonstrated on a broad substrate scope, including complex drugs such as Spiramycin and a cyclic peptide.

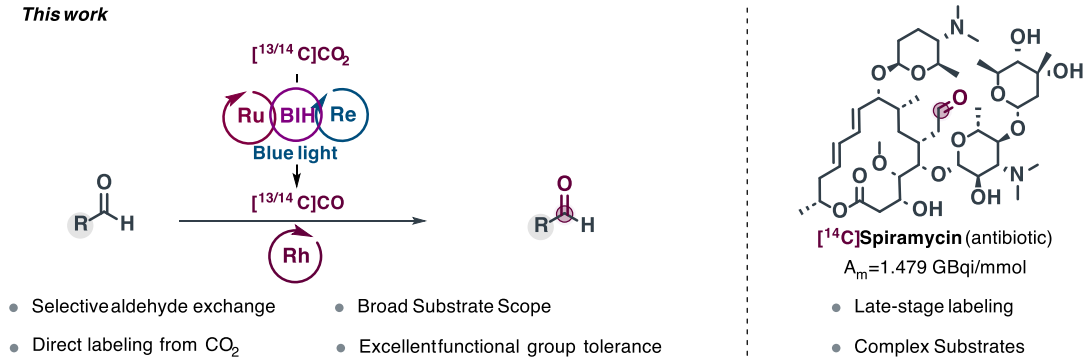


Figure 5: Rhodium Catalyzed Carbon Isotope Echange (CIE) of Aldehydes

[1] Isin, E. M.; Elmore, C. S.; Nilsson, G. N.; Thompson, R. A.; Weidolf, L. Use of Radiolabeled Compounds in Drug Metabolism and Pharmacokinetic Studies. *Chem. Res. Toxicol.* **2012**, *25* (3), 532–542. https://doi.org/10.1021/tx2005212.
[2] Derdau, V.; Elmore, C. S.; Hartung, T.; McKillican, B.; Mejuch, T.; Rosenbaum, C.; Wiebe, C. The Future of (Radio)-Labeled Compounds in Research and Development within the Life Science Industry. *Angew. Chem. Int. Ed.* **2023**, *62* (52), e202306019. https://doi.org/10.1002/anie.202306019.
[3] Babin, V.; Taran, F.; Audisio, D. Late-Stage Carbon-14 Labeling and Isotope Exchange: Emerging Opportunities and Future Challenges. *JACS Au* **2022**, *2* (6), 1234–1251. https://doi.org/10.1021/jacsau.2c00030.
[4] Labiche, A.; Malandain, A.; Molins, M.; Taran, F.; Audisio, D. Modern Strategies for Carbon Isotope Exchange. *Angew. Chem. Int. Ed.* **2023**, *62* (36), e202303535. https://doi.org/10.1002/anie.202303535.

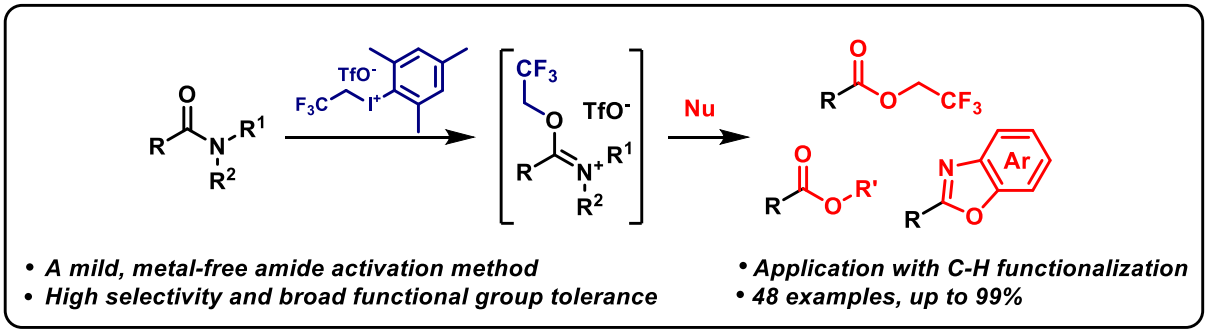
P A065

Electrophilic Amide Activation under Mild Conditions Using 2,2,2-Trifluoroethyl Iodonium Salt: Access to Esters and Benzoxazoles

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Amides are among the most common chemical moieties found in Nature, notably in amino acids.[1] Compared to other carbonyl groups, amides are generally more stable due to resonance stabilization, making their activation under mild conditions a significant synthetic challenge.[2] Recent efforts have focused on developing efficient methods for the transformation of amides, including transition-metal-catalyzed C–N activation, nucleophilic activation and electrophilic activation strategies.[3] In this study, we developed a novel, metal-free method for amide activation using 2,2,2-trifluoroethyl(mesityl)iodonium triflate as an electrophilic reagent.[4] Upon activation, aqueous acidic treatment enabled the formation of fluoroesters via hydrolysis of the imidate intermediate. Alternatively, alcohols and bis-nucleophiles such as 2-aminophenols could be incorporated to access esters and benzoxazoles, respectively. The method was further applied in a C–H functionalization sequence, demonstrating its synthetic utility in complex molecule derivatization. A plausible mechanism was proposed based on NMR studies. This method provides a versatile platform for further developments in amide functionalization, including selective activation and nucleophile incorporation.

[1] Pitzer, J.; Steiner, K. *J. Biotech.* ***2016***, *235*, 32-46.

[2] Li, G.; Ma, S.; Szostak, M. *Trends in Chemistry* **2020,** *2* (10), 914-928.

[3] (a) Zhu, R.-Y.; Farmer, M. E.; Chen, Y.-Q.; Yu, J.-Q. *Angew. Chem. Int. Ed.* **2016**, *55*, 10578-10599. (b) Kalepu, J.; Pilarski, L. T. *Molecules* **2019**, *24*, 830-852. (c) Thakur, R.; Jaiswal, Y.; Kumar, A. *Tetrahedron* **2021**, *93*, 132313. (d) Hie, L.; Fine Nathel, N. F.; Shah, T. K.; Baker, E. L.; Hong, X.; Yang, Y.-F.; Liu, P.; Houk, K. N.; Garg, N. K. *Nature* **2015**, *524*, 79-83. (e) Hie, L.; Baker, E. L.; Anthony, S. M.; Desrosiers, J.-N.; Senanayake, C.; Garg, N. K. *Angew. Chem. Int. Ed.* **2016**, *55*, 15129-15132. (f) Chen, X.; Hu, S.; Chen, R.; Wang, J.; Wu, M.; Guo, H.; Sun, S. *RSC Adv.* **2018**, *8*, 4571-4576. (g) Nagae, H.; Hirai, T.; Kato, D.; Soma, S.; Akebi, S.; Mashima, K. *Chem. Sci.* **2019**, *10*, 2860-2868. (h) Wang, T.; Wang, Y.; Xu, K.; Zhang, Y.; Guo, J.; Liu, L. *Eur. J. Org. Chem.* **2021**, 3274-3277.

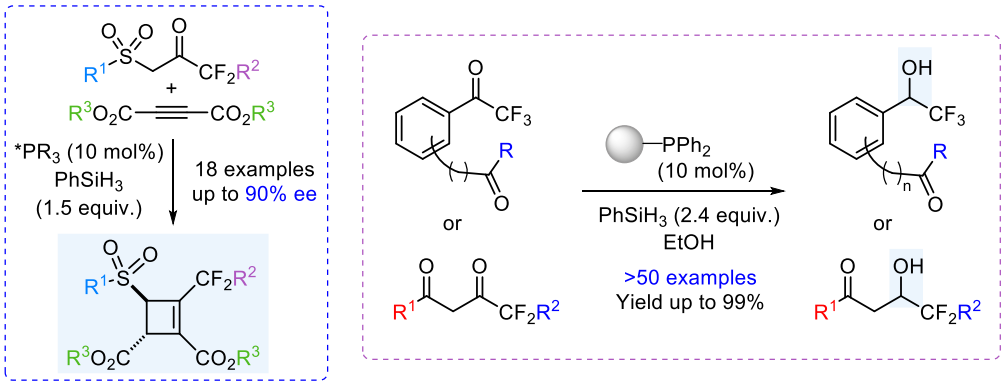
[4] Tiancheng, Z.; Hugo, A-R.; Julie, T.; Sébastien, P. *Organic Letters* **2025** *27* (32), 8858-8862.

P A066

New Developments in Phosphine Organocatalysis

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Phosphines play a crucial role in many reactions in organic chemistry. As Lewis bases, they can be used as catalysts in the Morita-Baylis-Hillman reaction or in Michael additions.[1] Furthermore, some key reactions as the Wittig, Mitsunobu and Staudinger reactions require stoichiometric amount of phosphine, as their driving force relies on the generation of phosphine oxide byproducts. However, this has many drawbacks, in particular environmental and purification issues. Thus, in 2009 the O'Brien team published the first example of a catalytic Wittig reaction, thanks to the use of a silane as reducing agent, for the chemoselective reduction of the phosphorus-oxygen bond.[2] This breakthrough paves the way for the development of catalytic (and asymmetric) versions of well-known transformations, and the discovery of new processes.[3]
In this context, we have developed an asymmetric version of a tandem "Michael addition/intramolecular Wittig reaction" allowing access to chiral fluorinated sulfonyl-cyclobutenes. Thus, 18 chiral compounds were synthesized with up to 90% ee. Preliminary biological evaluations revealed significant cytotoxicity against leukemia K562 cells.[4]
Moreover, the development of this reaction led to the discovery of a previously unreported reactivity: the chemoselective reduction of activated ketones using a silane as reductant and a phosphine as catalyst. To investigate this new reactivity, over 50 substrates containing activated ketones were subjected to the chemoselective reduction, affording the corresponding alcohol with yields up to 99%.[5]



[1] Guo, H.; Fan, Y. C.; Sun, Z.; Wu, Y.; Kwon, O., Phosphine Organocatalysis. *Chem. Rev.* **2018**, *118*, 10049.
[2] O'Brien, C. J.; Tellez, J. L.; Nixon, Z. S.; Kang, L. J.; Carter, A. L.; Kunkel, S. R.; Przeworski, K. C.; Chass, G. A., Recycling the Waste: The Development of a Catalytic Wittig Reaction. *Angew. Chem. Int. Ed.* **2009**, *48*, 6836.
[3] (a) Voituriez, A.; Saleh, N., From phosphine-promoted to phosphine-catalyzed reactions by in situ phosphine oxide reduction. *Tetrahedron Lett.* **2016**, *57*, 4443; (b) Lorton, C.; Castanheiro, T.; Voituriez, A., Catalytic and Asymmetric Process via PIII/PV═O Redox Cycling: Access to (Trifluoromethyl)cyclobutenes via a Michael Addition/Wittig Olefination Reaction. *J. Am. Chem. Soc.* **2019**, *141*, 10142; (c) Losa, R.; Lorton, C.; Retailleau, P.; Bignon, J.; Voituriez, A., Fluorinated 2-Azetines: Synthesis, Applications, Biological Tests, and Development of a Catalytic Process. *Org. Lett.* **2023**, *25*, 5140.
[4] Zimmermann, M.; Retailleau, P.; Voituriez, A., Asymmetric Synthesis of Bioactive Fluorinated Sulfonyl-Cyclobutene Derivatives via P(III)/P(V) Redox Catalysis. *Submitted article*, **2025**.
[5] Zimmermann, M.; Audor, S.; Voituriez, A., *Article in preparation*, **2025**.

P A067

C(sp^3)-H functionalization of Spiropiperidines

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The development of transition-metal-catalyzed methods for the direct functionalization of C-H bonds has attracted much attention over the past decade. While the direct functionalization of sp^2 C-H bonds is a well-established and active area of research, the corresponding knowledge and methodologies for sp^3 C-H bonds remain relatively limited and represent one of the current challenges in organic chemistry. Within the field of sp^3 C-H activation, the transformation of C-H bonds in the α-position to the nitrogen atom of saturated cyclic amines is of particular importance, since such heterocyclic motifs can be found in an impressive number of natural products and marketed drugs. Spiropiperidine-based structures represent a new class of saturated azacycles. In particular, novel small-molecules[1], based on a 1,3,8-triazaspiro[4.5]decane scaffold, have recently identified as inhibitors of mitochondrial permeability transition pore (mPTP) opening, a key process involved in enhancing cell survival following blood flow restoration.

The real challenge lies in applying to these compounds different catalysis protocols for C(sp^3)-H activation in α-position to nitrogen which are normally used on simple azacycles[2]. The aim of the project is to promote arylation, alkenylation, alkylation or borylation on C2 carbon using the well-known directing group, as pyridines, pyrimidines, thioamides or imines, to coordinate compatible transition metal catalyst (Ru, Pd, Ir, Co, Rh). In this field boronic acids or esters, olefin or alkyne can be used as source of functional group.

The intermolecular, direct transition-metal-catalyzed functionalization of spiropiperidines adjacent to nitrogen offers a simple and efficient synthetic approach towards valuable building blocks. This approach could lead to the discovery of new spiro-based small molecules suitable for in vitro and in vivo evaluation.

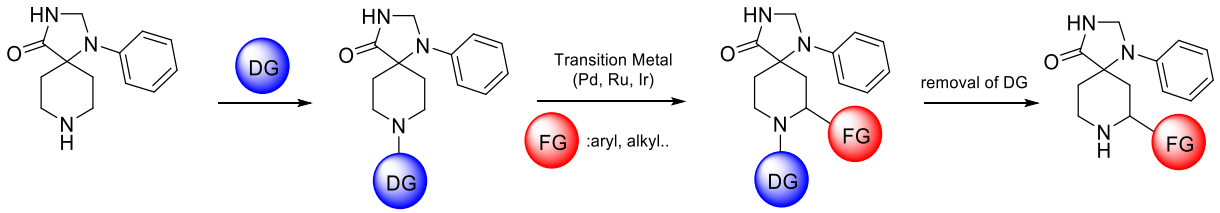


Figure 1. *Synthetic route for C(sp^3)-H functionalization in α-position to nitrogen on Spiropiperidines*

[1] Morciano, G.; Preti, D.; Pedriali, G.; Aquila, G.; Missiroli, S.; Fantinati, A.; Caroccia, N.; Pacifico, S.; Bonora, M.; Talarico, A.; Morganti, C.; Rizzo, P.; Ferrari, R.; Wieckowski, M. R.; Campo, G.; Giorgi, C.; Trapella, C.; Pinton, P. Discovery of Novel 1,3,8-Triazaspiro[4.5]Decane Derivatives That Target the c Subunit of F_1 /F_O -Adenosine Triphosphate (ATP) Synthase for the Treatment of Reperfusion Damage in Myocardial Infarction. *J. Med. Chem.* **2018**, *61* (16), 7131–7143.

[2] Antermite, D.; Bull, J. A. Transition Metal-Catalyzed Directed C(Sp^3)–H Functionalization of Saturated Heterocycles. *Synthesis* **2019**, *51* (17), 3171–3204.

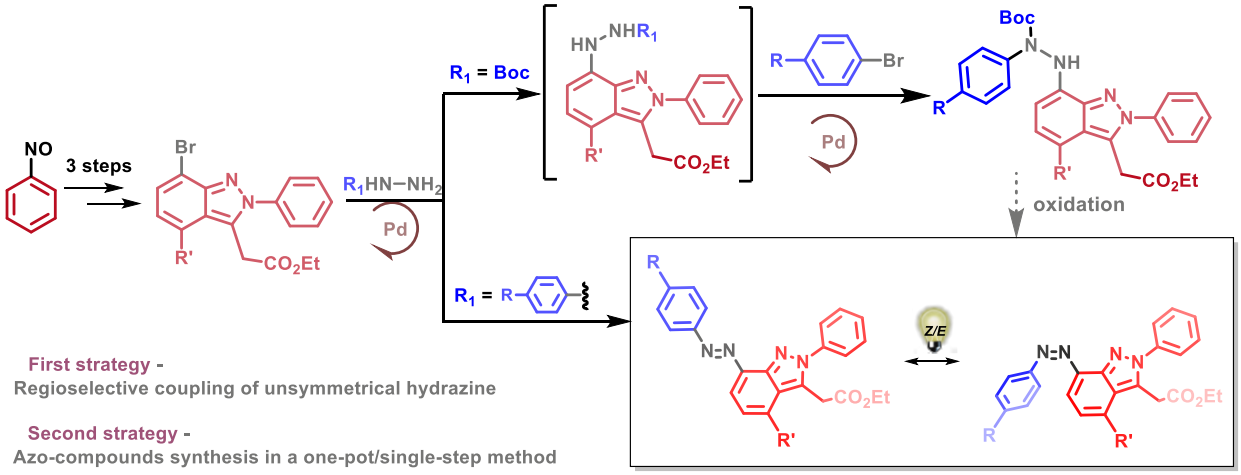
P A068

Development of a new one pot synthetic method to access photoswitchable and fluorescent azoheteroarenes

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As a part of a mechanistic study of pentameric ligand-gated ionic channels [1], we designed an off-on fluorescent model probe (A) which incorporates a fluorescent indazole motif and photoswitchable azobenzene group. This compound exhibits encouraging photophysical properties with reversible E to Z isomerization at 406 nm and enhanced fluorescence in the Z-isomer. To optimize the photophysical properties of this lead compound and design new functional molecular switches with tailored optical and switching properties, the project aims to develop a general and convergent one-pot synthetic method of dissymmetric azoheteroarenes. As traditional methods are limited in terms of substituent diversity [2], we propose to investigate a sequential Pd-catalyzed Buchwald-Hartwig coupling approach.

Here, we present not only the results of our catalytic system optimization for the first coupling step, leading to the 7-hydrazino-indazoles in excellent yields, but also unexpected results obtained in the second coupling step. Indeed, the second coupling competes with a secondary oxidation reaction, leading to the main formation of quinone-imine by-products. We thus present new challenges, including stabilizing intermediates against oxidation and refining catalytic conditions. Surprisingly, the discovery of generating azo compounds from arylhydrazines in a single step.



[1] Sauguet, L.; Shahsavar, A.; Poitevin, F.; Huon, C.; Menny, A.; Nemecz, À.; Haouz, A.; Changeux, J.-P.; Corringer, P.-J.; Delarue, M. Crystal structures of a pentameric ligand-gated ion channel provide a mechanism for activation. *Proc. Natl. Acad. Sci.* **2014**, *111*, 966-971.
[2] Crespi, S., Simeth, N. A. & König, B. Heteroaryl azo dyes as molecular photoswitches. *Nat. Rev. Chem.* **2019**, *3*, 133-146.

P A069

Exploring Hydrocarbation and Carbo-carbation Reactions of Alkynes with Carbenium Ions

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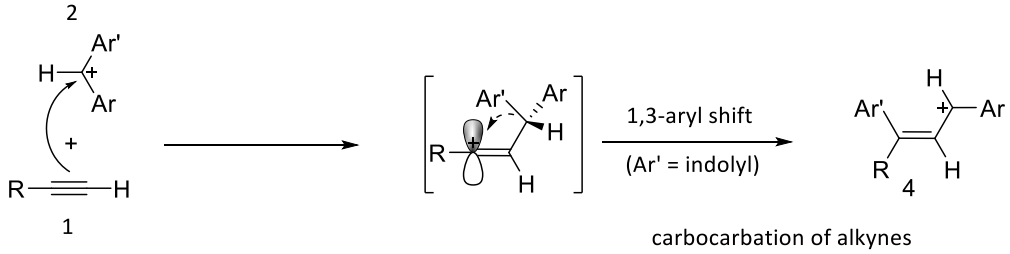
The reactivity of alkynes with carbenium ions is, surprisingly, an underexplored area in organic synthesis. This project investigates the hydrocarbation of alkynes with benzhydrylium ions, leading to the formation of stabilized allyl cations with high yields.

The reaction of donor-substituted diarylcarbenium ions (Ar_2CH^+) with ynamides, yielding 1-amido-substituted allyl cations (α, β-unsaturated iminium ions) has been a pioneering example of hydrocarbation chemistry in the literature. [1]

A detailed study of various alkynes and electrophiles was conducted, focusing on optimizing reaction conditions and characterizing the resulting products through spectroscopic techniques and X-ray crystallography. In addition, reaction kinetics were examined to construct the first nucleophilicity scale for alkynes, using stopped-flow UV-visible spectrophotometry to determine rate constants.

The investigation also extends to innovative carbo-carbation reactions of alkynes with heteroaryl carbenium ions, such as indolyl derivatives. These reactions reveal unique 1,3-aryl migrations in vinyl cation intermediates, paving the way for double C–C bond functionalization of alkynes. Subsequent transformations of the intermediate products with strong nucleophiles (hydride donors, phosphines, fluoride anion) enable access to novel alkenes bearing heteroatoms.

This research not only expands the scope of alkynes functionalization via electrophilic reactions but also opens avenues for the synthesis of bioactive compounds and conjugated molecules. The findings underscore the potential of carbenium ion chemistry in advancing organic synthesis, with implications for sustainable and functionalized material development.



carbocarbation of alkynes

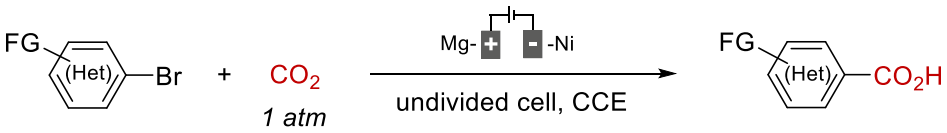
[1] H. A. Laub, G. Evano, H. Mayr, *Angew. Chem. Int. Ed.* **2014**, *53*, 4968-4971.

P A070

Direct electrocarboxylation of (hetero)aryl halides: from batch to flow approach

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Carboxylated compounds are extremely useful in the pharmaceutical field as they are perfect building blocks for more complex molecules. Carbon dioxide is considered an ideal C1 reagent for organic synthesis due to its absence of toxicity, low cost and availability as a renewable resource. Nonetheless, its high thermodynamic stability and kinetic inertness make activation under mild conditions challenging.[1] As a result, the development of efficient transition metal–catalyzed methods for the carboxylation of aryl halides is of great interest. Among transition metals, palladium and nickel have emerged as the most commonly employed catalysts in such transformations.[2] Nevertheless, such approaches often require more than a stoichiometric amount of metallic reductants, such as zinc or manganese, which constitutes a considerable limitation for large-scale industrial applications. In addition, the rising cost of transition metal catalysts presents an ongoing economic challenge. Building on the laboratory's expertise in organic electrosynthesis,[3] this project aims to develop a general method for the direct electrochemical carboxylation of aryl and heteroaryl halides using CO_2. Initially, experimental parameters will be studied,[4] then optimized conditions will be applied to assess the substrates scope and process limitations. The flow approach will also be presented.



[1] Tortajada, A.; Juliá-Hernández, F.; Börjesson, M.; Moragas, T.; Martin, R., Transition-Metal-Catalyzed Carboxylation Reactions with Carbon Dioxide. *Angew. Chem. Int. Ed.* **2018,** *57*, 15948-15982.
[2] (a) Correa, A.; Martín, R., Palladium-Catalyzed Direct Carboxylation of Aryl Bromides with Carbon Dioxide. *J. Am. Chem. Soc.* **2009,** *131*, 15974-15975. (b) Fujihara, T.; Nogi, K.; Xu, T.; Terao, J.; Tsuji, Y., Nickel-Catalyzed Carboxylation of Aryl and Vinyl Chlorides Employing Carbon Dioxide. *J. Am. Chem. Soc.* **2012,** *134*, 9106-9109.
[3] Sock, O.; Troupel, M.; Perichon, J., Electrosynthesis of carboxylic acids from organic halides and carbon dioxide. *Tetrahedron Lett.* **1985,** *26*, 1509-1512
[4] Lesko, I.; Sengmany, S.; Beltran, R.; Le Gall, E.; Léonel, E., Transition Metal-Free Direct Electrochemical Carboxylation of Organic Halides Using a Sacrificial Magnesium Anode: Straightforward Synthesis of Carboxylic Acids. *ChemistryOpen* **2025,** *14*, e202400426.

P A071

Mechanism-Guided Electrochemical *N*-Propargylation of *N*-Heterocycles via Decarboxylation of Allenoic Acids

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Nitrogen-based heterocyclic compounds can be found in numerous categories of therapeutic agents with diverse biological activities such as antimicrobial, anticancer, analgesic, anti-inflammatory, etc… Due to synthetic importance and various bioactivities showed by azole derivatives, a major synthetic effort have been dedicated into generating libraries of these compounds. Among those strategies, the C–N bond formation have attracted much attention and innovative processes from easily available starting materials under mild conditions have been developed. In particular, electrochemical decarboxylative cross-coupling of C(sp^3)–N bonds have recently been reported to functionalize azoles.[1] In sharp contrast, the propargylation of azoles is much less developed and only a limited number of methods were reported.[2]

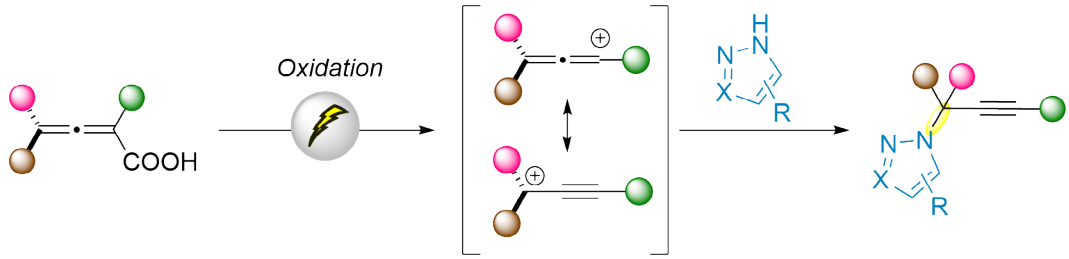


Figure 1. *Electrochemical propargylation of N-heterocycles.*

In that context, we aim to developpe a mechanism-guided study of the electrochemical utilization of 2,3-allenoic acids in the presence of *N*-heterocycles, enabling the synthesis of various *N*-propargylated products in moderate to good yields (**Figure 1**). Mechanistic insights were obtained through electrochemical analysis, kinetic studies, and DFT computations.

[1] a) Shao, X.; Zheng, Y.; Tian, L.; Martín-Torres, I.; Echavarren, A. M.; Wang, Y. Decarboxylative C*sp*3-N Bond Formation by Electrochemical Oxidation of Amino Acids. *Org. Lett.* **2019**, *21*, 9262. b) Sheng, T.; Zhang, H.-J.; Shang, M.; He, C.; Vantourout, J. C.; Baran, P. S. Electrochemical Decarboxylative N-Alkylation of Heterocycles. *Org. Lett.* **2020**, *22*, 7594. c) Chen, R.; Yuan, H.; Wang, Y.; Chen, H.; Zhang, Y. Aerobic Electrochemical C*sp*3–N Coupling between Aliphatic Carboxylic Acids and N-heterocycles. *Organometallics* **2023**, *42*, 1.

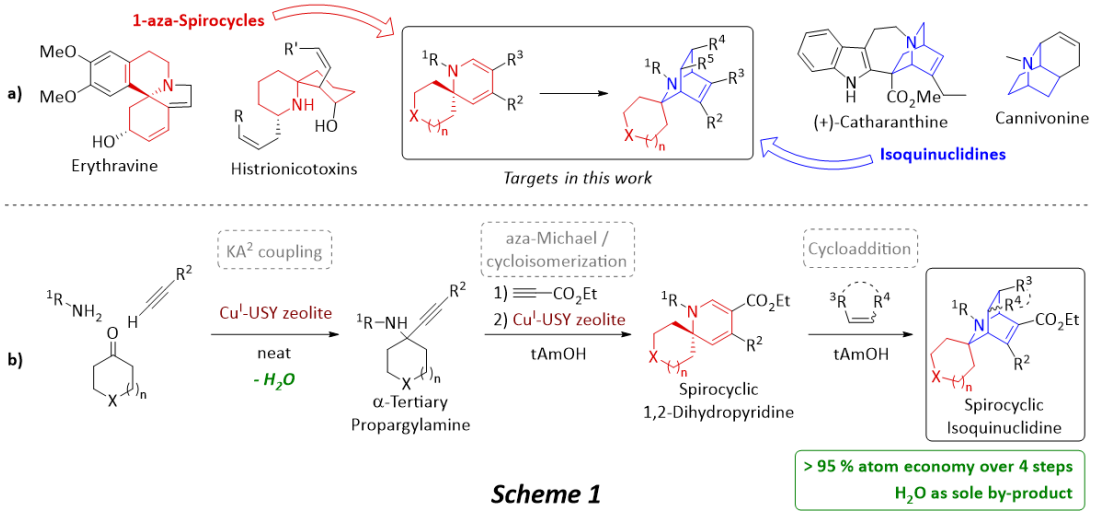
[2] a) Yan, W.; Wang, Q.; Chen, Y.; Petersen, J. L.; Shi, X. Iron-Catalyzed C–O Bond Activation for the Synthesis of Propargyl-1,2,3-triazoles and 1,1-Bis-triazoles. *Org. Lett.* **2010**, *12*, 3308. b) González-Pelayo, S.; López, L. A. Microwave-Assisted Generation and Capture by Azoles of *ortho*-Quinone Methide Intermediates under Aqueous Conditions. *Eur. J. Org. Chem.* **2017**, 6003. c) Wang, Y.; Wang, S.; Shan, W. Shao, Z. Direct asymmetric N-propargylation of indoles and carbazoles catalyzed by lithium SPINOL phosphate. *Nat. Commun.* **2020**, *11*, 226.

P A072

Synthesis of bioinspired complex polycyclic motifs supported by DFT mechanistic studies

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Constructing 3D *aza*-polycyclic architectures remains a big challenge in organic synthesis. In particular, much synthetic efforts have been devoted to **1-*aza*-spirocyclic** and **isoquinuclidine** ring systems, due to their presence in many natural products of biological relevance (**Scheme 1a**).[1,2] Our goal is to go further in 3D structural complexity by accessing to unprecedented architectures merging these two *aza*-cyclic systems of high relevance (**Scheme 1b**).



Scheme 1

Herein, we wish to report our synthetic approach towards this complex *aza*-spiro/isoquinuclidine hybrid skeleton from simple starting materials (**Scheme 1b**). Our approach starts with a 3-step sequence, including 2 steps under Cu^{I}-zeolite catalysis (*i.e.,* KA^2 coupling and enyne cycloisomerization reactions)[3], that first furnishes **1-*aza*-spirocyclic** systems featuring a 1,2-dihydropyridine motif. The potential of the resulting 1,2-dihydropyridine motif as DIELS-ALDER diene is finally exploited to construct the additional **isoquinuclidine** ring system *via* a formal cycloaddition process.[4] DFT calculations are conducted in parallel to rationalize the reaction mechanism and energetic pathway of the cycloaddition process. Noteworthy is that this methodology is highly atom and step economical, with water as sole by-product during the whole 4-step sequence.

[1] Lovering, F.; Bikker, J.; Humblet, C. Escape from Flatland: Increasing Saturation as an Approach to Improving Clinical Success. *Journal of Medicinal Chemistry* **2009**, *52*(21), 6752-6756.
[2] Lavaud, C. Massiot, G. The Iboga Alkaloids. *Progress in the Chemistry of Organic Natural Products* ; Kinghorn, A.; Falk, H.; Gibbons, S.; Kobayashi, J.; Springer, **2017**, *105*, 89-136.
[3] Schlimpen, F.; Plaçais, C.; Starck, E.; Bénéteau, V.; Pale, P.; Chassaing, S. α-Tertiary Propargylamine Synthesis *via* KA^2-Type Coupling Reactions under Solvent-Free Cu^{I}-Zeolite Catalysis. *Journal of Organic Chemistry* **2021**, *86*(23), 16593-16613 ; Schlimpen, F.; Ast, T.; Bénéteau, V.; Pale, P.; Chassaing, S. From A3 /KA2 to AYA/KYA multicomponent coupling reactions with terminal ynamides as alkyne surrogates – a direct, green route to γ-amino-ynamides. *Green Chemistry* **2022**, *24*(17), 6467-6475.
[4] Wayama, T.; Arai, Y.; Oguri, H. Regiocontrolled Dimerization of Densely Functionalized 1,6-Dihydropyridines for the Biomimetic Synthesis of a Halicyclamine-type Scaffold by Preventing Disproportionation. *Journal of Organic Chemistry* **2022**, *87*(9), 5938-5951 ; Martin, R. M.; Bergman, R. G.; Ellman, J. A. Synthesis of Isoquinuclidines from Highly Substituted Dihydropyridines via the Diels–Alder Reaction. *Organic Letters* **2013**, *15*(3), 444-447.

P A073

Straightforward Access to Pentafluorosulfanylated Phenols and Aminophenols via [4+2] Diels-Alder Cycloaddition Reaction

Floriane René,[1] Mariam Abd El Sater,[1] Nicolas Blanchard,[1] Jorge Juan Cabrera-Trujillo,[2,3] Karinne Miqueu,[3,*] Vincent Bizet[1,*]

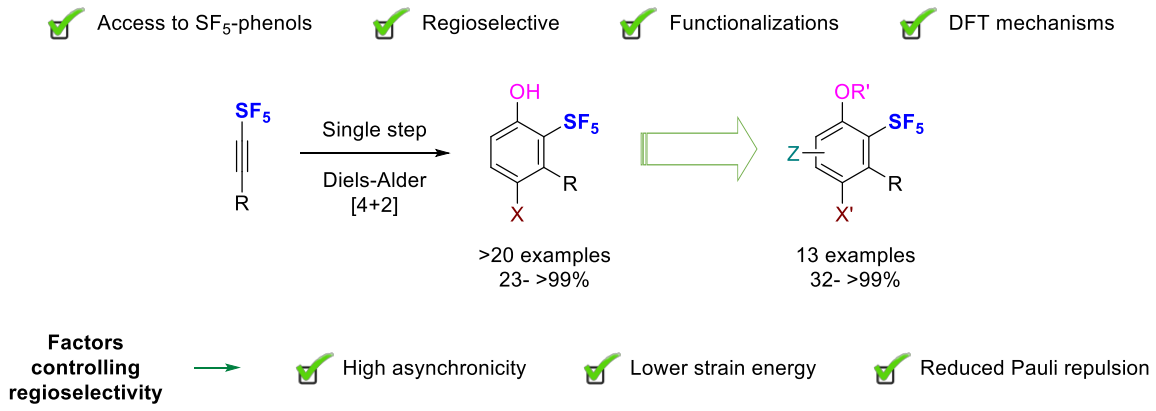
[1] *Université de Haute-Alsace, Université de Strasbourg, CNRS, LIMA, UMR 7042, 68200 Mulhouse, France*

[2] *Departamento de Química Orgánica, Universidad de La Laguna, 38206 La Laguna, Tenerife, Spain*

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Nowadays, increased efforts are deployed to broaden the access to pentafluorosulfanyl (SF_5) compounds.[1] SF_5-aromatics are usually prepared by oxidative fluorination of thiols or sulfur derivatives under very harsh reaction conditions which are poorly compatible with most of functional groups. Therefore, linear multi-step syntheses are then required to install subsequently functional groups. In contrast, SF_5-alkynes are easily accessible building blocks that demonstrate wide applicability for the synthesis of functionalized SF_5-products.[2] Herein, we capitalize on the polarization of SF_5-alkynes to develop a convergent and highly regioselective synthesis of SF_5-phenols and SF_5-aminophenols, performed in a single step of Diels-Alder cycloaddition. A counter-intuitive regioselectivity is observed, which is rationalized by experimental and computational experiments. Further post-functionalizations are also proposed, making this strategy very appealing to access multi-functionalized SF_5-compounds.[3]



[1] Abd El Sater, M.; Popek, L.; Blanchard, N.; Bizet, V. Recent advances in the chemistry and the application of SF_5-compounds. *Synthesis* **2025**, *57* (06), 1117-1137. DOI:10.1055/a-2383-6620.

[2] a) René, F.; Clément–Comoy, L.; Blanchard, N.; Bizet, V. Recent achievements in the synthesis and reactivity of pentafluorosulfanyl-alkynes. *C. R. Chim.* **2024**, *27*, 227-240. DOI:10.5802/crchim.350. b) Popek, L.; Nguyen, T. M.; Blanchard, N.; Cahard, D.; Bizet, V. Synthesis and further use of SF_5-alkynes as platforms for the design of more complex SF_5-containing products. *Tetrahedron* **2022**, *117-118*, 132814. DOI:10.1016/j.tet.2022.132814.

[3] Abd El Sater, M.; René, F.; Blanchard, N.; Cabrera-Trujillo, J. J.; Miqueu, K.; Bizet, V. Straightforward Access to Pentafluorosulfanylated Phenols and Aminophenols via [4 + 2] Diels–Alder Cycloaddition Reaction. *ACS Org. Inorg. Au* **2025**, *5* (4), 275-287. DOI:10.1021/acsorginorgau.5c00042.

P A074

Repurposing Fluorophosphonium Ions by Geometric Constraints: From Phosphorus Lewis Acids to Electrophilic Fluorinating Reagents

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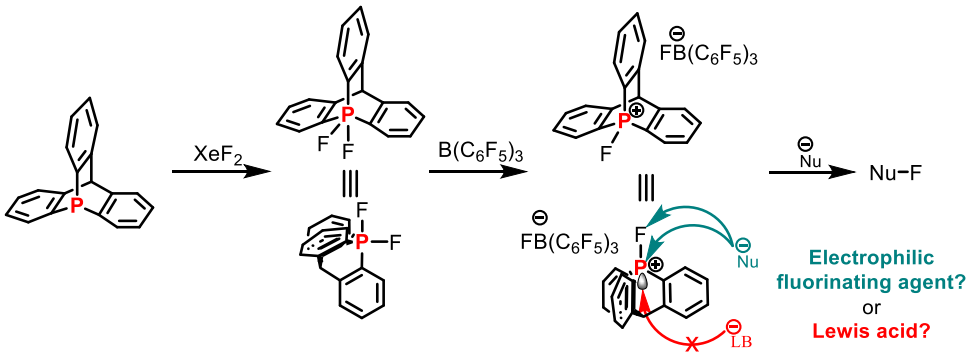
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In a geometrically constrained environment, such as triptycene, proximal groups and steric effects significantly influence the chemical properties of phosphines.[1] Recently, electrophilic fluorophosphonium cations (EFPCs) derived from triarylphosphines have been widely studied as Lewis acid catalysts and for activating small molecules.[2] Inspired by these studies, we decided to explore the properties, structures, and reactivities of EFPCs derived from the cage-shaped 9-phosphatriptycene to examine how geometric constraints affect the properties of the phosphorus atom.

In this study,[3] we synthesized a series of fluoro-9-phosphonium triptycene salts through the reaction of 9-phosphatriptycene with XeF_2. Geometric constraints inherent in difluoro-9-phosphoranetriptycene induce the placement of one fluorine atom in an apical position. To assess the Lewis acidity at the P(III) cationic center, we employed the Gutmann-Beckett method, infrared (IR) spectroscopy, and computational techniques. Additionally, we synthesized related fluorophosphonium salts featuring a localized positive charge in proximity to the phosphorus atom, which enhances Lewis acidity. Alternative fluorinating agents were evaluated, and several stoichiometric fluorine transfer reactions were achieved utilizing electron-rich phosphines and amines. Current research focuses on the activation of small molecules and the investigation of fluorine transfer kinetics with various nucleophiles.



[1] a) Agou, T.; Kobayashi, J.; Kawashima, T. *Chem. Lett.* **2004**, *33*, 1028–1029 ; b) Mahaut, D.; Berionni, G.; Champagne, B. *J. Phys. Chem. A* **2022**, *126*, 2794–2801 ; c) Hannah, T. J.; Chitnis, S. S. *Chem. Soc. Rev.* **2024**, *53*, 764–792

[2] a) Caputo, C. B.; Winkelhaus, D.; Dobrovetsky, R.; Hounjet, L. J.; Stephan, D. W. *Dalton Trans.* **2015**, *44*, 12256–12264; b) Bayne, J. M.; Stephan, D. W. *Chem. Soc. Rev.* **2016**, *45*, 765–774; c) Krämer, F.; Paradies, J.; Fernández, I.; Breher, F. *Nat. Chem.* **2024**, *16*, 63–69; d) Dobrovetsky, R.; Bawari, D.; Malahov, I. *Angew. Chem. Int. Ed.* **2024**, *e202419772*.

[3] Berionni, G. *et al.* Manuscript in preparation.

P A075

Synthesis and Characterization of Novel Bismuth Cationic Complexes

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Many catalytic homogeneous transformations rely on the use of complexes of rare late-transition metals from the 2nd and 3rd rows of the periodic table, such as Pd, Ru, Rh, Ir, Pd, Pt, Au. One way to reduce the cost of these processes is to use surrogates of precious metal catalysts based on abundant main group elements (e.g.Ca, Ga, In and Bi) or 1st row transition metals.
Organobismuth compounds are of particularly interest as they can be easily obtained from inexpensive and low-toxicity inorganic bismuth salts, and hold significant appeal in synthesis due to their unique properties and reactivity. Indeed, they exhibit an extensive geometric diversity, influenced by factors such as the oxidation state and charge of bismuth, and the number of coordinated elements. The most common oxidation state + III exhibits a soft Lewis acidic behavior due to the weak shielding of its 4f electrons.[1] Hence, its synthetic applications are mainly based on Lewis acidic catalysis. In particular, bismuth triflate ($Bi(OTf)_3$) has been extensively studied in that application.[2]
On the other hand, the team of Pr Christophe Bour has been studying weakly coordinating anions (WCA). These species, typically perfluoro- or teflate- aluminate anions, exhibit high electronic delocalization, which reduces electrostatic interactions. As a result, their corresponding cations display enhanced electrophilicity and improved Lewis acidity.[3]
In the aim of improving the Lewis acidity of bismuth(III) complexes, we present here the synthesis and characterization of novel bismuth cationic complexes, and the study of their Lewis acidity. We employed two ligand geometries that were radically different: a planar N,C,N pincer ligand , and a tridentate C,N,C ligand.

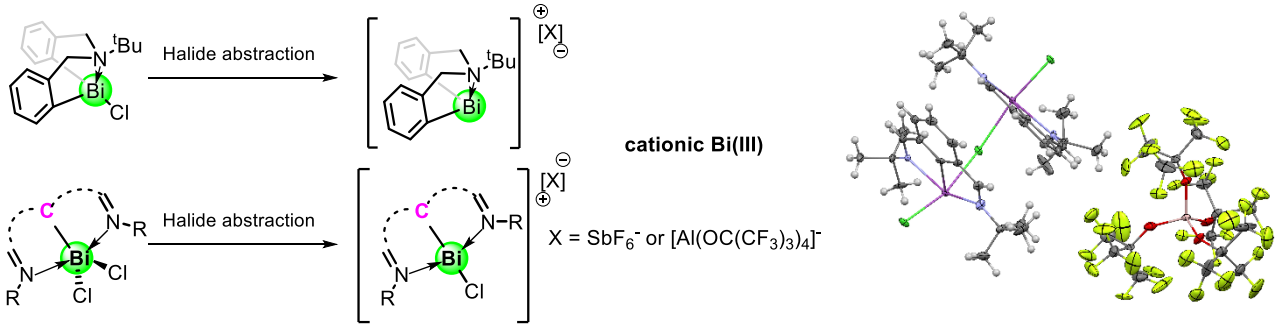


Figure 1. Formation of bismuth salt (left) and X-ray analysis of one of the salt synthesized (right).

[1] Berger, R. J. F.; Rettenwander, D.; Spirk, S.; Wolf, C.; Patzschke, M.; Ertl, M.; Monkowius, U.; Mitzel, N. W. Relativistic Effects in Triphenylbismuth and Their Influence on Molecular Structure and Spectroscopic Properties. Physical Chemistry Chemical Physics 2012, 14 (44), 15520–15520.
[2] Antoniotti, S.; Dalla, V.; Duñach, E. Metal Triflimidates: Better than Metal Triflates as Catalysts in Organic Synthesis-the Effect of a Highly Delocalized Counteranion. Angewandte Chemie 2010, 49 (43), 7860–7888.
[3] Li, Z.; Thiery, G.; Lichtenthaler, M. R.; Guillot, R.; Krossing, I.; Gandon, V.; Bour, C. Catalytic Use of Low-Valent Cationic Gallium(I) Complexes as π-Acids. Advanced Synthesis and Catalysis 2017, 360 (3), 544–549.

P A076

Bio-Inspired Total Synthesis of Daphnepapytone A

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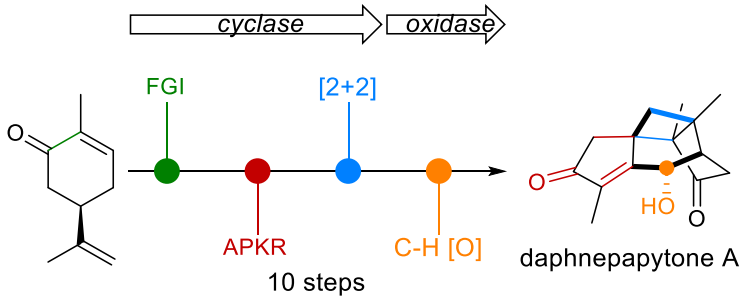
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Daphnepapytones are sesquiterpene natural products isolated from the stems of Daphne papyracea in 2022, a plant utilized in traditional Chinese medicine against diabetes, rheumatic pain, and traumatic injury.[1,2] The exploration of these constituents has been delayed by limited biomass availability, and their total synthesis has emerged as an attractive objective for additional studies.

In this presentation, we will disclose the first total synthesis of daphnepapytone A, a tetracyclic structure incorporating a unique, highly substituted cyclobutane ring.[3,4,5] Our retrosynthetic approach is partly biomimetic and involves a two-phase sequence: skeleton construction followed by late-stage oxidation. The key steps include an Eschenmoser–Tanabe fragmentation of (*R*)-carvone epoxide to generate a suitable aldehyde, which undergoes an allenylation, followed by a regioselective distal allenic Pauson Khand reaction to construct the guaiane core. Then, oleodaphnone intermediate was engaged in a [2+2] photocycloaddition, affording the bridged cyclobutane core of the target molecule. Finally, a late-stage, chemoselective C–H oxidation yielded a triketone intermediate, which was reduced in a remarkably chemo- and stereoselective manner to deliver the natural product.

During the course of this work, we observed unexpected rearrangements of the bridged core. In addition to the first total synthesis of daphnepapytone A, we achieved the first total syntheses of three other guaiane-type sesquiterpenes: oleodaphnone, diarthroncha C, and daphnenicillata W.



[1] Huang et al. *J. Nat. Prod.* **2022**, 85 (1), 3–14.
[2] Hu et al. Shanghai Scientific & Technical Publishers **1999**, 1.
[3] Pereira et al. *Chem. Sci.* **2025**, 16 (25), 11375–11380.
[4] Gonzalez et al. *Chem. Sci.* **2025**, 16 (25), 11381–11385.
[5] Zhang et al. *Org. Lett.* **2025**, 27 (21), 5480–5484.

P A077

Design and synthesis of glycosyl hemithioindigos for antibacterial photopharmacology

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Photopharmacology is an emerging field that seeks to modulate the activity of pharmaceutical compounds through light activation, offering a high degree of spatial and temporal control over drug activity. As highlighted by Feringa et al. (2014)[1], this strategy can potentially reduce side effects, environmental toxicity, and the development of antibiotic resistance. The principle of photopharmacology uses the fact that photochromic scaffolds—such as azobenzenes or hemiindigoids— undergo reversible isomerization between distinct isomers (*E* and *Z* forms). These isomers often exhibit significant differences in three-dimensional structure, which can influence their interactions with target proteins. The design of photoresponsive drugs is challenging. It requires the successful integration of a photochromic group into bioactive molecules while ensuring that one isomer is active while the other is not. This constraint complicates the synthetic and design processes.

My PhD project focuses on the development of photoswitchable glycosides targeting *Pseudomonas aeruginosa* infection via the lectin lecA, a galactose binding protein involved in bacterial adhesion and biofilm formation[2]. To guide the molecular design and reduce synthetic workload, an in silico study was preliminary conducted by performing molecular docking of 20 hemithioindigo-derived compounds into the lecA PDB structure 7Z63 to predict the difference in binding affinity between their two isomers[3]. From these computational screenings and using the team's expertise in photochrome and glycoconjuguate synthesis a series of promising candidates was identified and synthesized from a newly developed bifunctional hemithioindigo scaffold. The obtained compounds were then evaluated for their photoswitching efficiency and thermal stability to assess their compatibility with biological application.

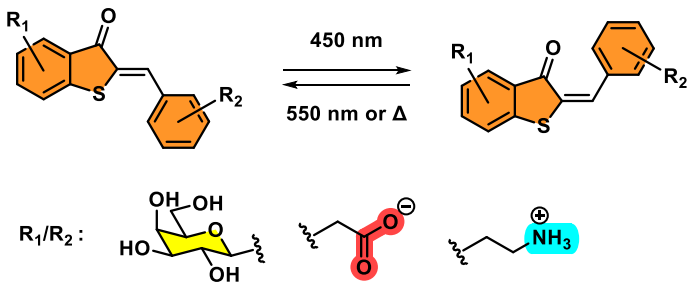


Figure 1: General structure of synthetized hemithioindigos

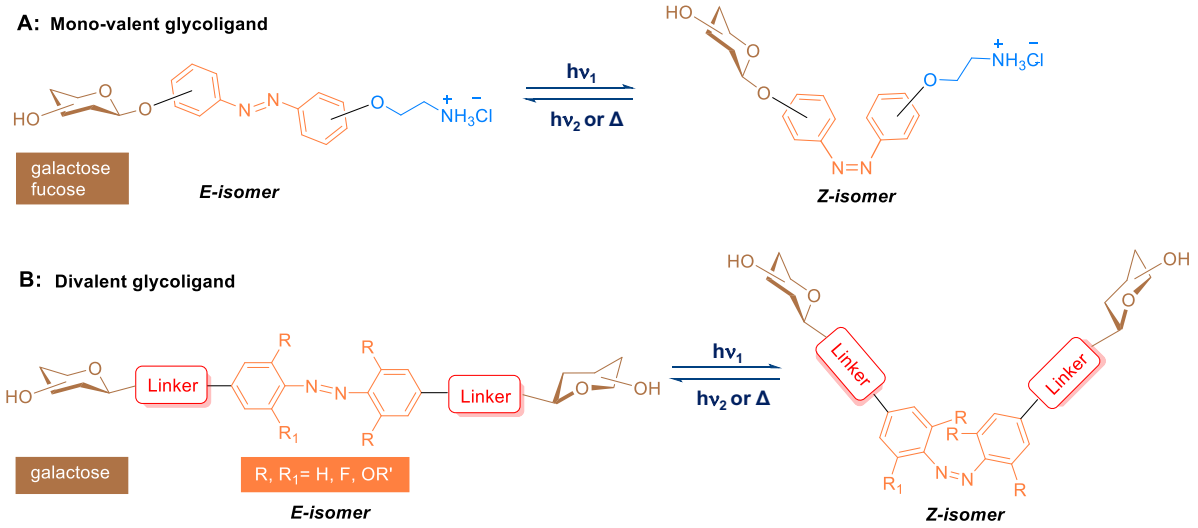
[1] Velema, W. A.; Szymanski, W.; Feringa, B. L., *J. Am. Chem. Soc.*, **2014**, *136*, 2178
[2] Imberty, A.; Wimmerová, M.; Mitchell, E. P.; Gilboa-Garber, N., *Microbes Infect.*, **2004**, *6*, 221
[3] Kobauri, P.; Dekker, F. J.; Szymanski, W.; Feringa, B. L. *Angew. Chem. Int. Ed.*, **2023**, *62,* e202300681

P A078

Synthesis and study of photoswitchable glycoligands targeting *Pseudomonas aeruginosa* lectins

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Biofilm formation is one of main causes of bacterial antimicrobial resistance infections. The soluble lectins LecA and LecB are essential for the bacterial adhesion, biofilm formation and host cell invasion of *Pseudomonas aeruginosa*, a bacterium classified as a Priority 1 pathogen by the WHO.[1] Bacterial lectins are therefore attractive targets for the development of new antibiotic-sparing anti-infective drugs. Carbohydrate-based ligands toward LecA and LecB have been shown to effectively inhibit bacterial adhesion and biofilm formation.[2] Photoswitchable lectins ligands could allow the reversible modulation of lectins activity with precise spatiotemporal control. As a proof of concept, we have designed and synthesized the first mono-valent galactosyl and fucosyl azobenzene derivatives targeting LecA and LecB (Scheme 1, A).[3] The azobenzene moiety undergoes reversible *E/Z* isomerization through irradiation, inducing significant conformational changes so as to reversibly tune glycosides-lectins interaction by light. Furthermore, we have also designed and synthesized the divalent galactosyl ligands (Scheme 1, B) in order to increase the binding affinity towards LecA and amplify the difference of affinity between *E*- and *Z*-isomers upon photoswitching. All the synthesized glycoligands display excellent photoswitching properties in aqueous media, with the lectins binding affinity from µM to nM range. All these results will be presented.



***Scheme 1**: Structure and photoisomerisation reaction of glyco-ligands.*

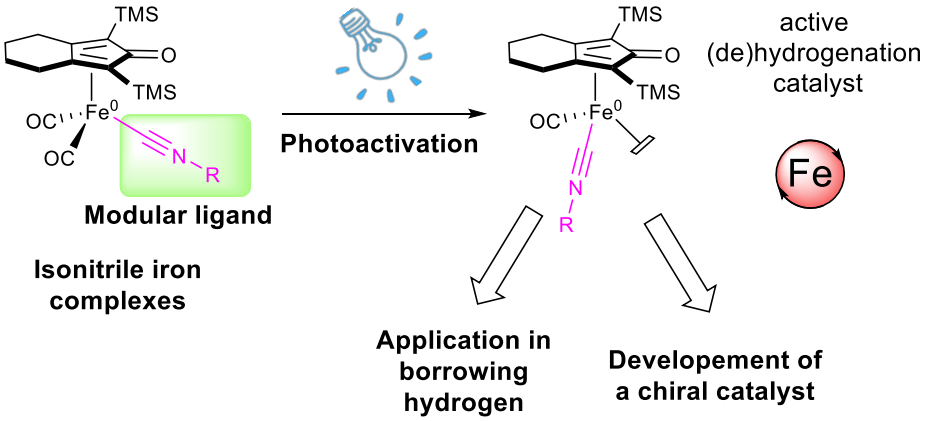
[1] Pelegrin, A. C.; Palmieri, M.; Mirande, C.; et al. *FEMS Microbiology Rev*. **2021**, *45*, 1.
[2] Yu, G.; Vicini, A. C.; Pieters, R. J. *J. Org. Chem.* **2019**, *84*, 2470; Stober, K.; Kuhaudomlarp, S.; Meiers, J.; Titz, A. *Angew. Chem. Int. Ed.* **2023**, *62*, e202215535.
[3] Fan, Y.; El Rhaz, A.; Maisonneuve, S.; Gillon, E.; Fatthalla, M.; Le Bideau, F.; Laurent, G.; Messaoudi, S.; Imberty, A.; Xie, J. *Beilstein J. Org. Chem.* **2024**, *20*, 1486.

P A079

Novel iron-based catalysts for photoinduced reversible hydrogen transfer reactions

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The quest for sustainable and cost-efficient synthetic processes has led to the development of iron cyclopentadienone catalysts, replacing costly noble metal complexes notably for hydrogen transfer reactions. These catalysts, featuring cooperativity between iron and the cyclopentadienone ligand, provide unique reactivities, particularly in borrowing hydrogen reactions. Modification of these catalysts has mainly focused on changing the cyclopentadienone core, but little has been done with the iron tricarbonyl structure. In order to potentially enhance the activity of these complexes and obtain different reactivities, the CO ligands were replaced by different isonitrile ligands, creating a library of modular complexes.[1] These catalysts demonstrated notable activity, surpassing classical catalysts, in a photoinduced multicatalytic borrowing hydrogen process. This enabled easy enantioselective functionalization of allylic alcohols under mild conditions. Finally, we recently could develop chiral versions of these isonitriles complexes, providing up to 78:22 *er* in the transfer hydrogenation of ketones.[2]



[1] G. Quintil, L. Diebold, G. Fadel, J. Pécaut, C. Philouze, M. Clémancey, G. Blondin, R. Bjornsson, A. Quintard, A. Kochem, *ACS Catalysis*, **2024**, *14*, *14,* 7795
[2] G. Quintil, J. Pécaut, R. Bjornsson, A. Kochem, A. Quintard, *Submitted.*

P A080

Catalytic Methoxylation of Aryl Halides Using ^{13}C- and ^{14}C-Labeled CO_2

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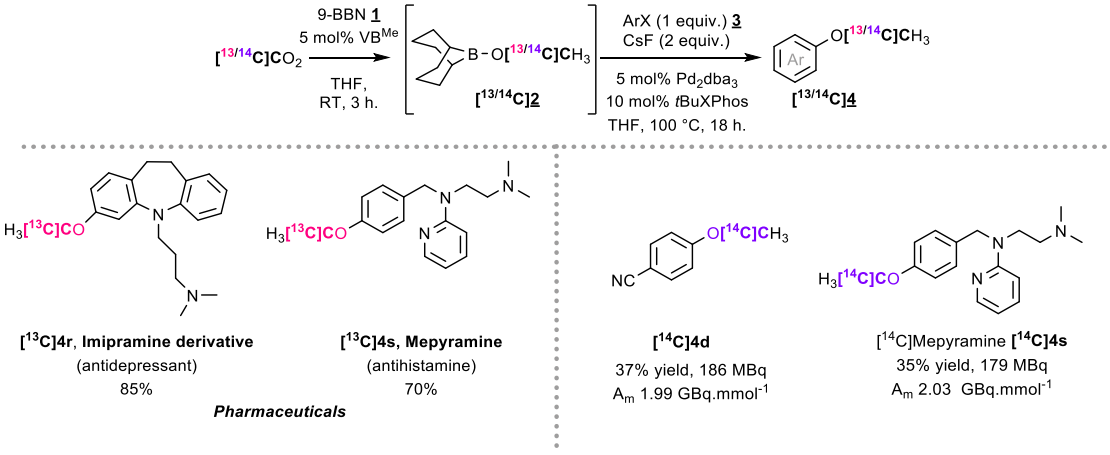
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In the field of isotopic labeling, carbon dioxide (CO_2) is the most accessible primary source of carbon-14.[1] Methods for functionalizing CO_2 into high-value building blocks are therefore of major interest for synthesis of radiolabeled compounds, which are widely used in medical imaging and ADME studies.[2, 3] However, the incorporation of carbon-14 from $[^{14}C]CO_2$ often takes place at early-stage of multi-step syntheses ($[^{14}C]CO_2$: 1600 €/mmol[1]), generating undesired radioactive waste (half-life: 5730 years).[4] The development of late-stage strategies based on CO_2 transformations are highly appealing. For example, the labeling of *O*-methyl groups with a ^{14}C-radioisotope is particularly relevant, as this is one of the most common structural features in medicinal chemistry.[5] In this context, we have developed a reverse polarity methoxylation strategy using labeled $[^{14}C]CO_2$.[6] After an initial step of reducing CO_2 with 9BBN **1**, the intermediate BBN-OCH_3 **2** can then be used as a new secondary labeled nucleophile source. Thus, after a palladium-catalyzed Suzuki coupling between BBN-OCH_3 **2** and aromatic halides **3**, this strategy enabled the labeling of a series of substrates, including complex pharmaceuticals containing tertiary alkylamine substituents.



[1] Bragg, R. A.; Sardana, M.; Artelsmair, M.; Elmore, C. S. *J. Label. Compd. Radiopharm.* **2018**, *61*, 934–948.

[2] Tu, Z.; Mach, R. H. *Curr. Top. Med. Chem.* **2010**, *10*, 1060–1095.

[3] Boscutti, G.; Huiban, M.; Passchier, J. *Drug Discov. Today Technol.* **2017**, *25*, 3–10.

[4] Voges, R.; Heys, J. R.; Moenius, T. *Preparation of Compounds Labeled with Tritium and Carbon-14*, 1st ed.; Wiley, 2009.

[5] https://njardarson.lab.arizona.edu/content/top-pharmaceuticalsposter: D. T. Smith, M. D. Delost, H. Qureshi and J. T. Njararson, J. Chem. Educ., 2010, 87, 1348.

[6] Ohleier, A.; Sallustrau, A.; Mouhsine, B.; Caillé, F.; Audisio, D.; Cantat, T. *Chem. Commun.* **2022**, *58*, 12831–12834.

P A081

Superbase catalyzed electrocyclization of monoterpenes for jet-fuels synthesis: an experimental and theoretical study

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Monoterpenes are abundant alkene-type molecules derived from biomass and represent promising precursors for advanced biobased jet fuels.[1] However, to achieve fuels with optimal performance, these compounds must be converted into their cyclic and hydrogenated forms.[2] While previous efforts have succeeded in synthesizing 4-, 5-, 6-, and 8-membered ring scaffolds for biofuel applications, efficient strategies for 7-membered ring cycloalkanes formations remain unachieved.

In organic synthesis, an underexplored approach for constructing seven-membered rings involves the electrocyclization of the heptatrienyl anions.[3] Those species, a seven-carbon conjugated system containing eight π-electrons, can undergo thermal electrocyclization to form a new C–C bond, thereby closing the seven-membered ring. The generation of this anion using superbases under stoichiometric conditions was investigated in the 1970s but mostly led to complex mixtures that were difficult to separate and analyze.[4] Over the past few years, catalytic transformations mediated by alkali-metal amides have emerged as powerful alternatives, achieving performances increasingly comparable to those of traditional transition-metal-based-methods, while relying of simple and cheap reagents.[5]

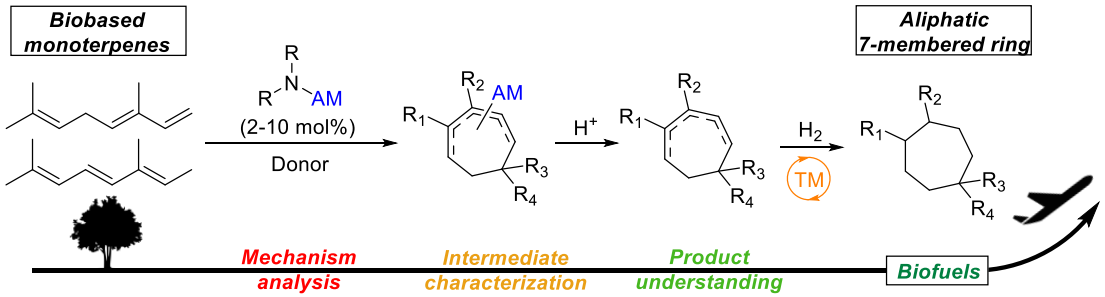


Figure 6 : *Proposed method for the formation of aliphatic 7-membered cycles as jet-fuels.*

Breaking ground in this field, here we report the formation of 7-member ring-based biofuels starting from biobased monoterpenes such as ocimene and employing catalytic amounts of an alkali-metal amide system under carefully controlled conditions. The choice of alkali-metal and Lewis donor was crucial to achieve high yields, avoiding the formation of undesired products. The reaction has been analyzed using a multidisciplinary set of analytical techniques (NMR reaction monitoring, X-ray crystallography, semi-preparative GC-TCD, GC-MS) and further explored through quantum chemical calculations to understand the factors governing these reactions.

[1] Hanssens, J.; Meneses, D.; Saya, J. M.; Orru, R. *Eur. J. Org. Chem.* **2025**, e202401151.
[2] *(a)* Ju, C.; Wang, M.; Huang, Y.; Fang, Y.; Tan, T. *ACS Sustain. Chem. Eng.* **2018**, *6* (4), 4871–4879. *(b)* Woodroffe, J.-D.; Harvey, B. G. *Energy Technol.* **2021**, *9* (8), 2100221.
[3] Komijani, S.; Orellana, A. *Synthesis* **2024**, *56* (05), 701–713.
[4] *(a)* David, L.; Kergomard, A. *Tetrahedron* **1971**, *27* (3), 653–662. *(b)* Zuech, E. A.; Crain, D. L.; Kleinschmidt, R. F. *J. Org. Chem.* **1968**, *33* (2), 771–775.
[5] *(a)* Anderson, D. E.; Tortajada, A.; Hevia, E. *Angew. Chem. Int. Ed.* **2024**, *63* (4), e202313556. *(b)* Tortajada, A.; Righetti, G. L.; McGinley, A.; Mu, M.; García-Melchor, M.; Hevia, E. *Angew. Chem. Int. Ed.* **2024**, *63* (38), e202407262. *(c)* Tortajada, A.; Hevia, E. *Catal. Sci. Technol.* **2023**, *13* (17), 4919–4925.

P A082

C(sp³)-C(sp²) Suzuki-Miyaura Reactions Catalyzed by a Well-Defined Anilido-Aldimine Iron(II) Catalyst: Insights into the Mechanism

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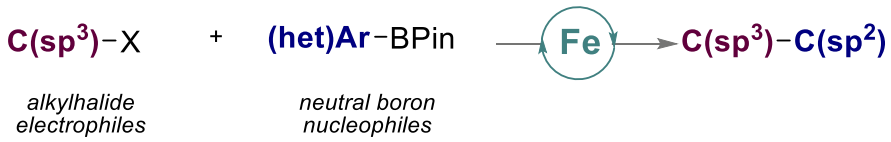
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The Suzuki–Miyaura cross-coupling reaction is a powerful tool for C–C bond formation in organic synthesis. This reaction is typically carried out using palladium-based catalysts, which have demonstrated tremendous utility but are toxic and costly. In addition, despite significant advances in ligand design, palladium-based catalysts also have some limitations in terms of substrate scope, particularly for reactions involving secondary or tertiary alkyl halides in C(sp²)-C(sp²) couplings and for the formation of C(sp³)-C(sp³) coupling products.[1] To address these issues, researchers have turned their attention to first-row transition metal complexes (iron, cobalt, copper and nickel) which, in addition to their potential cost and environmental benefits, offer the opportunity to extend the scope of metal-catalyzed cross-coupling reactions beyond those typically carried out with palladium. Nevertheless, catalytic systems based on iron, the first-row metal offering the greatest promise for sustainable catalysis, are still in their infancy for sp³-hybridized partners and thus many challenges remain.[2]

In this context, our team has recently reported a well-defined anilido-aldimine iron(II) catalyst that demonstrates excellent efficiency in both sp³–sp² and sp³–sp³ Suzuki–Miyaura couplings of alkyl halides with unactivated boron nucleophiles.[3] Herein, we report an investigation into the mechanism of this novel iron-catalyzed sp³–sp² Suzuki–Miyaura coupling, focusing on the identification of key species involved in the catalytic cycle and the elucidation of the elementary steps that drive the transformation.

Mechanistic insights



[1] Choi, J.; Fu, G. C. Transition Metal–Catalyzed Alkyl–Alkyl Bond Formation: Another Dimension in Cross-Coupling Chemistry. *Science* **2017**, *356*, eaaf7230.

[2] (a) Bedford, R. B.; Brenner, P. B.; Carter, E.; Carvell, T. W.; Cogswell, P. M.; Gallagher, T.; Harvey, J. N.; Murphy, D. M.; Neeve, E. C.; Nunn, J.; Pye, D. R. *Chem. Eur. J.* **2014**, *20*, 7935. (b) Hatakeyama, T.; Hashimoto, T.; Kondo, Y.; Fujiwara, Y.; Seike, H.; Takaya, H.; Tamada, Y.; Ono, T.; Nakamura, M. *J. Am. Chem. Soc.* **2010**, *132*, 10674. (c) Crockett, M. P.; Tyrol, C. C.; Wong, A. S.; Li, B.; Byers, J. *Org. Lett.* **2018**, *20*, 5233. (d) Crockett, M. P.; Wong, A. S.; Li, B.; Byers, J. *Angew. Chem. Int. Ed.* **2020**, *59*, 5392. (e) Peterson, P. O.; Joannou, M. V.; Simmons, E. M.; Wisniewski, S. R.; Kim, J.; Chirik, P. J. *ACS Catal.* **2023**, *13*, 2443.

[3] Chen, D.; Lepori, C.; Guillot, R.; Gil, R.; Bezzenine, S.; Hannedouche, J. *Angew. Chem. Int. Ed.* **2024**, e202408419.

P A083

Targeting proteins with novel hydrogen peroxide-responsive borinic acid probes using the HALO-Tag strategy

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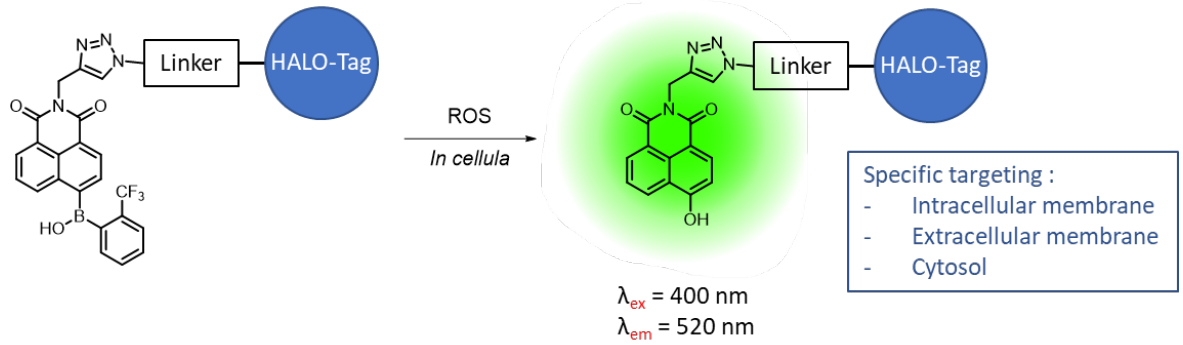
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Hydrogen peroxide (H_2O_2), especially at low concentration, plays a critical role in the regulation of numerous biological activities as a signaling molecule. However, aberrant production or accumulation of highly diffusive H_2O_2 induces oxidative stress conditions, damaging biomolecules and contributing to ageing, cancer, and several neurodegenerative diseases such as Alzheimer's or Parkinson's. [1]

In order to detect hydrogen peroxide, many fluorogenic organic probes have been developed, relying on a boronate trigger. However, this design suffers from slow kinetics, preventing a special resolution of hydrogen peroxide imaging. To address this issue, our team has successfully developed borinic acid-based fluorogenic probes, which display kinetic constants 10,000-fold faster than their boronic acid analogs toward H_2O_2.[2]

In this work, we wish to improve the design of the *"Off-on"* fluorogenic borinic acid-based sensors by adding a protein-specific targeting moiety, *i.e.,* an HALO-Tag[3], to a naphthalic scaffold. The specific targeting of this new sensor will allow analysis of redox events at different subcellular levels.



[1] Finkel, T.; Serrano, M.; Blasco, M. A. The common biology of cancer and ageing. *Nature* **2007**, *448*, 767-774.

[2] a) Gatin-Fraudet, B.; Ottenwelter, R.; Le Saux, T.; Norsikian, S.; Pucher, M.; Lombès, T.; Baron, A.; Durand, P.; Doisneau, G.; Bourdreux, Y.; Iorga, B. I.; Erard, M.; Jullien, L.; Guianvarc'h, D.; Urban, D.; Vauzeilles, B. Evaluation of borinic acids as new, fast hydrogen peroxide-responsive triggers. *PNAS* **2021**, *118*, e2107503118; b) Gatin-Fraudet, B.; Pucher, M.; Le Saux, T.; Doisneau, G.; Bourdreux, Y.; Jullien, L.; Vauzeilles, B.; Guianvarc'h, D.; Urban, D. Hydrogen peroxide-responsive triggers based on borinic acids: molecular insights into the control of oxidative rearrangement. *Chem. Eur. J.* **2022**, e202201543.

[3] Los, G.V.; Encell, L.P.; McDougall, M.G.; Hartzell, D. D.; Karassina, N.; Zimprich, C.; Wood, M.G.; Learish, R.; Ohane, R.F.; Urh, M.; Simpson, D.; Mendez, J.; Zimmerman, K.; Otto, P.; Vidugiris, G.; Zhu, J.; Darzins, A.; Klaubert, D. H.; Bulleit, R. F.; Wood, K. V. HaloTag: a novel protein labeling technology for cell imaging and protein analysis. *ACS Chem. Biol*. **2008**, *3*, 373-382.

P A084

Unsubstituted Nitrene Transfer Catalyzed by Bio-inspired Mononuclear Iron(II) Complexes

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It is estimated that about 80% of therapeutic molecules contain at least one nitrogen atom, making this element a central feature in medicinal chemistry.[1] Many catalytic systems have been developed for the selective introduction of nitrogen atoms, but most of these reactions introduce nitrogens protected by tosyl groups which are extremely difficult to remove. Recently, Bill Morandi's team described a very efficient method for the preparation of amine by amino chlorination of alkene using Fe(acac)2 complex and hydroxylamine ester reagent as amine donor, via a mechanism which has been demonstrated to be radical based.[2,3]
Here, we propose to use the same hydroxylamine ester reagent to study its reactivity with bio-inspired iron complexes in order to catalyze nitrogen transfer reaction, opening new opportunities to compare its reactivity to bio-inspired oxene transfer reactions. In this communication and poster, I will present the first results we obtained for catalytic amination reactions on sulfides and alkenes.[4,5]

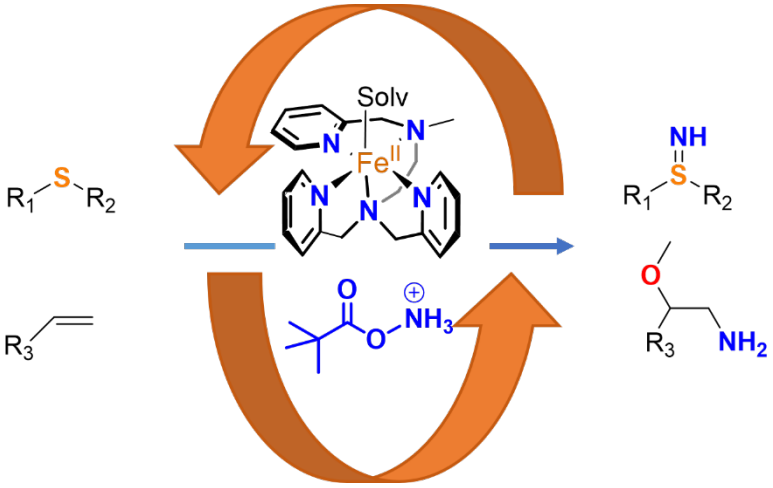


Figure 1 : Unprotected amine transfer catalyzed by a iron complex

[1] Vitaku, E.; Smith, T.; Njardarson J. T.; *J. Med. Chem* **2014**, *57,* 10257.
[2] Morandi, B.; *et al.*; *Science* **2018** 362, 434.
[3] DeBeer, S.; *et al.*; *J. Am. Chem. Soc.* **2022**, 144, 2637.
[4] Boullé, A.; Doumbia, A.; Mahy, J. P.; Avenier, F.; *Chem. Commun.* **2023**, 59, 79.
[5] Avenier, F.; *et al.* ; *Angew. Chem. Int. Ed.* **2019**, 58, 854.

P A085

Csp3 rich piperidines: from methodological developments to applications in Fragment-Based Drug Discovery

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Fragment-Based Drug Discovery (FBDD) has emerged in the recent years as powerful tool in the drug discovery process[1] and has led to six marketed drugs as well as numerous candidates under clinical trials. In spite of this success, the available fragment libraries are mainly based on sp^2-rich (hetero)aromatic planar compounds.[2] Consequently, efforts are made to optimize fragment collections with the elaboration of original 3D-fragments, able to better explore the chemical space. We have addressed this issue by synthesizing different libraries of Csp3 rich, three dimensional piperidines. Methodological developments were needed, bringing on one hand to some advances in i) tandem triflation-allylation and RCM[3] and ii) aza-Prins cyclization with ketones[4]. On the other hand, a library of fluorinated piperidines has been evaluated by chemoinformatic tools in order to establish modification of the pKa, and three-dimensional character.[5] Finally, a random screening revealed that one scaffold is recognized by the catalytic pocket of 3CLPro (main protease of SARS-CoV-2 coronavirus).

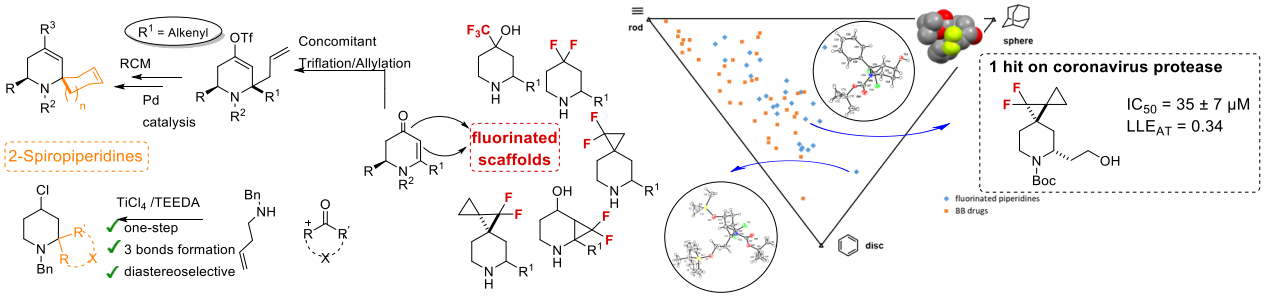


Figure 1. Three different routes to piperidines, chemoinformatic analysis, biological evaluations

[1] a) Erlanson, D. A.; Davis, B. J.; Jahnke, W. *Cell Chem. Biol.* **2019**, *26*, 9; b) Troelsen, N. S.; Clausen, M. H. *Chem. Eur. J.* **2020**, *26*, 11391.

[2] a) Klein, H. F.; Hamilton, D. J.; de Esch, I. J. P.; Wijtmans, M.; O' Brien, P. *Drug Disc. Today* **2022**, *27*, 2484–2796; b) Ritchie, T. J.; Macdonald, S. J.F. *Drug Disc. Today* **2009**, *14*, 1011–1020.

[3] Gantasala, N.; Fournet, C.; Le Roch, M.; Lalli, C.; Pabbaraja, S.; Gouault, N. *Org. Biomol. Chem.* **2023**, *21*, 5245-5253.

[4] Bergounioux, A.; Lhotellier, R.; Roisnel, T.; Gouault, N.; Argouarch, G.; Lalli, C. *Adv. Synth. Catal.* **2024**, *366*, 31-35.

[5] Le Roch, M.; Renault, J.; Argouarch, G.; Lenci, E.; Trabocchi, A.; Roisnel, T.; Gouault, N.; Lalli, C. *J. Org. Chem.* **2024**, *89*, 4932–4946.

P A086

Spirocyclisation and Subsequent Dyotropic rearrangement: A Sequential Route to the Synthesis of Exotines Scafold

Arthur Baudement,[1] Radosław Suchanek,[2] Luc Neuville,[1] Géraldine Masson[1]

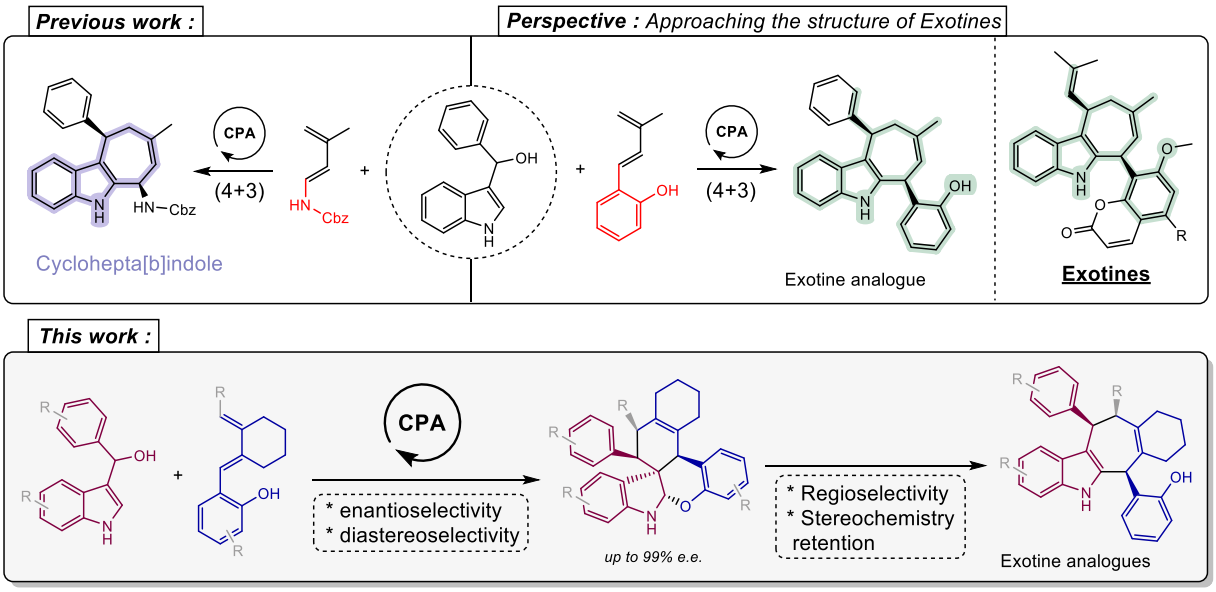
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Exotines are two natural products isolated from *Murraya exotica*, a plant native to Southeast Asia.[1] These compounds exhibit promising biological activity and feature a unique chiral cyclohepta[b]indole core, making them appealing targets for total synthesis. To date, two total syntheses have been reported, but none of them is enantioselective. [2,3]

Building on previous work from our team dealing with a chiral phosphoric acid (CPA)-catalysed asymmetric (4+3) cycloaddition of diene-carbamates to access the cyclohepta[b]indole scaffold,[4] we sought to adapt this methodology by replacing the carbamate with a phenol group to more closely mimic the natural product structure. Unexpectedly, the phenolic dienes did not undergo the anticipated (4+3) cycloaddition. Instead, they gave rise to a novel class of polycyclic compounds. Through extensive optimization, we developed an enantio- and diastereoselective version of this transformation, achieving full control over five stereogenic centers. Further investigation revealed that, under specific conditions, these polycyclic compounds could undergo a dyotropic rearrangement leading to the desired cyclohepta[b]indole core with complete regioselectivity and preservation of stereochemical information, ultimately providing access to Exotines analogues.



[1] Liu, B.-Y.; Zhang, C.; Zeng, K.-W.; Li, J.; Guo, X.-Y.; Zhao, M.-B.; Tu, P.-F.; Jiang, Y. *Org. Lett.* **2015**, *17* (17), 4380–4383.
[2] Cheng, B.; Volpin, G.; Morstein, J.; Trauner, D. *Org. Lett.* **2018**, *20* (14), 4358–4361.
[3] Lepovitz, L. T.; Martin, S. F. *J. Org. Chem.* **2021**, *86* (16), 10946–10953.
[4] Gelis, C.; Levitre, G.; Merad, J.; Retailleau, P.; Neuville, L.; Masson, G. *Angew. Chem. Int. Ed.* **2018**, *57* (37), 12121–12125.

P A087

To design and evaluate amphiphilic cyclodextrin derivatives as anti-aggregants for neurodegenerative diseases

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β-Cyclodextrin (β-CD) derivatives are a promising structure for the vectorization and development of therapeutics for neurodegenerative diseases, such as Alzheimer's disease (AD), due to their biocompatibility, ability to enhance the solubility of hydrophobic molecules, and potential to penetrate the blood-brain barrier (BBB).The objective of this project is to engineer a conjugate comprising a mono-6-amino-per-methylated β-CD and a KLVFF mimetic peptide. The conjugate is designed to inhibit the aggregation of amyloid-β 42 (Aβ42), a peptide associated with amyloid plaque formation in Alzheimer's disease (AD), while concurrently enhancing its solubility and penetration into the brain. In this study, the KLVFF-mimicking peptides will be synthesized from the original sequence and improved variants, then combined with modified β-CD. Consequently, a series of conjugates will be obtained and evaluated in terms of their ability to inhibit Aβ42 aggregation. This work is currently in progress. The KLVFF-β-CD conjugates and their mimetic versions will undergo analysis to identify those most effective in preventing aggregation and neutralizing toxicity linked to soluble forms of Aβ. The present project has the potential to contribute to the development of new therapeutic approaches targeting the preliminary stages of Alzheimer's disease (AD).

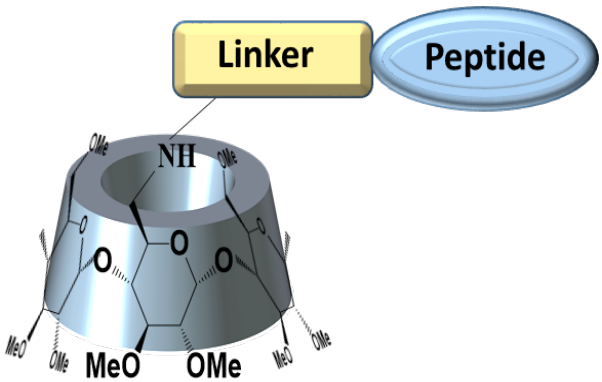


Figure 1. *This is a model of target molecules against Amyloid Aβ42 aggregation*

[1] H. Wang, X. Xu, Y.-C. Pan, Y. Yan, X.-Y. Hu, R. Chen, B. J. Ravoo, D.-S. Guo, T. Zhang, Adv. Mater. (2020) 32, 2006483
[2] H. Zhang, X. Dong, F. Liu, J. Zheng, Y. Sun, Biophys. Chem. (2018) 285, 40.

P A088

Merging central and axial chirality in Cyclic (alkyl) (amino) carbenes: The keystone for high enantioselectivities in Ru-catalyzed asymmetric olefin metathesis

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In 2007, a new class of carbenes, namely cyclic (alkyl) (amino) carbenes (CAACs), emerged as a competitor to NHCs as ligands for olefin metathesis catalysts.[1] Since then, CAACs have been intensively studied, demonstrating exceptional productivity in ethenolysis processes[2] while achieving remarkable catalytic performances in a number of other metathesis transformations.[3] Despite these impressive results, the use of chiral CAAC ligands in asymmetric catalysis is still in its infancy.[4] This communication will present pioneering developments of chiral CAAC-Ruthenium complexes and their evaluation in asymmetric olefin metathesis.[5]

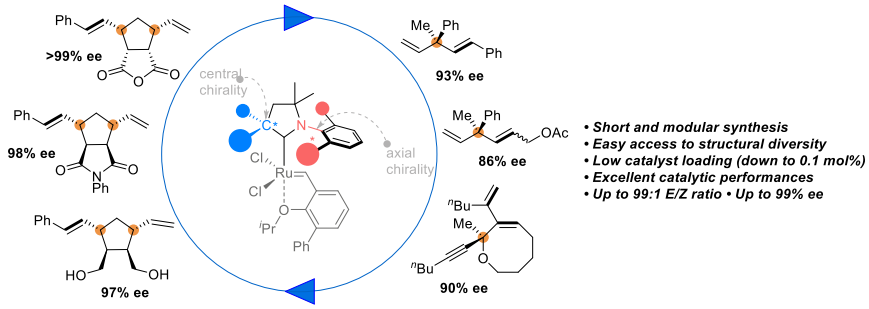


Figure 7. Asymmetric ROCM and RCEYM Catalyzed by Chiral CAACs Ru-Complexes

In summary, a new class of optically pure ruthenium CAAC complexes featuring both axial chirality and merged axial and central chirality was synthesized in good yields (57-93%) with excellent enantiomeric purities (up to >99.5% ee), thanks to preparative HPLC resolution on a chiral stationary phase. These complexes demonstrated excellent catalytic activity (0.1-2 mol%) and high enantioinduction in AROCM (up to >99% ee) and ARCEYM (up to 90% ee).

[1] Anderson, D. R.; Lavallo, V.; O'Leary, D. J.; Bertrand, G.; Grubbs, R. H. Synthesis and reactivity of olefin metathesis catalysts bearing cyclic (alkyl)(amino) carbenes. *Angew. Chem. Int. Ed*. **2007**, *46*, 7262.

[2] Gawin, R., Tracz, A.; Krajczy, P.; Kozakiewicz-Piekarz, A.; Martinez, J. P.; Trzaskowski, B. Inhibition of the decomposition pathways of ruthenium olefin metathesis catalysts: Development of highly efficient catalysts for ethenolysis. *J. Am. Chem. Soc.* **2023**, *145*, 25010.

[3] For a specific review on CAAC-Ru-complexes in olefin metathesis, see: Morvan, J.; Mauduit, M.; Bertrand, G.; Jazzar, R. Cyclic (alkyl)(amino) carbenes (CAACs) in ruthenium olefin metathesis. *ACS Catal*. **2021**, *11*, 1714.

[4] Pichon, D.; Soleilhavoup, M.; Morvan, J.; Junor, G. P.; Vives, T.; Crévisy, C.; Bertrand, G. The debut of chiral cyclic (alkyl)(amino) carbenes (CAACs) in enantioselective catalysis. *Chem. Sci.* **2019**, *10*, 7807.

[5] Morvan, J.; Vermersch, F.; Zhang, Z.; Falivene, L.; Vives, T.; Dorcet, V.; Roisnel, T.; Crévisy, C.; Cavallo, L.; Vanthyne, N.; Bertrand, G.; Jazzar, R.; Mauduit, M. Optically Pure C 1-Symmetric Cyclic (alkyl)(amino) carbene Ruthenium Complexes for Asymmetric Olefin Metathesis. *J. Am. Chem. Soc.* **2020**, *142*, 19895. b) Morvan, J.; Vermersch, F.; Zhang, Z.; Vives, T.; Dorcet, V.; Roisnel, T.; Crévisy, C.; Falivene, L.; Cavallo, L.; Vanthuyne, N.; Bertrand, G.; Jazzar, R.; Mauduit, M. Ambivalent Role of Rotamers in Cyclic(alkyl)(amino)carbene Ruthenium Complexes for Enantioselective Ring-Opening Cross-Metathesis. *Organometallics* **2023**, *42*, 495. c) Del Vecchio, A.; Talcik, J.; Colombel-Rouen, S.; Lorkowski, J.; Serrato, M.R.; Roisnel, T.; Vanthuyne, N.; Bertrand, G.; Jazzar, R; Mauduit, M. Highly robust and efficient Blechert-type cyclic (alkyl)(amino) carbene ruthenium complexes for olefin metathesis. *ACS Catal*. **2023**, *13*, 6195.

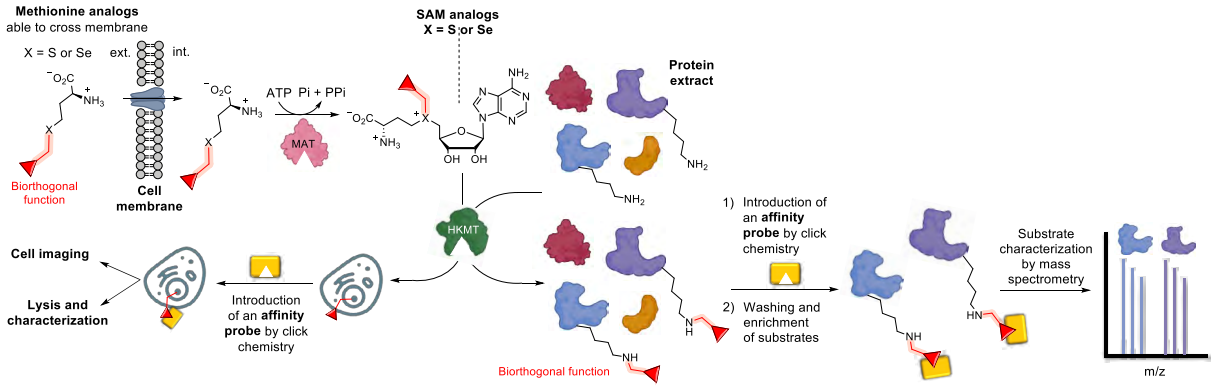
P A089

Chemoenzymatic labeling of protein substrates of a lysine methyltransferase using S-adenosyl-L-methionine analogues

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Histone lysine methylation is a key epigenetic modification that regulates chromatin structure and gene expression, catalyzed by histone lysine methyltransferases (HKMTs). These enzymes transfer methyl groups from S-adenosyl-L-methionine (SAM) to lysine residues on both histones and non-histone proteins. The regulation of this process is crucial for cellular functions, and its dysregulation is linked to diseases such as cancer and neurodegenerative disorders, making HKMTs attractive targets for antitumor agents.

To characterize the methylome of PR-Set7, an important HKMT, we employed a novel "bump and hole"[1] strategy that combines chemical and enzymatic techniques to label and identify its substrates. We synthesized SAM analogs with bioorthogonal groups (alkynes or azides) and methionine analogs, which serve as precursors to produce SAM using methionine adenosyltransferase (MAT)[2] . These analogs, designed to fit the active site of PR-Set7 mutants, were incubated with nuclear extracts or in cells, enabling substrate labeling. The labeled substrates were then functionalized with affinity tags via click chemistry and identified by mass spectrometry[3]. This strategy allows for the precise identification of enzyme substrates.



[1] a) Dalhoff, C.; Lukinavičius, G.; KlimašauskasS.; Weinhold, E. Direct Transfer of Extended Groups from Synthetic Cofactors by DNA Methyltransferases. Nature Chemical Biology 2005, 2 (1), 31–32. b) Wang, R.; Islam, K.; Liu, Y.; Zheng, W.; Tang, H.; Lailler, N.; Blum, G.; Deng, H.; Luo, M. Profiling Genome-Wide Chromatin Methylation with Engineered Posttranslation Apparatus within Living Cells. Journal of the American Chemical Society 2013, 135 (3), 1048–1056.

[2] Singh, S.; Zhang, J.; Huber, T.; Sunkara, M.; Hurley, K.; Goff, R.; Wang, G.; Liu, C.; Rohr, J.; Van Lanen, S.; Morris, A.;Thorson, J. Facile Chemoenzymatic Strategies for the Synthesis and Utilization of S-Adenosyl-L-Methionine Analogues. Angew. Chem. Int. Ed. 2014, 53, 3965 –3969.

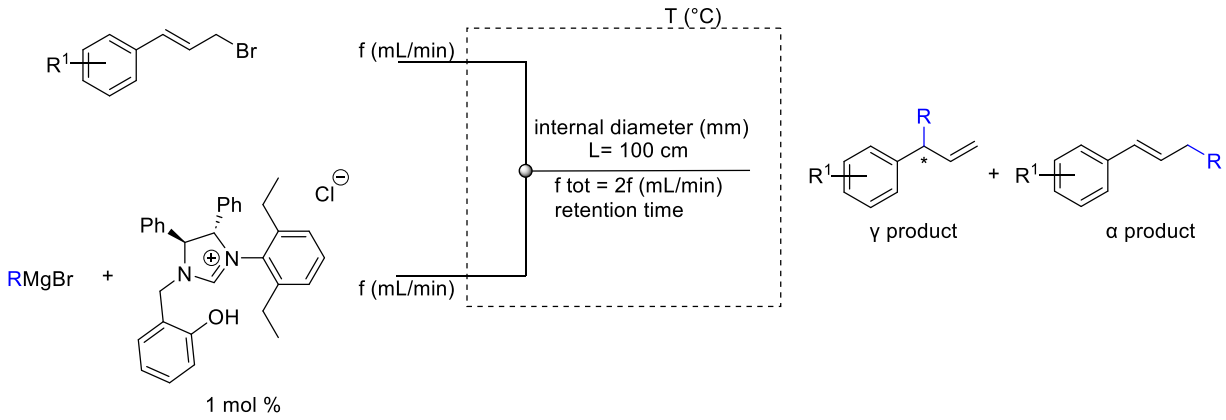
[3]Désert, A.; Guitot, K.; Michaud, A.; Holoch, D.; Raphaël Margueron; Fabienne Burlina; Guianvarc'h, D. Characterization of SET-Domain Histone Lysine Methyltransferase Substrates Using a Cofactor S-Adenosyl-l-Methionine Surrogate. Methods in molecular biology 2022, 297–311.

P A090

Lewis-base Activation of Grignard Reagents for Enantioselective Catalysis and Continuous Flow Process

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The stereoselective formation of C-C bonds using Grignard and dialkylzinc reagents has been largely developed, particularly in the context of allylic substitution reactions. Traditionally, these transformations require the use of transition-metal catalysts. However, over the past fifteen years, an alternative strategy based on Lewis-base activation of Grignard reagents by N-heterocyclic carbenes (NHCs) has emerged, enabling such reactions to proceed under transition-metal-free conditions with good to excellent regio- and enantioselectivities[1,2].
In this context, we aim to adapt this Lewis base activation strategy to continuous flow chemistry, both in homogeneous and heterogeneous systems, with the aim of improving catalytic performance in enantioselective allylic substitution. To achieve this, a small library of chiral NHC ligands was synthesized to study the parameters influencing selectivity. So far, results show improved regioselectivity, comparable enantiomeric excesses while the reactions proceed under milder conditions.



[1] Jackowski, O.; Alexakis, A. Copper-Free Asymmetric Allylic Alkylation with Grignard Reagents. *Angewandte Chemie International Edition* **2010**, *49* (19), 3346–3350. https://doi.org/10.1002/anie.201000577.
[2] Pérez Sevillano, R.; Ferreira, F.; Jackowski, O. Transition-Metal-Free Synthesis of Enantioenriched Tertiary and Quaternary α-Chiral Allylsilanes. *Chemistry – A European Journal* **2023**, *29* (59), e202302227. https://doi.org/10.1002/chem.202302227.

P A091

Photocatalyzed Oxidation of Oximes under visible light

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The [3+2] cycloaddition of nitrile oxides onto unsaturated bond systems is widely recognized as an efficient and versatile approach for constructing nitrogen-containing heterocycles, including dioxazoles, isoxazoles, and oxadiazoles.[1i] Nitrile oxide itself can be generated from various precursors through different ways, often involving the use of oxidizing agents in stoichiometric amounts.[2] However, conventional oxidizing processes come with some challenges, including the significant use of stoichiometric reagents, potential safety considerations, and the formation of by-products that may require additional purification steps, affecting overall efficiency.[3] This study presents a novel approach to the visible-light-induced oxidation of oximes, using oxygen from air as an oxidant to form the nitrile oxide intermediate which can then undergo a [3+2] cycloaddition in the presence of various dipolarophiles, generating the desired heterocyclic compounds. By leveraging 4-DPAIPN as a photocatalyst under blue light irradiation, this photochemical process offers a green and versatile route for crafting these important molecular frameworks, with potential applications in pharmaceutical, agrochemicals, and polymer industries.

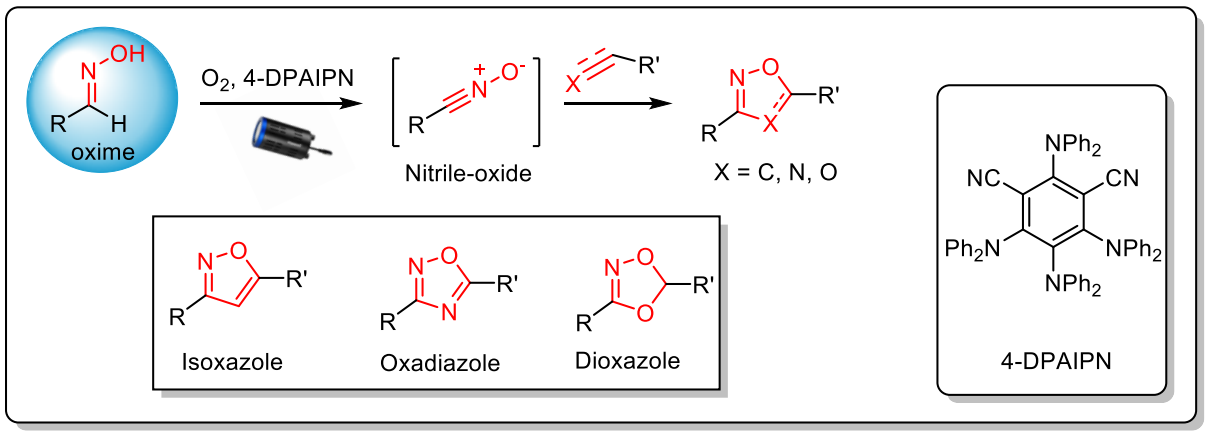


Figure 1. *Photocatalyzed oxidation of oximes using 4-DPAIPN under blue light irradiation.*

[1] Padwa, A.; Pearson, W., *Synthesis Applications of 1, 3-Dipolar Cycloaddition Chemistry*. Wiley, New York: 1984.

[2] Minakata, S.; Okumura, S.; Nagamachi, T.; Takeda, Y., Generation of nitrile oxides from oximes using *t*-BuOI and their cycloaddition. *Org. Lett.* **2011,** *13*, 2966-2969.

[3] Singh, M. S.; Chowdhury, S.; Koley, S., Progress in 1, 3-dipolar cycloadditions in the recent decade: an update to strategic development towards the arsenal of organic synthesis. *Tetrahedron* **2016,** *72*, 1603-1644.

P A092

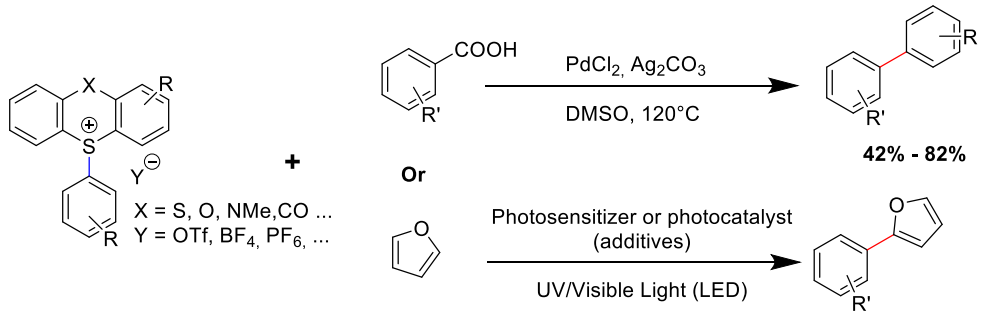
Development of new synthetic methods using arylsulfonium salts for aryl-aryl bond formations

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The formation of new carbon-carbon bonds is a subject of constant development in organic chemistry. Reactions allowing formation of such bonds represent often crucial steps in the synthesis of natural products or various organic molecules presenting interesting applications as active pharmaceutical ingredients (API), agrochemicals or monomers for polymerizations. Cyclic Arylsulfonium Salts (CAS) suscite currently huge interest in organic chemistry, especially for carbon-carbon (C-C) bond formations using either a palladium catalyst or a light source.

During this thesis, we were firstly interested in studying the potential of various CAS for the creation of aryl-aryl (Ar-Ar) bonds using pallado-catalysis. Among the numerous synthetic strategies that can be envisaged, we developed a decarboxylative coupling between CAS and arene carboxylic acids (*Scheme 1 – top*) inspired by previous results from our group that involved either iodoarenes[1] or aryl iodonium salts[2] instead of CAS. To this end, a complete methodology was carried out in order to determine the best reaction conditions and the synthetic potential of this new reaction, by describing several examples of couplings and by changing the type of substitution of the aryl motif in order to see their influence on the reaction[3].

Afterwards, since some of the CAS previously studied absorb near UV light, it is also interesting to study their potential for Ar-Ar bond formations in the presence of a LED via the in-situ formation of an aryl radical. Our first results concerning this novel strategy for C-C bond formations under very mild conditions (LED irradiation) will also be presented (*Scheme 1 – bottom*).



Scheme 8: Reactions studied in this thesis

[1] Becht, J.-M.; Catala, C.; Le Drian, C.; Wagner, A. Synthesis of Biaryls via Decarboxylative Pd-Catalyzed Cross-Coupling Reaction. *Org. Lett.* **2007**, 9 (9), 1781 – 1783. DOI: 10.1021/ol070495y

[2] Becht, J.-M.; Le Drian, C. Biaryl Synthesis via Decarboxylative Pd-Catalyzed Reactions of Arenecarboxylic Acids and Diaryliodonium Triflates. *Org. Lett.* **2008**, 10 (14), 3161-3164. DOI: 10.1021/ol8011293

[3] Boulay, P.; Konte, M.; Lalevée, J.; Becht. J.-M. Synthesis of Biaryls via Pd-Catalyzed Cross-Coupling Reaction between Arene Carboxylic Acids and Aryl Thianthrenium Trifluoromethanesulfonates. *Eur. J. Org. Chem.* **2025**, 28 (23). DOI: 10.1002/ejoc.202401408

P A093

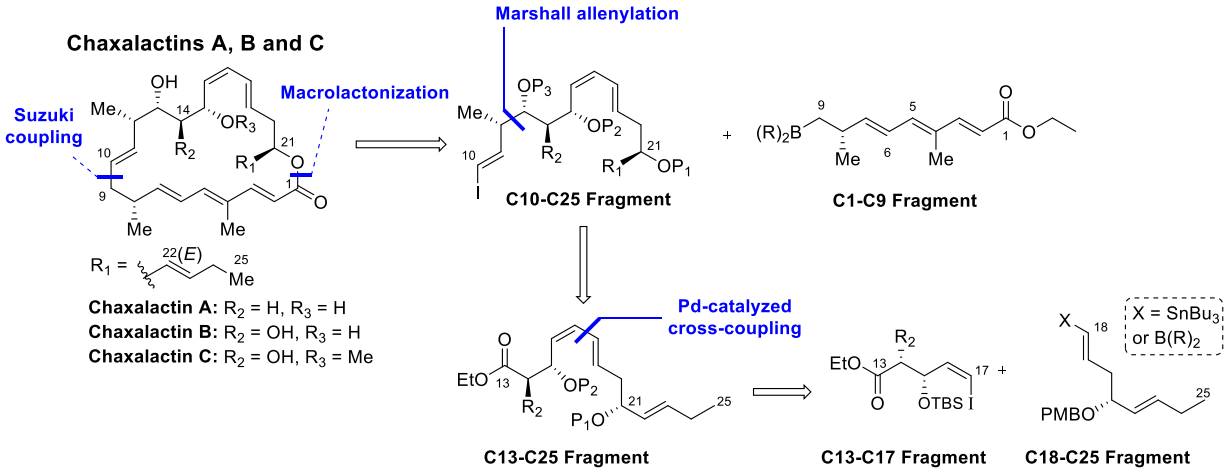
Optimized total synthesis of chaxalactin B and progress toward the synthesis of chaxalactin A

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Chaxalactins A, B and C are 22-membered macrolactones first isolated in 2011 from *Streptomyces sp. C34*, a strain collected in the hyper-arid Atacama Desert.[1] Their structural complexity combined with notable antibiotic and potential antitumor activities make them highly attractive targets, though synthetically challenging. Despite their interest, no total synthesis of these natural products has been reported so far. This project aims to achieve the first total synthesis of chaxalactins A, B, and C, as well as related analogues. The proposed synthetic strategy involves a **Suzuki coupling** between the C1-C9 and C10-C25 fragments, followed by a **macrolactonization** reaction. The C10-C25 fragment could be prepared from the C13-C25 fragment using a Marshall allenylation key step, in order to introduce and control the C12, C13 stereocenters. The C13-C25 fragment could in turn be obtained by a Pd-catalyzed cross-coupling between the C13-C17 and C18-C25 fragments.



Scheme 3 : Retrosynthetic analysis of chaxalactins

In this communication, our journey toward the total synthesis of the chaxalactin B will be reported, highlighting key optimizations, such as the evaluation of several cross-couplings for the formation of the C13-C25 fragment. Our ongoing synthetic efforts towards the total synthesis of the chaxalactin A will also be presented.

[1] M. E. Rateb, W. E. Houssen, W. T. A. Harrison, H. Deng, C. K. Okoro, J. A. Asenjo, B. A. Andrews, A. T. Bull, M. Goodfellow, R. Ebel, M. Jaspars, Diverse Metabolic Profiles of a Streptomyces Strain Isolated from a Hyper-arid Environment *J. Nat. Prod.* 2011, 74, 1965.

P A094

Steric and electronic properties of highly hindered tertiary phosphines derived from triptycene scaffold

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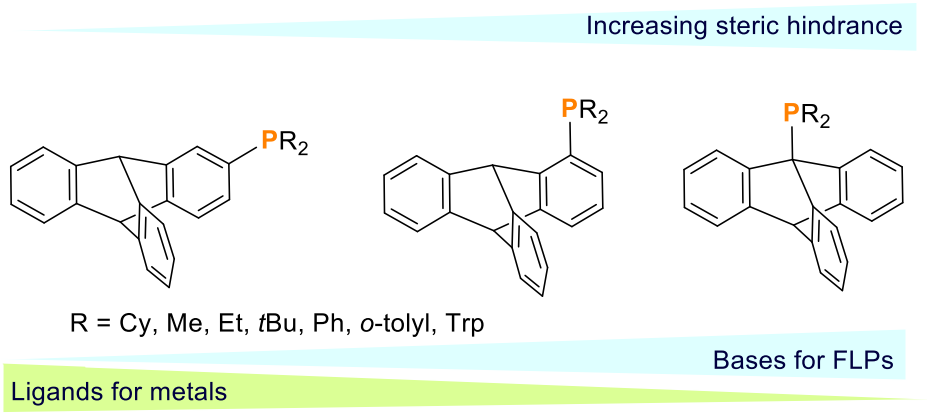
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Tertiary phosphines are versatile organic compounds with multiple applications as reducing agents, nucleophilic agents, Lewis bases and ligands for transition-metals.[1] One of the most widespread applications in organometallic chemistry is the use of phosphine as a ligand for metal-mediated organic transformations such as cross-couplings, hydrogenation, ect.[2] Highly hindered tertiary phosphines based on a triptycene scaffold represent a unique class of ligands with distinct steric and electronic properties. The triptycene framework, known for its rigid three-dimensional structure, imparts significant steric hindrance around the phosphine centre, which can stabilise reactive intermediates and control catalytic activity.[3]

The steric environment provided by the barrelene structure facilitates the tailoring of the electronic properties of the phosphorus atom, making them advantageous for use in transition metal catalysis. This poster will focus on the synthesis, characterisation and applications of 1-, 2- and 9-triptycenyl phosphines as ligands for metals and frustrated Lewis pairs (FLPs) for hydrogenation reactions.[4,5] Their size, Lewis and Brøndsted basicity as well as computed structures will be evaluated by quantum-chemical chemistry.



[1] Melen, R. *Science* **2019**, *363*, 479–484.
[2] Simin, W.; Haifeng, D. *J. Am. Chem. Soc.* **2014**, *136*, 12261–12264.
[3] Lyons, T. W.; Bézier, D.; Brookhart, M. *Organometallics* **2015**, *34*, 4058–4062.
[4] Stephan, D. W. *J. Am. Chem. Soc.* **2021**, *143*, 20002–20014.
[5] Willems, A.; Gama, M.; Hu, L.; Tumanov, N.; Wouters, J.; Robiette; R.; Berionni, G. unpublished work.

P A095

Diazapentalene, a promising unstudied heterocyclic scaffold: synthesis and energetic application

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Among organic energetic materials, nitrogen-rich heterocycles containing two or more rings gave rise of a unique class of large conjugated structures. For example, DNPP (3,6-Dinitropyrazolo[4,3-c]pyrazole)[1] or TATOT (3,6,7-Triamino[1,2,4]triazolo[4,3-b][1,24]triazole)[2], [5-5]-bicyclic heterocycle-fused compounds, were described as energetic applications. In our laboratories, triazapentalene compounds studies have highlighted an original structure and a mesoionic character, as well as interesting properties for energetics applications[3].

The diazapentalene scaffold is another [5-5]-biheterocyclic system connected by two nitrogen atoms (Figure 1) with a mesoionic character, which is also promising because of its interesting properties and an attractive carbon/nitrogen ratio for energetics applications. This original structure was described by Trofimenko[4,5] in 1965. Very few papers have been studying the synthesis and reactivity of 3a-6a-diazapentalene compounds. They were described as low chemical stability derivatives and needed tedious isolation.

Recently, we have developed an efficient approach in three steps for the synthesis of stable functionalized diazapentalenes. Then, we studied reactivity with an aromatic electrophile substitution. This raises new prospects for the development of this underexploited class of compounds.

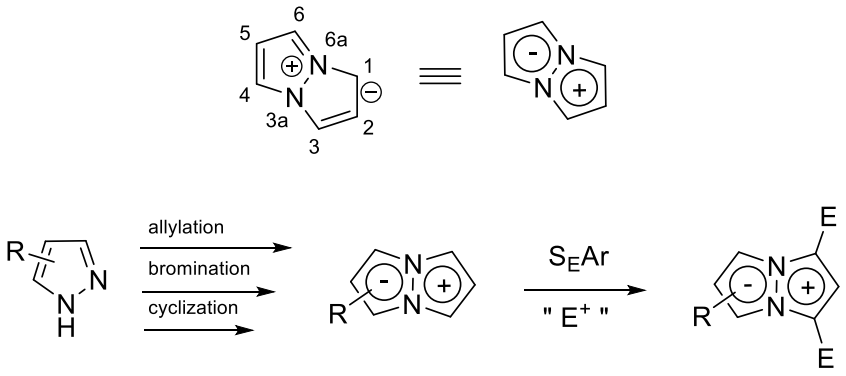


Figure 9 : Structure, synthesis and reactivity of diazapentalenes

[1] J. Zhang, D. A. Parrish, J. M. Shreeve, *Chem. Asian J*. 2014, 9, 2953-296.
[2] T.M. Klapötke, P.C. Schmid, S. Schnell, and J. Stierstorfer, *Chem. Eur. J*. 2015, 21, 9219-9228
[3] C. Nyffenegger, E. Pasquinet, F. Suzenet, D. Poullain, G. Guillaumet, *Synlett*, 2009, 1318-1320
[4] S. Trofimenko and all, US3431275A, 1965
[5] S. Trofimenko, *J. Am. Chem. Soc*. 1966, 88:23

P A096

Electrochemical induced Alkynylation of Alkyl boronate compounds

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Over the last years, electrochemically-induced reactions have emerged as a powerful tool for initiating various organic transformations under mild conditions,[1] and thus gained significance in the field of sustainable chemistry.[2] Indeed, they provide a clean and traceless energy source to notably induce the formation of C–C bonds. Nevertheless, the use of this versatile energy source has been hampered in the chemical industry mainly due to its limited scale-up potential.[3] In recent years, great progress has been made with regard to electrochemical continuous processes using microreactor technology.[4]

For many years our group has shown interest in electrosynthesis processes,[5] hence we have developed a protocol for the direct electrochemical mediated alkynylation of readily available activated alkyl boronates by using acetylenic sulfones as alkynylating reagents. The alkynylation under transition metal- and oxidant-free conditions give the desired products in moderate to good yields under ambient conditions. Interestingly, significant acceleration rates, productivity as well as reduced energy consumption were achieved under microfluidic conditions.



[1] (a) Yan, M.; Kawamata, Y.; Baran, P. S. Synthetic Organic Electrochemical Methods Since 2000: On the Verge of a Renaissance. *Chem. Rev.* **2017**, *117*, 13230–13319. (b) Pollok, D.; Waldvogel, S. R. Electro-Organic Synthesis – a 21stCentury Technique. *Chem. Sci.* **2020**, *11*, 12386–12400. (c) Zhu, C.; Ang, N. W. J.; Meyer, T. H.; Qiu, Y.; Ackermann, L. Organic Electrochemistry: Molecular Syntheses with Potential. *ACS Cent. Sci.* **2021**, *7*, 415–431.

[2] (a) Cembellín, S.; Batanero, B. Organic Electrosynthesis Towards Sustainability: Fundamentals and Greener Methodologies. *The Chemical Record* **2021**, *21*, 2453–2471. (b) Horn, E. J.; Rosen, B. R.; Baran, P. S. Synthetic Organic Electrochemistry: An Enabling and Innately Sustainable Method. *ACS Cent. Sci.* **2016**, *2*, 302–308.

[3] Cardoso, D. S. P.; Šljukić, B.; Santos, D. M. F.; Sequeira, C. A. C. Organic Electrosynthesis: From Laboratorial Practice to Industrial Applications. *Org. Process Res. Dev.* **2017**, *21*, 1213–1226.

[4] (a) Gütz, C.; Stenglein, A.; Waldvogel, S. R. Highly Modular Flow Cell for Electroorganic Synthesis. *Org. Process Res. Dev.* **2017**, *21*, 771–778. (b) Capaldo, L.; Wen, Z.; Noël, T. A Field Guide to Flow Chemistry for Synthetic Organic Chemists. *Chem. Sci.* **2023**, *14*, 4230–4247.

[5] (a) Leclercq, E.; Moncomble, A.; Debavelaere, C.; Beaucamp, M.; Penhoat, M.; Chausset-Boissarie, L. Electrolyte-Free Electrochemical C–H Trifluoromethylation of 2-Pyridones under Batch and Flow Conditions. *Green Chem.* **2022**, *24*, 7388–7394. (b) Déjardin, C.; Renou, A.; Maddaluno, J.; Durandetti, M. Nickel-Catalyzed Electrochemical Cyclization of Alkynyl Aryl Iodide and the Domino Reaction with Aldehydes. *J. Org. Chem.* **2021**, *86*, 8882–8890.

P A097

Synthesis of Sulfinamidines via Rhodium–Catalyzed Asymmetric Imidation of Sulfenamides

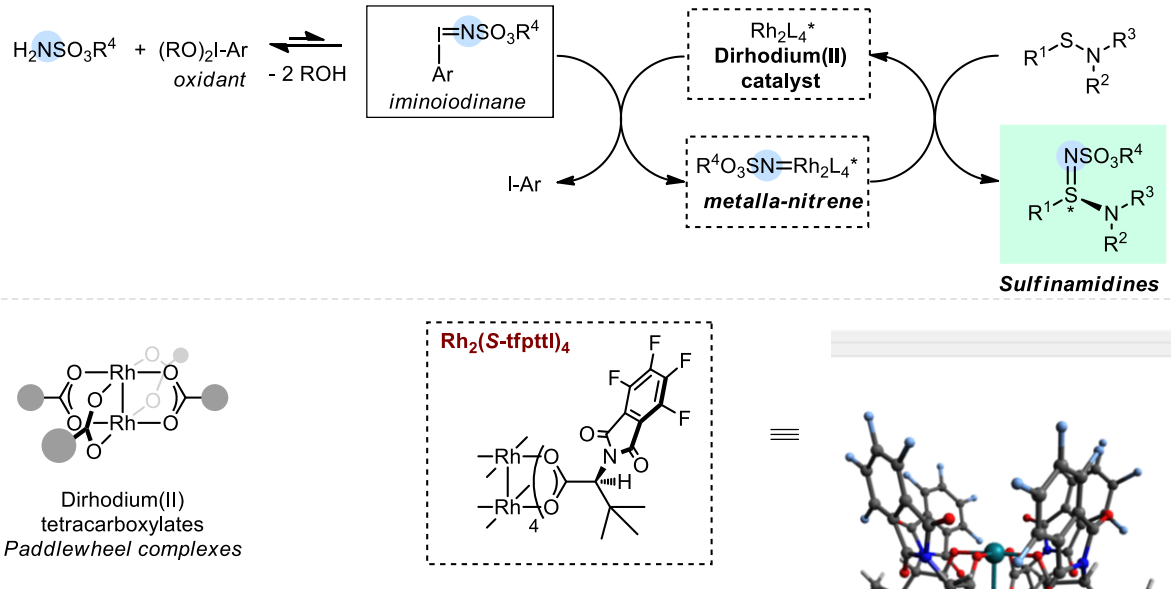
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The asymmetric preparation of chiral S(IV)- and S(VI)-compounds is a topic of interest due to their increasing use as pharmacophores in drug discovery.[1] Among these sulfur derivatives, sulfinamidines recently emerged as new promising chiral S(IV)-candidates in terms of molecular diversity and complexity.[2,3] However, their asymmetric synthesis remains an issue to address, with the sole existing method requiring stoichiometric amounts of a camphor-derived chiral reagent.[4] In this communication, we will discuss the first catalytic asymmetric synthesis of sulfinamidines. The reaction relies on the use of a chiral dirhodium(II) complex that catalyzes the imidation of sulfenamides using a sulfamate as the nitrene source in the presence of an iodine(III) oxidant. This method enables the preparation of *N*,*N*-bisalkyl sulfinamidines with yields of up to 98% and enantiomeric ratios of up to 98:2. Furthermore, the oxidation of the enantioenriched products to sulfonimidamides proved to be stereospecific.



Acknowledgement: The project has received funding from the French National Research Agency (programs n° ANR-23-CE07-0042-02) and the European Union's Horizon Europe research and innovation program under the Marie Skłodowska-Curie Action (MSCA) Postdoctoral Fellowship Rhod-to-N, grant agreement ID: 101203754.

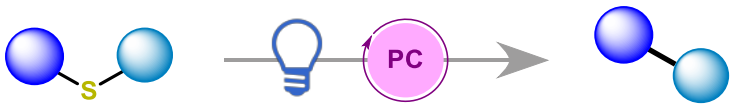
[1] Tilby, M. J.; Willis, M. C. *Expert Opin. Drug Discov.* **2021**, *16* (11), 1227–1231.
[2] Andresini, M.; Carret, S.; Degennaro, L.; Ciriaco, F.; Poisson, J.; Luisi, R. *Chem. Eur. J.* **2022**, *28* (59), e202202066.
[3] Andresini, M.; Colella, M.; Degennaro, L.; Luisi, R. *Org. Biomol. Chem.* **2023**, *21* (38), 7681–7690.
[4] Fimm, M.; Saito, F. *Angew. Chem. Int. Ed.* **2024**, *63* (35), e202408380.

P A098

Desulfurization of Thioethers by Photocatalysis

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Molecular editing is currently a trending topic in synthetic methodology, and for good reason: it allows for the precise modification of a specific moiety in a complex carbon skeleton, in a way that is highly intuitive for the conception of synthetic pathways towards complex targets.[1] In particular, single-heteroatom deletion reactions are an effective tool to forge a C–C bond starting from compounds bearing a nitrogen and an oxygen atom, for instance.[2] While major advances have also been made using thioethers,[3] most of the developments are restricted to $C(sp^2)$–$C(sp^2)$ bond formation, with only sporadic examples in the case of $C(sp^3)$ centers.[4] In this context, we have developed an approach based on photocatalysis for the single-atom deletion of sulfur in R^1SR^2 derivatives.[5]



[1] Jurczyk, J.; Woo, J.; Kim, S. F.; Dherange, B. D.; Sarpong, R.; Levin, M. D. Single-Atom Logic for Heterocycle Editing. *Nat. Synth* **2022**, *1*, 352–364.
[2] Shimazumi, R.; Tobisu, M. Unimolecular Fragment Coupling: A New Bond-Forming Methodology via the Deletion of Atom(s). *JACS Au* **2024**, *4*, 1676–1695.
[3] Zhou, J.; Liu, R. Y. Ni-Catalyzed Reductive Ring Contraction via Desulfurative Cross-Coupling. *J. Am. Chem. Soc.* **2025**, *147*, 25841–25850.
[4] Corey, E. J.; Block, E. Sulfur-Bridged Carbocycles. II. Extrusion of the Sulfur Bridge. *J. Org. Chem.* **1969**, *34*, 1233–1240.
[5] Meunier, E.; Ruzhylo, I.; Besset, T. *Unpublished results.*

P A099

Haloaminocyclopropanes as Precursors of Natural Product-like Polycyclic Compounds

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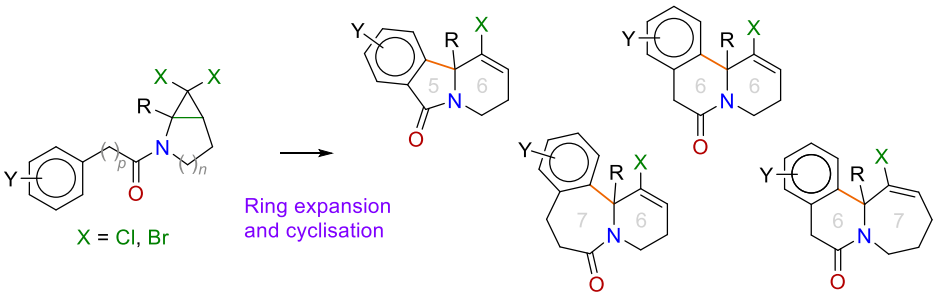
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The transformation of *N*-halocyclopropanes into allylcations has been known for over 60 years. It proceeds by an electrocyclic ring-opening mechanism, with concurrent departure of the halide leaving group.[1] Although a number of applications have been developed with *gem*-dihalocyclopropane substrates, very few involve the creation of carbon-carbon bonds.[2]

In line with our long-standing interest in the chemistry of aminocyclopropane derivatives, we explored the generation of acyliminium species from bicyclic *N*-(2,2-dihalocyclopropyl)amides fitted with a remote electron-rich aromatic group, as well as the conditions required for subsequent cyclisation.[3]



The present contribution will describe the synthesis of the substrates and the results of our efforts aimed at performing the desired ring expansion/cyclisation sequence.

[1] a) Woodward, R. B.; Hoffmann, R. Stereochemistry of Electrocyclic Reactions. *J. Am. Chem. Soc.* **1965**, *87*, 395-397; b) DePuy, C. H.; Schnack, L. G.; Hausser, J. W.; W. Wiedemann, W. Chemistry of Cyclopropanols. III. The Mechanism of the Solvolysis of Cyclopropyl Tosylates. *J. Am. Chem. Soc.* **1965**, *87*, 4006-4006; c) Cristol, S. J.; Sequeira, R. M.; DePuy, C. H. Bridged Polycyclic Compounds. XXXI. Stereochemical Aspects of the Solvolysis of Cyclopropyl Chlorides. *J. Am. Chem. Soc.* **1965**, *87*, 4007-4008.

[2] Selected articles: a) Gassman, P. G.; Tan, L.; Hoye, T. R. Intramolecular Cationic Cyclizations Initiated by Electrocyclic Cleavage of Cyclopropanes. Synthesis of Trienic Cyclopentane Derivatives. *Tetrahedron Lett.* **1996**, *37*, 439-442; b) Grant, T. N.; West, F. G. Interrupted Nazarov Reactions Using Dichlorocyclopropanes: A Novel Mode of Arene Trapping. *Org. Lett*. **2007**, *9*, 3789-3792; c) Kazakovaa, A. N.; Spirikhin, L. V.; Zlotskii, S. S. Alkylation of Benzene and Toluene with Chloromethyl-gemdichlorocyclopropanes. *Pet. Chem.* **2012**, *52*, 123-125.

[3] Šlachtová, V.; Casaretto, N.; Brulíková, L.; Six, Y. Bicyclic N-dihalocyclopropylamide derivatives as precursors of nitrogen-containing fused polycyclic systems. *Org. Biomol. Chem.* **2023**, *21*, 6325-6341.

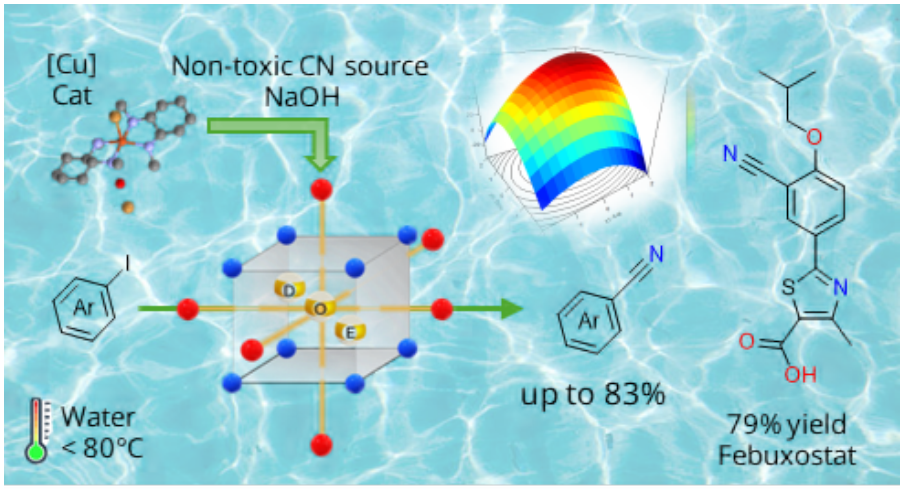
P A100

Design of Experiment (DoE) Based Optimization Applied to a Copper-Catalyzed Cyanation of Aryl Halides in Water

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The cyanation of aryl halides holds significant practical value, as aromatic nitriles serve as crucial intermediates in the synthesis of pharmaceuticals, perfumes, and dyes, among other fine chemicals. Pioneering work by Beller et al. introduced the non-toxic and cost-effective potassium hexacyanoferrate(II) as a safer cyanide source,[1] although these reactions typically operated in volatile organic solvents like toluene, dioxane, or N-methyl-2- pyrrolidinone (NMP).
By applying Response Surface Methodology (RSM)—a statistical optimization technique based on Design of Experiments (DoE) that models the relationships between multiple input variables (e.g., temperature, solvent, catalyst, concentration) and the desired response (e.g., yield)—we successfully identified mild reaction conditions for cyanation in water below 80°C. Using a non-toxic cyanide source, we discovered a novel copper complex capable of catalyzing the cyanation of iodo-aryls with a 7 mol% loading. The method's applicability was demonstrated through the synthesis of a broad range of aryl nitriles and the FDA-approved drug Febuxostat, achieving a 79% yield under significantly milder conditions compared to previously reported protocols.[2]



[1] T. Schareina et al. *J. Organomet. Chem.* **2004**, 689, 4576
[2] Brugemann, K. et al. *ACS Sustainable Chem. Eng.* (**2025**) 13, 12232–12241.

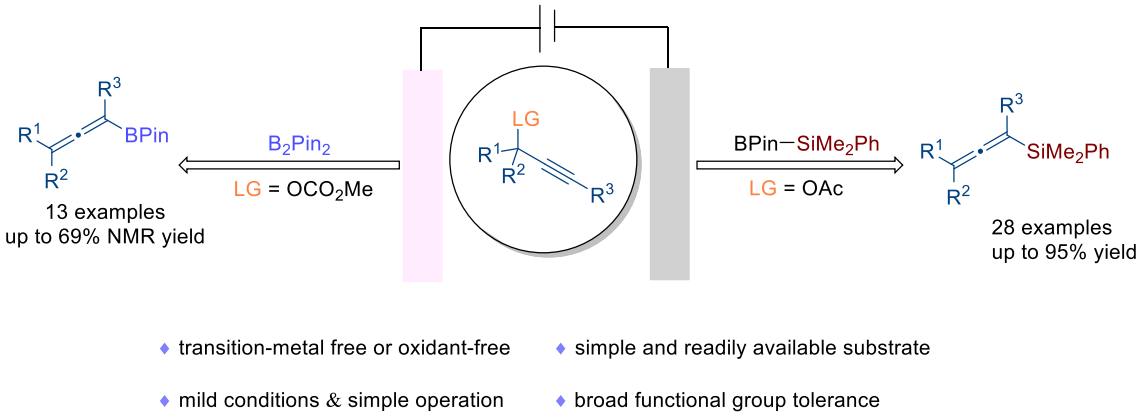
P A101

Electrochemical Synthesis of Allenyl Silanes and Allenyl Boronic Esters

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Allenyl silanes and boronates are pivotal building blocks in organic synthesis.[1,2] Nevertheless, their synthesis requires the manipulation of transition metal or highly reactive species. Hence, the development of more sustainable protocol is highly sought after. Here we show the electrochemical synthesis of allenyl silanes and allenyl boronic esters. This catalyst-free method proceeds under mild reaction conditions. The protocol for the synthesis of allenyl silanes shows an excellent efficiency and a good functional group tolerance. The allenyl silanes are isolated in good yields (28 examples, 45–95% yields) without the use of a transition metal catalyst and under mild reaction conditions. A similar protocol is developed for the synthesis of allenyl boronates, which are obtained in low to moderate yields (13 examples, 5–55% yields). Finally, a mechanism based on an oxidative generation of the silyl and boryl radicals is suggested to access these classes of allenes.

Figure 1. Electrochemical Synthesis of Allenyl Silanes and Allenyl Boronic Esters[3]



[1] Masse, C. E.; Panek, J. S. Diastereoselective reactions of chiral allyl and allenyl silanes with activated C=X bonds. *Chem. Rev*. **1995**, *95*, 1293-1316.

[2] (a) Yamashita, Y., Cui, Y., Xie, P.; Kobayashi, S. Zinc amide catalyzed regioselective allenylation and propargylation of ketones with allenyl boronate. *Org. Lett*. **2015**, *17*, 6042-6045. (b) Huang, A., Chakrabarti, N., Morita, U., Schneider, S.; Kobayashi, A. Catalytic asymmetric borono variant of Hosomi–Sakurai reactions with N,O-aminals. *Angew. Chem. Int. Ed*. **2011**, *50*, 11121-11124. (c) Wu, H., Haeffner, F.; Hoveyda, A. H. An efficient, practical, and enantioselective method for synthesis of homoallenylamides catalyzed by an aminoalcohol-derived, boron-based catalyst. *J. Am. Chem. Soc*. **2014**, *136*, 3780–3783.

[3] (a) Feng, T. T.; Biremond, T.; Jubault, P.; Poisson, T. Electrochemical synthesis of allenyl silanes and allenyl boronic esters. *Nat Commun.* **2025**, *16*, 4593; (b) Aelterman, M., Biremond, T., Jubault, P. Poisson, T. Electrochemical synthesis of *gem*-difluoro- and *γ*-fluoro-allyl boronates and silanes. *Chem. Eur. J*. **2022**, *28*, e202202194; (c) Aelterman, M., Sayes, M., Jubault, P. Poisson, T. Electrochemical hydroboration of alkynes. *Chem. Eur. J*. **2021**, *27*, 8277-8282; (d) Biremond, T., Jubault, P. Poisson, T. Electrochemical hydrosilylation of alkynes. *ACS Org. Inorg. Au*. **2022**, *2*, 148-152.

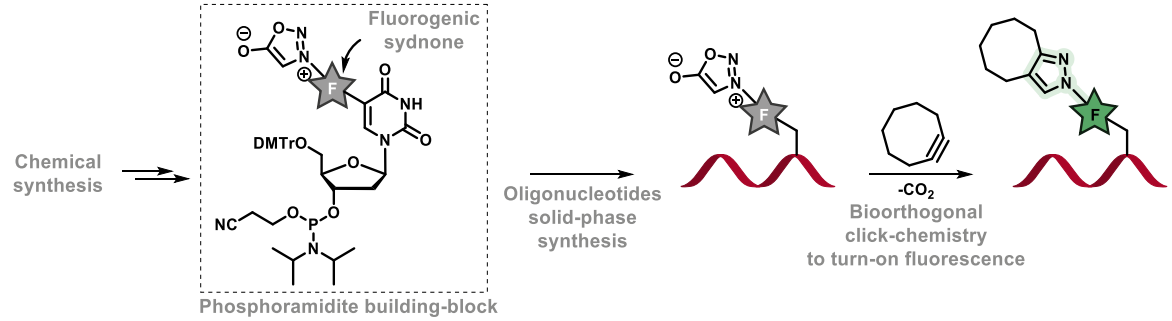
P A102

Bioorthogonal click-chemistry for on-demand fluorescence imaging of oligonucleotides

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Oligonucleotides (ON) are able to specifically target cellular nucleic acids of interest by complementary base-pairing interactions. As such, they are undergoing extensive developpement in both chemical biology and the parmaceutical industry. The exponentially growing interest in therapeutic ON is evidenced by the FDA approval of more than 20 different sequences, many within the past five years. Despite their success, ON still suffer from a limited biodistribution and an inefficient delivery to and within cells.[1] In this framework, gathering crucial informations (*e.g.* cellular uptake kinetics, intracellular trafficking) is pivotal to further optimize their properties and envision the next-generation ON-based therapeutics. Thus, on-demand imaging strategies that are compatible in cells and with high specificity and minimal background interference are of great interest.

In this project, we are focusing our efforts toward a fluorescence imaging strategy of ON based on bioorthogonal click-chemistry. To broaden the limited number of phosphoramidite building blocks featuring a compatible bioorthogonal anchor, we studied the strain-promoted sydnone-alkyne cycloaddition (SPSAC). The latter offers fast kinetics in mild conditions and already proved successful for *in vivo* applications. We firstly synthetized novel phosphoramidite building blocks incorporating a sydnone handle at various positions (nucleobase, ribose, phosphorous) and demonstrated –for the first time– the compatibility of the sydnone moiety in oligonucleotides solid-phase synthesis.[2] Then, with the aim to develop a fine-tuned imaging strategy without background interference, we designed fluorogenic arylstyrylsydnone-based nucleosides analogs. Incorporation proved efficient and fast turn-on kinetics could be measured when using a non-fluorescent cyclooctyne counterpart. Live cells experiments are on going to evaluate compatibility, efficiency and specificity of this turn-on imaging strategy, holding the potential to contribute positively to the developpements of next-generation oligonucleotides therapeutics.



[1] A. Khvorova, *et al.* RNAi-based drug design: considerations and future directions, *Nat. Rev. Drug Discov.* **2024**, *23*, 341-364
[2] A. Bristiel, *et al.* 2'-Modified Thymidines with Bioorthogonal Cyclopropene or Sydnone as Building Blocks for Copper-Free Postsynthetic Functionalization of Chemically Synthesized Oligonucleotides, *Bioconjugate Chem.* **2023**, *34*, 1613-1621

P A103

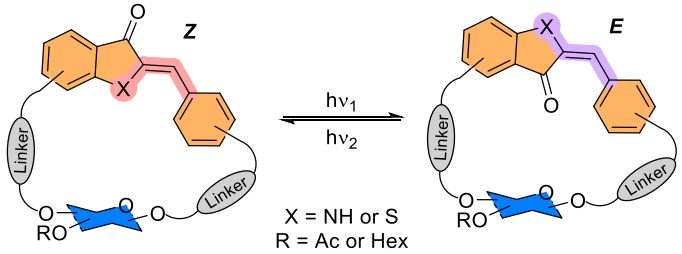
Synthesis and Photoswitching Properties of Indigoïds Functionalized Carbohydrates

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Light is a versatile stimulus that enables precise control of molecular behavior with high spatial and temporal resolution. Among the various strategies to harness light in chemistry, photoswitchable compounds can reversibly switch between two or more forms upon light irradiation. This enables precise and controlled usage, making them highly relevant for applications in biomedical and material sciences. Through chemical modulation, their properties can be finely tuned for specific purposes.[1]

Sugars, being optically transparent, offer key advantages for enhancing the properties of photochromic compounds, such as chirality and tunable solubility, without compromising the photophysical properties of the system. Several photochromic carbohydrate conjugates have been synthesized, most of them incorporating azobenzene, a well-known photochrome that undergoes *E*/*Z* isomerization of its N=N double bond upon light irradiation.[2] The challenging synthesis of photoswitchable glycomacrocycles has been undertaken by Despras, Xie and their coworkers, who successfully synthesized diverse azobenzene-based glycomacrocycles.[3,4]

Following this work, we report the design and synthesis of a series of glycomacrocycles based on a less common family of visible-light tunable photochromes, indigoïds. It is to be noted that indigoïd based glycomacrocycle has never been reported in the literature. The synthesis and photoswitching properties, will be presented (**Scheme 1**).



Scheme 4. *Reversible photoisomerization of indigoïd based glycomacrocycle.*

[1] Zhang, Z.; Wang, W.; O'Hagan, M.; Dai, J.; Zhang, J.; Tian, H. Stepping Out of the Blue: From Visible to Near-IR Triggered Photoswitches. *Angew Chem Int Ed* **2022**, *61* (31), e202205758.
[2] Despras, G.; Poonthiyil, V.; Lindhorst, T. K. Photochromic Carbohydrate Conjugates. In *Molecular Photoswitches* [Online]; Pianowski, Z. L., Ed.; Wiley-VCH: Weinheim, Germany, 2022; Vol. 2, Chapter 41. https://onlinelibrary.wiley.com/doi/10.1002/9783527827626.ch41 (accessed July 15, 2025)
[3] Hain, J.; Despras, G. A Two-Step Approach to a Glycoazobenzene Macrocycle with Remarkable Photoswitchable Features. *Chem. Commun.* **2018**, *54* (62), 8563–8566.
[4] Jiao, J.; Maisonneuve, S.; Xie, J. Synthesis and Azobenzene Isomerization Investigation of Photoswitchable Glycomacrocycles. *J. Org. Chem.* **2022**, *87* (13), 8534–8543.

P A104

Preparation of Se(IV) aryltrifluoromethylselenide dichlorides

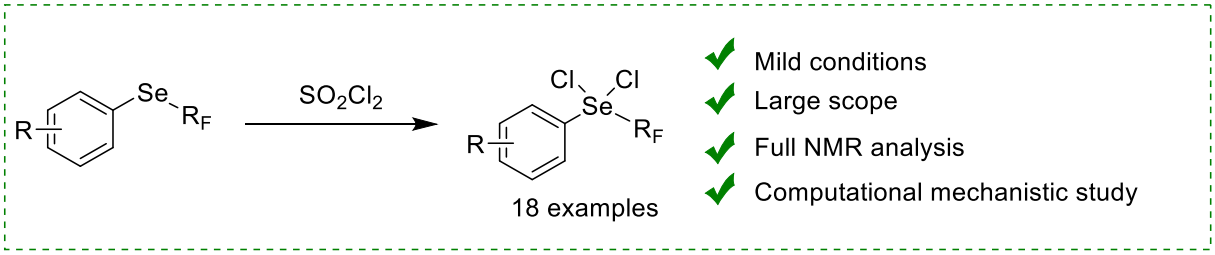
Bruce Pégot,[1] Julien Paut, [1] Gabriel Goujon, [1] Arnaud de Zordo-Banliat, [1] Guillaume Dagousset, [1] Jorge Juan Cabrera-Trujillo, [2] Karinne Miqueu, [2] Emmanuel Magnier[1]

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Trifluoromethylselenide dichlorides[1] are rare selenium(IV) derivatives that have received limited attention despite their potential in organoselenium chemistry.[2] We report a straightforward and efficient synthesis of dichloro(aryl)(trifluoromethyl)-λ^4-selanes ($ArSeCl_2CF_3$) via chlorination of aryl trifluoromethylselenides. After evaluating various chlorinating agents, sulfuryl chloride (SO_2Cl_2) revealed to be very efficient in a broad scope of substrates. Complementary DFT calculations provided mechanistic insight, indicating that chlorination proceeds via an asynchronous concerted mechanism with an accessible activation barrier and is exergonic, readily leading to the formation of Se(IV) fluorinated compounds. In contrast, the formation of the Se(VI) tetra-chlorinated derivative via oxidative addition of Cl_2 to the Se(IV) derivative was found to be both kinetically and thermodynamically infeasible.



[1] a) L. M. Yagupolskii, I. I. Maletina, N. V. Kondratenko, V. V. Orda, "A new method of perfluoroalkylation" *Synthesis* **1978**, 835; b) L. M. Yagupolskii, V. G. Voloshchuk, "Aryl trifluoromethyl selenides and aryl(trifluoromethyl)selenium oxides" *Zh. Obshch. Khim.* **1967**, *37*, 1543

[2] a)T. Billard, F. Toulgoat, *When fluorine meets selenium*, in: D. Cahard, J.A. Ma (Eds.), *Emerging Fluorinated Motifs: Synthesis, Properties and Applications*" Wiley, Weinheim, Germany, **2020**, pp. 691; b) A. de Zordo-Banliat, K. Grollier, N. Vanthuyne, S. Floquet, T. Billard, G. Dagousset, B. Pégot, E. Magnier, "Perfluoroalkyl Selenoxides, Selenones and Selenoximines: General Preparation and Properties" *Angew. Chem. Int. Ed.* **2023**, *62*, e20230095.

P A105

Exploring the RNA-Binding Properties of Three Dimensional Cyanines Derived from [2.2]Paracyclophane

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Targeting RNA with small molecules is considered the next frontier in drug discovery. Developing compounds that can bind to RNA structural motifs of low complexity with high affinity and selectivity could significantly expand the range of potential therapeutic targets.

Our group is currently investigating the potential of [2.2]paracyclophane (pCp) [1]
as a building block for designing novel RNA ligands to enhance selectivity in nucleic acid binding.

In a previous study,[2] a pCp-based cyanine was synthesized using a scaffold-hopping approach inspired by established aromatic nucleic acid binders[3] (Figure 1). Shifting from a 'flat' to a 3D molecular architecture led to the development of a fluorogenic ligand capable of differentiating between various nucleic acids (DNA, rRNA, tRNA). Notably, this cyanine derivative exhibited high selectivity for an RNA octa-loop over smaller loop sizes.

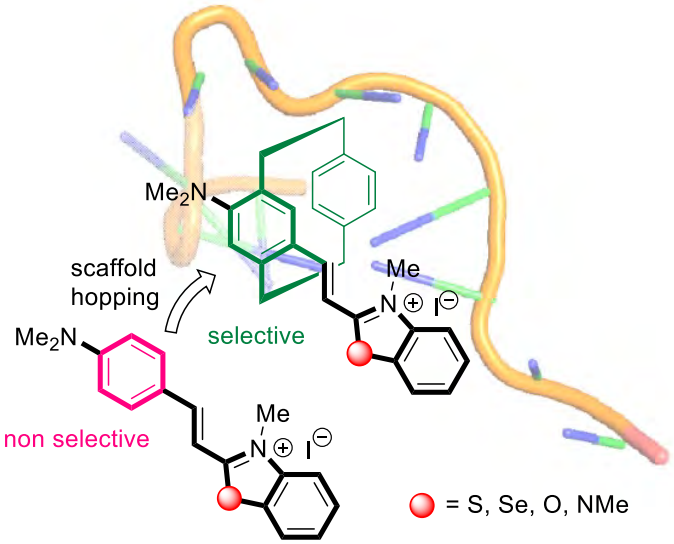


Figure 10. Novel 3D RNA binders

Building on this approach, we synthesized a series of cyanine dyes derived from pCp to establish structure–property relationships, offering valuable insights for designing more selective and effective RNA-targeting ligands. This study demonstrates the strength of the scaffold-hopping strategy in creating selective RNA binders by exploring new chemical spaces. It also emphasizes the potential of non-coplanar aromatic moieties as key motifs for targeting RNA secondary structures with improved selectivity.[4]

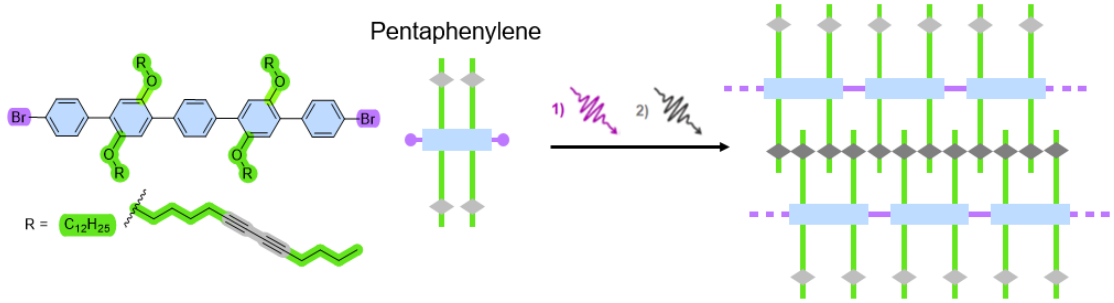
[1] Broadley, J. S.; Robertson, J. M. Structure of Dinitrogen Tetroxide. *Nature* **1949**, *164* (4178), 915–915.
[2] Felder, S.; Sagné, C.; Benedetti, E.; Micouin, L. Small-Molecule 3D Ligand for RNA Recognition: Tuning Selectivity through Scaffold Hopping. *ACS Chem. Biol.* **2022**, *17* (11), 3069–3076.
[3] Sun, H.; Tawa, G.; Wallqvist, A. Classification of Scaffold-Hopping Approaches. *Drug Discovery Today* **2012**, *17* (7–8), 310–324.
[4] Sun, R.; Siretanu, C.; Ilieska, G.; Felder, S.; Benedetti, E.; Micouin, L. *submitted*

P A106

Organic Nanostructures by Self-assembled Photoreticulation

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In the literature, reticulation is mostly triggered by a thermal stimulus whereas the use of a light stimulus is less explored and the few example are done in ultra-high-vacuum conditions.[1] In this context, we aim to stabilize a self-assembled molecular monolayers by on-surface (HOPG, Au (111) …) photo-reticulation in ambient conditions, to obtain functional 2D architectures.



Scheme 5. *Targeted molecule and its expected photo-reticulation.*

Previous results in our lab[2] demonstrated that oligo(para-phenylene) molecular building blocks adequately functionalized with alkoxy chains allow to reach long-range 2D self-assemblies on both HOPG and/or graphene substrates.
These observations led us to target a para-brominated pentaphenylene skeleton bearing four alcoxy-arms functionalized with a diacetylene moiety (**Scheme 1**). Indeed, we expect *in fine* to control two successive photo-reticulations stages under two orthogonal irradiations wavelengths: the first one could occur based on an Ullman coupling[3] (bromine reactivity) and the second one would happen *via* a diacetylene polymerization process.[4]
The retrosynthetic strategies initially proposed will be detailed and the synthesis of this pentaphenylene and of some other derivatives and/or key intermediates will be described, associated with their self-assembly characterization by scanning probe microscopy (STM, AFM …).

[1] Li, R. *et al.*, On-Surface Two-Dimensional Polymerization: Advances, Challenges,and Prospects. *Langmuir* **2023** *39*, 12521−12532.
[2] Zabarova, E. *et al.*, Synthesis of new dithia[3.3]parapara- and metapara-cyclophane based tectons: toward an universal surface-confined 2D/3D molecular binding motif. *Pure and Applied Chemistry* **2016**, *88*, 1005−1025.
[3] Nacci, C. *et al.*, Thermal- vs Light-Induced On-Surface Polymerization. *J. Phys. Chem. C* **2021**, *125*, 22554−22561.
[4] Verstraete, L. *et al.*, Confined polydiacetylene polymerization reactions for programmed length control. *Chem. Commun.* **2017**, *53*, 4207−4210.

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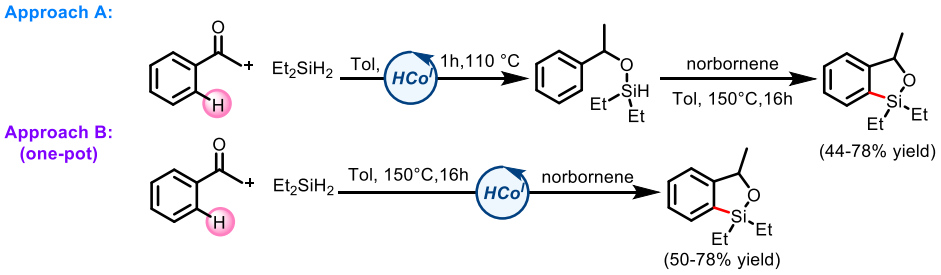
Cobalt-Catalyzed Intramolecular C–H Silylations : Toward Sustainable Access to Silacycles

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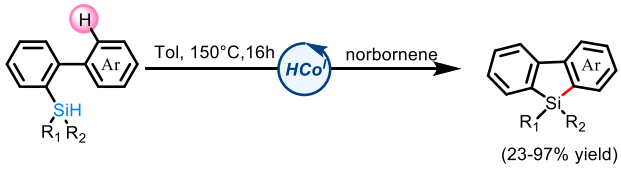
Silacycles are pivotal structural motifs in silicon-based functional molecules with wide-ranging applications in synthetic chemistry, pharmaceuticals and materials science. Developing efficient and sustainable synthetic routes to access these frameworks remains a major challenge. Among the available strategies, transition-metal-catalyzed direct C–H silylation offers a highly atom- and step-economical pathway to construct diverse silacycles. However, current methodologies predominantly rely on noble metal catalysts such as rhodium, iridium, and palladium, limiting their scalability and sustainability. In contrast, earth-abundant first-row transition metals remain underexplored in this context. Cobalt, in particular, has demonstrated promising reactivity in C–H activation and functionalization, making it an attractive alternative.

Building on previous work by Hartwig,[1] Takai,[2] and our own contributions,[3] we report a cobalt-catalyzed intramolecular C–H silylation of ketones (scheme 1a) and biphenyl derivatives (scheme 1b), enabling efficient access to structurally diverse silacycles.[4] This approach offers a sustainable and practical alternative to noble metal-based systems and expands the toolbox of C–H functionalization strategies for organosilicon synthesis.

scheme 1a. Cobalt-catalyzed intramolecular C−H silylations of ketones



scheme 1b. Cobalt-catalyzed intramolecular C−H silylations of biphenyl derivatives



[1] E. M. Simmons, J. F. Hartwig, *J. Am. Chem. Soc.* **2010**, *132*, 17092-17095.
[2] T. Ureshino, T. Yoshida, Y. Kuninobu, K. Takai, *J. Am. Chem. Soc.* **2010**, *132*, 14324-14326.
[3] B. J. Fallon, E. Derat, M. Amatore, C. Aubert, F. Chemla, F. Ferreira, A. Perez-Luna, M. Petit, *J. Am. Chem. Soc.* **2015**, *137*, 2448-2451.
[4] (a) S. C. Richter, M. Oestreich, *Trends in Chemistry* **2020**, *2*, 13-27. (b) J. Niu, Z. Guo, Z. Liu, *Chinese Journal of Organic Chemistry* **2025**, *45*.

P A108

Synthesis of novel iminosugars of therapeutic interest via metal-catalyzed reactions on iminoglycals

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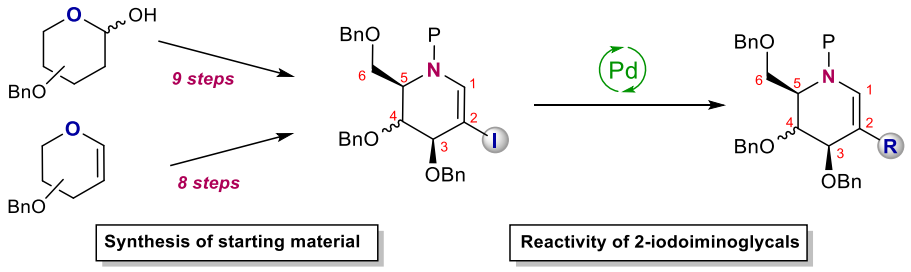
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Glycomimetics are ideal compounds to leverage new diagnostic and therapeutic target opportunities. Amongst glycomimetics, iminosugars, sugars in which the intracyclic oxygen atom has been replaced by a nitrogen atom, constitute one of the most promising classes as illustrated by the FDA approval of three medicines Miglustat, Miglitol and Migalastat to treat diabetes and rare diseases.[1] These molecules usually act as inhibitors of glycosidases and glycosyl transferases by mimicking the oxocarbenium ion character of the transition state, but they can also act by other mechanisms. In order to improve their potency and selectivity, chemical modulation has been pursued on iminosugars, however these modulations were limited at positions that do not impair recognition by carbohydrate processing enzymes, namely intracyclic nitrogen and pseudo-anomeric position (position 1). Encouraging biological data suggests exploring the C2 position further,[2] which has so far remained underexplored, likely due to its low chemical accessibility. Site-selective atom editing of iminosugars' C2 position is the goal of this project through metal-catalyzed reactions on iminoglycals. Considering the abundant chemistry developed on oxygenated 2-iodoglycals to access complex glycosides, in this project we are using 2-iodoiminoglycals as a precursor to expand the chemical space around the C2 position of iminosugars. 2-iodoiminoglycals in glucal, galactal and xylal series have been synthesized through a multistep process using either commercial benzylated pyranoses or glycals, depending on the *N*-protecting group. Subsequently, metal-catalyzed cross coupling aminocarbonylation, phosphonylation, and Suzuki-Miyaura type reactions were carried out on 2-iodoiminoglycals to further functionalize the C2 position.



[1] Horne, G.; Wilson, F. X.; Tinsley, J.; Williams, D. H.; Storer, R. **Iminosugars past, present and future: medicines for tomorrow.** *Drug Discov. Today* **2011**, *16*, 107.

[2] Ashmus, R. A.; Wang, Y.; González-Cuesta, M.; King, D. T.; Tiet, B.; Gilormini, P. A.; García Fernández, J. M.; Ortiz Mellet, C.; Britton, R.; Vocadlo, D. J. **Rational design of cell active C2-modified DGJ analogues for the inhibition of human α-galactosidase A (GALA).** *Org. Biomol. Chem.* **2021**, *19*, 8057–8062.

P A109

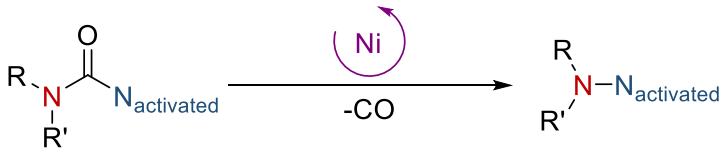
Towards N-N bonds : reductive elimination of Ni complexes

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The formation of N-N bonds is yet a little-known domain. However, it is interesting both from a fundamental and theoretical perspectives. In fact, over 200 natural products and pharmaceuticals products contain N-N bonds[1]. What's more, some polynitrogens compounds are promising for applications in energetic material. In the literature, the known methods are few and with a limited scope. Regarding the organometallic approach, the main developed strategies are oxidative coupling and nitrene transfer.

We propose to find a new way to access N-N bonds by decarbonylating activated ureas with nickel. The idea is to get in depth insights into the elementary steps of the envisioned pathways, i.e , C-N bond oxidative addition, decarbonylation, and N-N bond reductive elimination, by isolating and characterizing the key intermediates. In this context, we are currently focusing on the final reductive elimination step forming the N-N bond, for which we have very little knowledge[2,3].

Several key intermediates featuring Ni-N bonds were prepared through the insertion of Ni(0) into strained diazacycles such as diazetidine and diaziridinone. The complexes were characterized by mass spectrometry, NMR, X-Ray diffraction analysis and cyclic voltammetry.
The synthesis, characterizations as well as some reactivities of the complexes will be exposed.



Ureas : easy to synthesize

Ni favours O.A but R.E is difficult

Step by step study (isolation and characterization of the complexes)

Access to new polynitrogen compounds

[1] Natural Products Containing a Nitrogen–Nitrogen Bond. *J. Nat. Prod.* **2013**, *76* (4), 794–812.
[2] N–N Bond Forming Reductive Elimination via a Mixed-Valent Nickel(II)–Nickel(III) Intermediate. *Angew Chem Int Ed* **2016**, *55* (26), 7534–7538.
[3] Nitrogen–Nitrogen Bond Formation via a Substrate-Bound Anion at a Mononuclear Nickel Platform. *Organometallics* **2018**, *37* (4), 521–525.

P A110

PyrAtes: New generation of modular organic salts with large Stokes shifts for biological imaging

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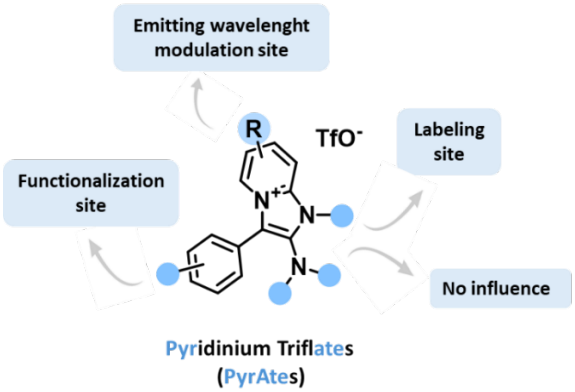
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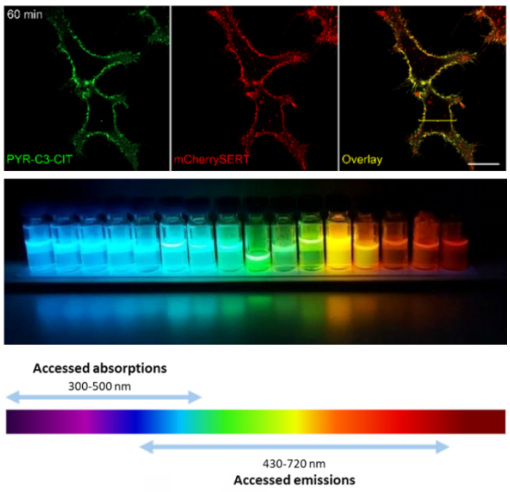
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With the growing interest of optical molecular imaging in medicine, fluorescence microscopy has seen constant development, driving the emergence of new technologies and probes without discontinuity for the past decades. Fluorogenic probes are now considered critical tools for the study of biological environments. Therefore, there is definite interest in creating a new easily tunable chemical scaffold exhibiting fluorescent behavior that could later be used for the design of chemical fluorogenic probes. Our research group recently reported the a-amination of amides through electrophilic activation involving alkyl azides as the aminating reagents.[1] Interestingly, we observed an unexpected reactivity from azides with benzylic amides that led to the serendipitous discovery of highly fluorescent pyridinium triflates, termed PyrAtes. Herein, we present a modular synthetic method from commercially available or easily accessible feedstocks to access a broad library of fluorescent analogues whose photophysical properties were investigated. The first generation of these new fluorophores exhibits original and promising properties in conventional fluorescence: an easy tunable emission, a large Stokes shift, a strong solvatochromism, high chemo- and photostability and biocompatibility.[2,3] Moreover, this new scaffold can be easily modified for the design of novel fluorogenic OFF-ON probes, and the existence of a versatile labeling site enables the conjugation of the PyrAte core to a wide range of bioactive compounds.





[1] D. Kaiser, A. Bauer, M. Lemmerer, N. Maulide, *Chem. Soc. Rev.* **2018**, *47*, 7899–7925.

[2] I. Saridakis, M. Riomet, O. Belleza, G. Coussanes, N. Singer, N. Kastner, Y. Xiao, E. Smith, V. Tona, A. de la Torre, E. Lopes, P. Sánchez-Murcia, L. González, H. Sitte, N. Maulide, *Angew. Chem. Int. Ed.* **2024**, *63*, e202318127

[3] O. Belleza, I. Saridakis, N.Singer, X. Westergaard, S. Armentia Matheu, M. Lemmerer, M. Riomet, P. Sanchez-Murcia, N. Kastner, S. Rukavina, Y. Xiao, K. Jantsch, M. Niello, K. Schicker, D. Sulzer, L. Gonzalez, N. Maulide, H. Sitte, *Chem. Sci.*, **2025**,*16*, 6003-601

P A111

Nickel-catalyzed direct cyanoalkylation of ketones

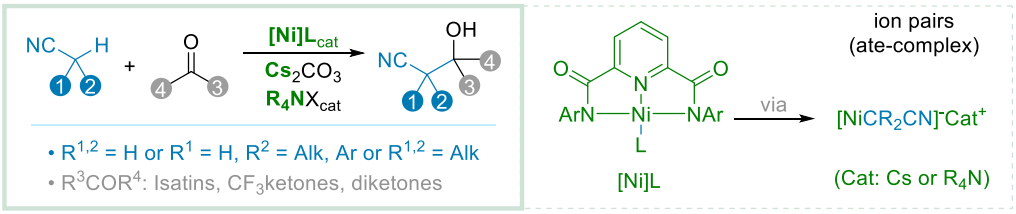
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The β-hydroxynitrile moiety is commonly found in bioactive molecules. Among all the strategies reported to date to obtain this motif, cyanomethylation of carbonyl groups has attracted considerable synthetic efforts.[1] Nevertheless, direct deprotonation of non-activated acetonitrile, which exhibits a high p*K*a value (31.3 in DMSO), usually requires a strong base and raises the question of the functional group tolerance. To overcome this limitation, efficient catalytic Ru, Pd, Cu,[2] and Ni-complexes[3] have enabled the addition of MeCN to various aldehydes and, to a lesser extent, ketones under less basic conditions. However, catalyzed addition of bulkier α-functionalized nitriles R^1R^2CHCN ($R^1 \neq H$, $R^2 = H$ or R^1 and $R^2 \neq H$) to ketones appears to be more challenging.



We are pleased to report on the use of putative ion paired Ni^{II}-based ate-complexes, from readily available pincer type precursors and different preparative protocols, and their use as efficient catalytic species for the cyanoalkylation reaction of a wider range of ketones and nitrile precursors under mild conditions.[4] A mechanistic insight by a computational approach will be tackled as well.

[1] (a) López, R.; Palomo, C. Cyanoalkylation: Alkylnitriles in Catalytic C-C Bond-forming Reactions. *Angew Chem Int Ed* **2015**, *54*, 13170–13184. (b) Kumagai, N.; Shibasaki, M. A Thirst for Enantioselectivity in Catalytic Addition of Alkylnitriles. *Chem. Lett.* **2019**, *48*, 1322–1327.

[2] (a) Kumagai, N.; Matsunaga, S.; Shibasaki, M. Catalytic Nucleophilic Activation of Acetonitrile via a Cooperative Catalysis of Cationic Ru Complex, DBU, and NaPF6. *Tetrahedron* **2007**, *63*, 8598–8608. (b) Wang, G.-W.; Zhou, A.-X.; Wang, J.-J.; Hu, R.-B.; Yang, S.-D. Palladium-Catalyzed Sp^2 and Sp^3 C–H Bond Activation and Addition to Isatin toward 3-Hydroxy-2-Oxindoles. *Org. Lett.* **2013**, *15*, 5270–5273. (c) Deng, T.; Wang, H.; Cai, C. Copper-Catalyzed Asymmetric Addition to Isatins to Give 3-Hydroxy-2-Oxindoles by C–H Activation. *Eur. J. Org. Chem*. **2014**, *2014*, 7259–7264.

[3] (a) Fan, L.; Ozerov, Oleg. V. Efficient Nickel Catalyst for Coupling of Acetonitrile with Aldehydes. *Chem. Commun.* **2005**, 4450. (b) Chakraborty, S.; Patel, Y. J.; Krause, J. A.; Guan, H. A Robust Nickel Catalyst for Cyanomethylation of Aldehydes: Activation of Acetonitrile under Base-free Conditions. *Angew Chem Int Ed* **2013**, *52*, 7523–7526. (c) Smith, J. B.; Miller, A. J. M. Connecting Neutral and Cationic Pathways in Nickel-Catalyzed Insertion of Benzaldehyde into a C–H Bond of Acetonitrile. *Organometallics* **2015**, *34*, 4669–4677. (d) Saito, A.; Adachi, S.; Kumagai, N.; Shibasaki, M. Direct Catalytic Asymmetric Addition of Alkylnitriles to Aldehydes with Designed Nickel–Carbene Complexes. *Angew Chem Int Ed* **2021**, *60*, 8739–8743.

[4] Coffinet, A.; Levacher, V.; Gillaizeau, I.; Brière, J.; Oudeyer, S. Nickel-Catalyzed Cyanoalkylation of Ketone Derivatives. *Adv Synth Catal* **2023**, *365*, 156–160.

P A112

Ligand control allows selective transfer hydrogenation of quinolines through cobalt catalysis

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1,2,3,4-Tetrahydroquinolines represent a common motif in agrochemicals or biologically active targets.[1] Their preparation often lies on heterogeneous hydrogenation reaction from the corresponding *N*-heterocyclic quinolines, although harsh conditions are required and may lack selectivity.[2] Recently, our group recently reported catalytic transfer hydroelementation reactions, that can allow the fine tuning of the quinoline backbone, thus leading to increased molecular complexity, while maintaining mild conditions.[3]

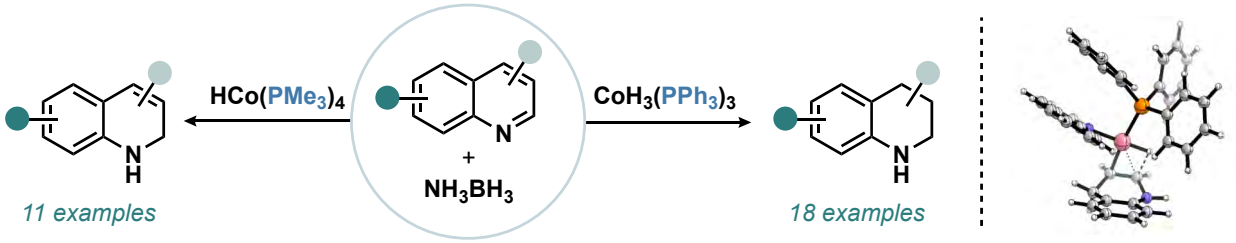


Figure 1: *Selective partial hydrogenation of quinolines using ammonia borane as hydrogen source through cobalt catalysis, and DFT-computed transition state of hydrocobaltation.*

Based on this, we disclose herein a cobalt-catalysed transfer hydrogenation reaction, using ammonia borane (NH_3BH_3) as hydrogen source. Switching the phosphine from triphenyl- to trimethylphosphine allows the partial hydrogenation leading preferentially to 1,2-dihydroquinoline. 18 examples are reported regarding the formation of 1,2,3,4-tetrahydroquinolines, while 11 examples show the selectivity towards 1,2-dihydroquinoline. Mechanistic investigations have been conducted to investigate the two catalytic systems involved. Deuteration, stoichiometric studies, and DFT calculations bring deeper insight into the pathways involved.[4]

[1] I. Muthukrishnan, V. Sridharan, J. C. Menendez, *Chem. Rev*. **2019**, *8*, 5057.

[2] (a) C. C. Bowen, F. C. Koelsch, U.S. Patent, 3322770A, 1967. (b) Y. Ren, Y. Wang, X. Li, Z. Zhang, Q. Chi, *New J. Chem.* **2018**, *42*, 16694.

[3] (a) C. C. Bories, G. Gontard, M. Barbazanges, E. Derat, M. Petit, *Org. Lett.* **2023**, *25,* 843 (b) C.C. Bories, G. Gontard, M. Barbazanges, G. Lemière, M. Petit, *Chem. Eur. J.* **2023**, *29*, e202303178.

[4] *Manuscript in preparation.*

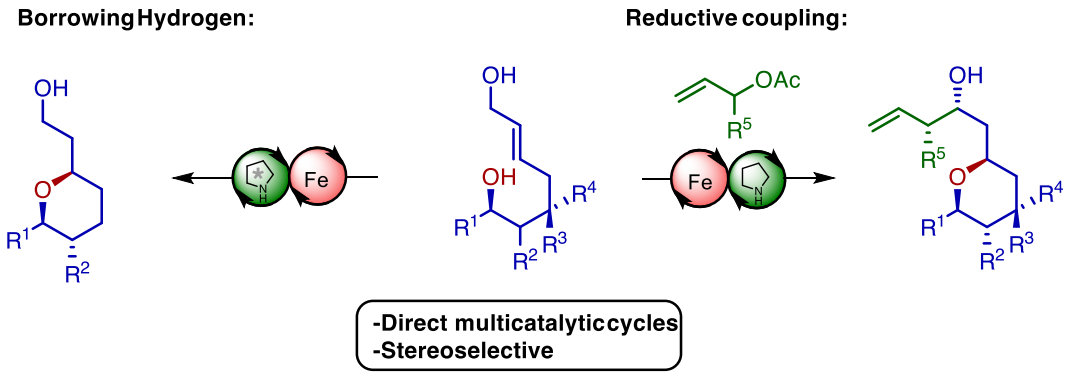
P A113

Constructing complex tetrahydropyrans by stereoselective multicatalytic reactions

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Selectively functionalizing alcohols commonly requires adjusting the oxidation state through several waste-generating oxidation and reduction steps, necessary in order to obtain the desired reactivity at the carbonyl level. In order to bypass these redox steps, several catalytic transformations were invented based on an initial metal-catalyzed dehydrogenation of the alcohol generating the reactive carbonyl compound and a metal-hydride. Upon functionalization of the carbonyl compound, hydrogen back-transfer in a borrowing hydrogen-type catalytic cycle generates the final alcohol. Alternatively, the metal-hydride can insert in a pro-nucleophile such as allylic acetates to generate a reactive organometallic specie condensing with the carbonyl in a Krische-type reductive coupling catalytic cycle.

In our group, we recently took advantage of those two strategies to prepare functionalized chiral tetrahydropyrans through their combination with oxa-Michael additions.[1] The challenge at developing these transformations lied in the selective dehydrogenation of the allylic alcohol and the control of the stereoselectivity over the newly formed stereocenters during the highly reversible oxa-Michael addition. Key to success was the implementation of a multicatalytic strategy merging the metal complexes catalytic cycles (iridium or iron complex), with a secondary amine organocatalysis.



[1] a) A. Alexandridis, A. Quintard, *ACS Catalysis*, **2023**, *13*, 14945; b) G. Quintil, L. Diebold, G. Fadel, J. Pécaut, C. Philouze, M. Clémancey, G. Blondin, R. Bjornsson, A. Quintard, A. Kochem, *ACS Catalysis*, **2024**, *14*, *14,* 7795; c) A. Alexandridis, T. Rancon, A. Kochem, A. Quintard, *Org. Lett.* **2024**, 26, 5788.

P A114

New access to spiroketal enol ether derivatives under relay catalysis

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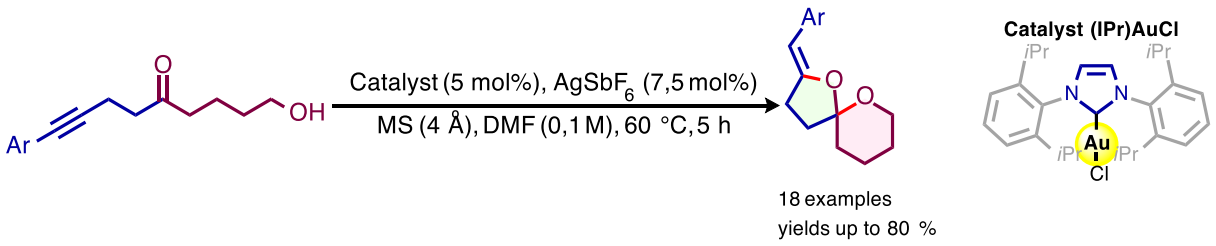
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Many spiroketal chemical compounds are natural molecules and exhibit biological activity[1], with applications in pharmaceutical chemistry. In particular, we are interested in the spiroketal enol ether motif. Despite the high recurrence of this spiroketal enolic ether motif in many natural products and its structural importance with various biological activities, there is no general and simple synthesis method to access it. Indeed, the synthetic approaches described for these compounds involve multi-step sequences and require numerous modifications of functional groups. Furthermore, the stereoselectivity of the double bond formed is not always controlled. In recent years, new methods for forming spiroketals have been developed, based on a trifunctional substrate. [2,3]

In this communication we set out to investigate a new route for the synthesis of compounds containing a spiroketal enol ether motif in a relay reaction sequence with high functional tolerance. This synthesis proceeds in two stages, the formation of a hemiketal intermediate by reaction between a carbonyl function and a hydroxyl group, followed by a 5-*exo*-dig cyclisation with an alkyne function using a gold-linked *N*-heterocyclic carbene unit catalyst. After optimization of reaction conditions, spiroketal enol ether derivatives were isolated in moderate to good yields (up to 80%).



The results of these studies will be presented and discussed in this communication.

[1] Sperry, J.; Wilson, Z. E.; Rathwell, D. C. K.; Brimble, M. A. Isolation, Biological Activity and Synthesis of Benzannulated Spiroketal Natural Products. *Nat. Prod. Rep.* **2010**, *27* (8), 1117–1137. https://doi.org/10.1039/B911514P.

[2] Toshima, H.; Furumoto, Y.; Inamura, S.; Ichihara, A. Synthesis of Spiroacetal Enol Ethers *via* Intramolecular Conjugate Addition of Hemiacetal Alkoxides to Alkynoates. *Tetrahedron Letters* **1996**, *37* (32), 5707–5710. https://doi.org/10.1016/0040-4039(96)01206-3.

[3] Yoneda, N.; Fukata, Y.; Asano, K.; Matsubara, S. Asymmetric Synthesis of Spiroketals with Aminothiourea Catalysts. *Angew Chem Int Ed Engl* **2015**, *54* (51), 15497–15500. https://doi.org/10.1002/anie.201508405.

P A115

Development of a non-viral delivery system for therapeutic nucleic acids in Diffuse Instrinsic Pontine Glioma

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Paediatric cancers are one of the leading causes of death in children. Some paediatric cancers are still incurable, notably diffuse intrinsic pontine glioma (DIPG). DIPG is a tumour with a very poor prognosis, with a median survival of only 9 to 12 months after diagnosis[1]. The diffuse nature of this tumour and its anatomical location within the brain stem make surgery almost impossible, and no chemotherapy has shown any long-term efficacy until now. Today, radiotherapy remains the reference treatment for DIPG, but is not curative. It is therefore essential to find new treatments[1]. Gene therapy is an innovative approach to combating certain genetic diseases and cancers. Two types of vector are traditionally used: viral vectors and non-viral vectors. Although effective, viral vectors have two major drawbacks, which are particularly important in young patients: the risk of provoking immune and/or inflammatory reactions, and the risk of insertional mutagenesis and oncogene activation in the case of retroviruses[2]. Synthetic non-viral vectors are therefore alternative methods for transporting a therapeutic gene into cells. They present fewer immune risks. Previous research has shown that compounds derived from nucleic acids, known as nucleolipids (NL), have a high transfection efficiency[3] thanks to hydrophobic and electrostatic interactions and nucleobase pairing. NLs are bioinspired, biodegradable molecules formed by the covalent bonding of a lipid to a nucleic acid derivative[4] resulting in a structure similar to cell membranes. Previous results of our team highlighted that lipophilic NLs designed as non-viral vectors or prodrugs exhibited greater compatibility with human neuronal cells than their lipid analogues[5]. Given the advantages of this system, our approach proposes to synthesize nucleolipid-based multimeric conjugates (MNLs) as non-viral chemical vectors for nucleic acid delivery.

[1] Capdevielle, C.; Desplat, A.; Charpentier, J.; Sagliocco, F.; Thiebaud, P.; Thézé, N.; Fédou, S.; Hooks, K. B.; Silvestri, R.; Guyonnet-Duperat, V.; Petrel, M.; Raymond, A.-A.; Dupuy, J.-W.; Grosset, C. F.; Hagedorn, M. HDAC Inhibition Induces Expression of Scaffolding Proteins Critical for Tumor Progression in Pediatric Glioma: Focus on EBP50 and IRSp53. *Neuro-Oncology* **2020**, *22* (4), 550–562.

[2] Baylot, V.; Le, T. K.; Taïeb, D.; Rocchi, P.; Colleaux, L. Between Hope and Reality: Treatment of Genetic Diseases through Nucleic Acid-Based Drugs. *Commun Biol* **2024**, *7* (1), 489.

[3] Allain, V.; Bourgaux, C.; Couvreur, P. Self-Assembled Nucleolipids: From Supramolecular Structure to Soft Nucleic Acid and Drug Delivery Devices. *Nucleic Acids Research* **2012**, *40* (5), 1891–1903.

[4] Baillet, J.; Desvergnes, V.; Hamoud, A.; Latxague, L.; Barthélémy, P. Lipid and Nucleic Acid Chemistries: Combining the Best of Both Worlds to Construct Advanced Biomaterials. *Advanced Materials* **2018**, *30* (11), 1705078.

[5] Brouillard, M.; Kinet, R.; Joyeux, M.; Dehay, B.; Crauste-Manciet, S.; Desvergnes, V. Modulating Lysosomal pH through Innovative Multimerized Succinic Acid-Based Nucleolipid Derivatives. *Bioconjugate Chem.* **2023**, *34* (3), 572–580.

P A116

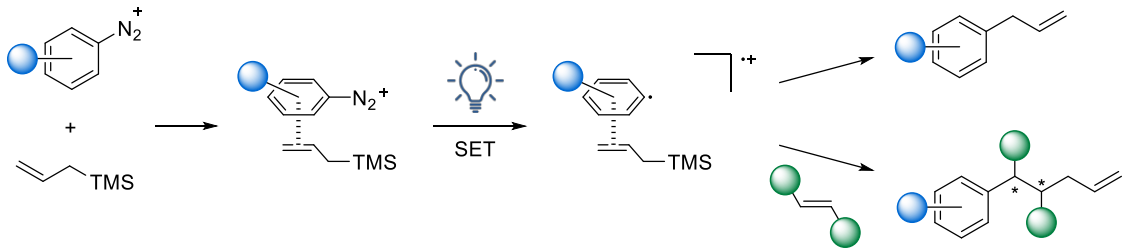
Light-induced three-component radical cascade: synthesis of allylbenzenes and 5-phenyl-pent-1-enes

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During the last decade, photochemistry has gained more and more attention.[1] Among the different photochemical transformations, photoinduced activation of Electron Donor-Acceptor (EDA) complexes is of particular interest as it does not require the presence of an exogenous catalyst to promote electron or energy transfer between the reaction partners.[2] Driven by our interest in this field, we investigated new donor/acceptor pairs, with a particular interest in deciphering the reaction mechanism.[3] Our recent efforts led us to discover the formation of EDA complexes between allylsilanes and diazonium salts which, upon photoactivation, triggers Single Electron Transfer (SET) to liberate the two reactive species. This manifold enabled the smooth and catalyst-free allylation of aryldiazonium salts. This reactivity was further explored in a three-component reaction, affording synthetically valuable 5-phenyl-pent-1-enes from simple building blocks (Scheme 1). The scope of the transformation as well as preliminary mechanistic studies will be presented.



Scheme 1: Reactivity of aryldiazonium-allylsilane EDA complex.

[1] Hoffmann, N. *Chem. Rev*. **2008**, *108*, 1052-1103.

[2] Crisenza, G. E. M.; Mazzarella, D.; Melchiorre, P. *J. Am. Chem. Soc.* **2020**, *142*, 5461-5476.

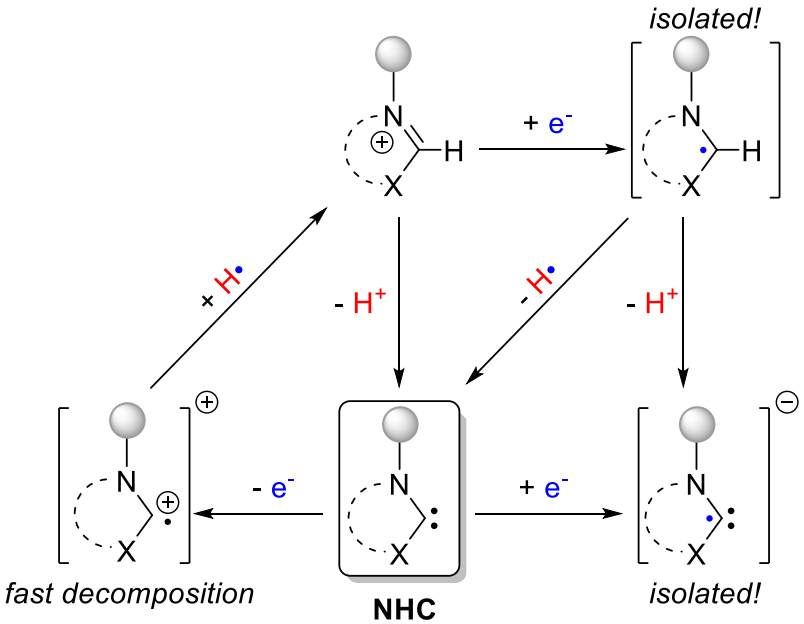
[3] Lapierre, R.; Truong, L.; Hedouin, M.; Oulyadi, H.; Schiavi, B.; Jean, A.; Jubault, P.; Poisson, T. *Org. Chem. Front*. **2024**, *11*, 2231-2240.

P A117

Exploring the redox properties of N-Heterocyclic carbenes

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N-Heterocyclic carbenes (NHCs) have had incredible success as ligands in organometallic chemistry for various applications, such as catalysts, photosensitizers, anti-cancer agents, etc., due to their tuneable electronic and steric properties. Advances in air-free synthesis techniques in the last 50 years have furthermore allowed for the isolation and study of a variety of stable carbenes.[1] Regardless, investigations involving NHCs are primarily focused on their use as covalent organocatalysts. While carbene-centred radicals in transition metal catalysts are well known,[2] the redox properties of free carbenes have been studied largely using transient methods (i.e. radiolysis, flash photolysis) due to the high inherent instability of the reduced or oxidized products.[3] Within the scope of this work, attempts at the observation of a singly oxidized carbene radical cation will be discussed in the context of its possible generation as an intermediate in some reductive NHC organocatalytic radical processes. Furthermore, the isolation and crystallization of the first stable singly reduced carbene radical anion will be examined with a perspective on its reactivity and photochemistry and the reactivity of its main group element adducts.



[1] Hopkinson, M. N.; Richter, C.; Schedler, M.; Glorius, F. An Overview of N-Heterocyclic Carbenes. *Nature* **2014**, *510* (7506), 485–496.
[2] Epping, R. F. J.; Vesseur, D.; Zhou, M.; De Bruin, B. Carbene Radicals in Transition-Metal-Catalyzed Reactions. *ACS Catal.* **2023**, *13* (8), 5428–5448.
[3] Feroci, M.; Chiarotto, I.; Inesi, A. Advances in the Knowledge of N-Heterocyclic Carbenes Properties. The Backing of the Electrochemical Investigation. *Catalysts* **2016**, *6* (11), 178.

P A118

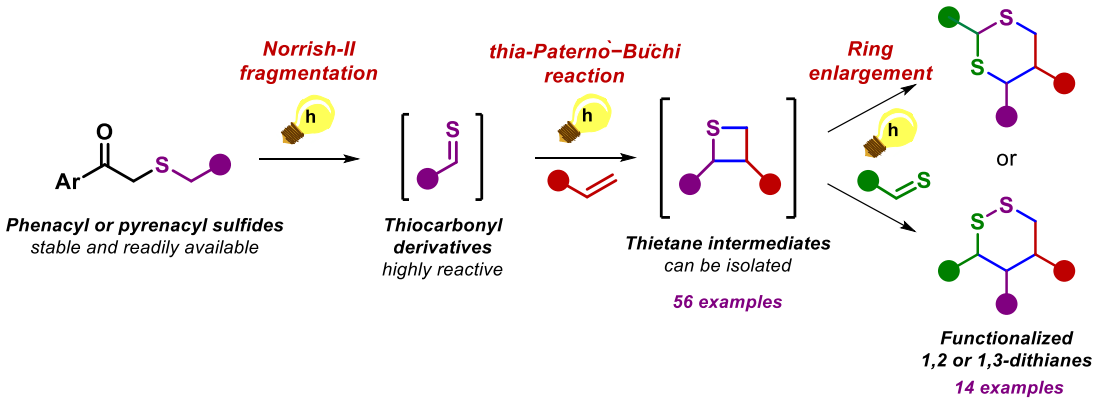
Domino photochemical reactions involving underexploited thiocarbonyl derivatives

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Photochemical reactions constitute powerful tools for the creation of chemical diversity from simple and readily available starting materials.[1] They provide access to complex molecular structures that are difficult to obtain using other methodologies.[2] These transformations induced by light absorption are attractive in the context of sustainable development and they can address this challenge more efficiently when they are incorporated in multiple bond-forming transformation processes, such as domino reactions.[3]

In this context, thiocarbonyl compounds have been underexploited due to their high instability and most studies involving these derivatives date from several decades ago.[4] We have therefore recently decided to reinvestigate the photochemistry of these derivatives by generating them in situ through a Norrish-II fragmentation of phenacyl or pyrenacyl sulfides. A library of thietanes was synthesized by combining this approach with a thia-Paternò-Büchi reaction,[5,6] and 1,2-dithianes were selectively prepared though an additional photochemical ring enlargement of the thietane intermediates.[7]



[1] *Photochemical Reactions as Key Steps in Natural Product Synthesis*. Bach, T.; Hehn, J. H. *Angew. Chem. Int. Ed.* **2011**, *50*, 1000-1045.
[2] *Introduction: Photochemistry in Organic Synthesis.* Beeler, A. B. *Chem. Rev.* **2016**, *116*, 9629-9630.
[3] *Light-induced domino and multicomponent reactions: How to reach molecular complexity without a catalyst*. Renzi, P.; Scafiello, J.; Lanfranco, A.; Deagostino, A. *Eur. J. Org. Chem*, ***2023**, 26, e202300713*.
[4] (a) *The photochemistry of thiocarbonyl compounds.* Coyle, J. D. *Tetrahedron* **1985**, *41*, 5393-5425. (b) *The photophysics, physical photochemistry, and related spectroscopy of thiocarbonyls.* Maciejewski, A.; Steer, R. P. *Chem. Rev.* **1993**, *93*, 67-98.
[5] *Domino Photochemical Norrish-Type-II / thia-Paternò_Büchi Reactions: Access to Thietane Derivatives.* Lapuh, M. I.; Cormier, G.; Chergui, S.; Aitken, D. J.; Boddaert, T. *Org. Lett.* **2022**, *24*, 8375-8380.
[6] *In situ generation of 1-acetylpyrene as a visible-light photocatalyst for the thia-Paternò-Büchi reaction.* Cormier, G.; Allain, C.; Boddaert, T. *Angew. Chem. Int. Ed.* **2024**, e202412602.
[7] *Visible-Light Photocatalyzed Selective Synthesis of 1,2- or 1,3-Dithianes from Thietanes: An Experimental and Theoretical Study.* Cormier, G.; Pedrón, M.; Lapuh, M. I.; Guillot, R.; Ciofini, I.; Boddaert, T. *submitted*.

P A119

Electrochemical $S_{RN}1$ reaction using S-Aryl Thianthrenium Salts

Cecile Boudet,[1] Thibaud Bregent,[2] Philippe Jubault,[1] Thomas Poisson[1]

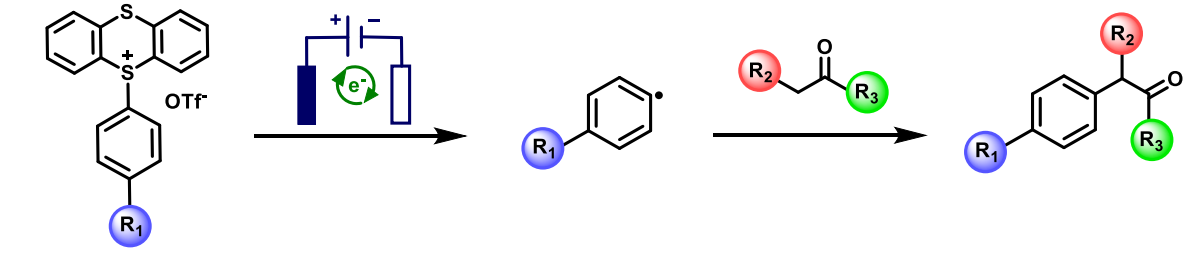
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Aryl radicals are highly reactive intermediates in organic synthesis. Nevertheless, numerous reactions involving these radicals (Sandmeyer, Pschorr, Meerwein reactions etc.) often require transition metals or oxidants to generate the reactive species.[1] Recently, organic electrosynthesis has enabled greener methods for generating aryl radicals, by using electrons as a green and renewable reagent, offering milder reaction conditions.[2] With the advent of thianthrenium salt as versatile reaction intermediates for the construction of complex molecular architectures, new transformations are now possible. In combination with electrochemistry, thianthrenium salts might offer a unique reactivity and great versatility because of their interesting reduction potential (- 1.5 V). Moreover, due to the excellent *para* selectivity during their synthesis, they provide a useful strategy for the late-stage introduction of diverse chemical functionalities on complex molecules.[3]

Here we present the reductive generation of aryl radical *via* electrochemistry to create new C–C bond and access substituted active methylene compounds thanks to the $S_{RN}1$ reaction, starting from thianthrenium salts. Discovered in 1960, this reaction is the most efficient reaction to create C–C bond via electron transfer between a reagent carrying a good leaving group (N_2^+, TT^+, Cl, Br etc.) and a nucleophile.[4] Because of its wide range of application, this contributes to a route for the synthesis of many heterocycles (indoles, carbazoles, pyrazoles).



Thianthrenium salt : para position selectivity

Electro-reductive generation of aryl radical

Catalyst free

[1] Mo, F.; Qiu, D.; Zhang, L.; Wang, J. Recent Development of Aryl Diazonium Chemistry for the Derivatization of Aromatic Compounds. *Chem. Rev.* **2021**, *121*, 5741–5829.

[2] Grudzień, K.; Zlobin, A.; Zadworny, J.; Rybicka-Jasińska, K.; Sadowski, B. Modern Photo- and Electrochemical Approaches to Aryl Radical Generation. *Org. Chem. Front.* **2024**, *11*, 5232–5277.

[3] Wu, X.; Gao, P.; Chen, F. Synthetic Applications of Sulfonium Salts as Aryl Radical Precursors. *Eur. J. Org. Chem.* **2023**, *26*, e202300864.

[4] Bardagí, J. I.; Vaillard, V. A.; Rossi, R. A. The S_{RN} 1 Reaction. In *Encyclopedia of Radicals in Chemistry, Biology and Materials*; Chatgilialoglu, C., Studer, A., Eds.; Wiley, 2012.

P A120

Thiophenols and heptazines: a route to reach near-zero ΔE_{ST} for OLED applications

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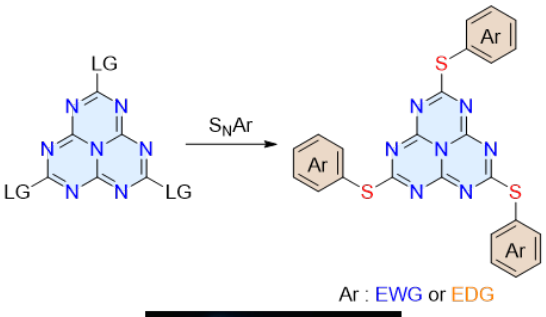
[1] *PPSM, Université Paris-Saclay, ENS Paris-Saclay, 5 Avenue des Sciences, 91190 Gif-sur-Yvette, France*

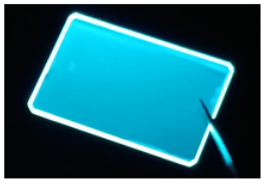
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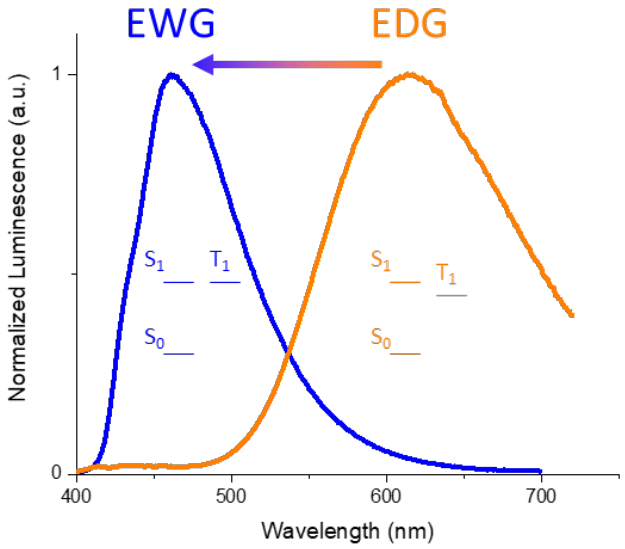
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Thermally Activated Delayed Fluorescence (TADF) has emerged during the last decade as one of the most promising properties for the lighting application, especially for Organic Light Emitting Diodes (OLEDs).[1] TADF arises from the small energy difference between the lowest excited singlet and triplet states (ΔE_{ST}) enabling the reverse InterSystem Crossing (rISC), the keystone parameter for organic emitter in OLED. Among a given family, the impact of substituents on ΔE_{ST} is scarcely reported but could provide huge interest in for understanding and optimization of devices. In this context, we have developed a new family of heptazines substituted with electron rich or electron poor thiophenols with the help of a simple nucleophilic substitutions step.[2] These small modifications of chemical skeleton induce important differences in photophysical behavior. In particular, the emission wavelength and the luminescence decay are impacted: while electron rich thiophenols induce a yellow-orange luminescence with a clear TADF behavior, electron poor substituents show electric-blue luminescence with a decrease of the singlet-triplet energy gap down to a near-zero ΔE_{ST} behavior.[3]





EWG derivative in DPEPO matrix (λ_{ex} = 254 nm)



[1] Uoyama, H.; Goushi, K.; Shizu, K.; Nomura, H.; Adachi, C. Highly Efficient Organic Light-Emitting Diodes from Delayed Fluorescence. *Nature* **2012**, *492* (7428), 234–238.

[2] Galmiche, L.; Allain, C.; Le, T.; Guillot, R.; Audebert, P. Renewing Accessible Heptazine Chemistry: 2,5,8-Tris(3,5-Diethyl-Pyrazolyl)-Heptazine, a New Highly Soluble Heptazine Derivative with Exchangeable Groups, and Examples of Newly Derived Heptazines and Their Physical Chemistry. *Chem. Sci.* **2019**, *10* (21), 5513–5518.

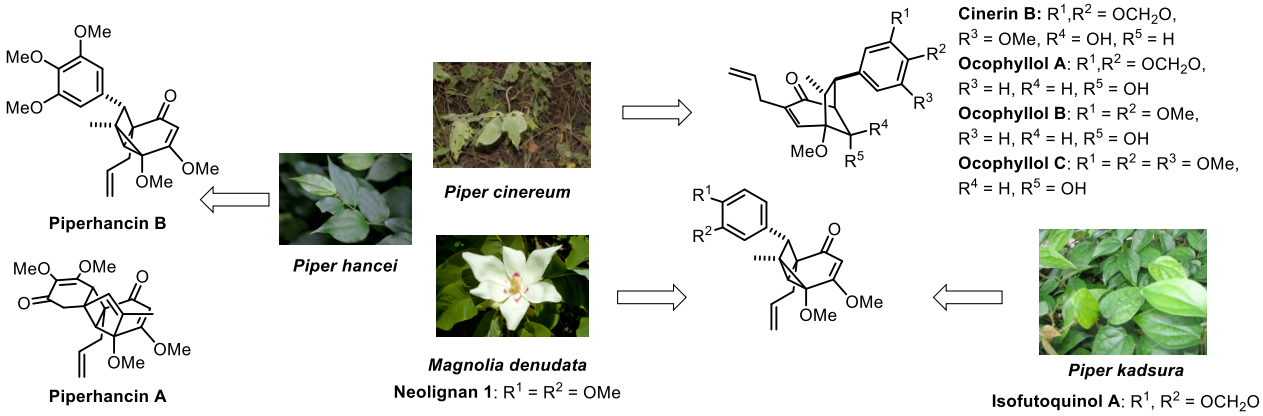
[3] Blasco, D.; Nasibullin, R. T.; Valiev, R. R.; Monge, M.; López-de-Luzuriaga, J. M.; Sundholm, D. Experimental and Computational Studies of the Optical Properties of 2,5,8-Tris(Phenylthiolato)Heptazine with an Inverted Singlet–Triplet Gap. *Phys. Chem. Chem. Phys.* **2024**, *26* (7), 5922–5931.

P A121

Total synthesis of polycyclic neolignans

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Neolignans are a class of natural products produced by various plant families, including *Magnoliaceae*, *Piperaceae* and *Lauraceae*. They are composed of two propylbenzene units, but display a diversity of possible cyclization and oxidation patterns, making it a natural product class of ca. 200 members[1]. Piperhancins A and B[2], neolignan 1[3] and ocophillols A-C[4] have not succumbed to total synthesis to date, while cinerin B[5] and isofutoquinol A[6] were only synthesized in racemic form[7]. Herein, we report our advances towards the total synthesis of these natural products.



[1] Teponno, R. B.; Kusari, S.; Spiteller, M. *Nat. Prod. Rep*. **2016**, *33*, 1044.
[2] Yang, F.; Su, B.-J.; Hu, Y.-J.; Liu, J.-L.; Li, H.; Wang, Y.-Q.; Liao, H.-B.; Liang, D. *J. Org. Chem*. **2021**, *86*, 5284.
[3] Li, J.; Tanaka, M.; Kurasawa, K.; Ikeda, T.; Nohara, T. *Chem. Pharm. Bull*. **2005**, *53*, 235.
[4] Coy, E. D.; Cuca, L. E.; Sefkow, M. *J. Nat. Prod*. **2009**, *72*, 1245.
[5] Coy, E. D.; Cuca, L. E.; Sefkow, M. *Phytochem.* **2009**, *70*, 1309.
[6] Matsui, K.; Munakata, K. *Tetrahedron Lett.* **1976**, *17*, 4371.
[7] (a) Shizuri, Y.; Nakamura, K.; Yamamura, S.; Ohba, S.; Yamashita, H.; Saito, Y. *Tetrahedron Lett.* **1986**, *27*, 727. (b) Coy, E. D.; Cuca, L. E.; Sefkow, M. *Org. Biomol. Chem.* **2010**, *8*, 2003.

P A122

Halogenated Iminosydnones For Fast Click & Release Reactions

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Iminosydnones belong to the mesoionic family, closely related to sydnones with the key distinction of containing a nitrogen atom at position 6. Discovered in the 1950s[1] and further developed in the 1970s for their biological properties, some of them have been approved as drugs.[2] Renewed interest in iminosydnones has recently emerged due to their ability to undergo chemoselective cycloaddition reactions with strained alkynes, termed SPICC (for Strained-Promoted Iminosydnones Cyclooctyne Cycloaddition).[3]

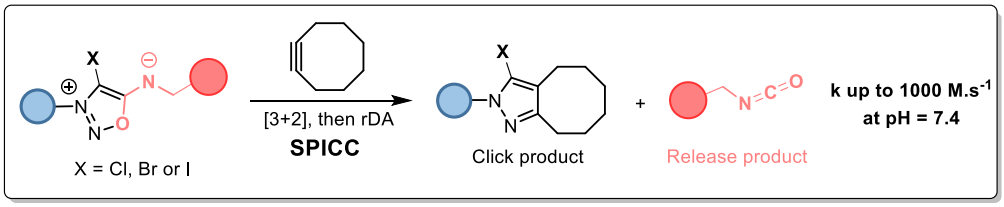


Figure 11 : Strained-Promoted Iminosydnones Cyclooctyne Cycloaddition with Halogenated Iminosydnones

In this work, we demonstrated that functionnalization in C4 position of iminosydnones with halogen atom increases up to 120-fold the speed of SPICC, leading to kinetic constant up to 1070 $L.mol^{-1}.s^{-1}$ with DBCO and 580 $L.mol^{-1}.s^{-1}$ with BCN. Thanks to their enhanced reactivity, halogenated iminosydnones were afterwards used for ultrafast radiolabelling of biologics.

[1] P. Brookes and J. Walker, Formation and properties of sydnone imines, a new class of meso-ionic compound, and some sydnones related to natural α-amino-acids, *J. Chem. Soc.*, **1957**, 4409–4416.
[2] E. Y. Khmel'nitskaya *et al.*, Sydnonimines as exogenous NO donors, *Russ. Chem. Bull.*, **2004**, 53, 2840–2844.
[3] S. Bernard et al., Bioorthogonal Click and Release Reaction of Iminosydnones with Cycloalkynes, *Angew. Chem., Int. Ed.*, **2017**, 56, 15612–15616.

P A123

Nickel catalyzed C-C bond activation and difunctionalization: A versatile strategy for molecular diversification

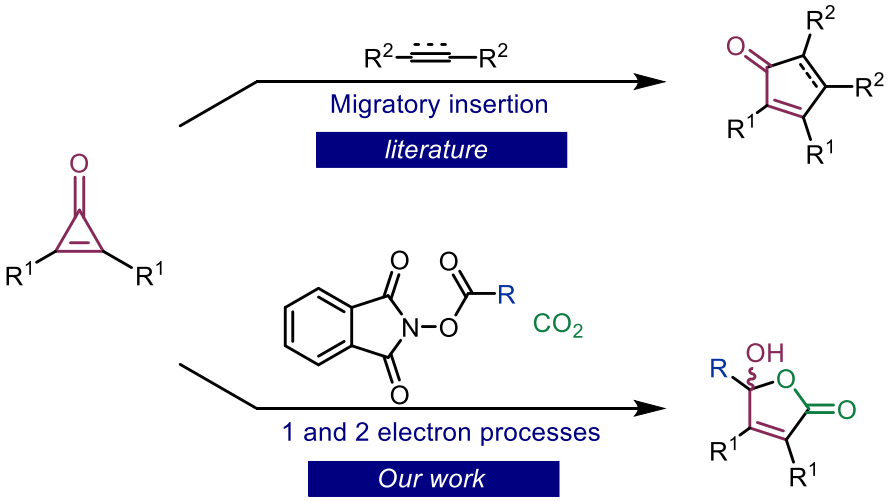
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A major challenge in organic chemistry is to rapidly synthesise complex molecules from simple building blocks. In this respect, the direct difunctionalization of ubiquitous σ C-C bonds by transition metals catalysis[1] offers tremendous perspectives. However, the difunctionalization of these robust bonds is highly challenging and remains underexplored today. The key issue lies in the necessity to have a catalyst that is: *i*) highly reactive to ensure activation of robust σ C-C bonds; but also *ii*) highly chemoselective towards the different functionalization reagents.

To address this challenge, we envisioned that the ability of nickel to engage in both one- and two-electron processes[2] *via* a wide range of oxidation states would enable orthogonal reactivity with different substrates.[3] The viability of this approach is demonstrated herein by the carbo-carboxylation of cyclopropenones, thus providing a the rapid access to hydroxybutenolide compounds, known for their diverse bioactive pharmacological properties.[4]



[1] P-H. Chen, B. A. Billet, T. Tsukamoto, G. Dong, Cut and Sew Transformations via Transition-Metal-Catalyzed Carbon–Carbon Bond Activation, *ACS Catal.* **2017**, *7*, 1340.

[2] J.B. Diccianni, T. Diao, Mechanisms of Nickel-Catalyzed Cross-Coupling Reactions *Trends in Chemistry* **2019**, *1*, 830.

[3] G. Fumagalli, S. Stanton, J. F. Bower, Recent Methodologies That Exploit C–C Single-Bond Cleavage of Strained Ring Systems by Transition Metal Complexes. *Chem. Rev.* **2017**, 117, 9404.

[4] S. Tilvi, S. Khan, M. S. Majik, γ-Hydroxybutenolide Containing Marine Natural Products and Their Synthesis, *Curr. Org. Chem.* **2019**, 23, 2436-2468.

P A124

Exploration of the Reactivity of Strained Polycyclic Frameworks: Application to Ansaranes and Ditwistanes

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Willows consist of more than 1,500 distinct species and are a significant source of bioactive compounds, including salicylic acid and its derivatives. Among them, (+)-Grandifloracin, isolated in 2012 from the species *Uvaria dac* [1] exhibits biological properties against pancreatic cancer cell lines. Although this activity is relatively modest (PC_{50} = 14.5 µM), it nevertheless warrants particular attention, notably due to the marked resistance of pancreatic tumors to most currently available chemotherapeutic agents. Additional studies have also revealed that the presence of unsaturations within this chemical structure is not essential for inducing a biological response [2].

Thus, we set out to explore the potential of one of the precursors of (+)-Grandifloracin, possessing a spiroepoxycyclohexadienone moiety which lends itself to numerous transformations. Thanks to the presence of unsaturations, different photochemical or radical cycloadditions have been explored leading to new rare polycyclic skeletons such as ansaranes and ditwistanes (**Figure 1**). Inspired by the work of B. Stoltz *et al.* [3] on (+)-Grandifloracin, we have applied these reactions to the synthesis of new constrained structures, parents of the natural product.

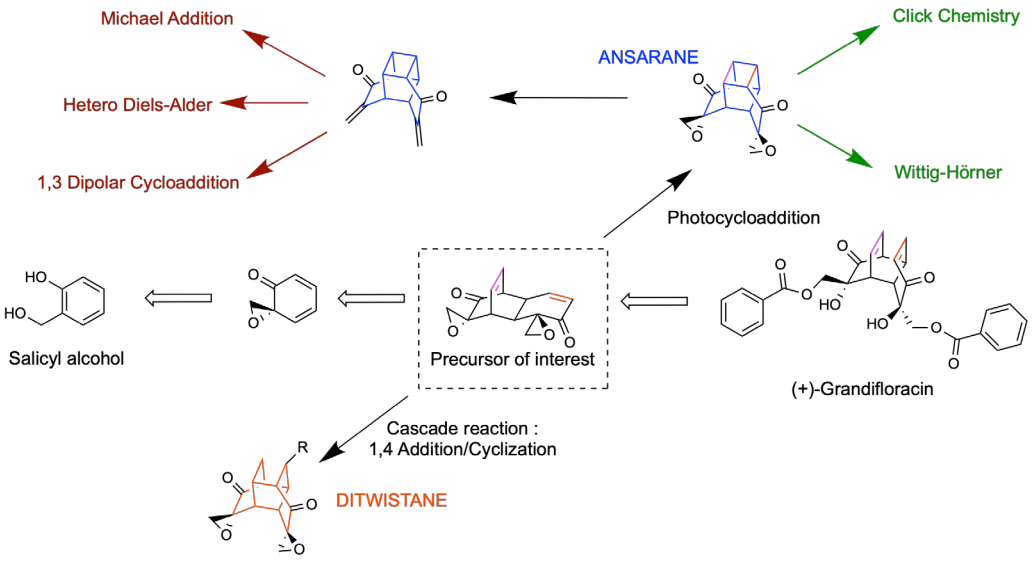


Figure 1 : *Synthesis of ansarane and ditwistane structures*

[1] Ueda, J. Y.; Athikomkulchai, S.; Miyatake, R.; Saiki, I.; Esumi, H.; Awale, S. *Drug Des. Devel. Ther*. **2013**, *8*, 39–47.
[2] Khan, M. A.; Wood, P. J.; Lamb-Guhren, N. M.; Caggiano, L.; Kociok-Köhn, G.; Tosh, D.; Lewis, S.E. *Bioorganic & Medicinal Chemistry Letters*. **2014**, *24*(13), 2815-2819.
[3] Bergner, M.; Duquette, D.C.; Chio, L.; Stoltz, B. M. *Org. Lett*. **2015**, *17*, 3008-3010.

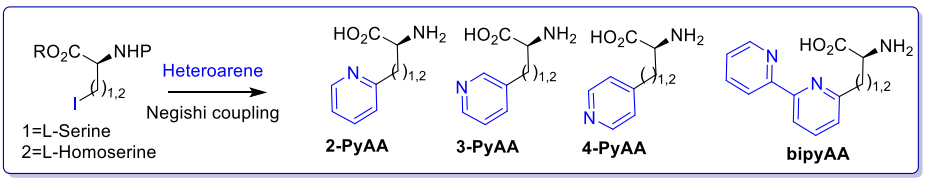
P A125

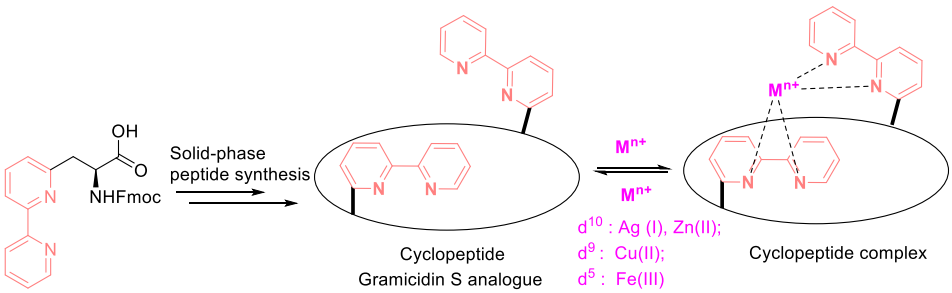
Metalation of synthetic anti-microbial peptides, a reversible stapling strategy towards a new kind of prodrug

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In the context of increasing bacterial resistance to antibiotics and the lack of new drug development in the last decade, there is an urgent need for new anti-infective treatments. Antimicrobial peptides (AMPs)[1], potent broad-spectrum antibiotics, are very promising candidates to address this problem. Thanks to their cationic and amphipathic character, these peptides disrupt the bacterial cell membrane and this particular mode of action induces few resistance phenomena. Among them, the alpha-helical temporin L (TL) and the beta-sheeted gramicidin S (GS) are potent antibiotics, but also have strong haemolytic activity and even low protein stability (for TL)[2].

The aim of this project is to design new metalated analogues of TL or GS in order to modify their properties and thus obtain new types of prodrugs and access to effective and original antibiotics. The objectives are therefore to develop the synthesis of enantiopure amino acids with a heteroaromatic group (pyridine or bipyridine) for the coordination of metals, to incorporate these into TL or GS at strategic positions and to test the antibacterial and haemolytic activities of these peptides in the presence or absence of metals. We will present our results on the synthesis of amino acids and peptides and our preliminary studies on complex formation with amino acids.





[1] Huan, Y.; Kong, Q.; Mou, H.; Yi, H. Antimicrobial Peptides: Classification, Design, Application and Research Progress in Multiple Fields. *Front. Microbiol.* **2020**, *11*.

[2] Manzo, G.; Ferguson, P. M.; Hind, C. K.; Clifford, M.; Gustilo, V. B.; Ali, H.; Bansal, S. S.; Bui, T. T.; Drake, A. F.; Atkinson, R. A.; Sutton, J. M.; Lorenz, C. D.; Phoenix, D. A.; Mason, A. J. Temporin L and Aurein 2.5 Have Identical Conformations but Subtly Distinct Membrane and Antibacterial Activities. *Sci Rep* **2019**, *9* (1), 10934.

P A126

Sustainable synthesis of transition metal phosphides nano catalyst for green production of hydrogen

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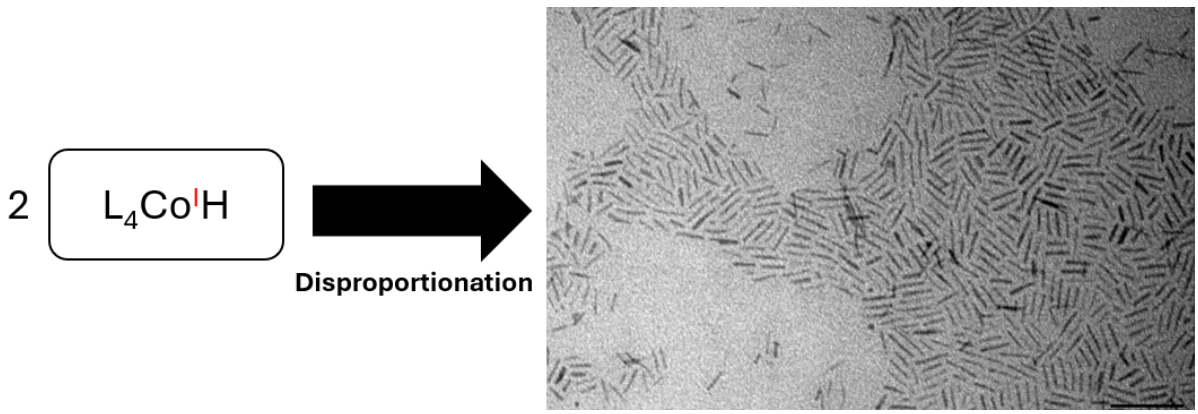
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In order to combat global warming, we need to generate renewable energy. One such energy source is hydrogen, but there are only 0.15% hydrogen resources on Earth. Methods of production are required, but green production methods using water hydrolysis account for just 4% of the world's total H_2 production[1]. In the literature, many nanomaterials have been used to produce H_2 by water electrolysis. The focus is now on phosphorus materials because they are highly efficient in the hydrogen evolution reaction[2].

We are collaborating with Dr Christophe Petit at the MONARIS laboratory and the SAMCAT team at the IC2MP in Poitiers. We aim to synthesize a nano-catalyst using cheaper metals (Co, Ni, Fe) and phosphorus to replace the expensive materials mainly used with Pt, Ir and Ru[3].
The aim is to create a better material for green hydrogen production.



Co_2P Nanorods

To achieve this, I first synthesized Co(I) complexes with different phosphorus ligands. Second, we use the complex to make nanomaterials using an easier method developed by my team from the literature[4]: the disproportionation process[5].
Finally, the SAMCAT team used the nanomaterials for water splitting in an alkaline medium.

[1] Ham, K.; Bae, S.; Lee, J. Classification and Technical Target of Water Electrolysis for Hydrogen Production. J. Energy Chem. 2024, 95, 554–576

[2] Zhu, J.; H, L.; Zhao, P.; Lee, L. Y. and Wong, K.Recent Advances in Electrocatalytic Hydrogen Evolution Using Nanoparticles. Chem. Rev. 2020, 2, 851-918

[3] Yang, Y. et al., Porous Cobalt-Based Thin Film as a Bifunctional Catalyst for Hydrogen Generation and Oxygen Generation, Adv. Mater., 2015,27, 3175.

[4] L. Meziane, C. Salzemann, C. Aubert, H. Gérard, C. Petit and M. Petit; Hcp cobalt nanocrystals with high magnetic anisotropy prepared by easy one-pot synthesis, Nanoscale, 2016, 8, 18640–18645

[5] Vivien, A.; et al. Role of Oleylamine Revisited: An Original Disproportionation Route to Monodispersed Cobalt and Nickel Nanocrystals, Chem. Mater. 2019, 31, 960

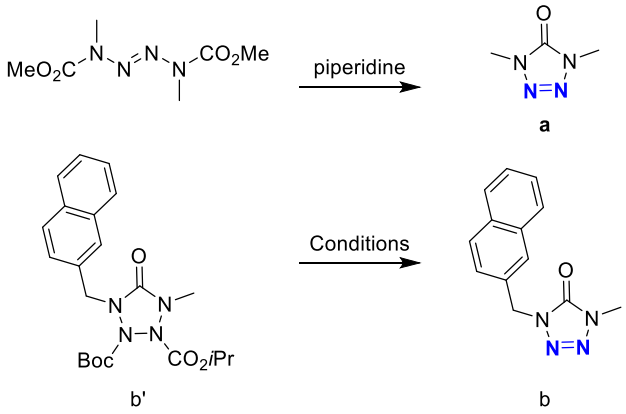
P A127

Synthesis and reactivity of tetrazene-based compounds

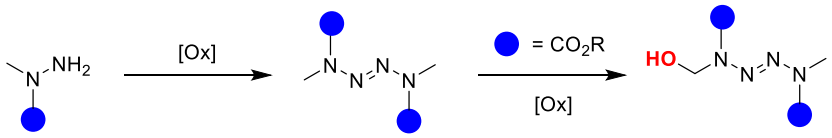
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The tetrazene function is composed of four consecutively bonded nitrogen atoms, building three N-N bonds within a n-σ-π resonance and offering functionalizable positions by means of its tetrasubstituted nature. The development of tetrazene compounds is of great interest for energetic applications, as they present high nitrogen content, promising energetic properties and tunable molecular structures [1].
Tetrazenes are synthesized from the oxidative dimerization of the corresponding hydrazines [2], which were also synthesized in order to introduce the desired substituents (synthetic route of multi steps, depending on the substituents R/Z).
Tetrazenes can exist in linear or cyclic structures. We also synthesized two cyclic tetrazenes (tetrazolinones). The 1,4-dimethyl tetrazolinone (a) was synthesized following the method reported by Wadsworth [2]. Another route was developed to reach tetrazolinone (b) which deprotection gave tetrazolidinone (b'), an unprecedented pathway to this structure.



The reactivity of our synthesized tetrazenes was also studied. Aiming at oxidizing the tetrazene moiety on the N-azo position, the oxidation of R/Z functionalized tetrazenes surprisingly yielded the oxidation product of one of the two methyl group in the alpha position of the tetrazene moiety.



[1] Klapötke, T. M.; Mayer, P.; Schulz, A.; Weigand, J. J. 1,4-Bis-[1-Methyltetrazol-5-Yl]-1,4-Dimethyl-2-Tetrazene: A Stable, Highly Energetic Hexamer of Diazomethane (CH2N2)6. *Propellants, Explosives, Pyrotechnics* **2004**, *29* (6), 325–332. https://doi.org/10.1002/prep.200400078.
[2] Wadsworth, W. S. Preparation and Reactions of 1,4-Bis(Alkoxycarbonyl)-1,4-Dialkyl-2-Tetrazenes. *J. Org. Chem.* **1969**, *34* (10), 2994–2997. https://doi.org/10.1021/jo01262a043.

P A128

Next-generation chemoenzymatic synthesis of chemically modified oligonucleotides

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Chemically modified oligonucleotides have advanced as key players in multiple applications such as efficient therapeutic agents, molecular probes, biosensors, or as platforms for biotechnological processes. Synthetic access to oligonucleotides equipped with chemical modifications is crucial and is currently granted by one of the two general strategies: 1) solid-phase chemical synthesis using modified phosphoramidites; 2) enzymatic synthesis using modified nucleoside triphosphates (dN*TPs). However, despite being efficient, these two strategies have inherent limitations.[1] Therefore, the development of next-generation synthetic approaches to produce modified oligonucleotides is in dire need. Herein, we propose an alternative hybrid chemoenzymatic approach for the assembly of polynucleotide fragments as it combines advantages coming from both chemical and enzymatic strategies, and at the same time circumvents their limitations (Abstract figure). The key novelty of this approach consists of the use of short (3 – 6 nt) oligomer 5'-mono- and 5'-triphosphates as substrates for DNA ligases and DNA polymerases in the enzymatic construction of oligonucleotides.[2,3] The proposed chemoenzymatic approach grants access to an ultimately broad range of chemically modified oligonucleotides and can be used in various applications.

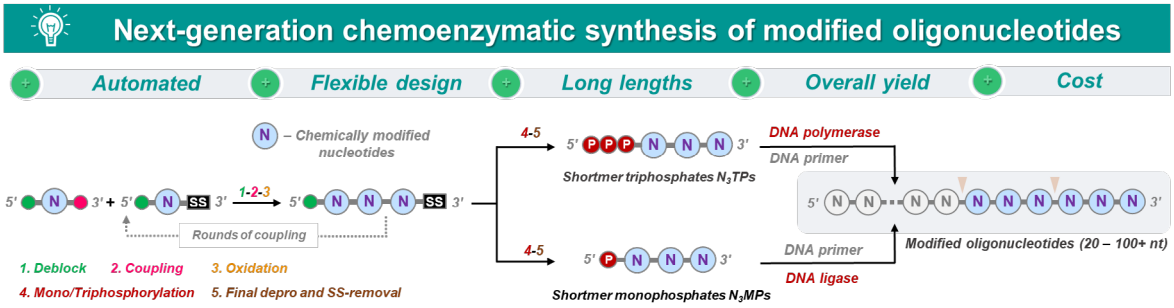


Figure. *General scheme for next-generation chemoenzymatic synthesis of oligonucleotides.*

Acknowledgment: This work was supported by Institut Pasteur, CNRS grant PEPR MolecularXiv (ANR-22-PEXM-0002), and Roche for financial support via its Technology, Innovation and Science program.

[1] Bizat, P. N.; Sabat, N.; Hollenstein, M.: "Recent advances in biocatalytic and chemoenzymatic synthesis of oligonucleotide" *ChemBioChem.* **2025**, *26,* e202400987;

[2] Sabat, N.; Hollenstein, M. et al.: "Template-dependent DNA ligation for the synthesis of modified oligonucleotides" *Nat. Commun.* **2024**, *15*, 8009;

[3] Sabat, N.; Hollenstein, M. et al.: "Artificial nucleotide codons for enzymatic DNA synthesis" *Chem. Commun*. **2023,** *59*, 14547 – 14550.

P A129

α-Trialkylsilyl-α-diazoacetones: a flexible tool for the synthesis of bioactive compounds

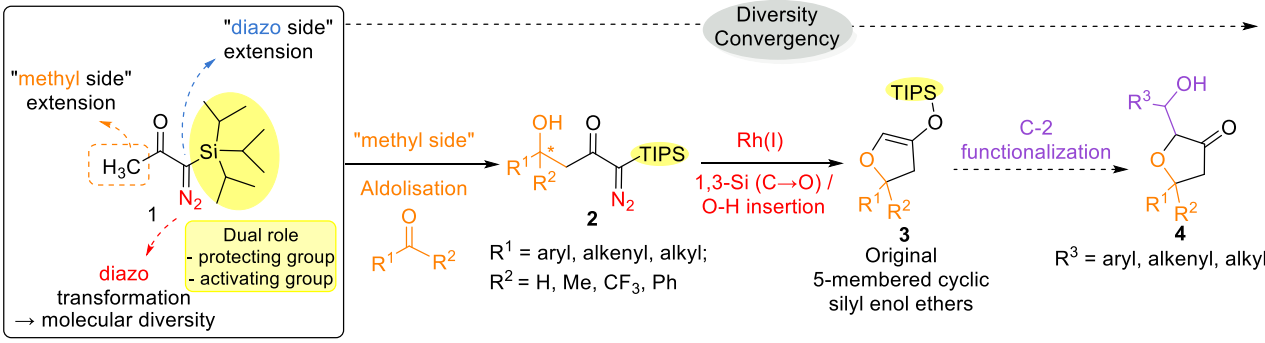
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In organic chemistry, innovative synthetic tools are constantly needed to achieve the synthesis of complex molecular scaffolds, particularly in the field of bioactive molecules.

To this aim, diazocarbonyl compounds are high-value synthetic intermediates. Indeed, diazo decomposition triggers a range of transformations such as X-H insertions, sigmatropic rearrangements and cycloadditions, leading to high molecular diversity.[1] In this context, our group is studying the reactivity of α-trialkylsilyl-α-diazoacetones, three-carbon building blocks displaying a particular synthetic potential based on the dual role of the trialkylsilyl substituent. The latter can behave alternately as a protecting or an activating group, allowing for example selective "*methyl-side*" or "*diazo-side*" chain extensions by aldol-type reactions.[2] This methodology has already proven its efficiency in the function-oriented synthesis of Peloruside A analogues.[3] In order to explore further the synthetic potential of these silylated diazocarbonyl building blocks, we are currently studying the reactivity of *C*-TIPS diazoaldols **2** resulting from "methyl-side" aldol addition on TIPS-diazoacetone **1**. We recently focused on the Rh(I)-catalyzed diazo decomposition/intramolecular X-H insertion process on substrates **2**. A simultaneous 1,3-Si(C→O) migration was highlighted, providing original dihydrofurane-3(*2H*)-ones derived silyl enol ethers **3**, precursors of polyfunctionalized tetrahydrofurans like **4** which are widespread in bioactive natural compounds.[4] These scaffolds are expected to be generated with high skeleton diversity through the convergent methodology described in this poster.



[1] (a) Ford, A.; Miel, H.; Ring, A.; Slattery, C. N.; Maguire, A. R.; McKervey, M. A. "Modern Organic Synthesis with α-Diazocarbonyl Compounds", *Chem. Rev.* **2015**, *115*, 9981–10080. (b) Wang, J., Diazo compounds: Recent applications in synthetic organic chemistry and beyond, *Tetrahedron Letters* **2022**, *108*, 154135.

[2] Gavelle, S.; Abid, I.; Biletskyi, B.; Henrion, S.; Hémon-Ribaud, A; Lhoste, J.; Martel, A.; Dujardin, G.; Gaulon-Nourry, C., TIPS-Diazoacetone Aldol Addition: Mechanistic Aspects and Contribution to the Synthesis, *J. Org. Chem.* **2021**, *86*, 4917-4931 and references therein.

[3] Chany, A.-C.; Legros, F.; Haroun, H.; Kundu, U. K.; Biletskyi, B.; Torlak, S.; Mathé-Allainmat, M.; Lebreton, J.; Macé, A.; Carboni, B.; Renoux, B.; Gosselin, P.; Dujardin, G.; Gaulon-Nourry, C.; Function-Oriented Synthesis toward Peloruside A Analogues, *Org. Lett.*, **2019**, 21, 2988-2992.

[4] (a) Murthy, A. S.; Mahipal, B.; Chandrasekhar, S., Asymmetric Synthesis of the C14–C26 Building Block of Eribulin Mesylate, *Eur. J. Org. Chem.* **2012**, 6959-6966; (b) Veerasamy, N.; Ghosh, A.; Li, J.;Watanabe, K.; Serrill, J. D.; Ishmael, J. E.; McPhail, K. L.; Carter, R. G., Enantioselective Total Synthesis of Mandelalide A and Isomandelalide A: Discovery of a Cytotoxic Ring-Expanded Isomer, *J. Am. Chem. Soc.* **2016**, *138*, 770-773.

P A130

Mapping the reactivity of *endo*- and *exo*-glycals

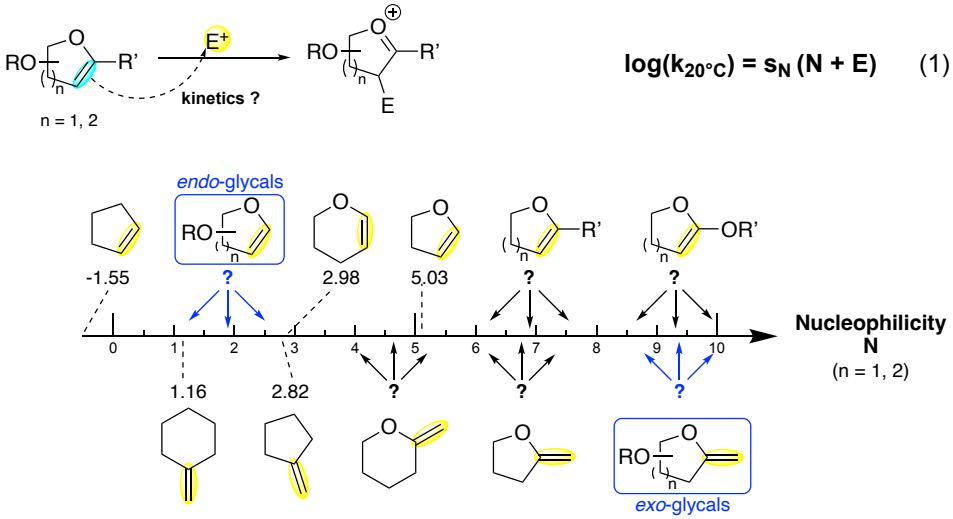
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Glycals are unsaturated sugar derivatives constituting a large family of polyhydroxylated chiral synthons. The *endo*-glycals are widely exploited in the synthesis of natural products and for biochemical applications.[1] In contrast, the chemistry and biology of *exo*-glycals remain less explored, with some specific methodologies to generate them as biochemical probes.[2] Furthermore, the reactivity and stability of the C=C bond, as well as their behavior as nucleophiles, were not thoroughly investigated. It is known that one of the most powerful tools to predict a molecule's reactivity profile is by understanding the mechanisms correlated with a comparative analysis of the reaction on a variety of substrates. A reactivity mapping approach has never been realized in *endo*- and *exo*-glycal chemistry, despite its broad usefulness. Indeed, such a predictive tool would be of great importance in the design of reaction pathways leading to stereoselective generation of polysubstituted glycals.

Kinetics studies are run with a stopped-flow UV/Visible spectrometer to determine the second order rate constant k_2 of a reaction between a glycal and various electrophiles E^+.



$$\log(k_{20°C}) = s_N\,(N + E) \qquad (1)$$

The Mayr and Patz equation (Eq. 1) will be employed for determining the nucleophilicity of the C=C bond of a representative set of glycals as well as simple enol ethers.[3] Thus, it will be possible to rank the glycals for the first time on the nucleophilicity scale.

[1] Taillefumier, C.; Chapleur, Y. Synthesis and Uses of *exo*-Glycals. *Chem. Rev.* **2004**, *104* (1), 263-292.

[2] Müller, B.; Schaub. C.; Schmidt, R. R. Efficient Sialyltransferase Inhibitors Based on Transition-State Analogues of the Sialyl Donor. *Angew. Chem. Int. Ed.*, **1998**, *37*, 2893-2897.

[3] Lucius, R.; Loos, R.; Mayr, H. Kinetic Studies of Carbocation-Carbanion Combinations: Key to a General Concept of Polar Organic Reactivity. *Angew. Chem. Int. Ed.*, **2002**, *41*, 91-95.

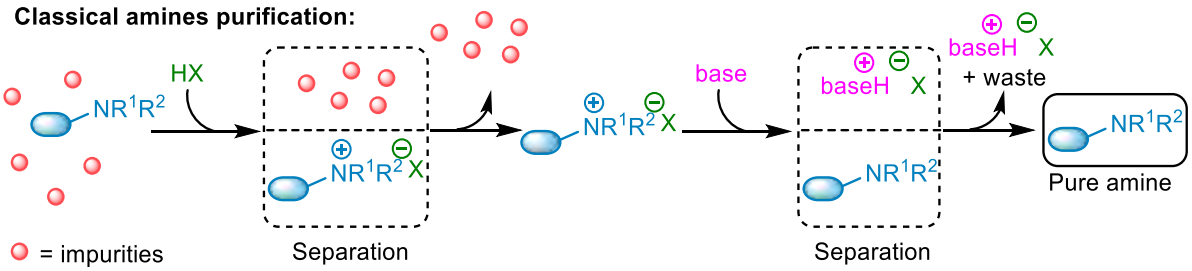
P A131

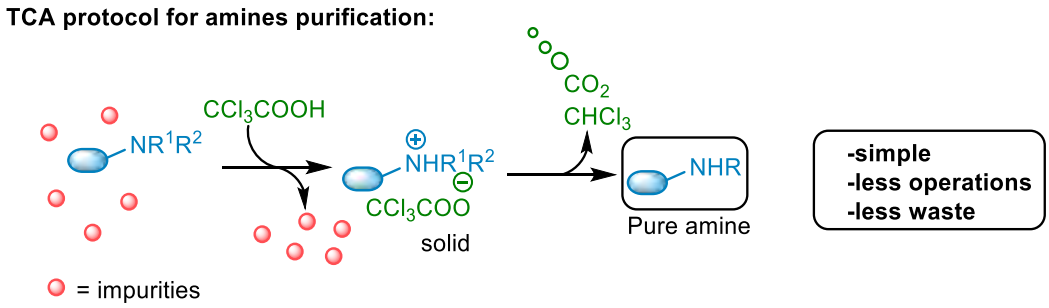
Trichloroacetic acid fueled practical amines purifications

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Amines purification have for long been dominated by tedious stepwise processes involving the generation of large amount of undesired waste. Inspired by recent work on out of equilibrium molecular machinery, using trichloroacetic acid (TCA), we disclose a purification technique considerably decreasing the number of operations and the waste generation required for such purifications. At first, TCA triggers the precipitation of the amines through their protonated salts formation, enabling the separation with the impurities. From the pure amine salt, simple decarboxylation of TCA liberates volatile CO_2 and chloroform affording directly the pure amines. Through this approach, a broad range of diversely substituted amines could be isolated with success.[1]

As a result, this approach constitutes a simple and eco-compatible protocol in order to purify all kinds of amines. It is easy to run, limits operations and wastes associated with traditional techniques.





[1] A. Thomas, B. Gasch, E. Olivieri, A. Quintard, *Beilstein J. Org. Chem.* **2022**, *18*, 225–231.

P A132

Engineering Donor-Acceptor Polymers for Energy Storage: from Synthesis to Application

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Relying on renewable energy sources requires improving energy storage technologies to have a reliable power source in the long run. They must be robust, energy-efficient, cost-effective, and eco-responsible during their life cycle to minimize their environmental and economic impacts. General opinion is that lithium-ion technologies cannot meet all requirements; however, they serve as a valuable temporary solution while next-generation storage systems are developed.
One of the new research leads is the use of donor–acceptor (DA) conjugated polymers, with both electron-rich and electron-deficient units that enable the tuning of the material properties. DA polymers are p-dopable (can be oxidized) and n-dopable (can be reduced) and thus can be used as anode and cathode materials for a full symmetric organic battery. Ideally, the system would be designed with a material that gives high energy density with high stability during an extended period of charge/discharge cycles. [1,2]
To contribute to this study, we synthesized monomers with different acceptors to enhance those properties. 3,4-ethylenedioxythiophene (EDOT) was chosen as a donor due to its stability and the obtained monomers were polymerized electrochemically. Several studies in three- and two-electrode cells were achieved both in potentiostatic and galvanostatic modes of charge-discharge, and particular attention is paid to stability.

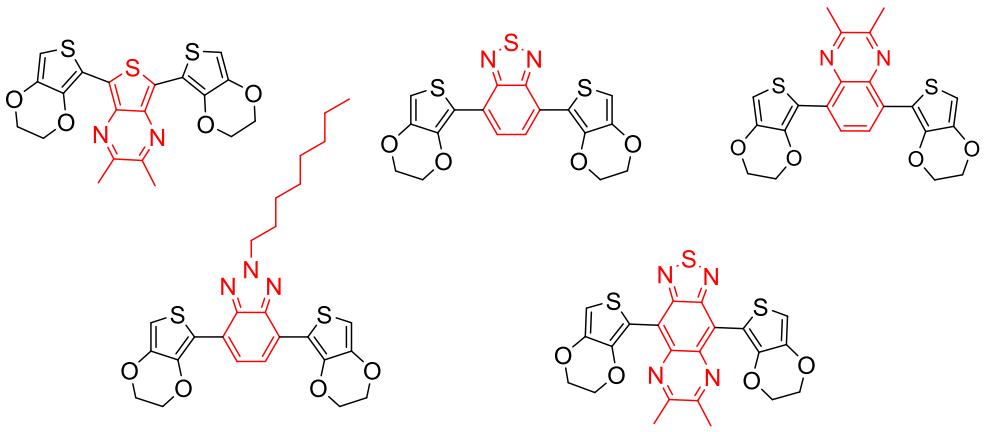


Figure 12 Schematic representation of DA monomers with different acceptors

[1] Hen, D. E.; Estrada, L. A.; Österholm, A. M.; Salazar, D. H.; Dyer, A. L.; Reynolds, J. R. Understanding the Effects of Electrochemical Parameters on the Areal Capacitance of Electroactive Polymers. *J. Mater. Chem. A* **2014**, *2* (20), 7509–7516.
[2] DiCarmine, P. M.; Schön, T. B.; McCormick, T. M.; Klein, P. P.; Seferos, D. S. Donor–Acceptor Polymers for Electrochemical Supercapacitors: Synthesis, Testing, and Theory. *J. Phys. Chem. C* **2014**, *118* (16), 8295–8304.

P A133

Synergistic Catalysis Beyond LMCT: Combining Iron-Mediated Radical Generation with Nickel for C–C Coupling from Alcohols and Carboxylic Acids

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The direct catalytic transformation of abundant native functional groups remains a significant challenge.[1] We present a unified strategy that merges iron ligand-to-metal charge transfer (LMCT) catalysis with nickel cross-coupling to enable the direct functionalization of alcohols and carboxylic acids using Earth-abundant catalysts.

This approach features two key advancements:

1. The **deconstructive arylation of unactivated alcohols** via photoinduced Fe-LMCT generation of alkoxy radicals, their fragmentation to carbon-centered radicals, and subsequent Ni-catalyzed coupling with aryl halides (Figure. 1.A).[2]
2. A **decarboxylative methylation of carboxylic acids** where Fe-LMCT generates carboxyl radicals, and a nickel catalyst mediates radical sorting and coupling with methyl radicals from cumyl peroxide (Figure. 2.B).[3]

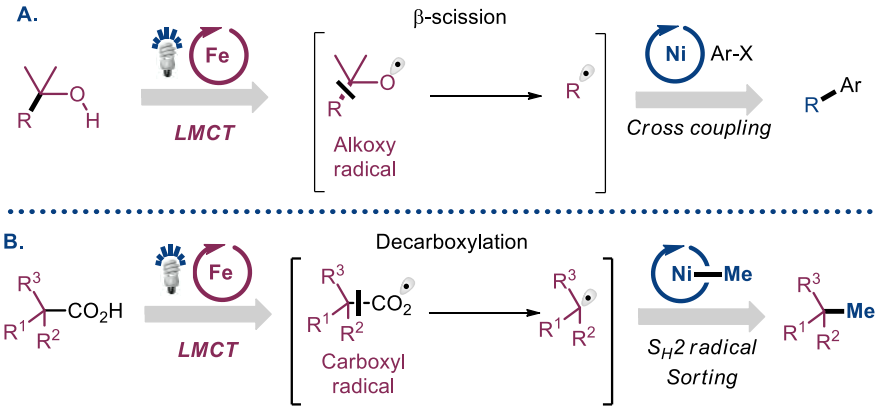


Figure 1 A. *Unified Ni/Fe LMCT Catalytic Platform for the Cross-Coupling of Alcohols and Aryl Halides,* ***B.*** *Dual Fe-LMCT/Ni Catalysis for the Peripheral Methylation of Native Alkyl Carboxylic Acids.*

Both methods exhibit broad scope and excellent functional group tolerance, providing practical routes for late-stage diversification. Mechanistic studies illuminate the critical role of the catalyst coordination sphere, establishing this synergistic platform as a general paradigm for activating native functionalities.

[1] Ertl, P. An Algorithm to Identify Functional Groups in Organic Molecules. *J Cheminform* **2017**, *9* (1), 36.

[2] Jaber, M.; Ozbay, Y.; Chefdeville, E.; Tran, G.; Amgoune, A. Unified Photocatalytic Strategy for the Cross-Coupling of Alcohols with Aryl Halides Enabled by Synergistic Nickel and Iron LMCT Catalysis. *ACS Catal.* **2024**, 12757–12768.

[3] Manuscript in preparation

P A134

Rh(I)-Catalysed Decarboxylative-Sulfonylation Reaction Unlocking Thiazete Dioxide Scaffold

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Emmanuel Nicolas,[1] Lucile Anthore-Dalion[1]
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Wilkinson's rhodium (I) catalyst, [$(PPh_3)_3RhCl$], was first described in 1967.[1] Since then, the commercially available complex is extensively described for the hydrogenation of olefins.[2] The group of Ohe demonstrated that Wilkinson's complex in stoichiometric amounts can also insert into the weak N–O bond of oxime derivatives, leading to well-defined rhodacycles (Figure 1a).[3] A reactivity, his group used to develop pyrrole's synthesis from isoxazolidinones.[4] Recognizing that rhodium(I) complexes can coordinate a SO_2 molecule (Figure 1b),[5-6] we aimed at merging these two reactivities.

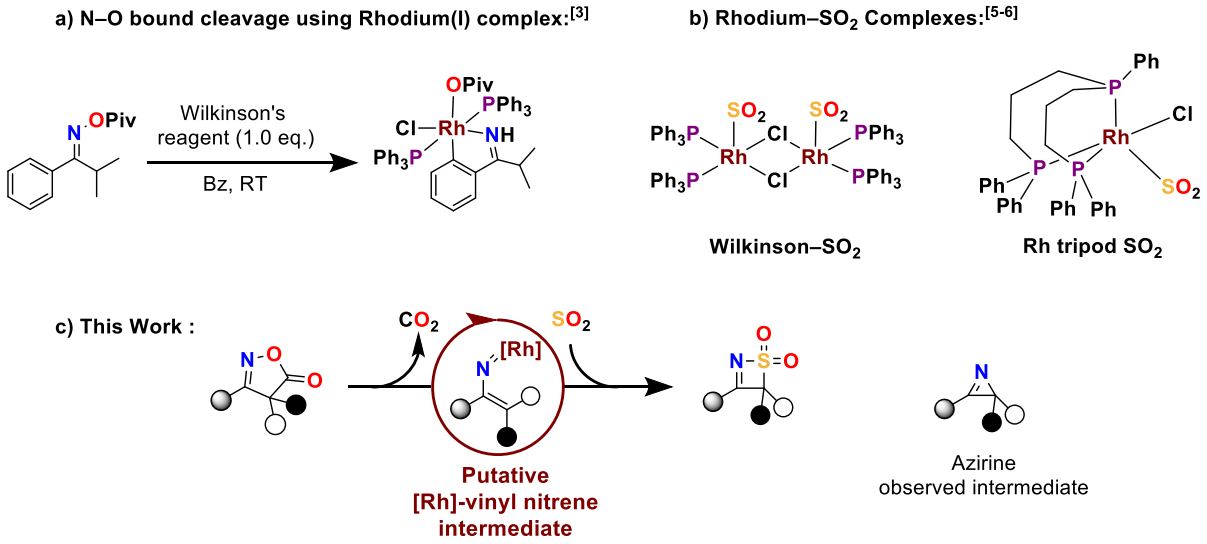


Figure 1

In this project, we have thus developed a rhodium–(I) catalyzed decarboxylative-sulfonative reaction, starting with easily accessible isoxazolidinones, where a CO_2 molecule is formally replaced with SO_2, leading to an unusual thiazete dioxide scaffold (Figure 1c). The structure of the product was confirmed through XRD analysis. Preliminary investigations on the catalytic system revealed that the catalyst's preparation is necessary to avoid rapid oxidation of the ligand by the SO_2 atmosphere. The reaction first goes through the *in situ* formation of azirine, which probably results from a [Rh]-vinyl nitrene.[3]

[1] J. A. Osborn, G. Wilkinson; *Inorg. Synth.*, **1967**, *10*, 67–71.
[2] B. Richter, A. L. Spek, G. van Koten, B.-J. Deelman; *J. Am. Chem. Soc.*, **2000**, *122*, 3945–3951
[3] T. Shimbayashi, K. Okamoto, K. Ohe; *Organometallics,* **2016**, *35*, 2026−2031.
[4] T. Shimbayashi, G. Matsushita, A. Nanya, A. Eguchi, K. Okamoto, K. Ohe; *ACS Catal*. **2018**, 8 (*9*) 7773–7780.
[5] G.J.Kubas, R.R.Ryan; *Crystal. Struct. Commun*., **1977**, 6, 295.
[6] P. Gary Eller, R. R. Ryan; *Inorg. Chem*., **1980**, *19*(1) 142–147.

P A135

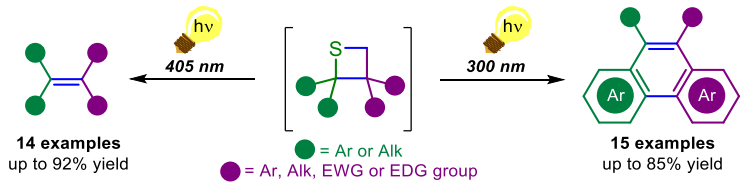
Wavelength-dependent formation of cycloreversion products from thietanes

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Because of their ubiquitous nature, alkenes have been the subject of extensive research and the olefin metathesis reaction rapidly supplanted the Wittig olefination to become the method of choice for preparing them. More recently, metal-catalyzed and photochemical carbonyl-olefin metathesis reactions, including the formation of the oxetane ring followed by the cycloreversion of the strained ring, emerged as reliable alternative strategies.[1,2] A Mallory electrocyclization reaction could also be included in the process to achieve functionalized phenanthrene derivatives.[3]

In contrast to oxetanes, fragmentation of thietanes,[4] which are their sulfur analogs, has been way less explored to date due to their synthetic access, which remained challenging until recently. Indeed, our group newly reported a domino photochemical synthesis of a wide variety of thietanes, where unstable thiocarbonyls are generated *in situ* via a Norrish-type II fragmentation of phenacyl[5] or pyrenacyl[6] sulfides precursors, which then participate in a thia-Paternò–Büchi reaction with diverse alkene partners.

Taking advantage of the straightforward access to functionalized thietanes, we investigated the cycloreversion of these four-membered ring sulfur-containing heterocycles and developed a selective general synthesis of sterically-hindered alkenes or phenanthrenes by a simple adjustment of the wavelength of irradiation of thietane substrates.



Scheme 6: Divergent method to access either olefins or PAHs from thietanes

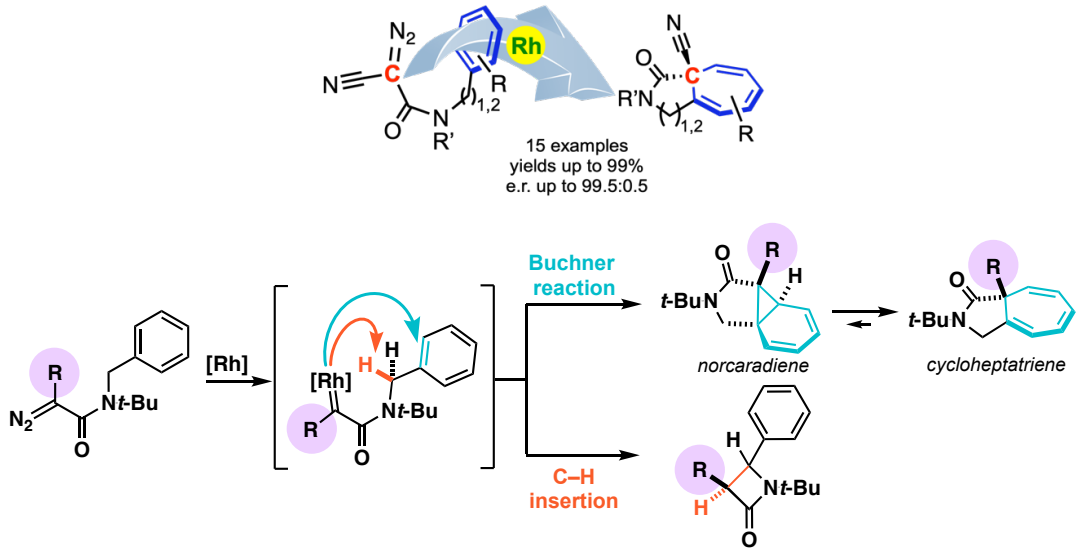
[1] Ludwig, J. R.; Zimmerman, P. M.; Gianino, J. B.; Schindler, C. S. Iron(III)-Catalysed Carbonyl–Olefin Metathesis. *Nature* **2016**, *533* (7603), 374–379.
[2] Harvey, F. M.; Bochet, C. G. Photochemical Methods in Metathesis Reactions. *Org. Biomol. Chem.* **2020**, *18* (40), 8034–8057.
[3] Zhang, Y.; Wang, J.; Guo, Y.; Liu, S.; Shen, X. Carbonyl Olefin Metathesis and Dehydrogenative Cyclization of Aromatic Ketones and *Gem* -Difluoroalkenes. *Angewandte Chemie* **2024**, *136* (5), e202315269.
[4] Gotthardt, H.; Nieberl, S. Synthese von Olefinen Durch Lichtinduzierte Thietan-Fragmentierungen Mit Einem Neuen Sensibilisator. *Liebigs Ann. Chem.* **1979**, *1979* (6), 866–869.
[5] Lapuh, M. I.; Cormier, G.; Chergui, S.; Aitken, D. J.; Boddaert, T. Preparation of Thietane Derivatives through Domino Photochemical Norrish Type II/Thia-Paternò–Büchi Reactions. *Org. Lett.* **2022**, *24* (45), 8375–8380.
[6] Cormier, G.; Allain, C.; Boddaert, T. *In Situ* Generation of 1-Acetylpyrene as a Visible-Light Photocatalyst for the Thia-Paternò-Büchi Reaction. *Angewandte Chemie* **2024**, *136* (51), e202412602.

P A136

Rhodium(II)-catalyzed Buchner reaction: Enantio- and Chemoselectivity Studies

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Carbenes are important synthetic species used in diverse types of reactions, and the development of organometallic catalysis has permitted major advances in carbene chemistry. Indeed, the formation of metallocarbene intermediates allow carbene transfers to occur in a much more efficient and selective way than with free carbenes. C–H insertion and cyclopropanation of unsaturated skeletons are the most common reactions involving carbenes. Noteworthy, the cyclopropanation between a carbene and a benzenic ring, namely the Buchner reaction, is a powerful method to build polycyclic systems and create tridimensionality from flat compounds. We thus explored the access to enantioenriched seven-membered carbocycle-containing bicyclic compounds using the asymmetric intramolecular Buchner reaction.[1]



However, for intramolecular carbene transfers, the competitive C–H insertion reactions are frequently observed when performing the Buchner reaction, although the factors responsible for this competition remain unclear. We thus studied the influence of the carbene substitution on the chemoselectivity of intramolecular carbene transfers catalyzed by $Rh_2(OAc)_4$.[2]

[1] Darses, B.; Maldivi, P.; Philouze, C.; Dauban, P.; Poisson, J.-F. Asymmetric Intramolecular Buchner Reaction: From High Stereoselectivity to Coexistence of Norcaradiene, Cycloheptatriene, and an Intermediate Form in the Solid State. *Org. Lett*. **2021**, *23*, 300-304.
[2] Phung, B. T.; Medini, A.; Maldivi, P.; Poisson, J.-F.; Bessières, B.; Darses, B. Intramolecular Buchner reaction: experimental and theoretical comparison of the effect of the carbene substituent on the chemoselectivity *Adv. Synth. Catal.* **2024**, *366*, 4211-4218.

P A137

Preventing the Photodegradation of Anthracene-Based Photosensitizers through the Formation of Zn(II) Molecular Tweezers

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Acenes are polycyclic aromatic hydrocarbons widely exploited for their unique π-conjugated systems. Among them, anthracene derivatives have emerged as versatile building blocks in materials science and photomedicine due to their ability to generate and trap singlet oxygen.[1] However, their high reactivity toward oxidative degradation and photodimerization remains a major limitation,[2] often disrupting the π-system and impairing their photophysical properties. While various steric and supramolecular strategies have been developed to protect anthracene cores, applications have mostly focused on luminescence. Based on our interest in the design of photosensitizers and singlet oxygen batteries,[3] we developed terpyridine-based molecular tweezers incorporating alkynylated anthracene units for the production of singlet oxygen.[4] These systems adopt a W-shaped geometry in their free form, which undergoes degradation upon light exposure. Zn(II) coordination induces a conformational switch to a U-shaped complex, significantly enhancing oxidative stability while maintaining singlet oxygen generation (Figure 1). The synthesis of these molecular tweezers and their photophysical studies related to singlet oxygen generation will be presented in this communication.

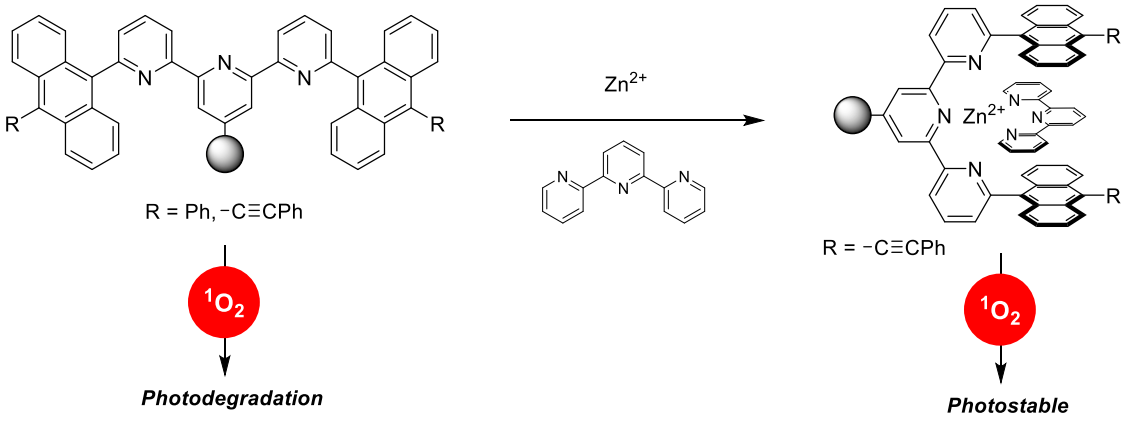


Figure 1: Molecular Tweezers Complex of an Anthracene-Based Photosensitizer.

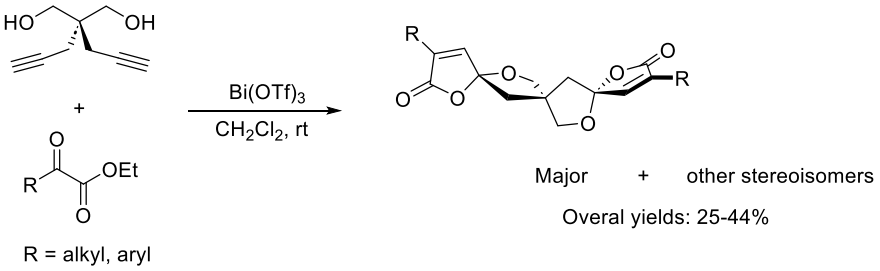
[1] M. Ma *et al. Adv Funct Materials* **2025**, *35*, 2414467; X. Liu *et al. Org. Biomol. Chem.* **2025**, *23*, 1708; A. F. Olea *et al. J. Phys. Chem.* **1995**, *99*, 4518.
[2] F. Becker *et al Macromol. Rapid Commun.* **2020**, *41*, 2000314; G. W. Breton *et al. J. Chem. Educ.* **1998**, *75*, 81.
[3] P. De Bonfils *et al. Eur J Org Chem* **2024**, *27*, e202400099; P. De Bonfils *et al. J. Org. Chem.* **2020**, *85*, 10603.
[4] P. De Bonfils *et al J*. Org. Chem. **2025**, *90*, 10037.

P A138

A Bidirectional Strategy for a Straightforward Synthesis of Bis(spiroketal) Butenolides

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The synthesis of new trispiro compounds possessing two spiroketal butenolide subunits only unified by a single carbon atom has been achieved according a one-pot sequence from a bis acetylenic diol and different α-ketoesters. The reaction catalyzed by bismuth salts delivered as main product trispiro derivatives which possess a D_4-symmetry.



P A139

Double addition of alkynylaluminum reagents onto nitriles to access diethynyl carbinamines

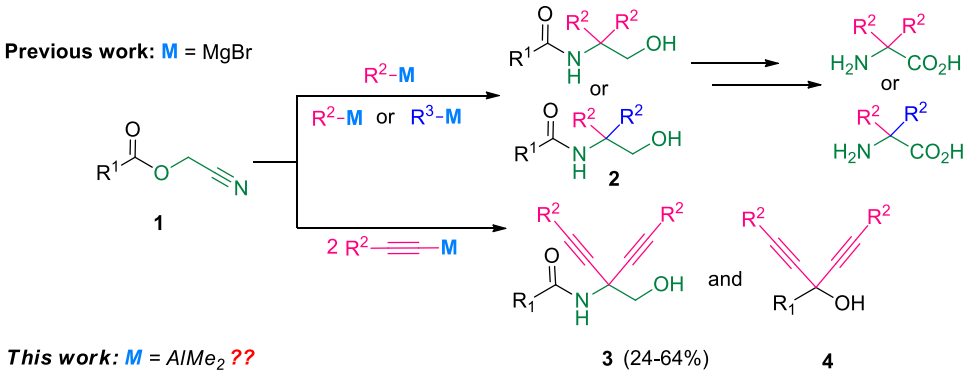
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The tertiary carbinamine moiety is present in various bioactive molecules, such as alkaloids, and constitutes the structural core of quaternary amino acids. Despite many classical methods developed over a decade, the synthesis of such scaffold bearing aryl, alkenyl, or alkynyl substituents remains challenging. One promising and direct strategy involves the double addition of organometallic reagents onto nitriles. However, this approach is often hampered during the second addition due to the low reactivity of the metallated imine intermediate, resulting in the formation of a ketone instead of a tertiary carbinamine. [1]

We previously demonstrated that a double addition of Grignard reagents to acyl cyanohydrins **1** provides an efficient, mild, and versatile access to hydroxyamides **2**, which are precursors of amino acids. [2] This method enabled broad structural diversity, including less accessible aryl and alkenyl moieties. However, the use of alkynyl magnesium bromides shown to be less efficient and faces a competing addition onto the ester group, leading to low yields in the corresponding diethynyl derivatives **3** (24-64%).



To tackle this challenge, the reactivity of organoaluminum reagents, in particular dimethylalkynylaluminum species, was explored as alkynyl agents. These reagents have only been studied once with nitriles by Lee in 2013 to afford α,β-alkynyl ketones. [3] Motivated by their selectivity in alkyne transfer, as well as the abundance of aluminum, we examined the application of these reagents in our strategy toward the synthesis of diethynyl carbinamines,[4] and the results will be presented in this communication.

[1] Pearson-Long, M. S. M.; Boeda, F.; Bertus, P. *Adv. Synth. Catal.* **2017**, *359*, 179–201.

[2] a) Boukattaya, F.; Stanovych, A.; Setzer, P.; Abid, S.; Ammar, H.; Pearson-Long, M. S. M.; Bertus, P. *Chem. Commun.* **2012**, *48*, 8655; b) Boukattaya, F.; Caillé, J.; Ammar, H.; Rouzier, F.; Boeda, F.; Pearson-Long, M. S. M.; Bertus, P. *Synthesis* **2016**, *48*, 906–916.

[3] Korbad, B. L.; Lee, S.-H. *Synlett* **2013**, *24*, 1953–1958.

[4] Nguyen, H. G.; Boeda, F.; Bertus, P.; Pearson-Long, M. S. M. *Org. Biomol. Chem.* **2025**, *23*, 7697–7701.

P A140

Aminium Radicals for Discovering Novel Antiparasitic Endoperoxides

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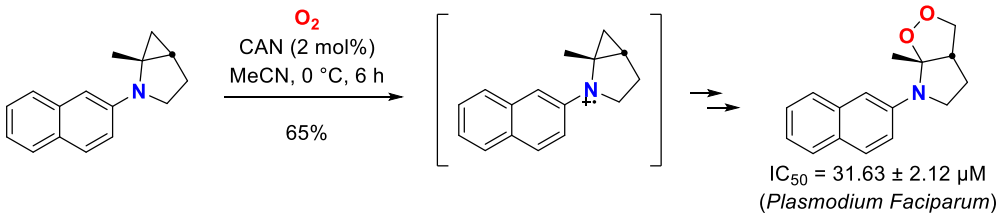
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Following Tu Youyou's Nobel prized discovery, the natural endoperoxide artemisinin and its derivatives have been widely used to cure the neglected parasitic disease malaria under artemisinin-based combination therapies (ACTs).[1] Endoperoxides exhibit further interesting bioactivities such as antileishmanial, anticancer, anthelmintic, anti-inflammatory… However, growing drug resistances result in the need of new synthetic replacements. In our lab, we focus on the challenging synthesis of α-aminoendoperoxides starting from aminium radical precursors. We previously described the anodic oxidation of aminocyclopropanes into aminoperoxides.[2,3,4] Single electron oxidants such as cerium ammonium nitrate (CAN) could also catalyze this transformation. In order to broaden the scope, various precursors were studied (aminocyclopropane, aminocyclobutane, allylic amine and aminodiene derivatives). Their oxidative potentials were measured and the reactivity towards oxygen was analyzed by cyclic voltammetry in aerobic conditions to validate the feasibility of the reaction. Then, (electro)chemical oxidation was performed to obtain the desired endoperoxides. Finally, their antimalarial and antileishmanial bioactivities were evaluated *in vitro*.



[1] *World malaria report 2024*. https://www.who.int/publications/i/item/9789240104440 (accessed 2025-05-09).

[2] Madelaine, C.; Six, Y.; Buriez, O. Electrochemical Aerobic Oxidation of Aminocyclopropanes to Endoperoxides. *Angew Chem Int Ed* **2007**, *46* (42), 8046–8049. https://doi.org/10.1002/anie.200702903.

[3] Madelaine, C.; Buriez, O.; Crousse, B.; Florent, I.; Grellier, P.; Retailleau, P.; Six, Y. Aminocyclopropanes as Precursors of Endoperoxides with Antimalarial Activity. *Org. Biomol. Chem.* **2010**, *8* (24), 5591. https://doi.org/10.1039/c0ob00308e.

[4] Nuter, F.; Dimé, A. K. D.; Chen, C.; Bounaadja, L.; Mouray, E.; Florent, I.; Six, Y.; Buriez, O.; Marinetti, A.; Voituriez, A. Access to New Endoperoxide Derivatives by Electrochemical Oxidation of Substituted 3-Azabicyclo[4.1.0]Hept-4-enes. *Chemistry A European J* **2015**, *21* (14), 5584–5593. https://doi.org/10.1002/chem.201406138.

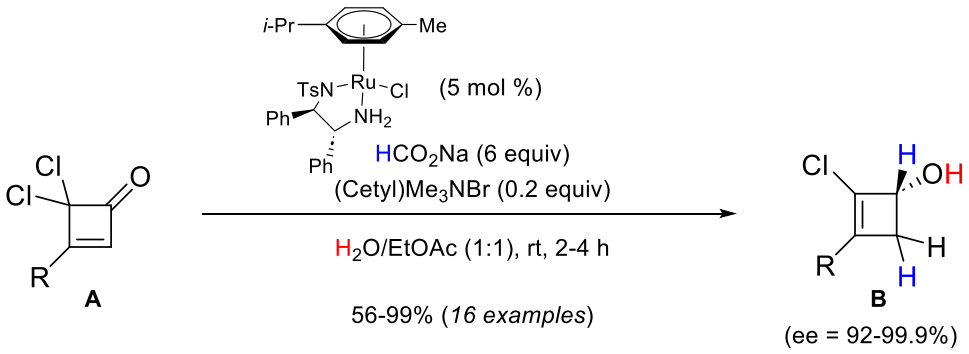
P A141

Synthesis of 2-Chlorocyclobutenols through an Allylic Reduction-Asymmetric Transfer Hydrogenation Cascade

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In the context of the "escape from flatland" strategy in medicinal chemistry, strained cycles hold a critical position as they can act as bioisosteres of aromatic rings with improved pharmacokinetic properties.[1] Among them, the cyclobutyl fragment has recently gained particular attention and stimulated the development of enantioselective catalytic methods to access chiral four-membered rings.[2] One possible strategy is the functionalization of unsaturated four-membered carbocycles such as cyclobutenones. Whilst many enantioselective transition metal-catalyzed conjugate addition reactions have been developed,[3] the asymmetric reduction of the carbonyl group of simple cyclobutenones has not yet been reported. Herein, we disclose the synthesis of chiral 2-chlorocyclobutenols **B** from *gem*-dichlorocyclobutenones **A** through an allylic reduction-asymmetric transfer hydrogenation cascade, catalyzed by a Noyori-Ikariya ruthenium complex. This method provides an efficient entry to 2-chlorocyclobutenols with high enantiomeric purities, which were involved in several post-functionalization reactions to demonstrate their synthetic utility to access diversely substituted four-membered carbocycles.[4]



[1] a) Lovering F.; Bikker J.; Humblet C. *J. Med. Chem.* **2009**, *52*, 6752; b) Subbaiah M. A. M.; Meanwell N. A. *J. Med. Chem.* **2021**, *64*, 14046.
[2] Van der Kolk M. R.; Janssen M. A. C. H.; Rutjes F. P.J. T.; Blanco-Ania D. *ChemMedChem* **2022**, *17*, e202200020.
[3] a) Zhong C.; Huang Y.; Zhang H.; Zhou Q.; Liu Y.; Lu P. *Angew. Chem. Int. Ed.* **2020**, *59*, 2750; b) Wang S.; Zhong C.; Huang Y.; Lu P. *Angew. Chem. Int. Ed*. **2024**, *63*, e202400515; c) Clement H. A.; Boghi M.; McDonald R. M.; Bernier L.; Coe J. W.; Farrell W.; Helal C. J.; Reese M. R.; Sach N. W.; Lee J. C.; Hall D. G. *Angew. Chem. Int. Ed*. **2019**, *58*, 18405
[4] Charron O.; Kosiuha M.; Ratovelomanana-Vidal V.; Phansavath P.; Gontard G.; Meyer C.; *Adv. Synth. Catal.* **2025**, *367*, e202401406.

P A142

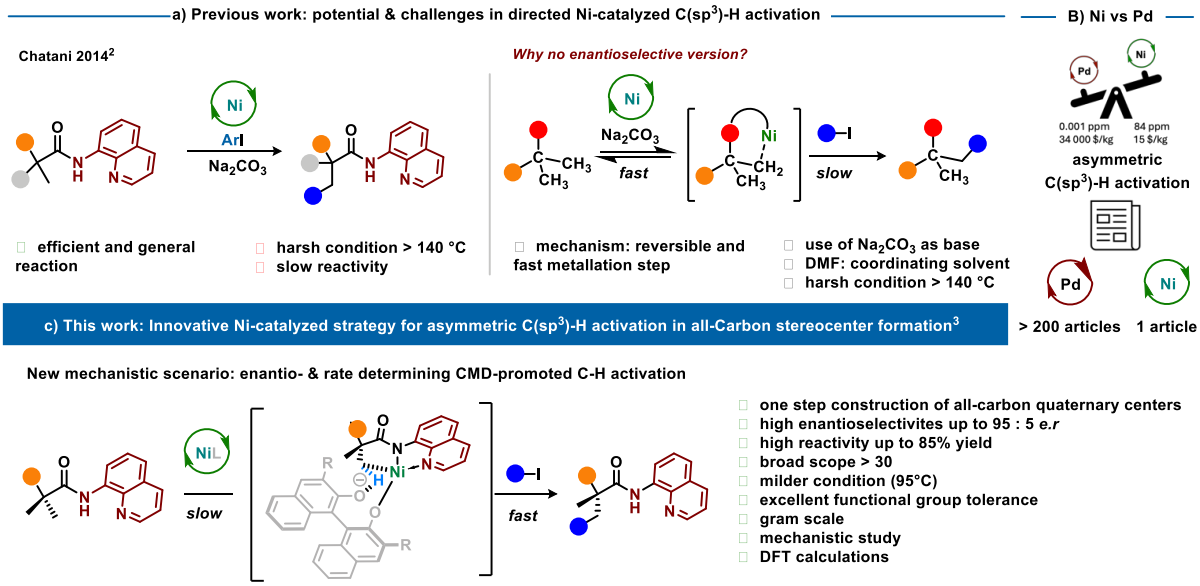
Intermolecular Enantioselective Nickel-Catalyzed Arylation of Un-Activated C(sp³)-H Bond

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The enantioselective activation of inert C(sp³)–H bonds represents one of the most powerful yet challenging strategies in modern asymmetric synthesis. [1] While palladium, rhodium, and cobalt catalysts have enabled progress in this field, the development of nickel-based systems has remained elusive due to the metal's variable oxidation states, reversible C–H activation steps, and complex coordination behavior.[2] In this work, we report the first example of an *intermolecular enantioselective nickel-catalyzed C(sp³)–H arylation*, enabling direct access to all-carbon quaternary stereocenters.[3] By employing a specially designed BINOL-derived ligand, in combination with $Ni(OTf)_2$ and sodium tert-butoxide, we achieved highly efficient and stereoselective desymmetrization of gem-dimethyl groups. The optimized catalytic system allows reactions to proceed under relatively mild conditions (95 °C) with broad functional group tolerance, delivering a wide scope of arylated products in high yields and enantiomeric ratios up to 95.5:4.5. Overall, this study introduces a sustainable and cost-effective nickel-based catalytic platform for asymmetric C–H functionalization, paving the way for new strategies in the synthesis of complex chiral molecules across pharmaceuticals, agrochemicals, and materials science.



[1] Newton, C. G.; Wang, S.-G.; Oliveira, C. C.; Cramer, N. Catalytic Enantioselective Transformations Involving C–H Bond Cleavage by Transition-Metal Complexes. *Chem. Rev.* **2017**, *117* (13), 8908–8976. https://doi.org/10.1021/acs.chemrev.6b00692.

[2] Aihara, Y.; Chatani, N. Nickel-Catalyzed Direct Arylation of C(Sp3)–H Bonds in Aliphatic Amides via Bidentate-Chelation Assistance. *J. Am. Chem. Soc.* **2014**, *136* (3), 898–901. https://doi.org/10.1021/ja411715v.

[3] Brunard, E.; Huang, F.; Díaz-Jiménez, A.; Kostiukovska, S.; Wencel-Delord J. Intermolecular Enantioselective Nickel-Catalyzed Arylation of Un-Activated C(sp³)-H Bond *submitted.*

P A143

Development of Dual Metallo-Photoredox-Catalyzed Methods for Allene Synthesis

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Allenes are key intermediates in organic synthesis due to their high and diverse chemical reactivity. They are important structural motifs found in natural products and pharmaceuticals, and used to design advanced functional materials as well, making them interesting target molecules.[1] Nowadays, SN2'-type nucleophilic substitution reactions of propargyl electrophiles still stand among the most attractive strategies for constructing allene motifs. However, these methods rely on nucleophilic additions of highly reactive organometallic reagents that need to be prepared/handled under inert conditions and allow limited functional group tolerance.[2] Therefore, the development of alternative new processes avoiding the use of such reagents is highly desirable.

Recently, dual metallo-photoredox catalysis has emerged as a powerful strategy that allows the cross-coupling of two readily available, bench-stable electrophilic species. These processes that combine transition metal catalysis (Ni, Cu, Co…) and photocatalysis operate under mild and eco-compatible conditions by converting light energy to chemical energy with the help of a photocatalyst.[3]

With this aim, two complementary methodologies were designed to access allenes. Firstly, a hydride-free reduction of propargyl carbonates to allenes using triethylamine under Ni/photoredox catalysis was developed to access mono-, di-, and trisubstituted allenes.[4] In this hydride-free process, the alkylamine plays the roles of both a redox mediator, as the reductive quencher of the photocatalytic cycle, and as a proton source, via proton transfer from its photochemically generated amine radical cation. To access diverse substituted allenes, a complementary approach relying on a silyl radical-mediated halogen-atom transfer (XAT) process under nickel and photoredox catalysis was developed to enable a direct allenylation of alkyl halides under mild conditions.[5] The direct use of these abundant and easily accessible alkyl electrophiles is particularly advantageous from the standpoint of functional group tolerance, atom economy, and safety. The strength of this method lies in its ability to deliver a large scope of functionalized tetrasubstituted allenes in good yields and total regioselectivity.

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[1] *Allenic natural products and pharmaceuticals:* A. Hoffmann-Röder, N. Krause, *Angew. Chem., Int. Ed.* **2004**, *43*, 1196. *Allenic materials:* P. Rivera-Fuentes, F. Diederich, *Angew. Chem., Int. Ed.* **2012**, *51*, 2818.

[2] *How easy are the syntheses of allenes?* S. Yua, S. Ma, *Chem. Commun.* **2011**, *47*, 5384.

[3] *Metallaphotoredox catalysis:* (a) J. Twilton, C. Le, P. Zhang, M. H. Shaw, R. W. Evans, D. W. C. MacMillan, *Nature Reviews Chemistry* **2017**, 1(7), 0052. (b) J. A. Milligan, J. P. Phelan, S. O. Badir, G. A. Molander, *Angew. Chem., Int. Ed.* **2019**, 58, 6152.

[4] *Hydride-free reduction of propargyl electrophiles: A nickelcatalyzed photoredox strategy for allene synthesis:* Hu T, Fagué V, Bouyssi D, Monteiro N, Amgoune A., *Green Chem* **2024**, *26*, 6124

[5] *Nickel-Catalyzed Photoredox Allenylation of Alkyl Halides :* Hu T, Beluze C, Fagué V et al., *Org Lett,* **2024**, 26, 9519.

P A144

Room-Temperature Phosphorescence Vapochromism Through Conformational Control

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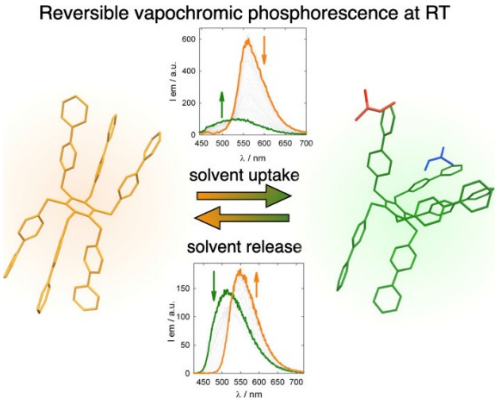
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Arylthio-substituted persulfurated benzenes (such as A6-Tol) represent an intriguing class of solid-state room-temperature phosphorescence emitters, a phenomenon most commonly detected in metal complexes[1], that our groups pioneered in 2013.[2,3] While the relationship between their luminescent properties and structural factors (such as intramolecular conformation,[2,4] polymorphism, aggregation[3,5]) or physical stimuli (such as temperature[2]) have been described, the phosphorescence tuning via application of a chemical stimulus has not been observed within this class of compounds.

In this work, we demonstrate that a decorated persulfurated benzene shows reversible phosphorescence switching in the solid state, as a consequence of conformational changes induced by inclusion of solvent molecules. Quantum-chemical calculations suggest that the luminescence changes are due to emission from triplet states of different character. These results display the close relationship between structural factors and phosphorescence in solid state emitters, representing a valuable benchmark for the design of all-organic luminescent sensors with desired photophysical properties.



[1] Ravotto, L.; Ceroni, P. Aggregation Induced Phosphorescence of Metal Complexes: From Principles to Applications. Coord. Chem. Rev. 2017, 346, 62–76. https://doi.org/10.1016/j.ccr.2017.01.006.

[2] Fermi, A.; Bergamini, G.; Peresutti, R.; Marchi, E.; Roy, M.; Ceroni, P.; Gingras, M. Molecular Asterisks with a Persulfurated Benzene Core Are among the Strongest Organic Phosphorescent Emitters in the Solid State. Dyes Pigments 2014, 110, 113–122. https://doi.org/10.1016/j.dyepig.2014.04.036.

[3] Fermi, A.; Bergamini, G.; Roy, M.; Gingras, M.; Ceroni, P. Turn-on Phosphorescence by Metal Coordination to a Multivalent Terpyridine Ligand: A New Paradigm for Luminescent Sensors. J. Am. Chem. Soc. 2014, 136 (17), 6395–6400. https://doi.org/10.1021/ja501458s.

[4] Ostroverkhova, O. Organic Optoelectronic Materials: Mechanisms and Applications. Chem. Rev. 2016, 116 (22), 13279–13412. https://doi.org/10.1021/acs.chemrev.6b00127.

[5] Shen, S.; Baryshnikov, G. V.; Xie, Q.; Wu, B.; Lv, M.; Sun, H.; Li, Z.; Ågren, H.; Chen, J.; Zhu, L. Making Multi-Twisted Luminophores Produce Persistent Room-Temperature Phosphorescence. Chem. Sci. 2023, 14 (4), 970–978. https://doi.org/10.1039/D2SC05741G.

P A145

Merging Ball-Milling and Supported Organocatalysis via Surface Functionalization of Mechanochemical Reactors

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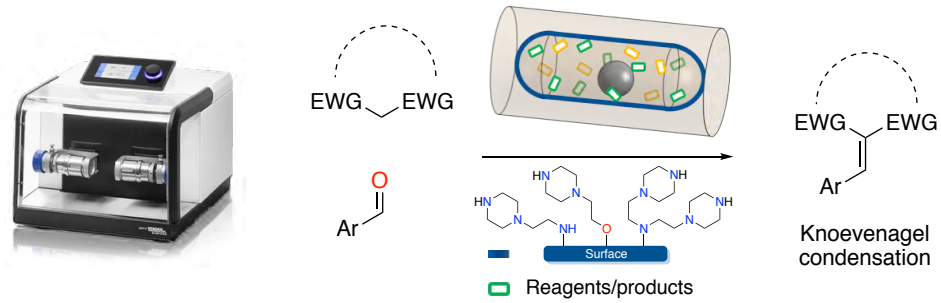
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Mechanochemistry, particularly ball milling, has emerged as a green and efficient alternative to traditional solution-based synthesis. This solvent-free approach has found broad applications in organic, medicinal, and materials chemistry.[1] To further expand the scope of these reactions, catalysts can be directly added to the reaction medium, enabling catalyzed transformations. However, this method often requires multiple purification steps to remove residual catalysts, leading to increased waste, longer reaction times, and a reduction in the overall sustainability of the process. To address these limitations, metal-based direct mechanocatalysis has been developed. This approach employs metal-coated vessels, balls, or even metal-based balls to catalyze reactions without introducing catalysts into the bulk reaction mixture.[2]

In contrast, direct mechanoorganocatalysis under ball-milling conditions has never been explored. Therefore, in this work, we present a novel approach using epoxy resin milling jars with pendant functional groups used to anchor organocatalysts onto the jar surface. This design prevents catalyst leaching into the reaction medium, enabling a reusable, heterogeneous catalytic system. These newly functionalized jars demonstrated high efficiency in both the Knoevenagel condensation[3] and a multicomponent reaction,[4] offering a sustainable and practical alternative for mechanochemical organic synthesis.[5]



[1] Howard, J.; Cao, Q.; Browne, D. L. Mechanochemistry as an emerging tool for molecular synthesis: what can it offer? *Chem. Sci.* **2018**, *9*, 3080-3094.

[2] Pickhardt, W.; Grätz, S.; Borchardt, L. Direct Mechanocatalysis: Using Milling Balls as Catalysts. *Chem. Eur. J.* **2020**, *26*, 12903-12911.

[3] Trotzki, R.; Hoffmann, M. M.; Ondruschka, B. Studies on the solvent-free and waste-free Knoevenagel condensation. *Green Chem.* **2008**, *10*, 767-772.

[4] Amirnejad, M.; Naimi-Jamal, M. R.; Tourani, H.; Ghafuri, H. A facile solvent-free one-pot three-component method for the synthesis of 2-amino-4H-pyrans and tetrahydro-4H-chromenes at ambient temperature. *Monatsh. Chem.* **2013**, *144*, 1219-1225.

[5] Tanepau, J.; Provost, M.; Gressier, M.; Menu, M.-J.; Duluard, S.; Lamaty, F.; Pinaud, J.; Bantreil X. Manuscript under preparation.

P A146

Ligand design of [Cu(P^P)(N^N)][X] complexes : Applications in Ligth-emitting Electrochemical Cells

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Nowadays organometallics complexes are widely applied for lighting fields as organic light-emitting diodes (OLEDs) or light-emitting electrochemical cells (LECs)[1]. For many years transition metals such as ruthenium, iridium, gold… were mainly used for this application because of their ability to enable emission from triplet excitons, but their low abundance and high price are important issues. In this context, we put our focus on copper(I) complexes which are more convenient and can also provide efficient photo- and electro-luminescence by organic thermally activated delayed fluorescence (TADF).

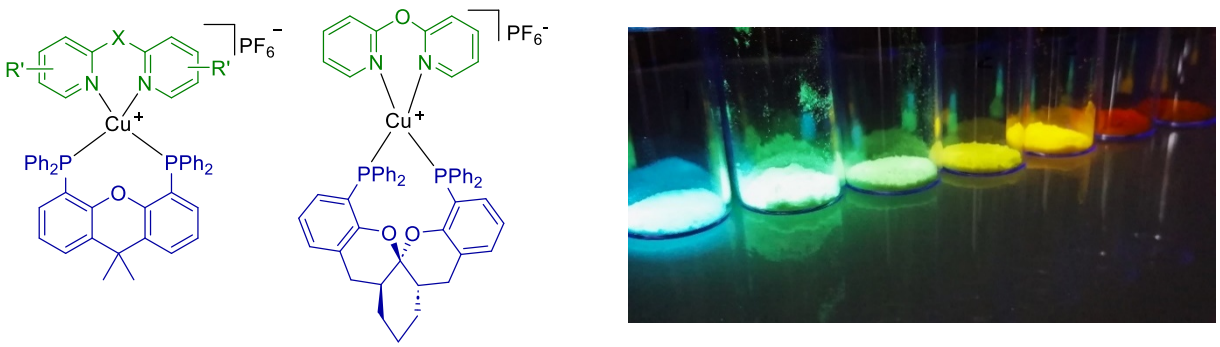


Figure 1 : Structure of Copper(I) complexes and their emission under UV light.

In this work, we have studied behavior of [Cu(P^P)(N^N)][X] emitters (Erreur ! Source du renvoi introuvable.), in which P^P is a bidentate diphosphine ligands as XantPhos or DPEPhos[2], N^N is a bis-2-pyridyl ligand and X is a hexafluorophosphate anion. We have developed a family of copper complexes which can provide emission in all the rainbow by modifying the nature of the N^N ligand (from blue to red emissions). Finally, we are exploring chiral copper (I) complexes with chirality centered in the P^P ligands for potential applications in circularly polarized luminescence (CPL).

[1] Elie. M.; Gaillard. S. and Renaud. J.-L., in Light-Emitting Electrochemical Cells: Concepts, Advances and Challenges, Springer International Publishing, *Cham*, **2017**, *pp*. 287–327.

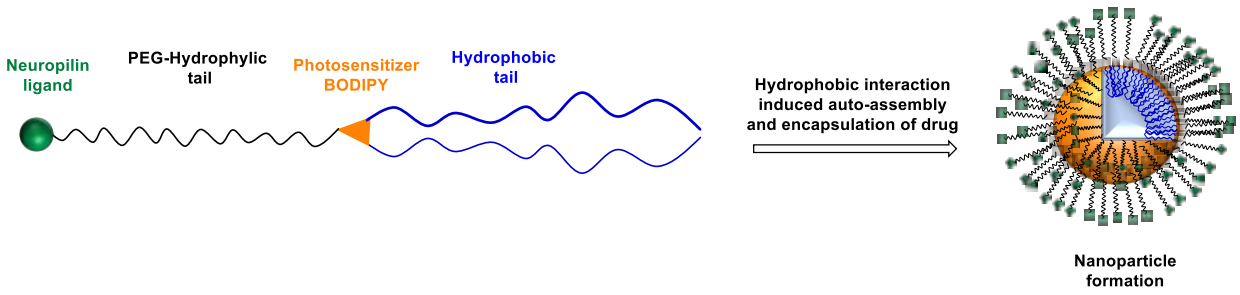
[2] Mahoro. G. U.; Fresta. E.; Elie. M.; Di Nasso. D.; Zhang. Q.; Lohier. J. F.; Renaud. J.-L.; Linares. M.; Wannemacher. R.; Cabanillas-Gonzalez. J.; Costa. R. D. and Gaillard. S., Towards rainbow photo/electro-luminescence in copper(i) complexes with the versatile bridged bis-pyridyl ancillary ligand, *Dalton Trans.*, **2021**, *50*, 11049.

P A147

Synthesis of BODIPY nanoparticles targeting neuropilins for cancer treatment

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Neuropilins are transmembrane glycoproteins involved in various processes related to tumor activity, such as cell proliferation, angiogenesis, lymphangiogenesis, and immune tolerance. [1]
Their overexpression in tumors is often associated with poor survival prognosis.[2] Given their roles in tumor activities, neuropilins represent a validated target for the development of anticancer therapies, particularly through the use of their specific inhibitors. These latter exhibit the ability to penetrate tumor cells, enabling the use of neuropilins as a tools for drug vectorization.[3] This approach has already been exploited using peptides, facilitating transcytosis into tumor cells overexpressing neuropilins.[4]
We already disclosed different series of non-peptidic neuropilin ligands.[3,5-7] The docking studies of one of this hits, namely NRP-a47, revealed an anchoring point at the methyl group located outside the neuropilin interaction pocket.[6] This feature provides the opportunity to attach novel linkers to this position.
The aim would be to use these linkers to couple them with photosensitizing agents, such as BODIPY derivatives, enabling a targeted photodynamic therapy. BODIPY are easily functionalized and hold significant promises for phototherapy. However, their predominantly hydrophobic nature limits their biomedical applications. To address this issue, BODIPY derivatives can be physically encapsulated within nanoparticles (NPs).[7]
Herein, we describe an amphiphilic molecule incorporating a BODIPY moiety that self-assembles in aqueous media into nanoparticles capable of encapsulating a therapeutic drug. The use of multitarget molecules is opening new prospects for innovative applications in targeted therapy for tumors.



[1] Dumond and *al.*, *Med Sci (Paris)* **2020**, *36* (5), 487–496. https://doi.org/10.1051/medsci/2020080.
[2] Grandclement and al., *Cancers* **2011**, *3* (2), 1899–1928. https://doi.org/10.3390/cancers3021899.
[3] Brachet and *al.*, *Bioorganic & Medicinal Chemistry Letters* **2019**, *29* (24), 126710. https://doi.org/10.1016/j.bmcl.2019.126710.
[4] Izci and *al.*, *Advanced Healthcare Materials* **2023**, *12* (24), 2300594. https://doi.org/10.1002/adhm.202300594.
[5] Liu and *al.*, *Bioorganic & Medicinal Chemistry Letters* **2014**, *24* (17), 4254–4259. https://doi.org/10.1016/j.bmcl.2014.07.028.
[6] Borriello and *al.*, *Cancer Letters* **2014**, *349* (2), 120–127. https://doi.org/10.1016/j.canlet.2014.04.004.
[7] Gayathri and *al.*, *ACS Med. Chem. Lett.* **2018**, *9* (4), 323–327. https://doi.org/10.1021/acsmedchemlett.7b00490.

P A148

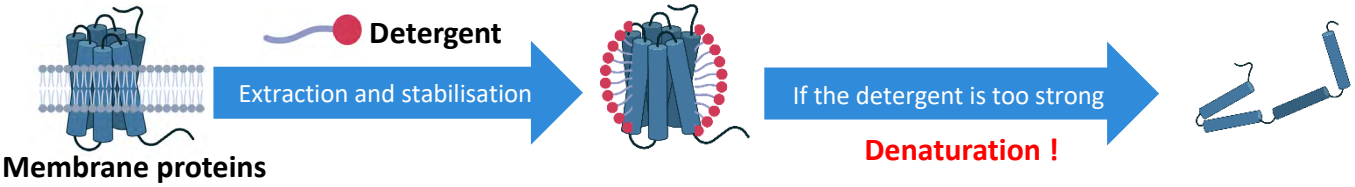
Detergents Reimagined: A Clearer Window into Membrane Protein Understanding

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Elucidating the structure of membrane proteins is a major challenge today. Indeed, membrane proteins represent over 60% of therapeutic targets, but only 2.5% of their structures are known[1,2,3]. To study membrane proteins, they must first be extracted from the membrane. This is made possible by detergents, which are amphiphilic compounds, meaning that they have a hydrophilic head and a hydrophobic tail. The detergents insert themselves into the lipid bilayer, destabilizing it until it becomes saturated and disintegrates, then forming micelles around the proteins, enabling them to be isolated, stabilized, and characterized[4].

Nevertheless, many common detergents lead to protein deactivation and denaturation and are therefore not suitable for protein stabilization. The instability of proteins in micelles can be explained by three properties : the flexibility of the alkyl chain; the low resemblance of detergents to the membrane; and unfavorable interactions between detergents and proteins (delipidation in particular) and/or the formation of large detergent-protein complexes.

It is therefore necessary today to synthesize new, milder detergents, enabling good solubilization of these membrane proteins without leading to denaturation. One way of reducing the flexibility of alkyl chains while preserving their hydrophobicity is to incorporate a ring into them, which will also reduce the size of detergent-protein complexes. What we suggest is to synthesize detergents inspired by oxylipins, to which will be grafted a polar head composed of sugars, whose anomeric bond stereochemistry will be β. After synthesis of these detergents, it will be necessary to characterize their physicochemical (hydrophilic-lipophilic balance, critical micellar concentration and micelle shape, size dispersity) and biochemical (protein solubilization, assessing protein stability and activity, and protein purification) properties.

[1] Overington, J. P.; Al-Lazikani, B.; Hopkins, A. L. How Many Drug Targets Are There? *Nat Rev Drug Discov* **2006**, *5* (12), 993–996. https://doi.org/10.1038/nrd2199.

[2] Lee, H. J.; Lee, H. S.; Youn, T.; Byrne, B.; Chae, P. S. Impact of Novel Detergents on Membrane Protein Studies. *Chem* **2022**, *8* (4), 980–1013. https://doi.org/10.1016/j.chempr.2022.02.007.

[3] Bunnage, M. E. Getting Pharmaceutical R&D Back on Target. *Nat Chem Biol* **2011**, *7* (6), 335–339. https://doi.org/10.1038/nchembio.581.

[4] le Maire, M.; Champeil, P.; Møller, J. V. Interaction of Membrane Proteins and Lipids with Solubilizing Detergents. *Biochimica et Biophysica Acta (BBA) - Biomembranes* **2000**, *1508* (1), 86–111. https://doi.org/10.1016/S0304-4157(00)00010-1.

P A149

Towards the enzymatic labelling of oligonucleotides with triantennary *N*-acetyl galactosamine

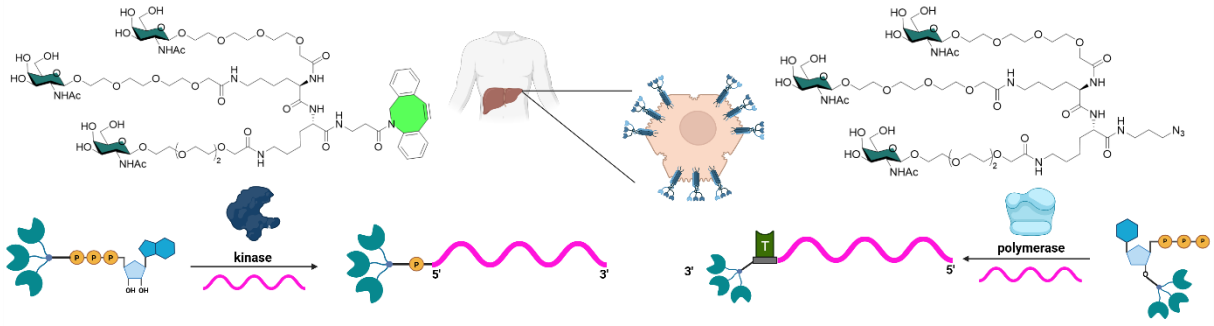
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Chemical modifications of oligonucleotides improve their resistance to nuclease-mediated degradation, enhance biological activity, and provide a degree of cellular delivery capacity. Among current delivery strategies, conjugation to triantennary *N*-acetylgalactosamine (GalNAc) ligands has proven highly effective for targeting hepatocytes. However, conventional methods for GalNAc conjugation are chemically complex, time-consuming, and require specialized equipment and/or expertise, limiting broader applicability.[1,2] To overcome these limitations, we investigated an enzymatic labeling approach to enable direct GalNAc conjugation to oligonucleotides in a sequence-independent manner. Two complementary strategies were explored. First, we synthesized a GalNAc-modified ATP by attaching the ligand to its γ-phosphate group, aiming to transfer it enzymatically to the 5′ end of oligonucleotides using kinases. Second, we designed a GalNAc-functionalized locked nucleic acid (LNA) nucleoside triphosphate, modified at the 3′ position, for incorporation at the 3′ end of oligonucleotides using template-independent polymerases.[3] Our results show that kinases exhibit poor tolerance to the bulky GalNAc modification located on ATP, preventing efficient transfer. In contrast, template-independent polymerases (such as terminal deoxynucleotidyl transferase) successfully incorporated the modified LNA nucleotide at the 3′ end of both DNA and RNA oligonucleotides without sequence constraints. This enzymatic strategy provides a promising, flexible alternative to conventional chemical conjugation methods and represents a first step toward the development of a universal, synthesis-free GalNAc-labeling platform for therapeutic oligonucleotides.[4]



[1] Engelhardt, D.; Nordberg, P.; Knerr, L.; Malins, L. R. *Angew. Chem. Int. Ed.* **2024**, *63* (49), e202409440.

[2] Tölke, A. J.; Gaisbauer, J. F.; Gärtner, Y. V.; Steigenberger, B.; Holovan, A.; Streshnev, F.; Schneider, S.; Müller, M.; Carell, T. *Angew. Chem. Int. Ed.* **2024**, *63* (25), e202405161.

[3] Bizat, P. N.; Sabat, N.; Hollenstein, M. *ChemBioChem.* **2025**, *26* (9), e202400987.

[4] Meron, E.; Bizat, P. N.; Simmons Hovorka, H.; Levi-Acobas, F.; Badji, Y.; Kitoun, C.; Sabat, N.; Hanlon, S.; Püntener, K.; Hollenstein, M. *ChemRxiv.* **2025**. DOI : 10.26434/chemrxiv-2025-808c6.

P A150

Development of original [^{18}F]-PET radiotracers targeting neurodegenerative diseases

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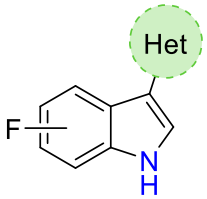
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In the past decades, most research has been focused on the development of molecular probes targeting the central nervous system (CNS) and more particularly the neuroinflammation. Neuroinflammation is the main and early physiological process implicated in neurodegenerative diseases such as Alzheimer's disease (AD), Parkinson's disease (PD) and amyotrophic lateral sclerosis (ALS). According to the 2016 World Health Organisation (WHO) report, the number of affected people could triple by 2050 as a result of population ageing.[1] Consequently, this proves the urge about the development of new tools permitting to visualise the progression of neuroinflammation in neurodegenerative disorders.

Currently, several targets have been listed to be involved in the neuroinflammation phenomenon and have been the centre of attention of clinicians. Lately, tryptophan 2,3-dioxygenase (TDO) has been discovered as a new interesting target taking place in the kynurenine pathway. This enzyme catalyses the first and limiting step tryptophan's conversion into kynurenine which leads to the secretion of neurotoxic species.

To date only two ^{18}F PET tracers could be potential candidates on TDO toward PET imaging application but remain untested on humans.[2,3] However, no ^{18}F radioligands have been placed on the market yet. Consequently, the search of new ^{18}F radiotracers remains essential.

Thanks to literature results our team explored structure-activity relationships through the synthesis of references and analogues and their biological evaluation. Our team is currently providing novel fluorinated indoles and analogues with optimised synthetic routes. Among the 25 tested molecules, one of them have shown promising inhibition effects with high activity and selectivity for TDO toward the Indoleamine 2,3-dioxygenase. The preliminary radiosynthesis attempts starting from a pinacol borane precursor allowed us to prepare the desired radiolabelled tracer in 60 min with a satisfying molar activity but low radiochemical yield (6 %). Some optimisation of the radiosynthesis conditions are currently under review for a forthcoming automated process.



[1] WHO (World Health Organisation). *WORLD REPORT ON AGEING AND HEALTH*, **2016**

[2] *John, F. et al., Mol. Imaging Biol.* ***2020****, 805–819*

[3] *Qiao, Z. et al., Nucl. Med. Biol.* ***2020****, 84–85, 1–10*

P A151

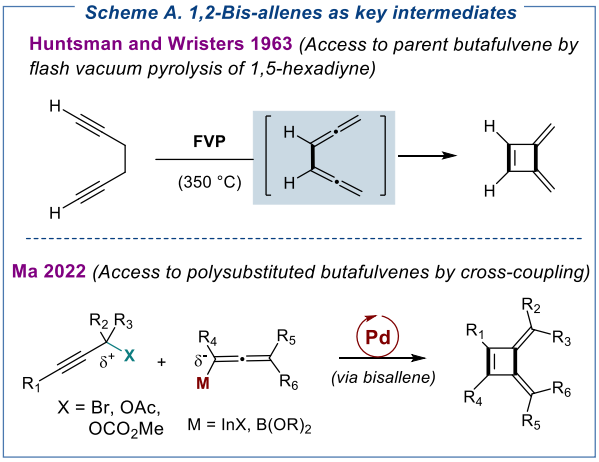
Electrochemically-Driven Auto-Tandem Nickel Catalysis for the Production of Butafulvenes

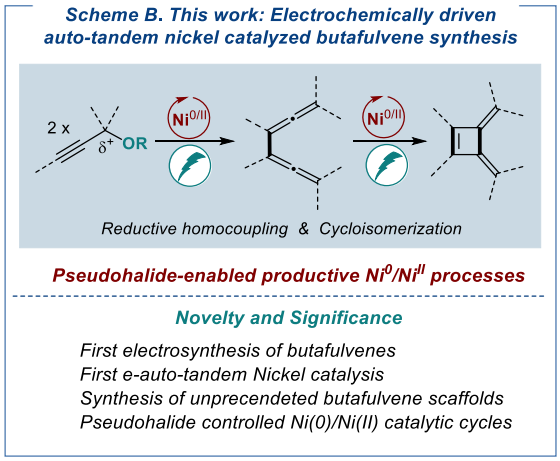
Tingjun Hu,[1] Camille Beluze,[1] Coralie Duchemin, Didier Bouyssi, Julien C. Vantourout, Nuno Monteiro, Abderrhamane Amgoune*

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Butafulvenes (3,4-bis(methylene)cyclobutenes) are a unique class of highly strained, anti-aromatic cyclic compounds that hold great promise for advanced applications such as the de-sign of highly unsaturated materials, solid state luminescent materials, as well as the construction of complex cyclobutene-containing natural product-like molecules. However, the synthetically challenging structural features of these compounds still hamper their broad investigation and application. A classical synthetic approach relies on the preparation, or in situ generation, of a bisallenic (1,2,4,5-tetraene) intermediate followed by its electrocyclization, a process that requires relatively high temperatures (Scheme A).[1] Over the years, transition metals (Ni, Cu, Pd) have been shown to facilitate the conversion of bisallenes into butafulvenes, allowing milder reaction conditions.[2] In this context, we have successfully developed an efficient catalytic method relying on the combination of nickel catalysis and electrochemistry for the synthesis of butafulvenes from propargyl electrophiles operable under mild conditions. Our approach exploits the capacity of nickel to catalyze in tandem the generation of bisallenes directly through dimerization of propargyl electrophiles, and their subsequent cycloisomerization to butafulvenes (Scheme B). Overall, this study presents a robust, and sustainable methodology, setting the stage for new advancements in the exploration of the reactivity and properties of butafulvenes.





[1] Hopf, H.; Markopoulos, G. The chemistry of bisallenes. *Beilstein J. Org. Chem*. **2012**, *8*, 1936-1998

[2] a) Pasto, D. J.; Mitra, D. K. *J. Org. Chem*. **1982**, *47*, 1381-1382; b) Pasto, D. J.; Zhong, H. N. *J. Org. Chem*. **1985**, *50*, 4465-4467; c) Pasto, D. J.; Yang, S. H. *J. Org. Chem*. **1989**, *54*, 3544-3549; d) For a recent study involving Pd catalysis, see: Huang, X.; Chen, B. Z.; Li, P. B.; Ma, S. M. *Nat. Chem*. **2022**, *14*, 1185-1192.

P A152

Exploring N-Trideuteromethylation of Amide Derivatives via Copper Catalysis

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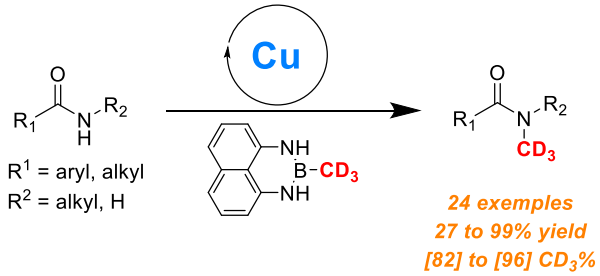
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Deuterium and methyl groups are powerful tools in drug design: the “deuterium switch” enhances metabolic stability and pharmacokinetics, while the “magic methyl effect” influences molecular recognition and selectivity.[1] Trideuteromethylation combines these advantages, offering a unique strategy to optimize drug properties. FDA-approved drugs such as deutetrabenazine highlight the clinical potential of deuterated molecules.[2] Although methods exist to install trideuteromethyl groups, their selective incorporation on amide nitrogen remains underexplored.[3,4]

Here, we present the development of a novel copper-catalyzed methodology for N-trideuteromethylation of amide derivatives using a trideutero-boronamide. High-throughput experimentation enabled rapid optimization, yielding functionalized benzamides and heterocycles with excellent yields and high D/H ratios. This approach provides a versatile platform for late-stage functionalization of nitrogen-containing bioactive molecules, emphasizing the growing importance of trideuteromethylation in medicinal chemistry.



[1] Chen, Y.; Du, Y. The Application of Deuteration Strategy in Drug Design. *ChemMedChem* **2025**, *20* (7), e202400836. DOI: 10.1002/cmdc.202400836

[2] Di Martino, R. M. C.; Maxwell, B. D.; Pirali, T. Deuterium in Drug Discovery: Progress, Opportunities and Challenges. *Nat. Rev. Drug Discov.* **2023**, *22* (7), 562–584. DOI: 10.1038/s41573-023-00703-8

[3] Xia, Q.; Liu, X.; Zhang, Y.; Chen, C.; Chen, W. Copper-Catalyzed *N*-Methylation of Amides and *O*-Methylation of Carboxylic Acids by Using Peroxides as the Methylating Reagents. *Org. Lett.* **2013**, *15* (13), 3326–3329. DOI: 10.1021/ol401362k

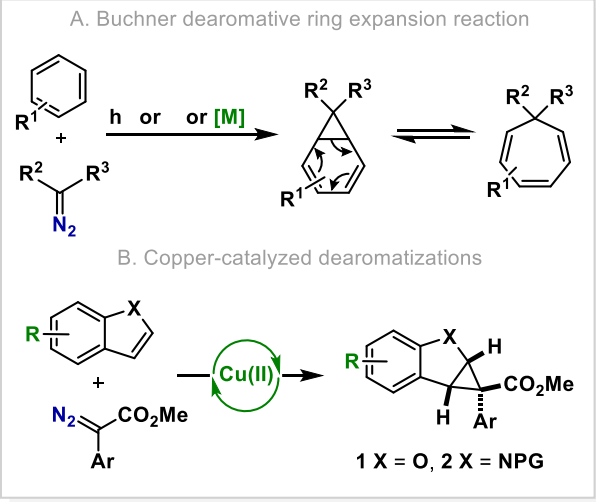
[4] Magre, M.; Szewczyk, M.; Rueping, M. *N*-Methylation and Trideuteromethylation of Amines via Magnesium-Catalyzed Reduction of Cyclic and Linear Carbamates. *Org. Lett.* **2020**, *22* (8), 3209–3214. DOI : 10.1021/acs.orglett.0c00988

P A153

Copper-Catalyzed Intermolecular Cyclopropanation of Benzofurans and Indoles

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Carbenes are very reactive species, generally obtained in the free form by extrusion of dinitrogen from a diazo precursor *via* a photo- or thermal activation or, for over 50 years, as metallocarbenes in the presence of an organometallic complex. Carbenes are known to be excellent species to perform the cyclopropanation of alkenes. However, the cyclopropanation of a benzenic ring leading to a cycloheptatrienes by ring expansion, namely the Buchner reaction, is much less trivial than alkene cyclopropanation (*Scheme path A*).
Dearomative cyclopropanation is thus a powerful strategy for converting simple heteroarenes into three dimensions complex molecular scaffolds. However, this transformation traditionally requires Rh based catalysts, which are scarce and expensive, in particular for benzenic rings dearomatization. Finding alternatives to the use of Rh-catalysts would allow the development of more sustainable strategies. Due to a lower aromatic character of heteroaromatic rings, Cu-catalyzed cyclopropanation of benzofurans and protected indoles has thus been studied (*Scheme path B*).[1] This preliminary work is intended to serve as a foundation for extending dearomative chemistry with earth-abundant metals to more various substrates, alternative ligands, and asymmetric variants.



Buchner reaction leading to the formation of a cycloheptatriene and dearomative cyclopropanation of benzofuranes and protected indoles

[1] Carrick, W.; Vallantin, D.; Nett, T.; Darses, B.; Johnson, J. Copper-Catalyzed Intermolecular Cyclopropanation of Benzofurans and Indoles. *J. Org. Chem.* **2025**, *90,* 10975.

P A154

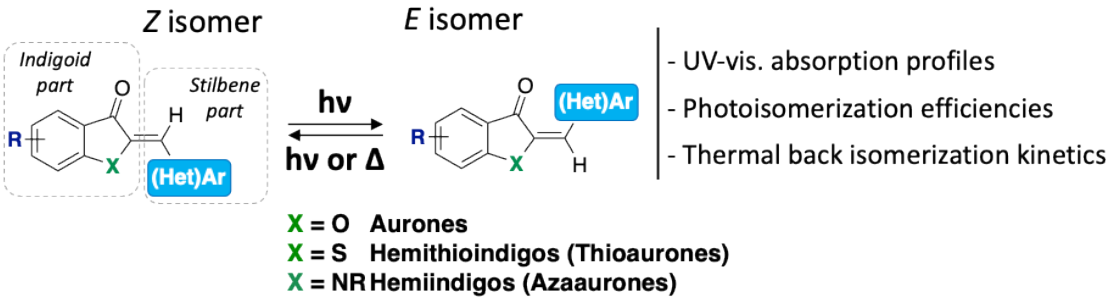
Hemiindigoïd photoswitches: a formal comparison of aurones, hemithioindigos and hemiindigos properties

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Organic compounds with photoswitching properties have garnered increasing attention due to their broad range of potential applications.[1,2] Among emerging photoswitch families, hemiindigoid derivatives, including, for the most-renowned, aurones (X=O), hemithioindigos (X=S), and hemiindigos (X=NR), stand out for their remarkable *Z-E* photoisomerization properties.[3–6] Moreover, their hybrid structure, combining an indigo-like part with a stilbene-like moiety around the central carbon-carbon double bond, offers exceptional structural modularity. However, comparative studies of the photochemical and photophysical properties across these three classes remain limited.[7] This poster aims to highlight the key differences in the properties of these photoswitchable compounds, providing insights into their structure–function relationships and potential for tailored applications.



[1] *Photochromic Materials: Preparation, Properties and Applications*; Tian, H., Zhang, J., Eds.; Wiley-VCH: Weinheim, 2016. https://doi.org/10.1002/9783527683734.

[2] *Molecular Photoswitches: Chemistry, Properties, and Applications*; Pianowski, Z. L., Ed.; Wiley-VCH: Weinheim, Germany, 2022. https://doi.org/10.1002/9783527827626.

[3] Petermayer, C.; Dube, H. Indigoid Photoswitches: Visible Light Responsive Molecular Tools. *Acc. Chem. Res.* **2018**, *51* (5), 1153–1163. https://doi.org/10.1021/acs.accounts.7b00638.

[4] Lazinski, L. M.; Royal, G.; Robin, M.; Maresca, M.; Haudecoeur, R. Bioactive Aurones, Indanones, and Other Hemiindigoid Scaffolds: Medicinal Chemistry and Photopharmacology Perspectives. *J. Med. Chem.* **2022**, *65* (19), 12594–12625. https://doi.org/10.1021/acs.jmedchem.2c01150.

[5] Kaplan, G.; Seferoğlu, Z.; Berdnikova, D. V. Photochromic Derivatives of Indigo: Historical Overview of Development, Challenges and Applications. *Beilstein J. Org. Chem.* **2024**, *20* (1), 228–242. https://doi.org/10.3762/bjoc.20.23.

[6] Gernet, A.; Toursel, L.; Balivet, L.-M.; Pagès, L.; Jean, L. Hemiindigoids as Prominent Photoswitch Scaffolds. *ChemPhotoChem* **2025**, *9* (3), e202400261. https://doi.org/10.1002/cptc.202400261.

[7] Llamosí, A.; Olejnik, M. A.; Danylyuk, O.; Rode, M. F.; Szumna, A. Competition between Photoswitching and Fluorescence in Hemiindigos and Hemithioindigos. *Chem. – Eur. J.* **2025**, e202501459. https://doi.org/10.1002/chem.202501459.

P A155

Catalytic enantioselective cyclopropanation from ethyl diazopyruvate and 1,3-dienes with Ru(II)Pheox

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The cyclopropane is the smallest and most constrained cycloalkane, and its introduction into bioactive molecules can affect their conformation, and hence their biological properties. The cyclopropyl ring is one of the most frequently encountered cycles in the drugs structure approved by the FDA.[1] In this context, developing new synthetic strategies is essential to access new cyclopropyl-containing scaffolds. One of the most efficient approaches is the [2+1] cycloaddition, i.e. the cyclopropanation of alkenes.[2] The first catalytic enantioselective cyclopropanation reaction was reported by Nozaki using a copper(II)-catalyst, styrene, and ethyl diazoacetate.[3] Since then, new catalysts and reaction conditions have been developed to obtain outstanding enantiomeric excess. In the literature, the enantioselective cyclopropanation of 1,3-dienes is less described. During the last four decades, different catalysts were used to promote the synthesis of cyclopropanes from 1,3-butadienes such as rhodium(II) acetate, copper, dinickel, or palladium[4]. Nevertheless, only three publications report the cyclopropanation between 1,3-dienes and diazopyruvates, based on the synthesis method of Mueller[5], but none is enantioselective. In this context, we decided to develop an enantioselective synthesis strategy of cyclopropanes from ethyl diazopyruvate (EDPv) and dienes. To catalyze the reaction, the Ru(II)-(*S*)-Pheox is used, a highly stereoselective catalyst developed by Iwasa[6].

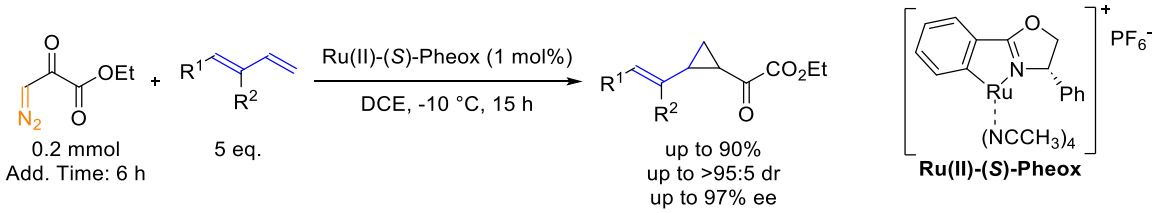


Figure: catalytic enantioselective cyclopropanation of 1,3-dienes with EDPv

[1] Taylor, R. D.; MacCoss, M.; Lawson, A. D. G. Rings in Drugs. *J. Med. Chem.* **2014**, *57*, 5845–5859.

[2] Lebel, H.; Marcoux, J.-F.; Molinaro, C.; Charette, A. B. Stereoselective Cyclopropanation Reactions. *Chem. Rev.* **2003**, *103*, 977–1050.

[3] Nozaki, H.; Moriuti, S.; Takaya, H.; Noyori, R. Asymmetric Induction in Carbenoid Reaction by Means of a Dissymmetric Copper Chelate. *Tetrahedron Letters* **1966**, *7*, 5239–5244.

[4] a) Garbo, M.; Besnard, C.; Guénée, L.; Mazet, C. Access to Optically Active 7-Membered Rings by a 2-Step Synthetic Sequence: Cu-Catalyzed Stereoselective Cyclopropanation of Branched 1,3-Dienes/Rh-Catalyzed Stereoconvergent [5 + 2] Cycloaddition. *ACS Catal.* **2020**, *10*, 9604–9611. b) Maity, A. K.; Kalb, A. E.; Zeller, M.; Uyeda, C. A Dinickel Catalyzed Cyclopropanation without the Formation of a Metal Carbene Intermediate. *Angew. Chem. Int. Ed.* **2021**, *60*, 1897–1902. c) Kastrati, A.; Jaquier, V.; Garbo, M.; Besnard, C.; Mazet, C. Pd-Catalyzed Regioselective Cyclopropanation of 2-Substituted 1,3-Dienes. *ACS Org. Inorg. Au* **2023**, *3*, 291–298.

[5] Mueller, L. G.; Lawton, R. G. Ring Expansion Synthesis of Fused Trans-.Alpha.Methylene-.Gamma.-Lactones. *J. Org. Chem.* **1979**, *44*, 4741–4742.

[6] Chanthamath, S.; Iwasa, S. Enantioselective Cyclopropanation of a Wide Variety of Olefins Catalyzed by Ru(II)–Pheox Complexes. *Acc. Chem. Res.* **2016**, *49*, 2080–2090.

P A156

Homopropargylic Alcohols as Linchpins for a Catalytic Access to γ-Arylated Ketones in Hexafluoroisopropanol (HFIP)

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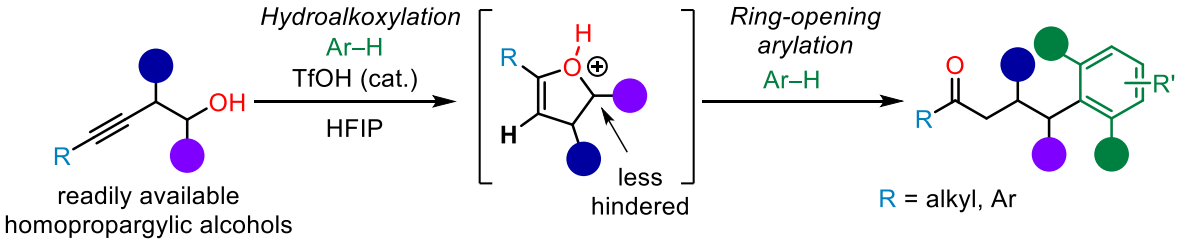
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Aryl-substituted ketones are prevalent structural motifs in natural products, pharmaceuticals, materials, and agrochemicals. While manifold α- and β-arylations of ketones have been developed, γ-arylation processes remain largely underdeveloped. In the past years, various disconnection strategies have emerged to respond to this challenge, including elegant transition metal-based C–C cleavage of cyclobutanols,[1] cross-coupling reactions,[2] isomerization-based processes,[3] and C–H activation.[4] Yet, these approaches often involve the use of tailored substrates or pre-constructed arenes to control the site selectivity. A direct consequence is that they rarely provide access to both linear and branched γ-arylated ketones, while only delivering either aromatic or aliphatic ketones. In addition, synthetically useful electron-deficient aryl ketones and sterically hindered arenes are still underrepresented substitution patterns in γ-arylated ketones.

Herein we report an operationally simple and atom-economic protocol to grant straightforward access to γ-arylated ketones from readily available homopropargylic alcohols, relying on a Brønsted acid-catalyzed hydroalkoxylation/ring-opening arylation sequence in HFIP. The transformation proves compatible with alkynes bearing both electron-deficient and -rich aryl as well as alkyl substituents and enables the introduction of sterically hindered arene nucleophiles in a regioselective fashion, while providing access to linear, β- and γ-branched ketones.



✔metal- and additive-free ✔operationnally simple ✔100% atom economy ✔regioselective
✔β- and γ-branched ketones ✔compatible with Ar bearing strong EWGs and sterically hindered Ar
✔dihydrofuran intermediacy supported by mechanistic experiments and DFT calculations

[1] Ziadi, A.; Martin, R. Ligand-Accelerated Pd-Catalyzed Ketone γ-Arylation via C–C Cleavage with Aryl Chlorides. *Org. Lett.* **2012**, *14*, 1266.

[2] Zheng, Y.-L.; Xie, P.-P.; Daneshfar, O.; Houk, K. N.; Hong, X.; Newman, S. G. Direct Synthesis of Ketones from Methyl Esters by Nickel-Catalyzed Suzuki–Miyaura Coupling. *Angew. Chem. Int. Ed.* **2021**, *60*, 13476.

[3] Wang, X.; Liu, F.; Yan, Z.; Qiang, Q.; Huang, W.; Rong, Z.-Q. Redox-Neutral Nickel-Catalyzed Cross-Coupling Reactions of (Homo)allylic Alcohols and Aryltriflates. *ACS Catal.* **2021**, *11*, 7319.

[4] Li, Y.-H.; Ouyang, Y.; Chekshin, N.; Yu, J.-Q. Pd^{II}-Catalyzed γ-$C(sp^3)$–H (Hetero)arylation of Ketones Enabled by Transient Directing Groups. *ACS Catal.* **2022**, *12*, 10581.

P A157

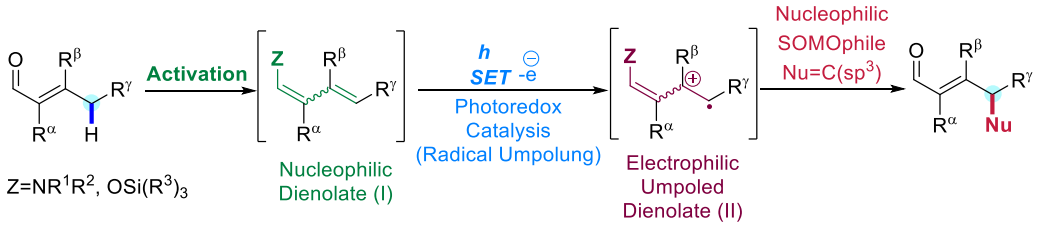
New γ-Functionalizations of Enals via Photochemistry

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A conventional approach to the γ-alkylation of α,β-unsaturated aldehydes, also known as enals, involves the generation of a nucleophilic dienolate derivative (I), which can react with a suitable polar electrophile, or in radical chemistry, with a carbon-centered radical.[1] However, the number of effective electrophiles remains limited, and in the radical approach, C–C bond formation at the γ-position is generally restricted to the inclusion of an activated C(sp^3).

We aim to address these challenges by developing innovative regio- and stereoselective γ-alkylation methods in enals. Our central strategy involves single-electron oxidation (SET) of the nucleophilic dienolate derivative via photocatalysis, thereby reversing its polarity (radical umpolung) and generating an electrophilic radical cation (II).[2] This intermediate could react with a variety of nucleophilic SOMOphiles, enabling regioselective incorporation of unactivated C(sp^3) groups at the γ-position.

In this work, we present a new photocatalytic approach involving SET of silylated dienol ethers, an activated form of enals, to enable intramolecular γ-C–C bond formation. Initial tests with intramolecular γ-alkylations of silylated dienol ethers, an activated form of enals, provided the desired γ-alkylated product in a good yield, confirming the viability of the strategy. Yields were shown to depend on the nature of the solvent, photocatalyst, the substrate, and the hydrogen atom donor.



[1] (a) Balletti, M.; Marcantonio, E.; Melchiorre, P. Photochemical Organocatalytic Enantioselective Radical γ-Functionalization of α-Branched Enals. *Chem. Commun.* **2022**, *58*, 6072–6075. (b) Briand, M.; Thai, L. D.; Bourdreux, F.; Vanthuyne, N.; Moreau, X.; Magnier, E.; Anselmi, E.; Dagousset, G. Remote Radical Trifluoromethylation: A Unified Approach to the Selective Synthesis of γ-Trifluoromethyl α,β-Unsaturated Carbonyl Compounds. *Org. Lett.* **2022**, *24*, 9375–9380. (c) Banoun, C.; Bourdreux, F.; Dagousset, G. Highly Selective γ-Alkoxylation, γ-Amination and γ-Alkylation of Unbiased Enals by Means of Photoredox Catalysis. *Chem. Commun.* **2023**, *59*, 760–763.

[2] (a) Seebach, D. Methods of Reactivity Umpolung. *Angew. Chem. Int. Ed. Engl.* **1979**, *18*, 239–258. (b) Chen, J.-J.; Zhang, Y.; Huang, H.-M. Radical Umpolung Chemistry Enabled by Dual Catalysis: Concept and Recent Advances. *Catal. Sci. Technol.* **2022**, *12*, 5241–5251.

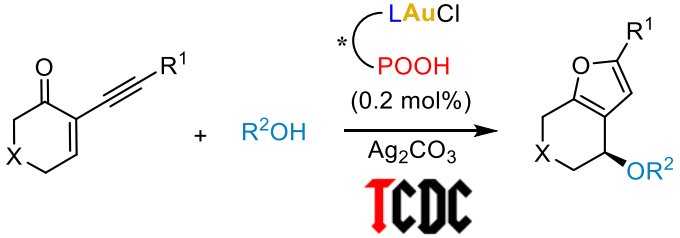
P A158

Enantioselective Au(I)-Catalyzed Cycloisomerization/Addition of Oxygen Nucleophiles to 2-Alkynylenones by the TDCD Strategy

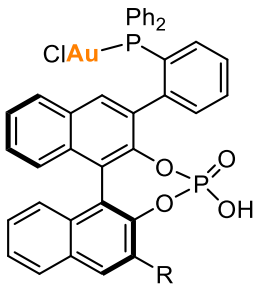
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This study presents an enantioselective Au(I)-catalyzed cycloisomerization/addition reaction of 2-alkynylenones with oxygen nucleophiles (alcohols, carboxylic acids, peroxides)[1] using the Tethered Counterion-Directed Catalysis (TCDC) strategy, that our group developed few years ago.[2] The TCDC approach, developed as an advanced variant of asymmetric counterion-directed catalysis (ACDC),[3] leverages chiral bifunctional phosphoric acid-phosphine ligands (CPAPhos) to tether the gold(I) cation to a chiral phosphate counterion, which induces a selective folding of the ligand during the catalytic reactions.

In this work we employed CPAPhosAuCl complexes (0.2–1 mol%) with silver carbonate as a chloride abstractor. This catalytic system promotes the cycloisomerization of 2-alkynylenones, that are then trapped by alcohols to deliver bicyclic furan derivatives in high yields (up to 98%) and enantioselectivities (mostly >90% ee, up to 97%). The TCDC strategy outperforms previous methods (e.g., 95% ee for methanol addition vs. 44% ee with H-bonded counterion-directed catalysis)[4] and accommodates diverse nucleophiles, including sterically hindered alcohols or water. Remarkably, carboxylic acids and organic peroxides also participated in the reaction, uncovering unknown classes of nucleophiles in this enantioselective reaction.



- **Nucleophiles: alcohols, carboxylic acids, peroxides**
- **High ees (up to 97%)** • **29 examples**



CPAPhosAuCl

[1] Xu, H.; Zhang, Z.; Marinetti, A.; Guinchard, X. *Enantioselective Au(I)-Catalyzed Cycloisomerization/ Addition of Oxygen Nucleophiles to 2-Alkynylenones by the TDCD Strategy. Org. Lett.* **2024**, *26*, 9525-9530.

[2] Zhang, Z.; Smal, V.; Retailleau, P.; Voituriez, A.; Frison, G.; Marinetti, A.; Guinchard, X. *Tethered Counterion-Directed Catalysis: Merging the Chiral Ion-pairing and Bifunctional Ligand Strategies in Enantioselective Gold(I) Catalysis. J. Am. Chem. Soc.* **2020**, *142*, 3797.

[3] (a) Hamilton, G. L.; Kang, E. J.; Mba, M.; Toste, F. D. *A Powerful Chiral Counterion Strategy for Asymmetric Transition Metal Catalysis. Science* **2007,** *317*, 496. (b) Mahlau, M.; List, B. *Asymmetric Counteranion-Directed Catalysis: Concept, Definition, and Applications*. *Angew. Chem., Int. Ed*. **2013**, *52*, 518.

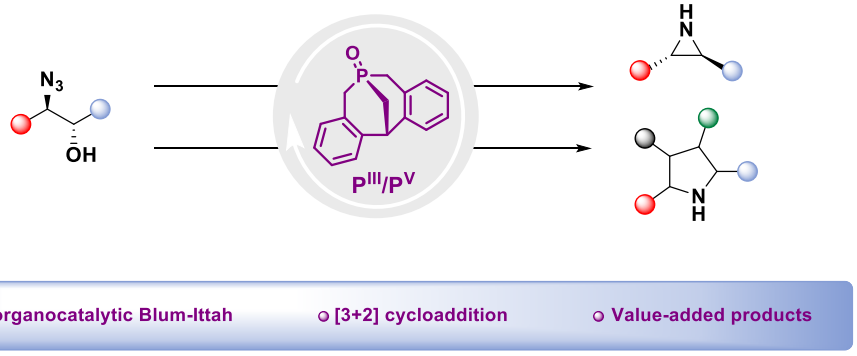
[4] (a) Franchino, A.; Martí, À.; Echavarren, A. M. *H-Bonded Counterion-Directed Enantioselective Au(I) Catalysis. J. Am. Chem. Soc.* **2022**, *144*, 3497.; (b) Martí, À.; Montesinos-Magraner, M.; Echavarren, A. M.; Franchino, A. *H-Bonded Counterion-Directed Catalysis: Enantioselective Gold(I)-Catalyzed Addition to 2-Alkynyl Enones as a Case Study*. *Eur. J. Org. Chem.* **2022**, *2022*, e202200518.

P A159

P^{III}/P^{V} Redox-Organocatalyzed Blum-Ittah Reaction: A Metal-Free Methodology for the Synthesis of Unprotected Aziridines and Pyrrolidines

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P^{III}/P^{V} redox cycling has recently emerged as an effective strategy to minimize chemical waste in phosphine-mediated reactions.[1] In the past few years, our group has designed methanophosphocines, a new class of electron-rich bridgehead phosphine oxides whose structural features make them particularly well-suited for P^{III}/P^{V} redox organocatalysis.[2] Herein, we present the first organocatalytic Blum-Ittah reaction for the synthesis of phenyl-1*H*-aziridine-2-carboxylate derivatives, providing a metal-free methodology for accessing unprotected N-H aziridines. Moreover, these aziridines can be directly transformed in a one-pot sequence into pyrrolidines through an electrocyclic ring-opening/1,3-dipolar addition sequence with an additional dipolarophile. Beyond the synthetic value of these various heterocycles, the reaction mechanism has been investigated and is further supported by ongoing DFT calculations.



[1] Lipshultz, J. M.; Li, G.; Radosevich, A. T. Main Group Redox Catalysis of Organopnictogens: Vertical Periodic Trends and Emerging Opportunities in Group 15. *J. Am. Chem. Soc.* **2021**, *143* (4), 1699–1721.
[2] Mele, L.; El Bekri Saudain, R.; Pirat, J.; Tomás-Mendivil, E.; Martin, D.; Virieux, D.; Ayad, T. Benchmarking Methanophosphocines as Versatile P^{III} /P^{V} Redox Organocatalysts. *Adv Synth Catal* **2024**, *366* (17), 3636–3645.

P A160

A more sustainable approach to NHC organocatalysis in aqueous media

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In light of the environmental situation, synthetic chemistry must shift toward a softer and greener approach[1]. One of the critical challenges in organic chemistry is achieving efficient C-C bond formation to construct complex molecules from simpler precursors. Traditional catalytic methods often rely on metal complexes, which are often costly, toxic, and associated with non-renewable resources, raising sustainability concerns.

Organocatalysis[2], utilizing small organic molecules, offers a powerful and metal-free alternative, making it an ideal approach for developing greener and more sustainable chemical processes. Among organocatalysts, N-heterocyclic carbenes (NHCs)[3] are particularly prominent, as they are derived from azolium salts, mimicking the structure and reactivity of the natural cofactor thiamine diphosphate. Pursuing greener chemistry, bioinspired methods and replacing organic solvents with eco-friendly alternatives like water[4] are especially relevant.

In our group, the Stetter reaction[5]—a key transformation enabling efficient C-C bond formation using carbenes—has been successfully adapted to aqueous media, demonstrating its potential for sustainable synthetic applications[6]. However, the use of carbenes in aqueous environments remains a significant challenge due to their inherent instability and potential side reactions. Our preliminary results involve the design and synthesis of new azolium-derived organocatalysts to evaluate the influence of catalyst structure on reaction reactivity, kinetics, and selectivity within various aqueous media. Our efforts also focus on more sustainable synthetic methods and the study of novel, potentially recyclable reaction environments. The catalysts we have synthesized notably exhibit concentration-dependent efficiency in aqueous media.

[1] Li C. J., Carbon–carbon bond formation and green chemistry: one dream and 30 years hence. *Can. J. Chem*. **2022**, *100*, 98-103.

[2] MacMillan D., The advent and development of organocatalysis. *Nature.* **2008***, 455*, 304-308.

[3] Chakraborty S., Barik S., Biju A.T., N-Heterocyclic carbene (NHC) organocatalysis: from fundamentals to frontiers. *Chem. Soc. Rev*. **2025**, DOI: 10.1039/d4cs01179a.

[4] Van der Helm M.P., Klemm B., Eelkema R., Organocatalysis in aqueous media. *Nat Rev Chem*, **2019**, *3*, 491-508.

[5] Stetter H., Catalyzed Addition of Aldehydes to Activated Double Bonds—A New Synthetic Approach. *Angew. Chem. Int. Ed. Engl*. **1976**, *15* (11), 639-647.

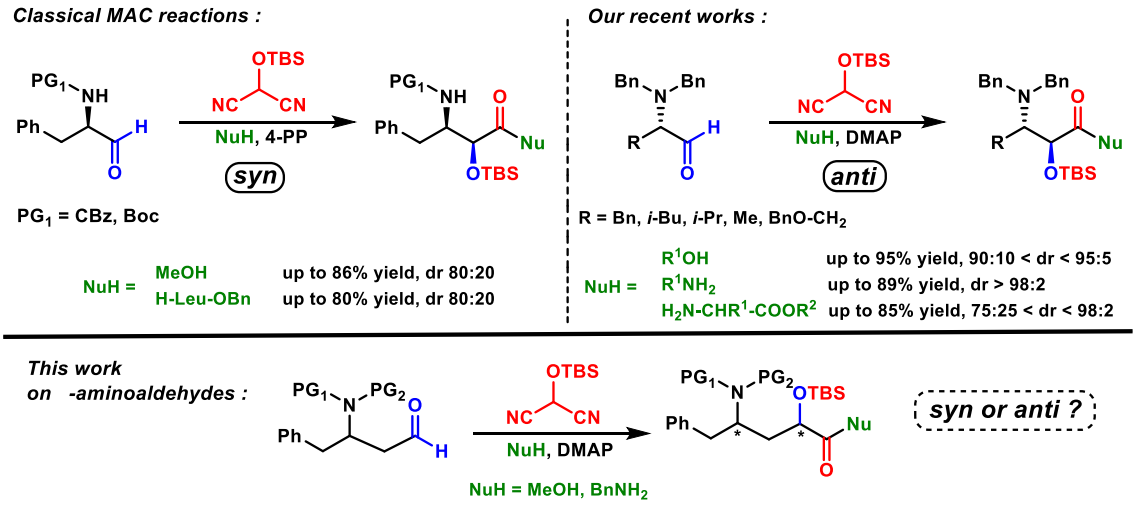
[6] Debiais M., Hamoud A., Drain R., Barthélémy P., Desvergnes V., Bio-inspired NHC-organocatalyzed Stetter reaction in aqueous conditions. *RSC Adv*., **2020**, *10*, 40709-40718.

P A161

MAC Methodology for the Stereoselective Synthesis of Complex Homologated Amino Acid Derivatives

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α-Hydroxy-β-amino acids (AHBAs) are widely distributed structural motifs in biologically active natural products and synthetic molecules, and their synthetic importance has stimulated the development of diverse stereoselective methodologies. Our group is focused on advancing the one-pot MAC (Masked Acyl Cyanide) methodology, which typically employs *tert*-butyldimethylsilyloxymalononitrile as an umpolung reagent. The three-component MAC reaction can be used to combined an α-aminoaldehyde and a nucleophile to construct AHBA motifs. From Nemoto's[1] first application of one-pot MAC reaction in peptide synthesis to our group's use of *N*-Boc-*O*-Bn-L-serinal[2] as electrophile, these oxyhomologation reactions have invariably demonstrated a *syn*-diastereoselectivity (dr 80:20). Recently, our group has efficiently synthesized a series of AHBA derivatives with a high *anti*-diastereoselectivity via MAC reactions, including *erythro*-β-hydroxyaspartic acid,[3] (2*S*,3*S*)-allophenylnorstatin,[4] (2*S*,3*S*,*S*)-epibestatin,[5] and *anti*-(2*R*,3*S*)-1,3-diamino-4-phenylbutan-2-ol derivatives.[6]



To date, most studies on MAC reactions have primarily focused on α-aminoaldehydes. To broaden the scope of these reactions, we turned our attention to β-aminoaldehydes, at first **with *N*-protected homophenylalaninal derivatives as** electrophiles, aiming to access α-hydroxy-γ-amino acids (AHGAs). AHGAs represent an important yet underexplored subclass of γ-amino acids with significant biological and pharmaceutical relevance.[7]

[1] Nemoto, H.; Ma, R.; Suzuki, I.; Shibuya, M. *Org. Lett.* **2000**, *2*, 4245-4247.
[2] Esgulian, M.; Belot, V.; Guillot, R.; Deloisy, S.; Aitken, D. J. *Org. Biomol. Chem.* **2017**, *15*, 1453-1462.
[3] Esgulian, M.; Buchotte, M.; Guillot, R.; Deloisy, S.; Aitken, D. J. *Org. Lett.* **2019**, *21*, 2378-2382.
[4] He, X.; Buchotte, M.; Guillot, R.; Deloisy, S.; Aitken, D. J. *Org. Biomol. Chem.* **2022**, *20*, 1769-1781.
[5] He, X.; Guillot, R.; Deloisy, S.; Aitken, D. J. *Org. Lett.* **2024**, *26*, 2207-2211.
[6] Cabua, M. C.; He, X.; Secci, F.; Deloisy, S.; Aitken, D. J. *ChemistryOpen* **2025**, *14*, e202400279.
[7] Ordóñez, M.; Cativiela, C.; Romero-Estudillo, I. *Tetrahedron: Asymmetry* **2016**, 27, 999–1055.

P B001

Synthesis and Optical Properties of a Water-Soluble Graphene Quantum Dots for Biological Applications

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Graphene exhibits remarkable mechanical and electronic properties. However, the semimetallic character of graphene constitute a severe limitation to its use for optical or optoelectronic applications. When the dimensions of a 2D graphene sheet are reduced to the nanometric scale, new properties coming from the confinement or electrons will emerge. Thus, we shine our interest in graphene quantum dots (GQDs). GQDs synthesis has been mostly described *via* top-down methods (*i.e.* lithography, harsh oxidative cutting conditions or hydrothermal treatments). [1] Though cheap and efficient, these methods do not allow for precise control of the size, shape and edges of the GQDs. In order to truly control, with the required level of precision, the morphology and the composition of the materials and of its edges, the bottom-up approach is the relevant way to proceed.[2]

In a previous study, our team synthesized a family of graphene nanoparticles soluble in classical organic solvents. Thanks to their particular functionalization, these nanoparticles are individualized in solution and in the solid state. They emit photons in the red and near-infrared regions and exhibit exceptional photoluminescence quantum yields ranging from 90 to 95%, a level never before achieved for particles of such size.[3] At the solid state, the GQDs also act as single photon emitters.[4] To extend the potential of these materials, my thesis aims at improving the solubility of these nanoparticles in water by grafting hydrophilic polymers such as polyethylene glycol (PEG). To this end, we decided to functionalize the nanographene with triple bonds and to perform Click Chemistry (CuAAC). I began my thesis work by functionalizing C_{60} and C_{96} nanoparticles with polyethylene glycol (Figure 1), and thoroughly characterized the final products. This modification is crucial to make them soluble in water and test these materials for biological and medical applications.

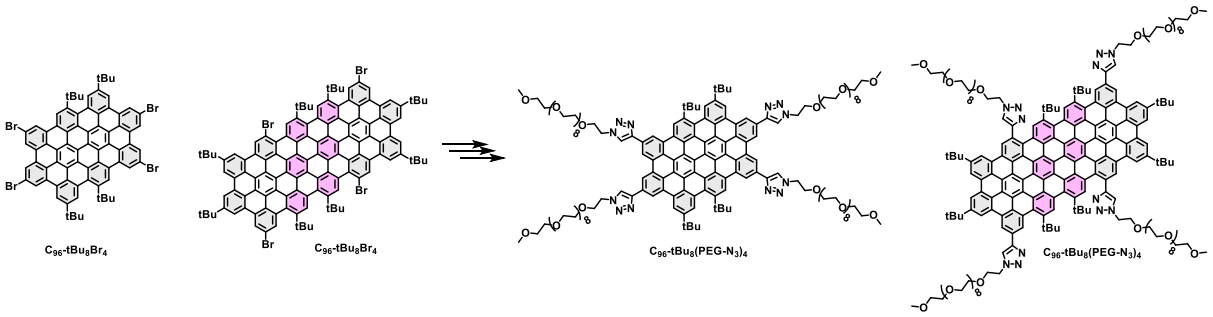


Figure 1. *Schematic representation of PEG-functionalized graphene quantum dots.*

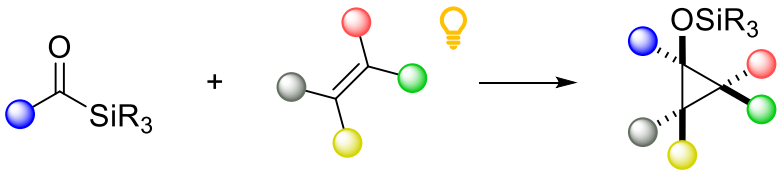
[1] Bacon M.; Bradley, S. J.; Nann, T. *Part. Syst. Charact.* **2014**, *31*, 415.
[2] Gu, Y.; Qiu, Z.; Müllen, K. *J. Am. Chem. Soc.* **2022**, *144*, 11499.
[3] D. Medina-Lopez et al; *Nat Commun.* **2023**, *14*, 4728.
[4] H. Levy-Falk et al; *Phys. Status Solidi B.* **2023**, *260*, 2300310.

P B002

Cyclopropanation of alkenes via carbene generation from acylsilanes

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Plethora of methods for the preparation of the cyclopropane ring have been developed over the years, since its first synthesis in 1882 by Freund.[1] « Michael Initiated Ring Closure » reactions, like the venerable Corey-Chaykovsky reaction,[2] can be used to achieve the cyclopropanation of Michael acceptors. On the hand, methods based on transition metal catalyzed cycloisomerisation[3] or cyclopropene reductions[4] were elaborated to afford complex multisubstituted cyclopropanes. Finally, approaches involving carbenoids, illustrated by the textbook Simmons-Smith reaction,[5] or carbenes has been extensively used to forge the cyclopropyl ring.[6] Finally, the decomposition of diazo-compounds upon light irradiation or in the presence of transition metal is often used for carbene generation.
Besides, acylsilanes are versatile and interesting reactive species. This class of carbene precursors has been sporadically used for the preparation of cyclopropanes. Due to the electronic mismatch between the photogenerated carbene and electron rich olefins, current methods almost exclusively provide fluorinated cyclopropanes or required a catalyst.[7]
Here, we report the development of the first and versatile photochemical intermolecular cyclopropanation of alkenes with acylsilanes.



[1] (a) Freund, A. *Monatsh. Chem.* **1882**, *3*, 625-635. (b) Freund, A. *J. Prakt. Chem.* **1882**, *26*, 367.
[2] Corey, E. J.; Chaykovsky, M. *J. Am. Chem. Soc.* **1965**, *87*, 1353.
[3] (a) Mainetti, E.; Mouriès, V.; Fensterbank, L.; Malacria, M.; Marco-Contelles, J. *Angew. Chem. Int. Ed.* **2002**, *41*, 2132. (b) Mamane, V.; Gress, T.; Krause, H.; Fürstner, A. *J. Am. Chem. Soc.* **2004**, *126*, 8654. (c) Lemière, G.; Gandon, V.; Cariou, K.; Hours, A.; Fukuyama, T.; Dhimane, A.-L.; Fensterbank, L.; Malacria, M. *J. Am. Chem. Soc.* **2009**, *131*, 2993.
[4] (a) Marek, I.; Simaan, S.; Masarwa, A. *Angew. Chem. Int. Ed.* **2007**, *46*, 7364. (b) Cohen, Y.; Marek, I. *Acc. Chem. Res.* **2022**, *55*, 2848.
[5] (a) Simmons, H. E.; Smith, R. D. *J. Am. Chem. Soc.* **1958**, *80*, 5323. (b) Charette, A. B.; Lemay, J. *Angew. Chem. Int. Ed.* **1997**, *36*, 1090. (c) Zimmer, L. E.; Charette, A. B. *J. Am. Chem. Soc.* **2009**, *131*, 15624. (d) Pontini, L.; A. Leitch, J.; L. Browne, D. *Green Chem.* **2023**, *25*, 4319.
[6] (a) Lebel, H.; Marcoux, J.-F.; Molinaro, C.; Charette, A. B. *Chem. Rev.* **2003**, *103*, 977. (b) Chen, Z.-L.; Xie, Y.; Xuan, J. *Eur. J. Org. Chem.* **2022**, e202201066.
[7] (a) Zhang, Y.; Zhou, G.; Gong, X.; Guo, Z.; Qi, X.; Shen, X. *Angew. Chem. Int. Ed.* **2022**, *61*, e202202175. (b) Zhou, G.; Shen, X. *Angew. Chem. Int. Ed.* **2022**, *61*, e202115334. (c) Inagaki, T.; Akita, Y.; Tobisu, M. *Org. Lett.* **2024**, *26*, 2141. (d) Sakurai, S.; Inagaki, T.; Kodama, T.; Yamanaka, M.; Tobisu, M. *J. Am. Chem. Soc.* **2022**, 144, 1099

P B003

Coordination Chemistry of Axially Chiral Bis-Phosphine Allenes

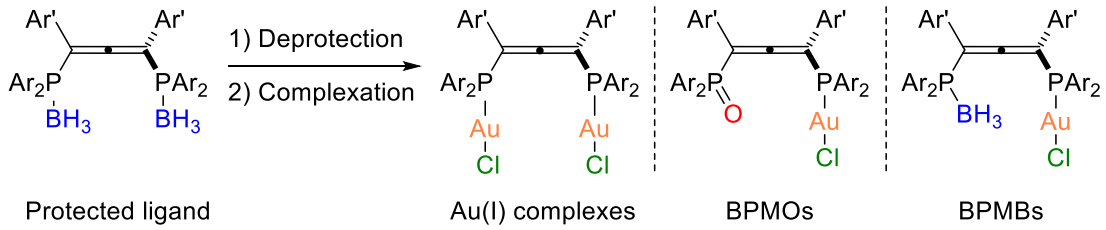
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Phosphines are among the most versatile ligands in organometallic catalysis, as their steric and electronic properties can be finely tuned by modifying the substituents on the phosphorus atom. This variability is crucial when it comes to optimizing the catalyst activity and selectivity for specific organic reactions. In this context, chiral phosphine-based bidentate ligands have found wide applicability in asymmetric catalysis, often delivering high enantioselectivities across a broad range of reactions. Among axially chiral compounds, allenes present an intriguing structural architecture and have been the subject of considerable interest over the past few decades, but their use as scaffolds for transition metal ligands has been scarcely explored. In 2016, our group reported the coordination properties of the bis-phosphine 1,3-bis(diphenylphosphino)-1,3-diphenylallene, first synthesised by the Schmidbaur group in 1989.[1] Remarkably, the ligand adopts distinct coordination modes depending on the transition metal employed.[2] Over time, we expanded the ligand family by varying the nature of the substituents on the allene core as well as those on the phosphorus atoms. Bench stability was also improved by protecting the phosphine groups through the formation of borane adducts. These bis-phosphine-borane allenes can be easily purified by column chromatography and then deprotected in situ under mild conditions to afford the desired ligands in quantitative yields. Given our long-standing interest in gold catalysis, we investigated the coordination properties of these bis-phosphine ligands toward Au(I), not only in their free form but also as unsymmetrical bis-phosphine monoxides (BPMOs) and bis-phosphine monoborane (BPMBs) (Scheme 1).



Scheme 1. Protected bis-phosphine allene-based ligands and related di- and mono-nuclear gold(I) complexes.

[1] Schmidbaur, H.; Frazão, C. M.; Reber, G.; Müller, G. Beiträge zur Synthese und Strukturchemie einiger Alkenyl- und Allenylphosphane. *Chem. Ber.* **1989**, 122, 259-263.

[2] Vanitcha, A.; Damelincourt, C.; Gontard, G.; Vanthuyne, N.; Mouriès-Mansuy, V.; Fensterbank, L. Bis-phosphine allene ligand: coordination chemistry and preliminary applications in catalysis. *Chem. Commun.* **2016**, 52, 6785-6788.

P B004

Towards Cr(III) coordination cages for circularly polarized luminescence

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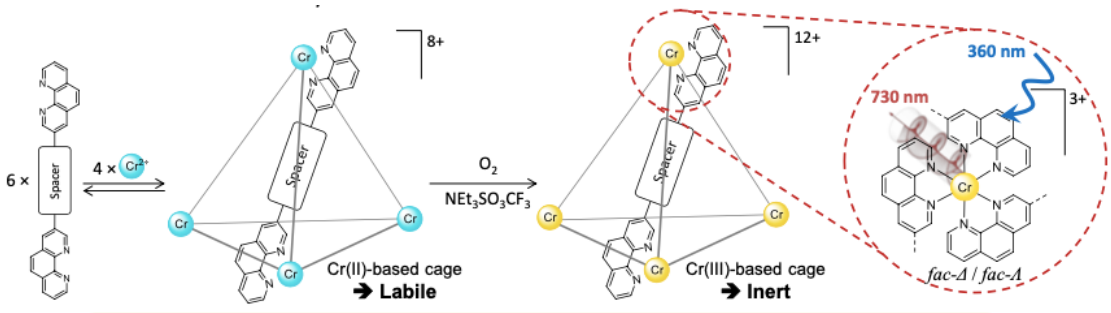
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Over the past two decades, circularly polarized luminescence (CPL) has attracted growing attention due to its potential applications in optoelectronics [1] and bioimaging.[2] CPL arises from chiral chromophores that emit left- and right-circularly polarized light differently. Developing new emitters with strong CPL responses is essential to move toward practical applications.

The objective of this work is to obtain strong CPL properties through a supramolecular approach based on tetrahedral metal–organic cages. Cr(III) was selected for its remarkable luminescence among non-lanthanide metals.[3] However, the paramagnetic nature of Cr(III) prevents NMR analysis, making the characterization of such assemblies particularly difficult. For this reason, Fe(II) analogues were first synthesized, since they are diamagnetic and therefore allow an easier structural characterization by NMR. While some Fe(II) cages were reported in the literature,[4] we have designed new bisphenathroline ligands more suitable to reach interesting photophysical properties for the targeted Cr(III) species. The successful formation of Fe(II) cages confirmed the feasibility of our ligand design.

In parallel, the synthesis of the Cr(III) cages was investigated: it first required the use of a labile Cr(II) salts for the self-assembly step, followed by oxidation to Cr(III). While the cage structure has not yet been unambiguously demonstrated, one assembly with bisphenanthroline-based ligands displays an emission signal consistent with the expected Cr(III) coordination, suggesting that cage formation may have occurred.

Altogether, these results validate the feasibility of assembling novel supramolecular cages with new bis-phenanthroline ligands and open the way toward the development of Cr(III)-based cages with enhanced CPL properties.



[1] Zinna, F.; Pasini, M.; Galeotti, F.; Botta, C.; Di Bari, L.; Giovanella, U. Design of Lanthanide-Based OLEDs with Remarkable Circularly Polarized Electroluminescence. *Adv. Func. Mater.* **2017**, *27* (1), 1603719.

[2] Tuchin, V. V.; Wang, L. V.; Zimnyakov, D. A. Optical Polarization in Biomedical Applications; Biological and Medical Physics, Biomedical Engineering; Springer: Berlin, Heidelberg, **2006**.

[3] Jiménez, J.-R.; Doistau, B.; Cruz, C. M.; Besnard, C.; Cuerva, J. M.; Campaña, A. G.; Piguet, C. Chiral Molecular Ruby $[Cr(Dqp)_2]^{3+}$ with Long-Lived Circularly Polarized Luminescence. *J. Am. Chem. Soc.* **2019**, *141* (33), 13244-13252

[4] Castilla, A. M.; Ramsay, W. J.; Nitschke, J. R. Stereochemistry in Subcomponent Self-Assembly. *Acc. Chem. Res.* **2014**, *47* (7), 2063–2073.

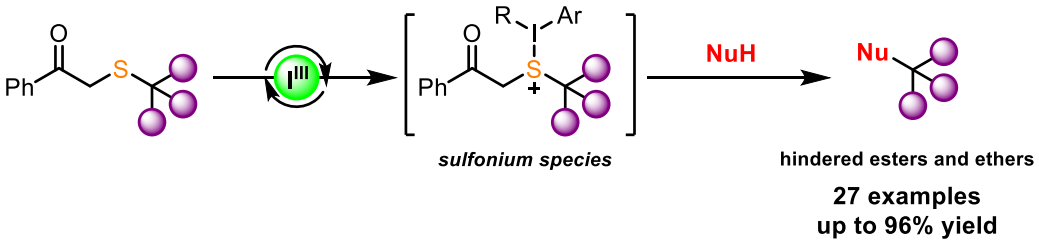
P B005

Hypervalent Iodine mediated Pummerer fragmentation reaction toward hindered ester and ether

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The facile synthesis of ethers and esters has long been a task in drug design, as the incorporation of the ether and ester group enhances the solubility and bioavailability, thereby improving the druggability.[1] Hindered dialkyl ethers can aid in the escape-from-flatland of bioactive molecules and improve the drug-target interaction to promote the drug efficacy and selectivity.[2] Moreover, the ester moiety is not only a common functional group in polymers, drugs and biologically relevant compounds, but also serves as a protecting group for alcohols.

Although reliable alternatives to classical synthetic methods, such as metal-catalyzed metathesis, photochemical and electrochemical approaches,[3-5] have recently emerged to prepare hindered esters and ethers, the development of convenient, green and efficient synthetic strategies is still being sought. To address this challenge, our group developed a hypervalent iodine mediated-Pummerer fragmentation reaction[6] to convert phenacyl sulfide derivatives into a large diversity of hindered ester and ether compounds under mild conditions.



[1] *Discovery of 4-Ethoxy-6-5-azaindazoles as Novel PDE4 Inhibitors for the Treatment of Alcohol Use Disorder and Alcoholic Diseases*. Zheng, L.; Aimaiti, Z.; Long, L.; Xia, C.; Wang, W.; Zhou, Z. Z. *J. Med. Chem*. **2024**, *67*, 728–753.
[2] *Antimalarial activity of new water-soluble dihydroartemisinin derivatives. 2. Stereospecificity of the ether side chain.* Lin, A. J.; Lee, M.; Klayman, D. L. *J. Med. Chem*. **1989**, *32*, 1249–1252.
[3] *Proton or Carbene Transfer? On the Dark and Light Reaction of Diazoalkanes with Alcohols.* Empel, C.; Pei, C.; He, F.; Jana, S.; Koenigs, R. M. *Chem. Eur. J.* **2022**, *28*, e202104397.
[4] *Facile Access to Hindered Ethers via Photoinduced O-H Bond Insertions.* Zhang, Y.; Han, X.; Li, D.; Wang, J.; Luan, X.; Ni, S.-F.; Das, S.; Zhang, W.-D. *ACS Cent. Sci.* **2025**, *11*, 742–752.
[5] *Sustainable electrochemical decarboxylative acetoxylation of aminoacids in batch and continuous flow.* Köckinger, M.; Hanselmann, P.; Roberge, D. M.; Geotti-Bianchini, P.; Kappe, C. O.; Cantillo, D. *Green Chem*. **2021**, *23*, 2382–2390.
[6] Bond-Forming and -Breaking Reactions at Sulfur(IV): Sulfoxides, Sulfonium Salts, Sulfur Ylides, and Sulfinate Salts. Kaiser, D.; Klose, I.; Oost, R.; Neuhaus, J.; Maulide, N. *Chem. Rev*. **2019**, *119*, 8701–8780.

P B006

Stereoselective Access to β-gem-Difluorinated Alcohols Through Enzymatic Reduction

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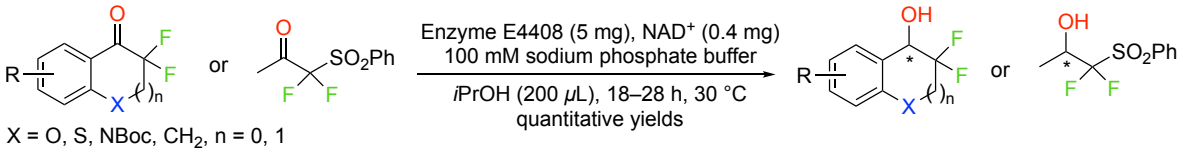
[2] *SEQENS, 78440, Porcheville, France*

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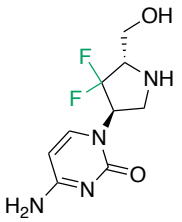
[4] *Protéus by SEQENS, 30035, Nîmes, France*

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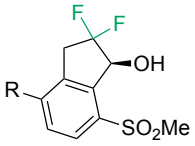
Many examples of drug candidates involve the replacement of a hydrogen atom by a single fluorine atom or a CF_3 group,[1] but the introduction of a geminal difluoromethyl group has also been successfully exploited to improve the performances of the corresponding active compounds. Consequently, a variety of geminal difluoromethylated bioactive molecules or drugs have been developed in the past decades. In that context, in line with our ongoing efforts directed towards the synthesis of enantioenriched fluorinated compounds[2] and aiming at developing an even greener procedure for the preparation of these high added value building blocks, we report here[3] a mild process to access diversely functionalized enantioenriched β-*gem*-di-fluorinated (*S*)-alcohols by using biocatalytic reduction[4] in >99% yield and enantiomeric excesses ranging from 96% to >99%. This novel approach involves enzymatic reduction of α-gem-difluorinated heterocyclic and carbocyclic ketone derivatives as well as an acyclic *gem*-difluorinated β-ketosulfone and proceeds under mild conditions at 30°C under aqueous conditions.



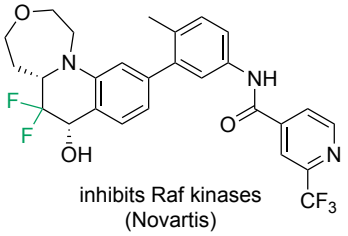
Examples of chiral bioactive *gem*-difluorinated compounds



L-OddC analogue



inhibits HIF-2a
(Arcus Biosciences)



inhibits Raf kinases
(Novartis)

[1] a) Inoue, M.; Sumii, Y.; Shibata, N. *ACS Omega* **2020**, *5*, 10633. b) Caron, S. *Org. Process Res. Dev*. **2020**, *24*, 470.

[2] a) Molina Betancourt, R.; Bacheley, L.; Karapetyan, A.; Guillamot, G.; Phansavath, P.; Ratovelomanana-Vidal, V. *ChemCatChem*. **2022**, *14*, e202200595. b) Molina Betancourt, R.; Phansavath, P.; Vidal, V. *Molecules* **2022**, *27*, 995. c) Bacheley, L.; Molina Betancourt, R.; Ravindra, R.; Guillamot, G.; Phansavath, P.; Ratovelomanana-Vidal, V. *Eur. J. Org. Chem.* **2023**, *26*, e202300383 (VIP). d) Bacheley, L.; Ravindra, R.; Guillamot, G.; Phansavath, P.; Ratovelomanana-Vidal, V. *Adv. Synth. Catal*. **2024**, 366, 1019.

[3] Bacheley, L., Boutet, J., Guillamot, G., Gilles, P., Martin, J., Phansavath, P., Ratovelomanana-Vidal, V. *Adv. Synth. Catal.* **2024**, *366*, 3511.

[4] a) Yi, D., Bayer, T., Badenhorst, C. P. S., Wu, S., Doerr, M., Höhne, M., Bornscheuer, U. T. *Chem. Soc. Rev.* **2021**, 8003. b) Sheldon, R. A., Brady, D., Bode, M. L. *Chem. Sci.* **2020**, 2587.

P B007

Photo-induced synthesis of fused polyheterocycles

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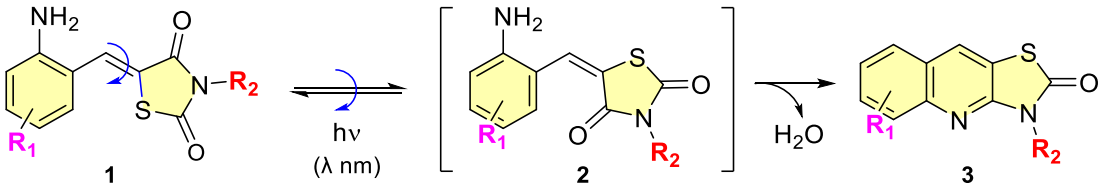
[1] *Université de Lorraine, UMR CNRS L2CM 7053, F-54000 Nancy, France*

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Quinoline derivatives are widely used synthons in organic synthesis and coordination chemistry and have numerous applications (catalysis, photovoltaics, etc.).[1] In the frame of our work devoted to the preparation of variously substituted arylidenethiazolidine-2,4-diones,[2] we recently developed a new one-pot synthesis pathway towards fused heterocyclic quinoline **3** using light and without any additional reagent[3], unlike the usual synthesis, which is typically multistep and tedious.[4]



In order to determine the appropriate substituents (R_1 and R_2) and determine the influence of the nature and position of these functional groups on the absorption wavelengths of the molecules, theoretical studies on the absorption maxima of precursors **1** have been explored. Based on these results, investigations were carried out to define a short and efficient reactional sequence, involving a photo-activated isomerization/cyclisation as a key-step. These optimized conditions afforded a wide range of substituted thiazolo[4,5-*b*]quinoline-2(3*H*)-ones **3** in good to very good yields. In addition, a detailed kinetic study of the isomerization/cyclisation step was conducted by using *in-situ* photo-NMR and UV-vis studies.

[1] R. Kumar et al. *Coordination Chemistry Reviews* **2024**, *499*, 215453.

[2] (a) D. Dupommier et al. *Eur. J. Med. Chem*. **2020**, *187*, 111939; (b) D. Dupommier et al. *J. Org. Chem*. **2023**, *88*, 3724-3739.

[3] E. Cortelazzo-Polisini et al. *J. Org. Chem*. **2022**, *87*, 9699-9713.

[4] I. Tânâsescu et al. *Chem. Ber*. **1957**, *90*, 495–499.

P B008

Synthesis of hydroboranes and borohydrides for hydrogen storage

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Boron for molecular chemistry represents a small fraction of the boron industry, mainly centered around glass, alloys, or detergent usages. However, boron-based compounds are inevitable in the organic chemist's toolbox. For example, the bench available $NaBH_4$, H-9-BBN, or pinacol borane are used as classic reductive reagents, for hydroboration reactions, or the preparation of cross-coupling starting materials. [1] The synthesis of these useful boron hydrides relies on the borane BH_3 and borohydrides BH_4^-, which are industrially obtained from the energy-intensive Schlesinger or Bayer processes involving sodium metal. [2,3]

More sustainable synthetic routes are highly desirable for borane and borohydrides, especially in the field of the energy transition. Solid borane-bases materials ($NH_3{\cdot}BH_3$ or $LiBH_4$) display high hydrogen storage capacity while being stable under atmospheric conditions (air and moisture).

Interested in the closure of the boron economy cycle (Figure 1), particularly by the regeneration of boron hydrides for reductant synthesis and hydrogen storage applications, our group investigated different strategies for the hydrodehalogenation of BCl_3, an intermediate of the boron cycle. Herein, we present our study on H/Cl interconversion between hydrosilanes and haloboranes and the unlocking access of borohydrides BH_4^-.

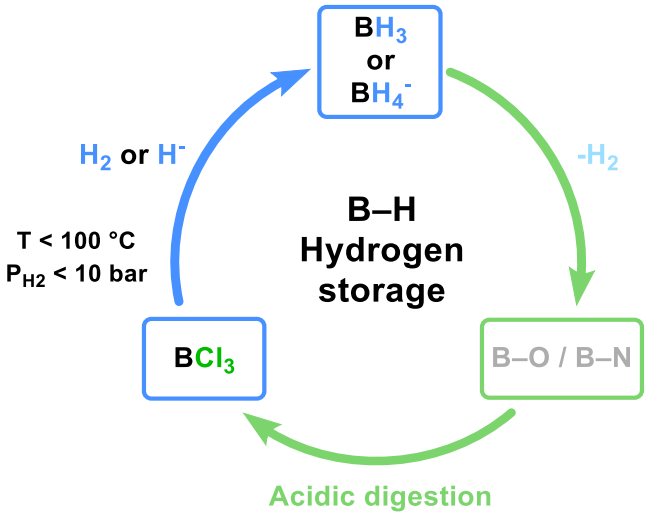


Figure 1: Development of new synthetic pathways to yield boron hydrides in mild conditions

[1] Brotherton, R. J.; Weber, C. J.; Guibert, C. R.; Little, J. L. *Boron Compounds: In Ullmann's Encyclopedia of Industrial Chemistry*, Wiley, **2000**.
[2] Schlesinger, H. I.; Brown, H. C.; Finholt, A. E., Sodium borohydride, its hydrolysis and its use as a reducing agent and in the generation of hydrogen. *J. Am. Chem. Soc.* **1953**, *75*, 205–209.
[3] Broja, G.; Schlabacher, W. Process for the production of alkali metal borohydrides. US3259474, **1959**.

P B009

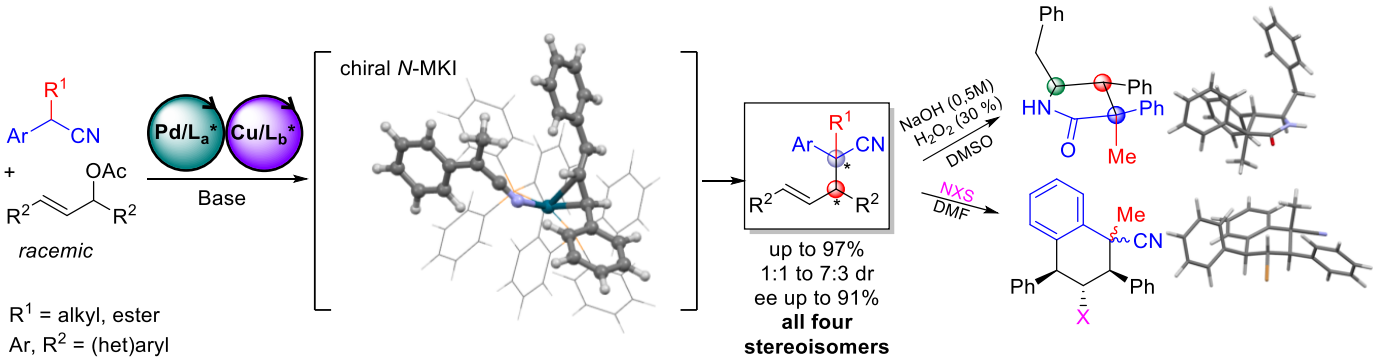
Cu/Pd Dual Catalyzed Stereoselective Construction of Vicinal Tri- and Tetrasubstituted Stereocenters Connected to Chiral α-Arylacetonitriles

Liliane Mimoun, Hamdi Sanaa, Quentin Chevrier, Florian Heppner, Hélène Gerard, Laurine Réset, Caroline West, Nicolas Vanthuyne, Pascal Retailleau, Cyril Nicolas, Isabelle Gillaizeau

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The key importance of the 3D structure of therapeutic and bioactive compounds has been highlighted by recent research. Despite their potential in pharmaceutical development, creating such complex structures, particularly those incorporating tetrasubstituted stereocenters, remains a formidable challenge.[1-4] Recently, α-cyanocarbanionic metal complexes have emerged as promising nucleophilic intermediates, due to the broad functionalization potential of the nitrile group. Herein, we present an optimized Pd/Cu dual catalytic system that enables the allylic alkylation of secondary and tertiary nitriles under mild conditions, using chiral metal complexes.[5] This strategy offers good to high levels of enantioselectivity (ee up to 91%). Mechanistic investigations, supported by DFT calculations, underscore the essential role of dual catalysis, wherein the orthogonal activation of Pd and Cu partners synergistically governs both reactivity and enantioselectivity. To demonstrate the synthetic utility of this newly developed methodology, the transformation of nitrile-containing compounds was also explored.



[1] Saito, A.; Kumagai, N.; Shibasaki, M. Cu/Pd Synergistic Dual Catalysis: Asymmetric α-Allylation of an α-CF_3 Amide. *Angew. Chem. Int. Ed.* **2017**, *56* (20), 5551–5555.

[2] Krautwald, S.; Sarlah, D.; Schafroth, M. A.; Carreira, E. M. Enantio- and Diastereodivergent Dual Catalysis: α-Allylation of Branched Aldehydes. *Science* **2013**, *340* (6136), 1065–1068.

[3] Liu, H.; Hu, Y.; Wang, Z.; Tao, H.; Wang, C. Synergistic Cu/Pd-Catalyzed Asymmetric Allenylic Alkylation of Azomethine Ylides for the Construction of α-Allene-Substituted Nonproteinogenic α-Amino Acids. *Chem. – Eur. J.* **2019**, *25* (37), 8681–8685.

[4] Li, C.; Liu, Y.; Han, Z.; Wang, Z.; Ding, K. Pd/Cu Catalyzed Asymmetric Allylation for Stereodivergent Synthesis of Glutamic Acid Derivatives. *Chem. – Eur. J.* **2025**, *31* (9), e202404209.

[5] Mimoun, L. ; Sanaa, H.; Heppner, F.; Gerard, H.; Réset, L.; West, C.; Vanthuyne, N.; Retailleau, P.; Nicolas, C.; Gillaizeau, I. , RSC Advances **2025** https://doi.org/10.1039/D5RA04516A

P B010

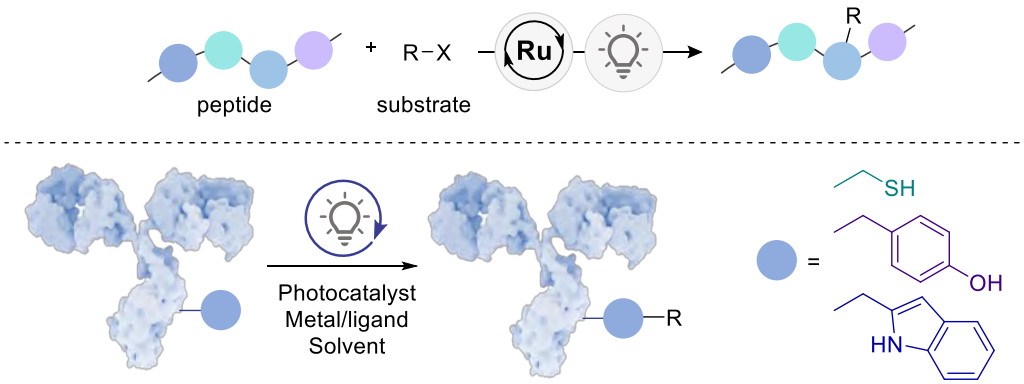
Photocatalysis as a Powerful Tool for Bioconjugation towards the Design of Next-Generation Therapeutics

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Antibody–drug conjugates (ADCs) have emerged as a powerful class of targeted therapeutics, combining the specificity of monoclonal antibodies with the potency of cytotoxic agents.[1] Their clinical success relies on highly selective and stable conjugation strategies that preserve protein function. However, current chemical approaches often involve harsh conditions or lack sufficient site-selectivity, potentially compromising protein integrity. Therefore, developing mild, biocompatible strategies with unparalleled selectivity is critical to advance next-generation ADCs and fully exploit their therapeutic potential.

By harnessing visible light, photocatalytic reactions enable the generation of reactive intermediates under mild conditions, leading to cleaner bond formation and greater control over selectivity.[2] Importantly, moving towards longer wavelengths reduces photodamage, allows for more controlled reactivity, and expands the range of compatible biomolecules.[3]

Within this framework, our project focuses on the development of new photocatalytic bioconjugation methods. We first explore ruthenium-based photocatalysts that operate under green light, allowing us to apply a wide range of photoredox bioconjugation methods on peptides across diverse substrates. Building on these results, we then implement photocatalytic strategies for the selective functionalization of antibodies, aiming to establish cleaner and more controlled methods for the preparation of ADCs.



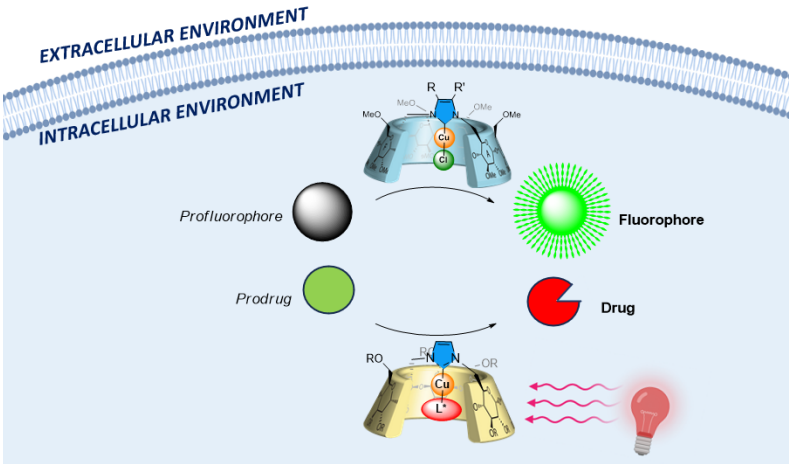
[1] Fan, Q.; Chen, H.; Wei, G.; Wei, D.; Wang, Z.; Zhang, L.; Wang, J.; Zhu, M. A Review of Conjugation Technologies for Antibody Drug Conjugates. *Antibody Ther.* **2025**, *8* (2), 157–170.
[2] Le Stum, M.; Romero, E.; Molander, G. A. Photocatalyzed Elaboration of Antibody-Based Bioconjugates. *Beilstein J. Org. Chem.* **2025**, *21*, 616–629.
[3] Fortier, L.; Lefebvre, C.; Hoffmann, N. Red Light Excitation: Illuminating Photocatalysis in a New Spectrum. *Beilstein J. Org. Chem.* **2025**, *21*, 296–326.

P B011

Metal complexes based on modified cyclodextrins for the development of (photo)catalytic reactions in cells

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The use of organometallic catalysis and photocatalysis in living cells offers promising avenues for imaging (via profluorophores) and therapeutic applications (via prodrugs). While most systems rely on rare and precious metals, copper(I) complexes represent an appealing alternative due to copper abundance and versatile reactivity.[1] However, intracellular copper catalysis and photocatalysis face key challenges: metal toxicity, cellular uptake, competition with endogenous copper pools, stability, compatibility with complex cell media, and the need for biocompatible activation wavelengths in the case of photoactivation. Our group previously developed NHC-based metal complexes (Ag, Cu, Au, etc.),[2,3,4] encapsulated in cyclodextrins (CDs), which protect the catalyst and preserve its catalytic activity while suppressing cytotoxicity.
Building on this, we were able to carry out *ipso*-hydroxylation reactions of boronic esters in DMEM cell culture medium and in cancer cells, by using water-soluble NHC–copper complexes encapsulated in CDs, demonstrating their compatibility with complex biological environments. Photocatalysis offers additional spatial and temporal control. Recently, we showed that copper complexes bearing photoactivatable ligands photocatalyzed the *ipso*-hydroxylation reaction in water. We now aim to adapt this system for cellular applications by improving cell permeability, intracellular copper competition and tuning activation to biocompatible wavelengths.



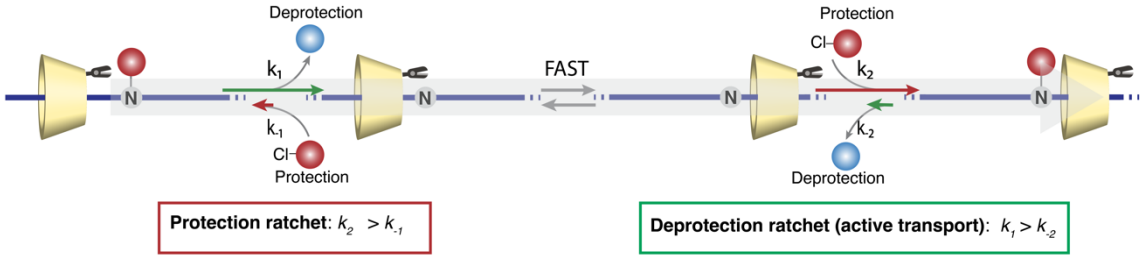
[1] Madec, H.; Figueiredo, F.; Cariou, K.; Roland, S.; Sollogoub, M.; Gasser, G. Metal Complexes for Catalytic and Photocatalytic Reactions in Living Cells and Organisms. *Chem. Sci.* **2023**, *14*, 409–442. https://doi.org/10.1039/D2SC05672K.
[2] Guitet, M.; Zhang, P.; Marcelo, F.; Tugny, C.; Jiménez-Barbero, J.; Buriez, O.; Amatore, C.; Mouriès-Mansuy, V.; Goddard, J.; Fensterbank, L.; Zhang, Y.; Roland, S.; Ménand, M.; Sollogoub, M. NHC-Capped Cyclodextrins (ICyDs): Insulated Metal Complexes, Commutable Multicoordination Sphere, and Cavity-Dependent Catalysis. *Angew Chem Int Ed* **2013**, *52*, 7213–7218. https://doi.org/10.1002/anie.201301225.
[3] Zhang, P.; Meijide Suárez, J.; Driant, T.; Derat, E.; Zhang, Y.; Ménand, M.; Roland, S.; Sollogoub, M. Cyclodextrin Cavity-Induced Mechanistic Switch in Copper-Catalyzed Hydroboration. *Angew. Chem Int Ed* **2017**, *129*, 10961–10965. https://doi.org/10.1002/ange.201705303.
[4] Zhu, X.; Xu, G.; Chamoreau, L.; Zhang, Y.; Mouriès-Mansuy, V.; Fensterbank, L.; Bistri-Aslanoff, O.; Roland, S.; Sollogoub, M. Permethylated NHC-Capped A- and β-Cyclodextrins (ICyD ^{Me}) Regioselective and Enantioselective Gold-Catalysis in Pure Water. *Chem. Eur J* **2020**, *26* (68), 15901–15909. https://doi.org/10.1002/chem.202001990.

P B012

Cyclodextrin-based molecular motor

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The present project aims at the elaboration of a novel cyclodextrin-based chemical motor, either rotatory in a [2]catenane or long-range translational in a rotaxane architecture. The originality of the proposed project is to obtain unidirectional motion of the CD (cyclodextrin) on the axle by a mechanism where the CD would open its own way, like a snowplow moves forward on the road by pushing the snow aside. Chemically speaking, the system is composed of an axle with at least two protecting groups constituting cleavable temporary stoppers (red balls) and an α-CD, functionalized on the primary rim by a defined number of catalytic functions (cisors). The net directionality results from an information ratchet mechanism with two kinetic biases: in the protection step the orientation of the conic shape of the CD favors the reaction next to the large rim as demonstrated in a preliminary work,[1] and the second is related to the presence of a catalytic group (the cisors) on the small rim of the CD that should accelerate the deprotection step. Furthermore, by controlling the functionalization of the CD, we aim at controlling the speed of motion. In doing so we would go well-beyond the state of the art[2] and propose an original concept in the very challenging field of molecular motors.



[1] **A molecular information ratchet using a cone-shaped macrocycle**, E. Liu, S. Cherraben, L. Boulo, C. Troufflard, B. Hasenknopf, G. Vives, M. Sollogoub, *Chem* **2023**, *9*, 1147-1163

[2] **Unidirectional rotation in a mechanically interlocked molecular rotor.** Leigh, D.A., Wong, J.K.Y., Dehez, F., and Zerbetto, F. (2003). Nature *424*, 174-179.

P B013

Computer-aided drug design of antibacterial bioinspired phthalide - a quantitative structure-activity relationship study -

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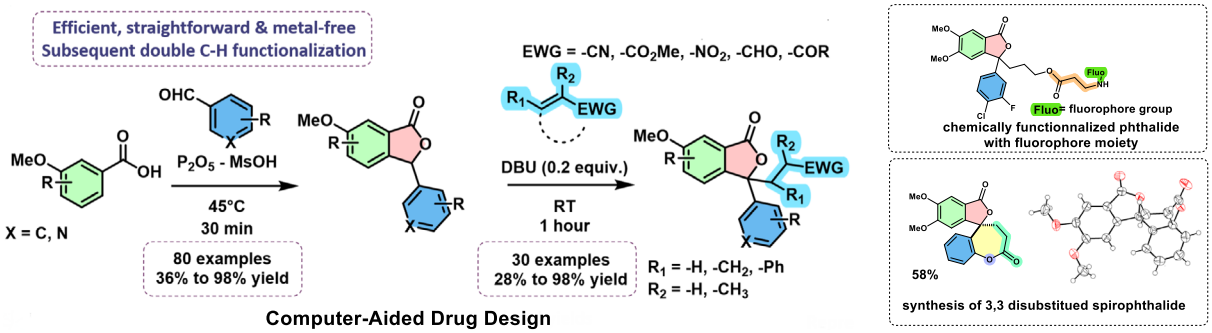
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The escalating prevalence of bacteria resistant to existing antibiotics poses a significant global health challenge. This situation underscores the urgent need for novel molecules to reinforce the therapeutic arsenal against pathogenic microorganisms.[1] In this context, our research focuses on the design and synthesis of compounds with antibacterial properties that specifically target bacterial replication and cell division processes.

Particular attention has been given to small bicyclic lactones of the phthalide family. Preliminary investigations revealed notable antibacterial activity of cytosporone E against methicillin-resistant *Staphylococcus aureus* (MRSA), prompting the synthesis of a library of aryl-series derivatives.[2,3]

To elucidate the structure–activity relationships governing the antibacterial properties of these compounds, we developed rational Quantitative Structure–Activity Relationship (QSAR) models. These models guided the optimization of antibiotic potency.[4]

The integration of QSAR modelling in this study established an iterative framework for the optimization of biologically active compounds. In parallel, we developed an unprecedented synthetic methodology for the efficient preparation of highly substituted phthalides via C–H functionalization, which we subsequently applied to chemical biology investigations.



[1] **Appelbaum**. *Clinical Microbiology and Infection* **2006**, *12*, 3–10.
[2] **Eddebbarh** et al. *Eur J Org Chem* **2024**, *27* (8), e202301303.
[3] **Eddebbarh** et al. *Advanced Synthesis & Catalysis* **2025**, *accepted with revision*
[4] **Ragno**. *J Comput Aided Mol Des* **2019**, *33* (9), 855–864.

P B014

Copper-mediated trifluoromethylation of amines

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The trifluoromethyl group improves the lipophilicity and helps crossing biological barriers. Such properties make it an asset for the activity of drugs, in which the CF_3 moiety is, in most cases, bounded to a carbon atom,[1] albeit O–CF_3, and S–CF_3 linkages can also be found.[2] In contrast, despite the ubiquity of nitrogen atoms in drugs, N–CF_3 groups are rarer, notably because of the difficulty to form those bonds. It appears that a direct trifluoromethylation of free amines is difficult.[3] Thus, N–CF_3 bonds are generally formed by *de novo* syntheses using the natural nucleophilicity of the nitrogen atom.[4] The incorporation of a CF_3 as a whole adduct would require finding a new reactivity.

In this work, we used chloramines and their electrophilic nitrogen atoms coupled with a nucleophilic CF_3 source to form the N–CF_3 bond. The Ruppert-Prakash's reagent[5] in the presence of a fluoride source resulted mainly in gaseous CF_3Cl. In contrast, an alternative source of nucleophilic CF_3, [(phen)CuCF_3] (phen = 1,10-Phenanthroline)[6] was used and enabled the formation of the desired amine. We then developed a one-pot two-steps synthesis of trifluoromethylamines from free amines in 30 minutes at room temperature using *N*-chlorosuccinimide (NCS) as the chlorinating agent. The mechanism has also been studied with DFT calculations and electrochemical analyses.

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[1] McGrath, N. A.; Brichacek, M.; Njardarson, J. T. A Graphical Journey of Innovative Organic Architectures That Have Improved Our Lives. *J. Chem. Educ.* **2010**, *87* (12), 1348–1349. https://doi.org/10.1021/ed1003806.

[2] A) Moujalled, D.; White, A. R. Advances in the Development of Disease-Modifying Treatments for Amyotrophic Lateral Sclerosis. *CNS Drugs* **2016**, *30* (3), 227–243. https://doi.org/10.1007/s40263-016-0317-8. B) Jeanguenat, A.; Lamberth, C. Sulfur-Based Functional Groups in Agrochemistry. *Pest Manag. Sci.* **2023**, *79* (8), 2647–2663. https://doi.org/10.1002/ps.7553.

[3] Niedermann, K.; Früh, N.; Vinogradova, E.; Wiehn, M. S.; Moreno, A.; Togni, A. A Ritter-Type Reaction: Direct Electrophilic Trifluoromethylation at Nitrogen Atoms Using Hypervalent Iodine Reagents. *Angew. Chem. Int. Ed.* **2011**, *50* (5), 1059–1063. https://doi.org/10.1002/anie.201006021.

[4] A) Yagupolskii, L. M.; Fedyuk, D. V.; Petko, K. I.; Troitskaya, V. I.; Rudyk, V. I.; Rudyuk, V. V. *N*-Trihalomethyl Derivatives of Benzimidazole, Benzotriazole and Indazole. *J. Fluor. Chem.* **2000**, *106* (2), 181–187. https://doi.org/10.1016/S0022-1139(00)00321-3. B) Dmowski, W.; Kamiński, M. Reaction of Tertiary Formamides with Sulphur Tetrafluoride. Direct Synthesis of (Trifluoromethyl)Amines. *J. Fluor. Chem.* **1983**, *23* (3), 207–218. https://doi.org/10.1016/S0022-1139(00)85127-1. C) Scattolin, T.; Deckers, K.; Schoenebeck, F. Efficient Synthesis of Trifluoromethyl Amines through a Formal Umpolung Strategy from the Bench-Stable Precursor (Me4N)SCF3. *Angew. Chem. Int. Ed.* **2017**, *56* (1), 221–224. https://doi.org/10.1002/anie.201609480.

[5] A) Ruppert, I.; Schlich, K.; Volbach, W. Die Ersten CF3-Substituierten Organyl(Chlor)Silane. *Tetrahedron Lett.* **1984**, *25* (21), 2195–2198. https://doi.org/10.1016/S0040-4039(01)80208-2. B) Prakash, G. K. S.; Krishnamurti, R.; Olah, G. A. Synthetic Methods and Reactions. 141. Fluoride-Induced Trifluoromethylation of Carbonyl Compounds with Trifluoromethyltrimethylsilane (TMS-CF3). A Trifluoromethide Equivalent. *J. Am. Chem. Soc.* **1989**, *111* (1), 393–395. https://doi.org/10.1021/ja00183a073.

[6] Morimoto, H.; Tsubogo, T.; Litvinas, N. D.; Hartwig, J. F. A Broadly Applicable Copper Reagent for Trifluoromethylations and Perfluoroalkylations of Aryl Iodides and Bromides. *Angew. Chem. Int. Ed.* **2011**, *50*, 3793–3798. https://doi.org/10.1002/anie.201100633.

P B015

PFAS-free omniphobic coatings via PDMS-based surface functionalization

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Perfluorinated compounds (PFAS), first synthesized in the late 1930s, gained widespread industrial use after World War II. Due to their remarkable chemical stability and omniphobic properties, PFAS have been widely used in diverse applications, including non-stick coatings, water-repellent fabric treatments, paints etc. However, their extreme environmental persistence and bioaccumulative nature have raised significant health and ecological concerns, prompting increasing regulatory scrutiny and gradual restrictions on their use. [1, 2]

To address the evolving regulatory landscape and the pressing demand for safer alternatives, we have developed an innovative surface treatment technology based on a covalent chemical bonding approach, using polydimethylsiloxane (PDMS)-derived compounds. This type of treatment is capable of adhering to a wide range of surfaces, including textiles, stone, glass, leather etc. Our robust synthetic methodology enables the efficient modulation of functional groups in a limited number of steps, allowing access to diverse precursors tailored to meet specific superhydrophobic and/or oleophobic performance requirements. The resulting coatings demonstrate excellent repellency to both polar and non-polar liquids, with durability validated under standard abrasion. This approach represents a promising pathway toward environmentally benign surface treatments, that are aligned with the evolving regulatory and industrial landscape.

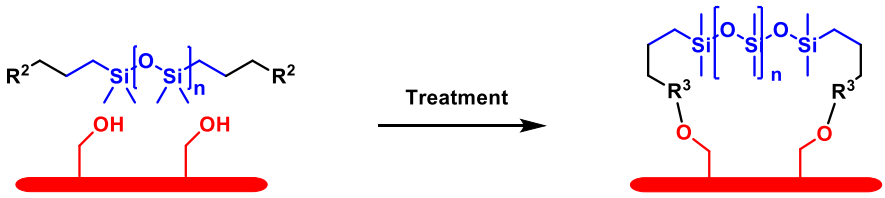


Figure 1. *Surface treatment by covalent chemical bonding.*

[1] a) Cousins, I. T.; Goldenman, G.; Herzke, D.; Lohmann, R.; Miller, M.; Ng, C. A.; Patton, S.; Scheringer, M.; Trier, X.; Vierke, L.; Wang, Z.; DeWitt, J.C. The concept of essential use for determining when uses of PFASs can be phased out. *Environmental Science: Processes & Impacts* **2019**, 21, 1803–1815. b) Bălan, S. A.; Bruton, T. A.; Leonetti, C.; Hazard, K. G., Toward a PFAS-free Future: Safer Alternatives to Forever Chemicals, Royal Society of Chemistry, **2023**. DOI : 10.1039/9781837671410.

[2] a) A complete file concerning textiles is available on the website of European Environment Agency. *An assessment on PFAS in textiles in Europe's circular economy*, february 2024 [summary (17 september 2024)]. b) On February 2025 the French National Assembly passed the country's first law regulating PFAS, effective from January 1, 2026 : https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000051260902. c) PFAS restriction proposal "*Restriction on the manufacture, placing on the market and use of PFASs*" submitted by the European Chemicals Agency (ECHA) in january 2023 : https://echa.europa.eu/-/echa-publishes-pfas-restriction-proposal.

P B016

Synthesis of a bioorthogonal trehalose monomycolate analogue for probing the membrane of Mycobacteria

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Corynebacteriales are a family of bacteria including *Mycobacterium tuberculosis*, the etiologic agent of human tuberculosis. These bacteria exhibit a unique outer membrane, the mycomembrane, which is highly resistant to antibiotics. This mycomembrane is composed of glycolipids named trehalose monomycolate (TMM) (Figure 1A). To investigate its biogenesis, several research groups, including ours, have developed TMM analogues bearing a bioorthogonal moiety (Figure 1B).[1,2] These analogues were used in metabolic labeling experiments on bacteria (Figure 1C). Once metabolized, they enable the specific conjugation of a fluorescent or affinity probe *via* a bioorthogonal reaction allowing the study of the mycomembrane[3,4]. Here, we developed the synthesis of three new TMM analogues bearing a bioorthogonal azido group (Figure 1B), expanding the available tools of our laboratory to study the mycomembrane. Those strategies involved several key steps including a Noyori enantioselective reduction of a β-ketoester, a diastereoselctive alkylation and a selective esterification. These compounds will soon be tested in metabolic labeling experiments for comparative studies. The impact of the azido moiety position will also be studied.

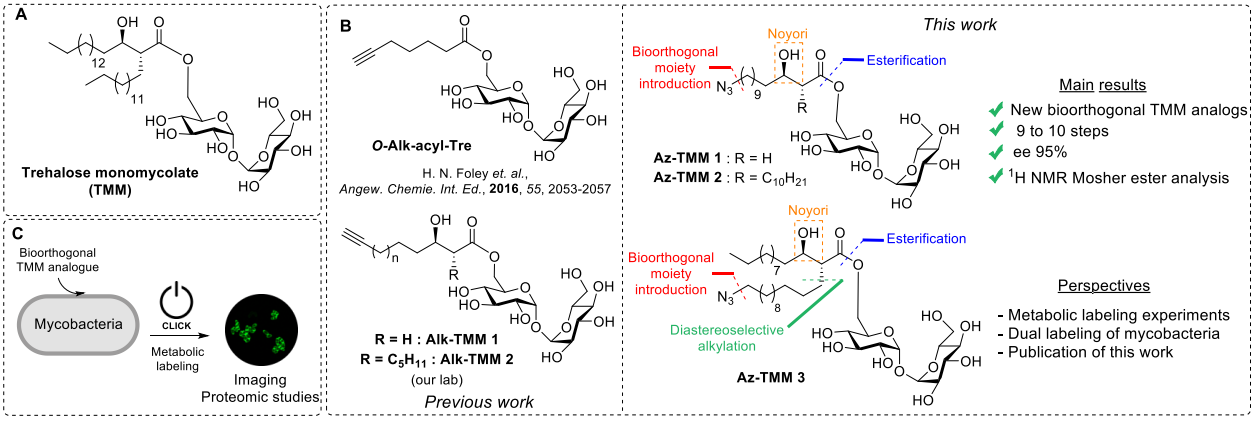


Figure 2. A) Structure of natural TMM. B) Bioorthogonal TMM analogues previously reported and newly obtained. C) Metabolic labeling approach.

[1] E. Lesur ; P. Rollando ; D. Guianvarc'h ; Y. Bourdreux, Synthesis of trehalose-based chemical tools for the study of the mycobacterial membrane, *Comptes Rendus. Chimie* **2023**, *26*, 17–38.

[2] Hannah N. Foley ; Jessica A. Stewart ; Dr. Herbert W. Kavunja ; Sarah R. Rundell ; Benjamin M. Swarts, Bioorthogonal Chemical Reporters for Selective In Situ Probing of Mycomembrane Components in Mycobacteria, *Angew. Chemie. Int. Ed.,* **2016**, *55*, 2053-2057.

[3] C. Labarre ; Y. Zhang ; E. Lesur ; M. Ley ; L. Sago ; C. Dietrich ; C. de Sousa-d'Auria ; F. Constantinesco-Becker ; A. Baron ; G. Doisneau ; D. Urban ; G. Chevreux ; D. Guianvarc'h ; Y. Bourdreux ; N. Bayan, Synthetic mycolates derivatives to decipher protein mycoloylation, a unique post-translational modification in bacteria, *ACS Chem. Biol.* **2024**, *19*, 2359–2371.

[4] E. Lesur ; A. Baron ; C. Dietrich ; M. Buchotte ; G. Doisneau ; D. Urban ; J.-M. Beau ; N. Bayan ; B. Vauzeilles ; D. Guianvarc'h ; Y. Bourdreux, First access to a mycolic acid-based bioorthogonal reporter for the study of the mycomembrane and mycoloyltransferases in Corynebacteria, *Chem. Commun.* **2019**, *55*, 13074–13077.

P B017

Activation of small molecules by Frustrated Lewis Pairs

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Catalysis lies at the heart of modern chemical industries, with hydrogenation of unsaturated compounds representing a cornerstone transformation. However, conventional methods rely heavily on transition-metal catalysts, raising issues of sustainability, cost, and environmental impact. As a promising alternative, main-group catalysis based on Frustrated Lewis Pairs (FLPs) has emerged as a powerful concept since 2006.[1] By combining a Lewis acid and a Lewis base that cannot form a stable adduct, FLPs enable the activation of small molecules such as dihydrogen. Despite this remarkable breakthrough, the catalytic efficiency and selectivity of current FLP systems remain far from matching those of established transition-metal catalysts. This limitation underscores the importance of developing new architectures to fully unlock the potential of FLPs in challenging transformation.

This project aims to expand the scope of FLP catalysis by developing ambiphilic architectures **1**, in which both Lewis acid and Lewis base sites are integrated into a single molecular framework.[2] Our design relies on an N-heterocyclic carbene (NHC) scaffold bearing a borenium unit as the Lewis acid, complemented by strategically positioned Lewis basic function on the boron atom, the imidazole ring, or near the stereogenic center. This modular design is expected to optimize spatial organization and intramolecular reactivity, providing a versatile platform for enantioselective catalysis.

Ultimately, the objective is to demonstrate that these borenium-based catalysts can split dihydrogen and drive the enantioselective reduction of unsaturated compounds, offering a sustainable, transition-metal-free pathway to asymmetric hydrogenation.[3]

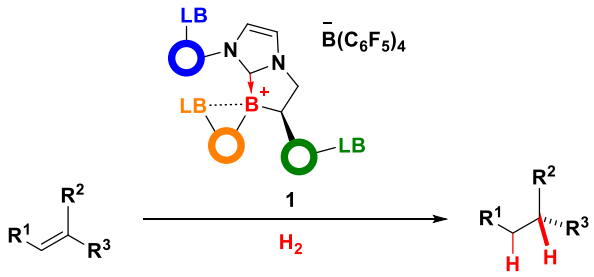


Figure 1: Enantioselective hydrogenation of unsaturated compounds using an FLP catalyst

[1] Welch, G. C.; San Juan, R.; Masuda, J.; Stephan, D. W. *Science*, **2006**, *314*, 1124–1126.
[2] Toure, M.; Chuzel, O.; Parrain, J.-L. *J. Am. Chem. Soc*. **2012**, *134*, 17892–17895.
[3] Aupic, C.; Mohamed, A. A.; Figliola, C.; Nava, P.; Tuccio, B.; Chouraqui, G.; Parrain, J.-L.; Chuzel, *O. Chem. Sci.* **2019**, *10*, 6524–6530.

P B018

Organocatalyzed PIII/PV Redox Strategy for Intramolecular Amide Formation: Toward the Synthesis of Dihydropyrimido[2,1-a]isoindole-6(2H)-one Derivatives

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Classical reactions in organic synthesis, such as the Wittig, Staudinger, Appel and Mitsnobu reactions, typically rely on the use of stoichiometric amounts of phosphines, generating phosphine oxide as a by-product. The formation of this by-product complicates purification processes and decreases overall reaction efficiency. Since 2009, however, P^{III}/P^{V} redox organocatalysis has emerged as an attractive approach to minimize phosphine consumption through the *in-situ* reduction of phosphine oxides by silanes at the end of the reaction.[1]
Recently, our group reported the synthesis of methanophosphocine, a new rigid, electron-rich bridgehead phosphine oxide that exhibits catalytic activity in the Wittig reaction, Staudinger reduction and alkene reduction.[2,3] Herein, we report a catalytic intramolecular aza-Wittig reaction of cyclic amides enabling the synthesis of dihydropyrimido[2,1-a]isoindole-6(2H)-ones derivatives. This methodology demonstrates broad applicability across a range of substrates (19 examples), including both alkyl- or aryl-substituted amides.

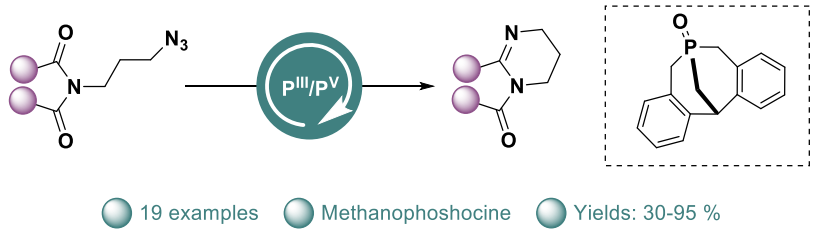


Figure 1: Intramolecular Aza-Wittig reaction for the formation of Dihydropyrimido[2,1-a]isoindole-6(2H)-ones derivatives catalysed by methanophosphocine

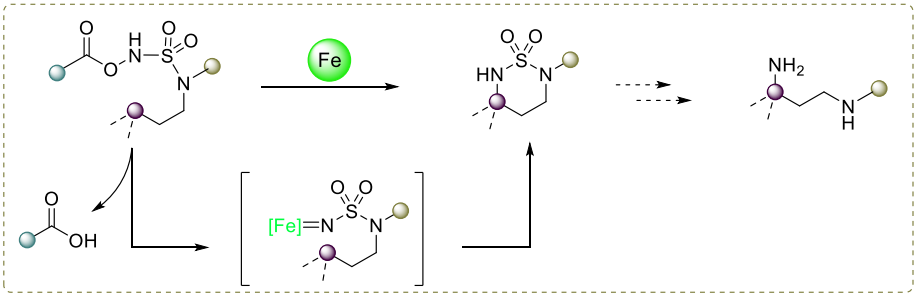
[1] Guo, H.; Fan, Y. C.; Sun, Z.; Wu, Y.; Kwon, O. Phosphine Organocatalysis. *Chem. Rev.* **2018**, *118* (20), 10049–10293.
[2] Babouri, R.; Traore, L.; Bekro, Y.-A.; Matveeva, V. I.; Sadykova, Y. M.; Voronina, J. K.; Burilov, A. R.; Ayad, T.; Volle, J.-N.; Virieux, D.; Pirat, J.-L. Golden Face of Phosphine: Cascade Reaction to Bridgehead Methanophosphocines by Intramolecular Double Hydroarylation. *Org. Lett.* **2019**, *21* (1), 45–49.
[3] Mele, L.; El Bekri Saudain, R.; Pirat, J.-L.; Tomás-Mendivil, E.; Martin, D.; Virieux, D.; Ayad, T. Benchmarking Methanophosphocines as Versatile P^{III} /P^{V} Redox Organocatalysts. *Adv. Synth. Catal.* **2024**, *366* (17), 3636–3645.

P B019

Sustainable Access to 1,3-Diamine Precursors via Iron-Catalyzed C(sp³)–H Amination of Sulfamate Derivatives

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Nitrogen-based scaffolds are ubiquitous in pharmaceuticals, forming the backbone of a wide range of bioactive molecules. Among these, diamines represent an important subcategory. While the synthesis of 1,2-diamines is well established, their isomeric counterparts—1,3-diamines—remain relatively underexplored, offering both a synthetic challenge and an opportunity for innovation. Current methods for 1,3-diamine synthesis often rely on metal catalysis under harsh conditions, frequently requiring external oxidants or environmentally harmful heavy metals such as rhodium or iridium.[1] For several years, our group has been developing more sustainable processes for nitrene insertion into C=C and C(sp³)–H bonds via iron-catalyzed activation of hydroxylamine, providing a versatile route to C–N bond formation.[2] Hydroxylamine has gained recently considerable as a clean, readily available nitrene precursor. Its intrinsic oxidizing properties eliminate the need for external oxidants, offering a more sustainable and environmentally benign alternative.



In this context, the group of Eric Meggers demonstrated the efficiency of benzoylated urea-based substrates in iron-catalyzed C(sp³)–H amination, yielding five-membered imidazolidinone heterocycles as precursors to 1,2-diamines.[3] Building on this concept, our strategy involves the use of acylated sulfamate substrates to enable the selective formation of analogous six-membered sulfamate products. This approach offers a green, efficient, and operationally straightforward route to access 1,3-diamine frameworks. In this communication, we will present and discuss the optimization of the reaction conditions, along with a comprehensive analysis of the reaction's scope and limitations.

[1] (a) H. Lebel, K. Huard, S. Lectard, *J. Am. Chem. Soc.* **2005**, *127*, 14198; (b) H. Lebel, S. Lectard, M. Parmentier, *Org. Lett.* **2007**, *9*, 4797; (c) S. D. Griggs, A. Martin-Roncero, A. Nelson, S. P. Marsden, *Chem. Commun.* **2021**, *57*, 919.
[2] (a) G. Kirby, L. Grimaud, M. R. Vitale, G. Prestat, F. Berhal, *J. Org. Chem.* **2021**, *23*, 9428; (b) H. Esteves, T. Xavier, S. Lajnef, F. Peyrot, G. Lefèvre, G. Prestat, F. Berhal, *ACS. Catal.* **2024**, *14*, 4329.
[3] L. Jarrige, Z. Zhou, E. Meggers, *Angew. Chem. Int. Ed.* **2021**, *60*, 6314.

P B020

Multivalent Chondroitin Sulfate Oligosaccharides as new tools to probe protein-CS interactions

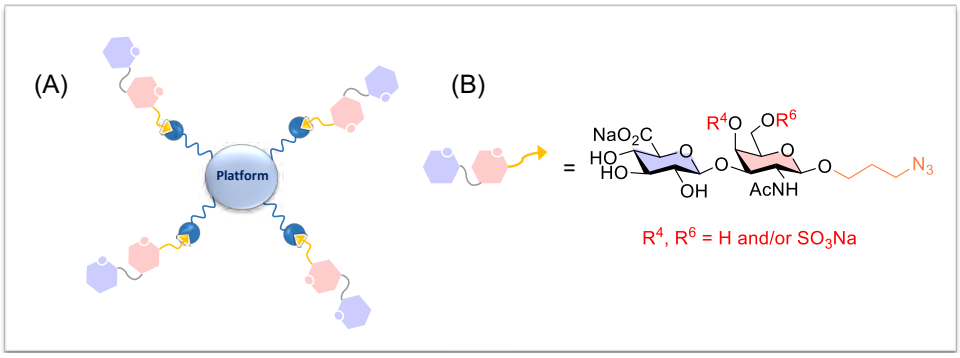
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Chondroitin sulfates (CS) are heteropolysaccharides that belong to a family of complex, polyanionic polymers called glycosaminoglycans (GAGs). They consist of a repeating disaccharide unit composed of a D-glucuronic acid (D-GlcA) and a 2-acetamido-2-deoxy-D-galactose (D-GalNAc) and contain, on average, one sulfate group per disaccharide unit.[1] The most commonly sulfated positions are positions 4 (CS-A) and/or 6 (CS-E and CS-C, respectively) of the D-GalNAc moiety. Due to their rich structural diversity and to their various sulfation patterns, CS play an important role in different physiological processes by their ability to bind various proteins such as lectins, cathepsins or midkines.[2] Multivalency is widely observed in Nature for glycan-proteins recognition mainly to counterbalance the rather weak association constants of carbohydrate ligands with their receptors (lectins for example). Indeed, multivalency offers significant enhancements in terms of affinity and selectivity and can induce specific supramolecular arrangement on the cell surface since proper presentation of the ligand is critical for recognition.[3] To date very few synthetic multivalent GAGs mimetics have been reported and the field of CS remains largely unexplored.[4] We will present here our recent results about the synthesis of well-defined functionalized CS fragments,[5] variously sulfated and of various sizes, and their anchoring onto different platforms to promote multivalency. Those innovative glycoconjugates will be used as new tools to probe protein-CS interactions.



(A) General structure of multivalent CS oligosaccharides; (B) Example with a CS disaccharide

[1] Mikami, T. *et al.* "Biosynthesis and function of chondroitin sulfate" *Biochim. Biophys. Acta*, **2013**, *1830*, 4719.

[2] Sugahara, K. *et al.* "Recent advances in the structural biology of chondroitin sulfate and dermatan sulfate" *Curr. Opin. Struct. Biol.* **2003**, *13,* 612.

[3] Jayaraman, N. "Multivalent ligand presentation as a central concept to study intricate carbohydrate–protein interactions" *Chem. Soc. Rev.* **2009**, *38*, 3463.

[4] Rojo, J.; Nieto, P. M.; de Paz, J. L. "GAG Multivalent Systems to Interact with Langerin" *CMC* **2022**, *29* (7), 1173-1192.

[5] Buisson, P.; Treuillet, E.; Schuler, M.; Lopin-Bon, C. "Multigram Scale Preparation of a Semi-Synthetic *N*-Trifluoroacetyl Protected Chondroitin Disaccharide Building Block Towards the stereoselective synthesis of chondroitin sulfates disaccharides" *Carbohydr. Res.* **2022**, *512*, 108514.

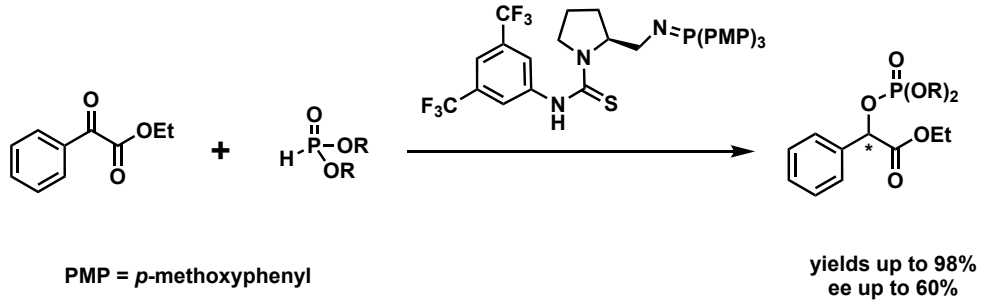
P B021

Enantioselective Phospha-Brook Rearrangement/Protonation Reactions with Chiral Bifunctional Iminophosphorane-Thiourea Catalysts

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Organocatalysis is a metal-free synthetic methodology, recognized as a highly attractive area in modern organic synthesis and green chemistry because it prevents metal pollution and relies on the use of small organic molecules from the "chiral pool", therefore relatively easy to access. Applications of organocatalysts have notably made it possible to promote numerous efficient enantioselective reactions, giving access to new synthetic routes for both natural and non-natural products. [1] Among them, chiral bifunctional organocatalysts associated with a hydrogen-bond donor function represent an interesting class of catalysts. [2] They allow for better asymmetric induction by activating simultaneously nucleophiles and electrophiles while keeping chiral scaffolds in their proximity.

In this communication, we focus on bifunctional organocatalysts bearing an iminophosphorane and a thiourea moiety that function as Brønsted bases and hydrogen-bond donors respectively. [3] Additionally, L-proline structure is known to be a rigid chiral source for asymmetric induction. These organocatalysts have been used for the asymmetric phospha-Brook rearrangement, followed by a protonation reaction to afford tertiary phosphate derivatives in excellent yields (up to 98%) with promising enantioselectivity (up to 60%).



The results of these studies will be presented and discussed in this communication.

[1] Han, B.; He, X.; Liu, Y.; He, G.; Peng, C.; Li, J. *Chem. Soc.* Rev. **2021**, *50*, 1522.
[2] Formica, M.; Rozsar, D.; Su, G.; Farley, A. J. M.; Dixon, D. J. *Acc. Chem. Res.* **2020**, *53*, 2235–2247.
[3] Kong, J.; Lacroix, C.; Bournaud, C.; Yamashita, Y.; Kobayashi, S.; Vo-Thanh, G. *Adv. Synth. Catal.* **2024**, *366*, 1101.

P B022

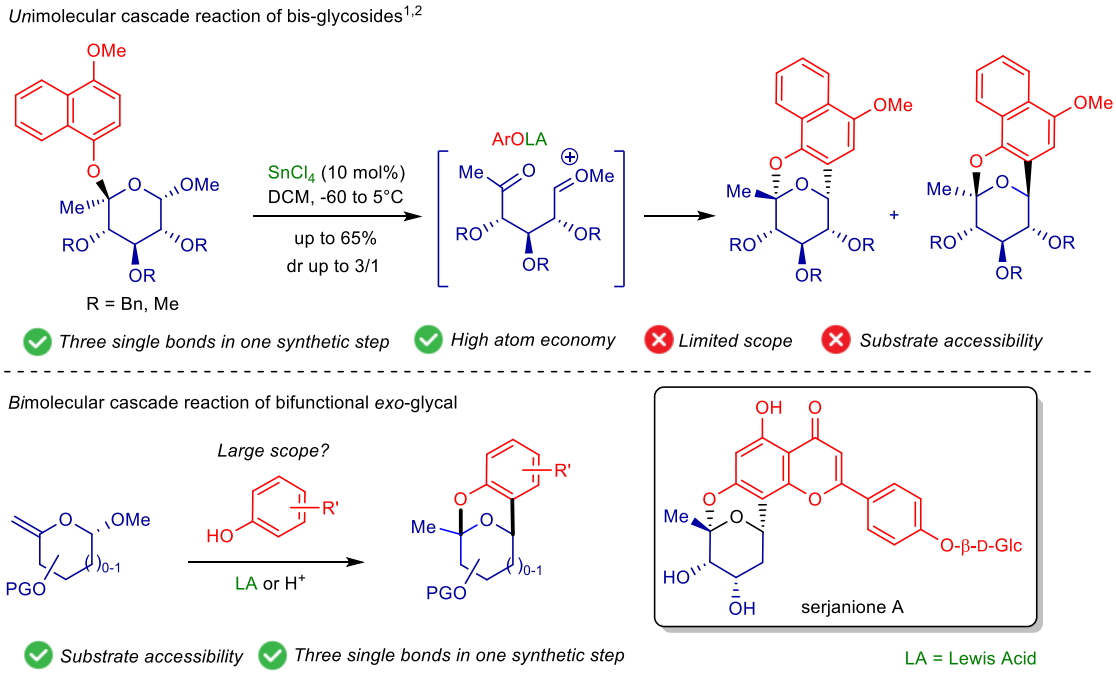
Synthesis of tricyclic epoxybenzoxocines via a new cascade reaction from *exo*-glycals

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We have recently reported the synthesis of tricyclic glycobenzoxocines via a unimolecular cascade reaction from *O*-arylglycosides.[1,2] The unprecedented mechanism of this transformation was elucidated through DFT calculations and trapping experiments.[1] To extend the synthetic potential of the reaction, we have developed a bimolecular cascade process employing bifonctionnal *exo*-glycals and phenols. A multiparameter study was conducted to optimize the efficiency of the transformation, focusing on the nature of the phenol partner and the catalyst. The resulting frameworks resemble those found in bioactive natural products such as serjanione A, a molecule derived from the plant *Serjania marginata*, with various interesting pharmacological activities (antimicrobial, antioxidant, anti-inflammatory).[3]



[1] Liu, H. J.; Laporte, A. G.; Gónzalez Pinardo, D.; Fernández, I. Hazelard, D.; Compain, P. An unexpected lewis acid-catalyzed cascade during the synthesis of the DEF-benzoxocin ring system of nogalamycin and menogaril: mechanistic elucidation by intermediate trapping experiments and DFT studies. *J. Org. Chem*. **2024**, *89*, 5634.

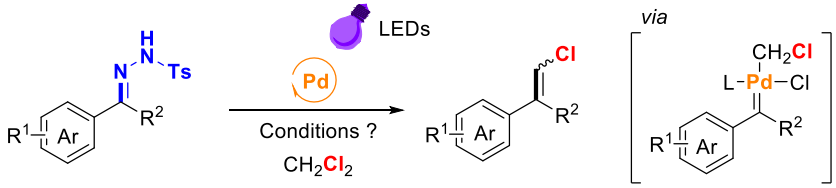
[2] Liu, H.; Laporte, A. G.; Tardieu, D.; Hazelard, D.; Compain, P. Formal glycosylation of quinones with *exo*-glycals enabled by iron-mediated oxidative radical-polar crossover. *J. Org. Chem.* **2022**, *87*, 13178.

[3] (a) Heredia-Vieira, S. C.; Simonet, A. M.; Vilegas, W.; Macías, F. A. Unusual *C,O*-fused glycosylapigenins from *Serjania marginata* Leaves. *J. Nat. Prod.* **2015**, *78*, 77. (b) Dias Silva, M. J.; Simonet, A. M.; Silva, N. C.; Dias, A. L. T.; Vilegas, W.; Macías, F. A. Bioassay-guided isolation of fungistatic compounds from *Mimosa caesalpiniifolia* Leaves. *J. Nat. Prod.* **2019**, *82*, 1496.

P B023

Photo-induced and palladium-catalyzed chlorinated alkenes synthesized by *N*-tosylhydrazones

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- mild reaction conditions
- safe and easy to operate
- easily accessible substrates
- good functional group tolerance

Chlorinated molecules are widely present in compounds of interest such as pharmaceuticals, agrochemicals, and natural products.[1] In particular, the synthesis of chlorinated alkenes is at the forefront of innovation because they have widespread applications in organic chemistry. To date, the preparation of chlorinated alkenes can be accomplished through a variety of methods, including a Vilsmeier-Haack reaction,[2] a Witting reaction, a chloropalladation/Heck reaction sequence, chlorocarbonylation reactions of alkynes5 and so on. Nevertheless, the development of novel methods still needs to be further explored.

Herein, we describe a new method for the synthesis of chlorinated alkenes from N-tosylhydrazones under metallaphotoredox conditions. Firstly, the reaction can generate in-situ highly reactive alkyl diazo species via photo-excitation of N-tosylhydrazone anions. The diazo intermediates produced can then react with palladium (II) complexes to form a Pd-carbene. Then an alkyl migration followed by a β-elimination finally formed chlorinated alkenes. The method is applicable to the synthesis of highly functionalized chlorinated alkenes through differently substituted N-tosylhydrazones from ketones or aldehydes. The reaction features mild conditions and high functional group tolerance. This strategy provides a simpler, safer method for the synthesis of chlorinated alkenes under mild conditions.

[1] (a) Gribble, G. W. Naturally Occurring Organohalogen Compounds. *Acc. Chem. Res*. **1998**, *31*, 141-152. (b) Hernandes, M. Z.; Cavalcanti, S. M. T.; Moreira, D. R. M.; de Azevedo Junior, W. F.; Leite, A. C. L. Halogen Atoms in the Modern Medicinal Chemistry: Hints for the Drug Design. *Curr. Drug Targets* **2010**, *11*, 303-314. (c) Jeschke, P. The Unique Role of Halogen Substituents in the Design of Modern Agrochemicals. *Pest Manage. Sci*. **2010**, *66*, 10-27.
[2] Krishnaraj, K. U.; Devaky, K. S. Synthesis of 2-Hydroxy-5,6-Diarylnicotinonitriles and 2-Chloro-5,6-Diarylnicotinonitriles From. *Tetrahedron* **2014**, *70*, 6450-6456.

P B024

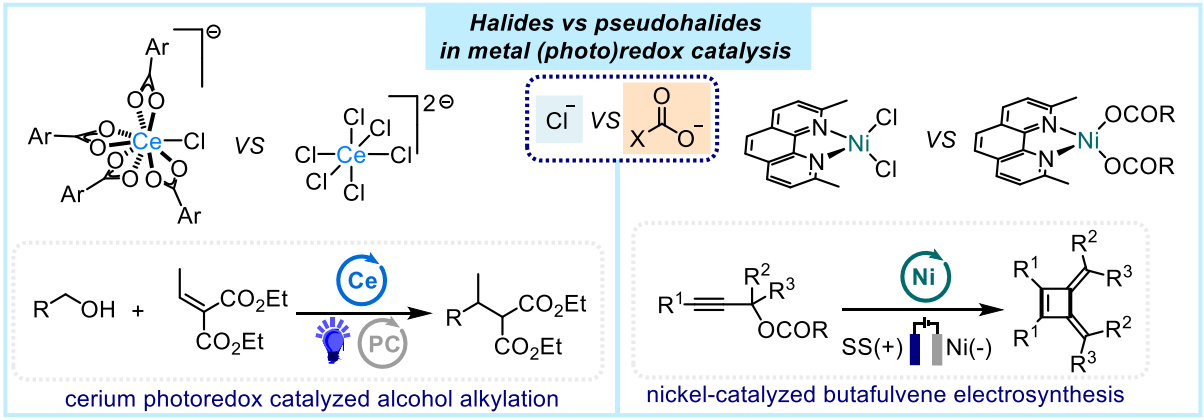
Influence of Pseudohalides in Metal (Photo)Redox Catalysis

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Synthetic chemistry has tremendously evolved the past decades with the development of modern metal redox catalysis. Photoredox catalysis[1] and electrosynthesis[2] coupled to metal catalysis have led to new paradigms in organic chemistry such as substrate activation and bond forming protocols via open-shell intermediates formation. Moreover, metal-catalyzed (photo)redox catalysis also provides more sustainable alternative methodologies to classical transition-metal catalysis employing molecular single-electron oxidant or reductant. In this context, having a better understanding of the use of additives in metal/(photo)redox catalysis could trigger the development of future catalytic systems.

Herein, the effect of pseudohalides versus halides will be presented in two distinct metal redox catalyzed reactions. In the first study, the role of benzoate anions versus chloride anions in cerium photoredox catalysis has been investigated. The identity of cerium benzoate complexes has been elucidated and their positive impact on the catalyzed functionalization of abundant alcohols via ligand-to-metal charge transfer reactivity has been demonstrated. In the second study, the impact of pseudohalides vs halides in nickel-catalyzed butafulvene electrosynthesis is described.[3] Notably, the *in-situ* generation of carboxylates or carbonates anions enables auto-tandem Ni(0)/Ni(II) catalysis converting propargylic carbonates and esters to a rare benzene structural isomer.



[1] Chang, L.; An, Q.; Duan, L.; Feng, K.; Zuo, Z. Alkoxy Radicals See the Light: New Paradigms of Photochemical Synthesis. Chem. Rev. 2022, 122, 2429. https://doi.org/10.1021/acs.chemrev.1c00256

[2] Ehehalt, L. E.; Beleh, O. M.; Priest, I. C.; Mouat, J. M.;Olszewski, A. K.; Ahern, B. N.; Cruz, A. R.; Chi, B. K.; Castro, A. J.;Kang, K.; Wang, J.; Weix, D. J. Cross-Electrophile Coupling: Principles, Methods, and Applications in Synthesis. Chem. Rev. 2024, 124, 13397−13569. https://doi.org/10.1021/acs.chemrev.4c00524

[3] Hu, T.; Duchemin, C.; Beluze, B.; Bouyssi, D.; Vantourout, J.; Monteiro, N; Amgoune, A. Electrochemically-Driven Auto-Tandem Nickel Catalysis for the Production of Butafulvenes. *Submitted*.

P B025

Skeletal Editing of Azetines

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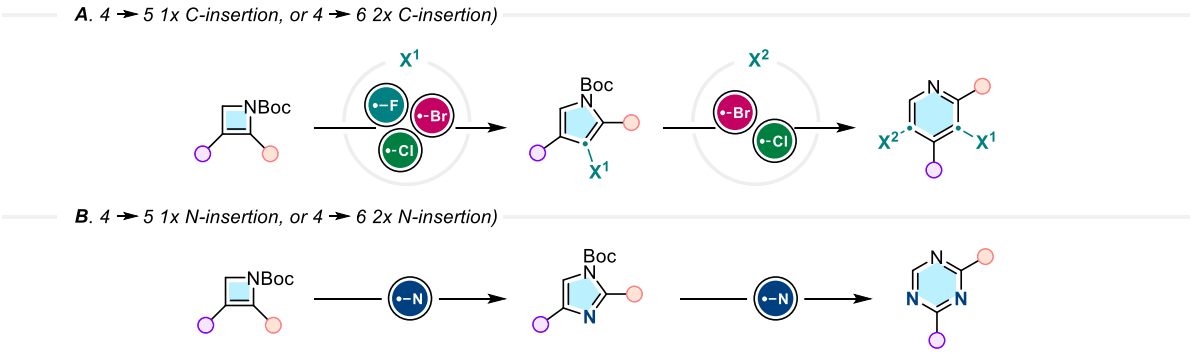
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While classical reaction design relies on fine retrosynthetic planning, skeletal editing strategies offer the opportunity to change the shape of pre-existing molecular scaffold in a selective way. Among these approaches, ring expansion by atom insertion represents a well-defined transformation with significant potential for molecular innovation.[1]

Despite numerous strategies exist for the synthesis of five- and six-membered *N*-heterocycles, efficient access to polysubstituted scaffolds such as pyrroles, pyridines, imidazoles and triazines still represents a major synthetic challenge.[2]

For the last decade, our group has focused on creating efficient and reliable strategies to access polysubstituted four-membered heterocycles, including 2*H*-azetines and azetidines.[3] We envisioned that adequate conditions that would use the inherent reactivity of the double bond in 2*H*-azetines could trigger a ring-expanding rearrangement towards the corresponding halogenated pyrroles[4] and bis-halogenated pyridines (**A**) using simple *in situ* generated dihalogenocarbenes, but also the corresponding imidazoles and triazines (**B**) *via in situ* generated nitrenes.

We will show that a single starting material provides access to a wide range of substituted structures in a chemodivergent way.



Regiospecific ring expansion - Synthesis of new halogenated pyrroles, bis-halogenated pyridines, imidazoles and triazines - >50 examples - Up to 99% yield - Post-functionnalization - One-pot and gram-scale synthesis - Simple protocol

[1] (a) Ciamician, G. L.; Dennstedt, M. Über die Einwirkung des Chloroforms auf die Kaliumverbindung Pyrrols. *Ber. Dtsch. Chem. Ges.* **1881**, *14*, 1153–1163. (b) Levin, M. D. Retrosynthetic Simplicity. *Synlett* **2023**, *35*, 1471–1474. (c) Kelly, P. Q.; Filatov, A. S.; Levin, M. D. Dearomative Ring Expansion of Polycyclic Arenes. *Angew. Chem. Int. Ed.* **2022**, *61*, e202213041.

[2] Jangir, N.; Surbhi Dhadda P.; Dhadda, S.; Jangid, D. K. Recent advances in the synthesis of five- and six-membered heterocycles as bioactive skeleton: A concise overview. *ChemistrySelect* **2022**, *7*, e202103139.

[3] (a) Baumann, A. N.; Eisold, M.; Music, A.; Haas, G.; Kiw, Y. M.; Didier, D. Methods for the Synthesis of Substituted Azetines. *Org. Lett.* **2017**, *19*, 5681–5684. (b) Trauner, F.; Ghazali, R.; Rettig, J.; Thiele, C. M.; Didier, D. Stereoselective polar radical crossover for the functionalization of strained-ring systems. *Commun. Chem.* **2024**, *7*, 139. (c) Reiners, F.; Joseph, E.; Nißl, B.; Didier, D. Stereoselective Access to Azetidine-Based α-Amino Acids and Applications to Small Peptide Synthesis. *Org. Lett.* **2020**, *22*, 8533–8537.

[4] Ghazali, R.; Schick, E.; Lèpre, S.; Kranich, J.; Didier D. Regiospecific Skeletal Editing of Azetines towards Halogenated Pyrroles. *ChemRxiv.* **2025**; doi:10.26434/chemrxiv-2025-25grb.

P B026

Isothiourea and organometallic salen combination: from homogeneous to heterogeneous asymmetric multicatalysis

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The synthesis of enantioenriched compounds is a challenging field in organic chemistry, where chiral catalysts offer good solutions in terms of efficiency and sustainability. The combination of two catalytic reactions, sequentially in the same pot, further extends the field of applications to functionalized enantioenriched building blocks, but remains still underdeveloped. Chiral salen complexes are well described for promoting the activation of non-reactive species thanks to their Lewis acidity.[1] On the other hand, isothioureas are widely used to catalyze the generation of nucleophilic intermediates from carbonyl derivatives.[2] From these two reactivities, a new sequential bi-catalysis was implemented under homogeneous conditions. The asymmetric Henry reaction first yields an enantioenriched β -nitro alcohol.[3] This is followed by enantioselective acylation[4] leading to an even more enantioenriched alcohol, easily separable from its acylated enantiomer. The latter can directly undergo elimination to afford the corresponding nitrostyrene derivative (Figure 1). As a result, highly interesting β-nitro alcohol derivatives are obtained in high enantiomeric excesses and better yields compared with conventional kinetic resolution. Efforts are now underway to implement this new efficient one-pot sequential reaction under heterogeneous conditions. Modifications on both catalyst structures[5] should enable them to be stacked by non-covalent interactions on two different carbon materials,[6] thus facilitating their respective recovery and reuse in numerous cycles without affecting catalytic activity.

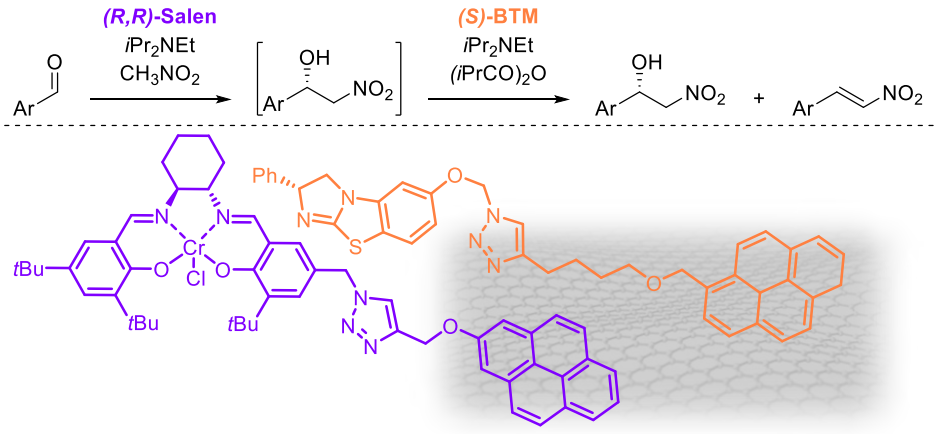


Figure 1. Asymmetric bi-catalysed sequence

[1] M. Tokunaga, F. Kakiuchi, R. G. Konsler, J. F. Larrow, E. N. Jacobsen, *Tet. Lett.* **1997**, *38*, 773
[2] D. Belmessieri, L. C. Morrill, C. Simal, A. M. Z. Slawin, A. D. Smith, *J. Am. Chem. Soc*. **2011**, *133*, 2714
[3] R. Kowalczyk, L. Sidorowicz, J. Skarżewski, *Tet. As*. **2007**, *18*, 2581
[4] X. Li, H. Jiang, E. W. Uffman, L. Guo, Y. Zhang, X. Yang, V. B. Birman, *J. Org. Chem*. **2012**, *77*, 172
[5] M. Abd El Sater, M. Mellah, D. Dragoe, E. Kolodziej, N. Jaber, E. Schulz, *Chem. Eur. J.* **2021**, *27*, 9454; Y.-C. Yuan, M. Abd El Sater, M. Mellah, N. Jaber, O. R. P. David, E. Schulz, *Org. Chem. Front*. **2021**, *8*, 4693
[6] L. Ibos, E. Schulz, *Comptes Rendus. Chimie*, **2024**, *27*, 57-83

P B027

Synthesis of Thioglycoside–1,2,4-Triazole Derivatives via Photocatalytic and Palladium-Catalyzed Approaches

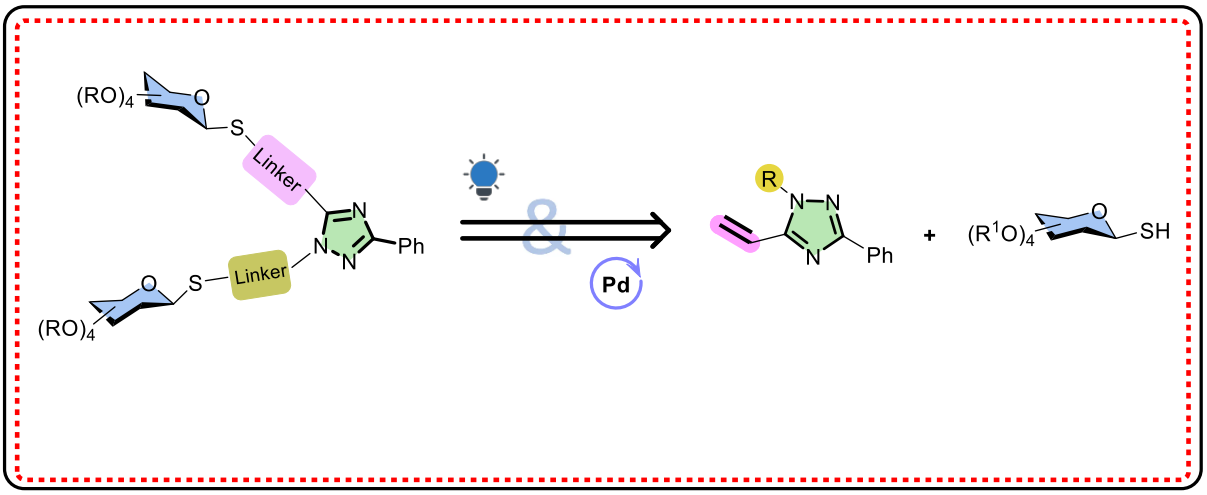
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Thioglycosides are widely investigated for their essential roles in biological systems, particularly as enzyme inhibitors and glycomimetics[1,2]. Meanwhile, 1,2,4-triazoles are renowned for their notable stability and broad spectrum of biological activities, making them valuable scaffolds in pharmaceutical and agrochemical research[3]. Building on these insights, we report the synthesis of novel thioglycoside–1,2,4-triazole derivatives through two complementary and efficient strategies. A visible-light photocatalytic thiol–ene reaction enabled the mild and selective functionalization of vinylic triazoles, while a Pd-G3 Xantphos catalyzed cross-coupling provided an alternative metal-mediated route. Both approaches afforded the target compounds in good to excellent yields with broad substrate scope, providing pratical routes to structurally diverse compounds of potential biological interest.



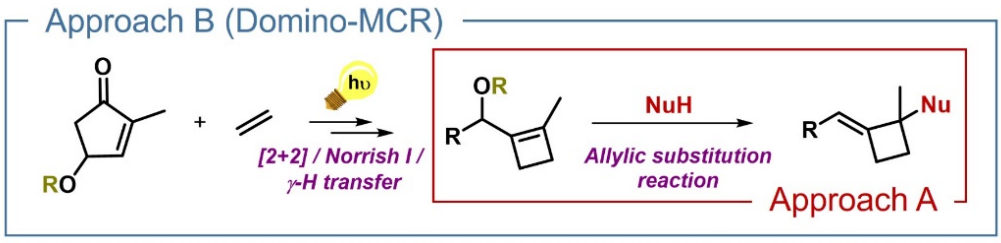
[1] Leusmann, S.; Ménová, P.; Shanin, E.; Titz, A. Chem. Soc. Rev. **2023**, 52, 99–120.
[2] Quintana, I.; Paul, A.; Chowdhury, A.; Moulton, K.; Kulkarni, S.; Dube, D. ACS Infect. Dis. **2023**, 9 (4), 789–799.
[3] Abdelli, A.; Azzouni, S.; Plais, R.; Gaucher, A.; Efrit, M.L.; Prim, D. Tetrahedron Lett. **2021**, 86, 153518.

P B028

Synthesis of functionalized alkylidenecyclobutanes

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Cyclobutane derivatives have become increasingly important as molecular building blocks because of their inherent ring strain and the selective modification of their structures can be strategically used in organic synthesis.[1] Cyclobutane rings also appear in the molecular structures of a wide panel of natural and synthetic molecules that display interesting biological activities.[2] Within this large family, alkylidenecyclobutane subunits are encountered in natural products, such as providencin,[3] and they exhibit enhanced reactivity providing access to complex molecular structures, including enlarged ring and functionalized cyclobutane derivatives.[4]
We recently described an efficient synthesis of cyclobutenes through a photochemical domino reaction starting from cyclopent-2-enones and ethylene.[5] In this poster, we will present two new developments: an original Brønsted acid-catalyzed allylic substitution reaction to convert functionalized cyclobutenes into alkylidenecyclobutanes (**Approach A**)[6] and a straightforward domino-multicomponent reaction (Domino-MCR), that combines the photochemical sequence and the substitution reaction (**Approach B**).[7] These synthetic procedures provide an access to a wide variety of post-functionalized cyclobutane derivatives.



[1] *Cyclobutanes in Catalysis.* Seiser, T.; Saget, T.; Tran, D. N.; Cramer, N. *Angew. Chem. Int. Ed.* **2011**, *50*, 7740-7752.
[2] *Attractive natural products with strained cyclopropane and/or cyclobutane ring systems*. Fan, Y.-Y.; Gao, X.-H.; Yue, J.-M. *Sci. China. Chem.* **2016**, 1126-1141.
[3] *Synthesis of the Cyclobutylfuran Sector of Providencin via Zirconium-mediated Oxygen Abstraction from a Furanoside.* White, J. D.; Jana, S. *Org. Lett.* **2009**, *11,* 1433-1436.
[4] (a) *Rhodium-Catalyzed Synthesis of 2,3-Disubstituted Indoles from β,β-Disubstituted Stryryl Azides*. Sun, K.; Liu, S.; Bec, P. M.; Driver, T. G. *Angew. Chem. Int. Ed.* **2011**, *50*, 1702-1706. (b) *Stereoselective access to alkylidenecyclobutanes through γ-selective cross-coupling strategies.* Eisold, M.; Didier, D. *Org. Lett.* **2017**, *19*, 4046-4049.
[5] *Preparation of Cyclobutene Acetals and Tricyclic Oxetanes through Photochemical Tandem and Cascade Reactions.* Buendia, J.; Chang, Z.; Eijsberg, H.; Guillot, R.; Xie, J.; Frongia, A.; Secci, F.; Robin, S.; Boddaert, T.; Aitken, D. J. *Angew. Chem. Int. Ed.* **2018**, *57*, 6592-6596.
[6] *Functionalized Alkylidenecyclobutanes from a Cyclopent-2-enone Substrate via a Tandem Photochemical Transformation and an Allylic Substitution Protocol.* Yu, X.; Boddaert, T.; Aitken, D. J. *Adv. Synth. Catal.* **2023**, *365*, 4002-4007.
[7] *Light-Initiated Four-Step Domino-Multicomponent Synthesis of Functionalized Alkylidenecyclobutanes.* Yu, X.; Desvals, A.; Chang, Z.; Oreve, V.; Aitken, D. J.; Boddaert, T. *Org. Lett.* **2024**, *26*, 9915-9919.

P B029

Expeditious Approach Towards Cyclic Phosphinamides Through Photoinduced Conditions

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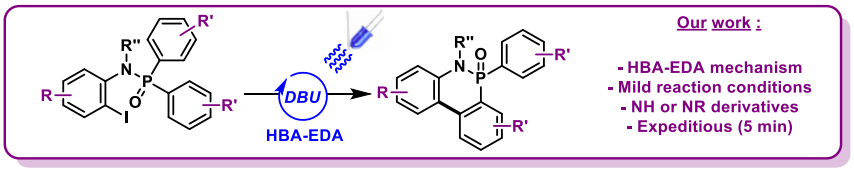
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The synthesis of novel heterocyclic structures represents a sophisticated challenge in contemporary organic chemistry, demanding innovative methodological approaches to explore uncharted chemical domains with potential technological applications. This research introduces a pioneering Halogen-Bonding-Assisted Electron Donor-Acceptor (EDA)-Single Electron Transfer (SET) strategy that demonstrates remarkable potential for generating unprecedented molecular frameworks. Preliminary investigations have highlighted the fascinating photophysical characteristics of cyclic phosphinamides which have stimulated extensive scientific interest.[1] The current research specifically focuses on developing phosphorous-containing scaffolds with significant implications for organic light-emitting diode (OLED) technologies.

The proposed methodology leverages visible light catalysis as an unexplored synthetic approach. Critically, the research introduces an unprecedented route for carbon-carbon bond formation utilizing solely visible light and an economical base, diazabicyclooctane (DBU). This innovative strategy capitalizes on recent advancements in halogen bonding mechanisms, facilitating electron transfer between DBU and halogen residues.[2] In this aim, we use Visible light catalysis since it offers multiple compelling advantages, including: Mild reaction conditions, Energy efficiency, Exploration of unconventional retrosynthetic pathways, Potential for novel mechanistic insights. The research's primary objective is to construct complex phosphoramidates and thiophosphoramidates scaffolds through strategic EDA complex formation. By integrating advanced photochemical principles with precise molecular engineering, this approach represents a significant advancement in synthetic organic chemistry, potentially unlocking new frontiers in materials science and technological applications.[3]



[1] Parham, A.; ENGELHART, J.; EICKHOFF, C.; Ehrenreich, C.; Kroeber, J. WO2020094542A1, May 14, 2020. https://patents.google.com/patent/WO2020094542A1/fr

[2] Peterson, A.; Kaasik, M.; Metsala, A.; Järving, I.; Adamson, J.; Kanger, T. *RSC Adv.* **2019**, *9* (21), 11718–11721. / Cavallo, G.; Metrangolo, P.; Milani, R.; Pilati, T.; Priimagi, A.; Resnati, G.; Terraneo, G. *Chem. Rev.* **2016**, *116* (4), 2478–2601 / Piedra, H. F.; Valdés, C.; Plaza, M. *Chem. Sci. 14* (21), 5545–5568.

[3] Faure, C. ; Yuan, Y. ; Lamaa, D. ; Derat, E. ; Lajnef, S. ; Peyrot, F. ; Belmont, P.; Brachet E.; **2024** doi : 10.26434/chemrxiv-2024-nhr99

P B030

Expanding the chemical space of Rifamycin S via Suzuki coupling: harnessing modern chemistry to redesign traditional antibiotics

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Rifamycin S is an antibiotic belonging to the ansamycin family, widely used for its activity against Gram-positive bacteria and certain mycobacteria. Nevertheless, its effectiveness is limited in the case of Gram-negative bacteria due to the presence of an impermeable outer membrane and efflux systems that reduce intracellular accumulation. It has been indicated by several SAR studies[1,2] that the modulations of the C3/4 positions of rifamycins are fundamental to their recognition by transporters. These transporters have been identified as the key mediators of the internalization of rifamycin derivatives within the bacterium. Being a natural product first isolated in 1957, Rifamycin S has long posed a challenge for chemical modification due to its intricate and highly functionalized structure. Nevertheless, the emergence of modern strategies such as pallado- catalyzed cross coupling reaction offers new opportunities to diversify this molecule and generate derivatives with improved antibacterial properties.

In this project, we developed and optimized the conditions of the Suzuki coupling between rifamycin S and several aryl and heteroaryl boronic acids. The optimization of the reaction conditions focused on classical key parameters (catalyst, ligand, base, temperature, etc.) with the added challenge of maximizing reaction selectivity and conversion while minimizing rifamycin degradation phenomena.

The recently synthetized derivatives were evaluated *in vitro* on a panel of Gram-positive and Gram-negative bacteria. All the analogs display low MICs (minimum inhibitory concentration) against *S. aureus* clearly indicating that target engagement with the RNA polymerase β-subunit is maintained. The approach presented in this study provides a rational framework for structural diversification of Rifamycin S via modern cross coupling chemistry. The resulting derivatives may provide opportunities for the development of antibiotics that are active against multidrug-resistant pathogens.

[1] Luna, B.; Trebosc, V.; Lee, B.; Bakowski, M.; Ulhaq, A.; Yan, J.; Lu, P.; Cheng, J.; Nielsen, T.; Lim, J.; Ketphan, W.; Eoh, H.; McNamara, C.; Skandalis, N.; She, R.; Kemmer, C.; Lociuro, S.; Dale, G. E.; Spellberg, B. A Nutrient-Limited Screen Unmasks Rifabutin Hyperactivity for Extensively Drug-Resistant Acinetobacter Baumannii. *Nat Microbiol* **2020**, *5* (9), 1134–1143.
[2] Wehrli, W.; Zimmermann, W.; Kump, W.; Tosch, W.; Vischer, W.; Zak, O. CGP 4832, a New Semisynthetic Rifamycin Derivative Highly Active against Some Gram-Negative Bacteria. J Antibiot (Tokyo) 1987, 40 (12), 1733–1739.

P B031

Access to Thioglycoconjugate Bioorganometallic Ferrocenes Via a Copper-Catalyzed Coupling

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The ferrocenyl derivatives have attracted significant interest due to their redox properties and therapeutic potential. The ferrocenyl moiety undergoes reversible oxidation within cells, generating reactive oxygen species (ROS) that may contribute to the eradication of tumor cells and pathogens. Additionally, its lipophilicity enhances bioavailability, making it a promising candidate for drug development. Notably, ferrocifen (Figure 1), an analogue of tamoxifen, has been extensively studied for its potential applications in breast cancer therapy.[1]

A key strategy in designing bioactive molecules is the incorporation of carbohydrate motifs, which can enhance solubility, bioavailability, and selective targeting of cancerous tissues through glucose transporters. Previous studies have highlighted the antibacterial, antiparasitic, and anticancer potential of ferrocenyl-carbohydrate conjugates. For instance, ferrocenyl-sugar derivatives have exhibited significant antibacterial activity against *E. coli* and *Pseudomonas aeruginosa* and promising antimalarial activity against chloroquine-resistant *Plasmodium falciparum* strains.[2]

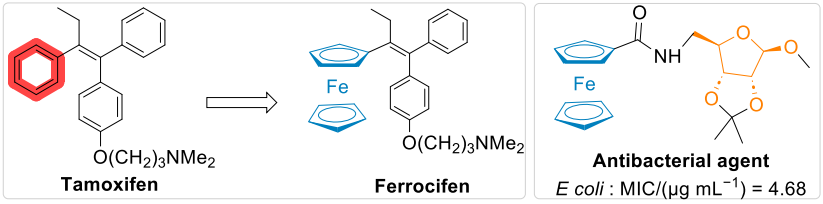


***Figure 1**: Structure of ferrocifen as an anticancer agent and an example of a ferrocenyl-sugar derivative with antibacterial activity.*

Building on these findings, we have synthesized novel ferrocenyl-carbohydrate conjugates incorporating thiosugars, chosen for their enhanced stability against enzymatic and chemical degradation. Using an Ullmann-type coupling reaction between thiosugars and ferrocenyl iodide, we successfully obtained structurally diverse conjugates (Figure 2).[3] Preliminary biological assessments indicate that these compounds exhibit significant anticancer activity against human colorectal carcinoma cell lines (HCT-116), highlighting their potential as promising candidates for future bioorganometallic drug development.

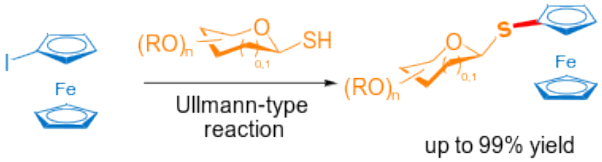


***Figure 2**: This study leading to the formation of compounds based on the direct coupling of thiosugars with ferrocene.*

[1] a) Metzler-Nolte, N *et al*. *Chem. Rev.* **2004**, *104*, 5931–5986; b) Gasser, G. *et al*. *Nat. Rev. Chem.* **2017**, *1*, 0066; c) Nemiwal, M. *et al. J. Mol. Struct.* **2025**, *1319*, 139589. d) Jaouen, G. *et al. Chem. Commun.* **1996**, 955–956.

[2] a)Toth, I. *et al. Chem. Sci.* **2016**, 7, 2492–2500. b) Hergenrother, P. J. *et al. Chem. Sci.* **2013**, *4*, 2319–2333. c) Hossain, F.; Andreana, P. R. *Pharmaceuticals* **2019**, *12*, 84–102.

[3] El Rhaz, A. *et al. Org. Lett.* **2025**, *27*, 7979–7985.

P B032

Synthesis of novel 1,3,2-oxazaphospholidine-2-oxides *via* ring expansion of 2-hydroxymethylaziridines

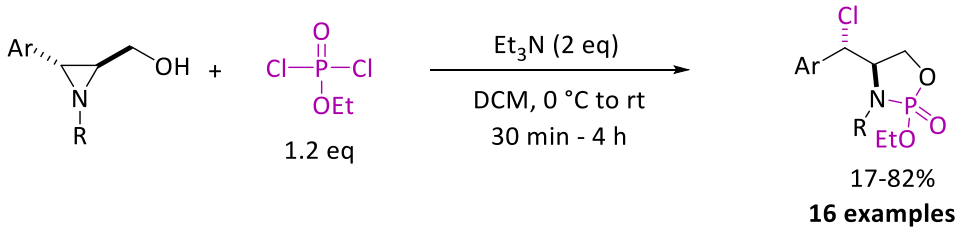
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2-Hydroxymethylaziridines represent valuable synthetic intermediates for the construction of diverse interesting heterocyclic systems.[1] In this communication, we report a simple and efficient approach for the synthesis of 1,3,2-oxazaphospholidine-2-oxides through the ring expansion of non-activated 2-hydroxymethylaziridines in the presence of ethyl dichlorophosphate, under mild conditions. Regio- and stereoselective aziridine ring opening yields α-chlorinated 5-membered ring heterocyclic compounds as the sole products of the reaction.



Some 1,3,2-oxazaphospholidine-2-oxides have been reported to exhibit anti-inflammatory,[2] antibacterial[3] or insecticidal[4] effects, however molecules containing such scaffold remain underinvestigated to date. Herein, we describe the preparation of 16 examples of 1,3,2-oxazaphospholidine-2-oxides, with the perspective of evaluating their applications at a later stage.

Key words: 2-hydroxymethylaziridine, 1,3,2-oxazaphospholidine-2-oxide, ring expansion.

[1] Stanković, S.; D'hooghe, M.; Catak, S.; Eum, H.; Waroquier, M.; Van Speybroeck, V.; De Kimpe, N.; Ha, H.-J. Regioselectivity in the Ring Opening of Non-Activated Aziridines. *Chem. Soc. Rev.* **2012**, *41*, 643–665.

[2] Abdou, W. M.; Sabry, E.; Shaddy, A. A. Synthesis Approach and Biological Activity Evaluation of a Series of 1,3,2-Oxazaphosphole-2-Oxides against Inflammation and Nociception. *Monatsh. Chem.* **2019**, *150*, 283–294.

[3] Krishna, B. S.; Rao, A. J.; Naidu, K. R. M.; Rao, V. K.; Raju, C. N. Synthesis and Antibacterial Activity Studies of Novel 2-Substituted- 1,3,2-Oxazaphosphole-2-Oxide Derivatives of (*S*)-(+)-Prolinol. *Org. Commun.* **2010**, *3*, 98–105.

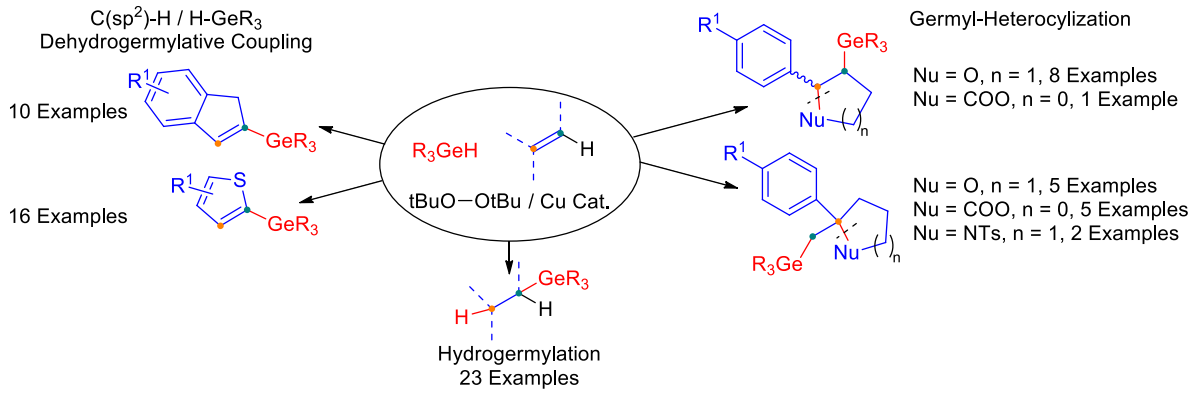
[4] Eto, M. Functions of Phosphorus Moiety in Agrochemical Molecules. *Biosci. Biotech. Biochem.* **1997**, *61*, 1–11.

P B033

Copper-Catalyzed Radical C(sp^2)-H Germylation and Germyl-Difunctionalization

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Owing to increasing applications in materials science and as bioactive compounds, organogermanes attract significant attention, with a surge of reports describing new strategies for C–Ge bond formation.[1] The radical activation of hydrogermanes allowing for C–Ge bond-formation by addition of germanium-centered radicals across C–C multiple bonds is a prevalent method for the synthesis of alkenylgermanes (from alkynes) and alkylgermanes (from alkenes). We have pushed this radical approach further by considering strategies for the oxidative functionalization of C–C double-bonds, with C–Ge bond formation, relying on systems involving di-*tert*-butylperoxide (DTBP) and Cu salts. First, we have achieved dehydrogenative couplings of C(sp^2)–H and Ge–H bonds for the first time and report the C2-regioselective C–H germylation of indenes, as well as the α-regioselective C–H germylation of thiophenes. These procedures offer particularly attractive synthetic routes to important classes of compounds avoiding substrate pre-functionalization and offering close-to-perfect atom economy. Second, we have developed the first methods to achieve the germylative heterocyclisation of alkenes. Protocols for germylfunctionalizations of alkenes are rare,[2] and previous reports only concern intermolecular trappings.[3] Here we disclose procedures for intramolecular alkene germyl-etherification, -lactonization and -amination that deliver original 5-membered heterocycles with triorganogermanium substituents which are inaccessible through conventional methods for organogermane synthesis. In a last part of our studies, we have also found new radical alkene hydrogermylation conditions giving excellent yields for a broad scope of alkenes, including (radical)polymerization-prone substrates.



[1] Rogova, T.; Ahrweiler, E.; Schoetz, M. D.; Franziska Schoenebeck. Recent Developments with Organogermanes: Their Preparation and Application in Synthesis and Catalysis. *Angewandte Chemie International Edition* **2023**, *63* (8). https://doi.org/10.1002/anie.202314709
[2] Lorenzini, L.; Perez-Luna, A. Ni-Catalyzed Three-Component Synthesis of Secondary and Tertiary C(Sp^3)-Organogermanes. *Chem Catalysis* **2023**, *3*, (12), 100860–100860. https://doi.org/10.1016/j.checat.2023.100860
[3] Luo, Y.; Leiyang Lv; Li, Z. Copper-Catalyzed Germyl-Azidation of Alkenes with Germanium Hydrides and Trimethylsilyl Azide. *Organic Letters* **2022**, *24* (43), 8052–8056. https://doi.org/10.1021/acs.orglett.2c03302

P B034

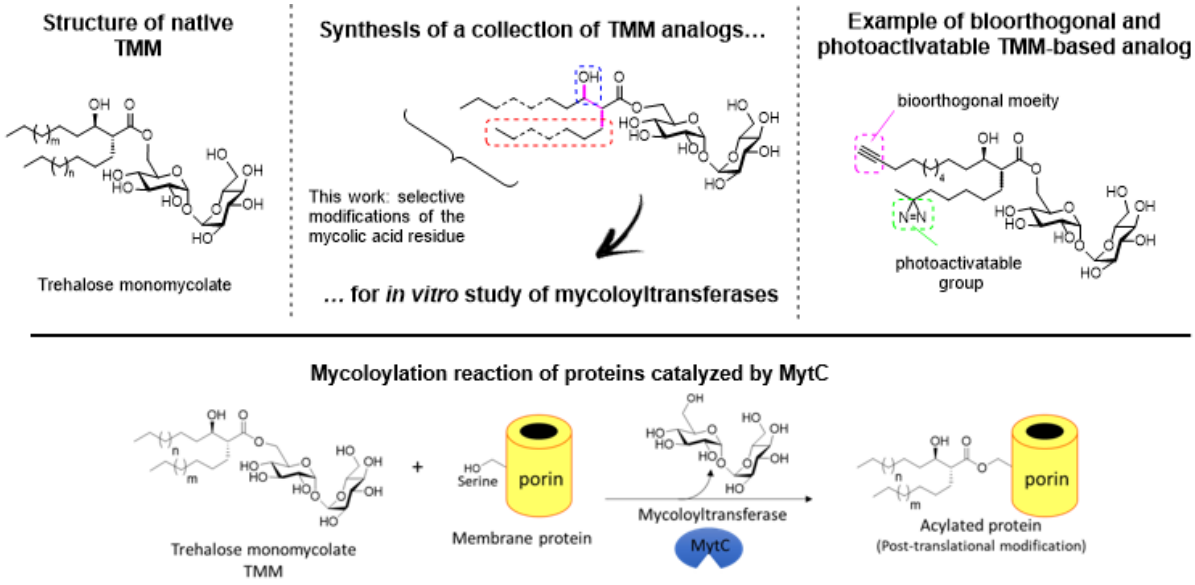
Synthetic mycolates derivatives to decipher protein mycoloylation, a unique post-translational modification in bacteria

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Corynebacteriales are a family of bacteria including *Mycobacterium tuberculosis*, the etiologic agent of human tuberculosis. *Corynebacteriales* possess a particular outer membrane, called mycomembrane. This rigid membrane is composed of mycolic acids esterified to trehalose leading to trehalose monomycolate (TMM). TMM is processed by enzymes called mycoloyltransferases (Myt) and acts as a donor of mycolates in the biogenesis of the mycomembrane. Recently one mycoloyltransferase (MytC) was identified to be responsible of mycoloylation of small membrane proteins in *Corynebacterium glutamicum*.[1] This is a unique post-translational modification in bacteria and its role remains to be clarified. In recent years, our laboratory developed several molecular tools for the study of the biogenesis of the mycomembrane.[2] One of our projects is to synthesize a large collection of TMM analogs to get insight in the mycoloylation mechanism of proteins in *C. glutamicum*.[3] The synthesis of several TMM analogs including biorthogonal and/or photoactivatable compounds will be presented as well as biological results obtained with these new tools.



[1] *a)* Huc E. *et al*. *O*-Mycoloylated Proteins from *Corynebacterium*. *J. Biol. Chem.* **2010**, *285* (29), 21908-21912.; *b)* Issa H. *et al*. Click-chemistry approach to study mycoloylated proteins: Evidence for PorB and PorC porins mycoloylation in *Corynebacterium glutamicum*. *N. PLOS ONE* **2017**, *12* (2) e0171955.

[2] *a)* Lesur E. *et al*. Synthesis of trehalose-based chemical tools for the study of the mycobacterial membrane. *Comptes Rendus Chimie* **2023**, *26* (S3), 17-38.; *b)* Lesur E. *et al*. First access to a mycolic acid-based bioorthogonal reporter for the study of the mycomembrane and mycoloyltransferases in *Corynebacteria*. *Chem. Commun.* **2019**, *55,* 13074-13077.

[3] Lesur E. *et al*. Synthetic mycolates derivatives to decipher protein mycoloylation, a unique post-translational modification in bacteria. *J. Biol. Chem.* **2025**, *301* (3), 108243.

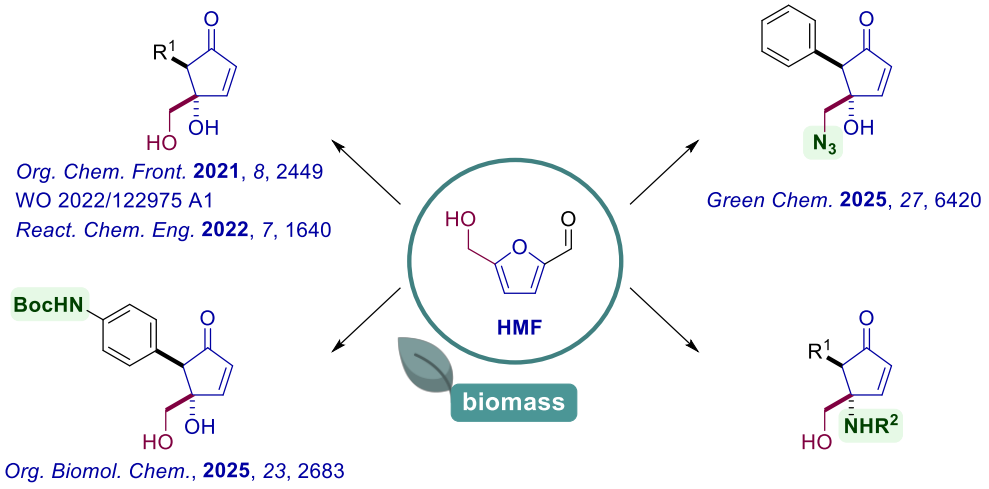
P B035

The Piancatelli rearrangement of renewable materials: a biobased opportunity for the synthesis of cyclopentenones

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In the field of renewable materials to substitute petroleum-based products, one of the main areas of research is the study and transformation of small molecules derived from biomass into high value-added compounds. Within the field of renewable materials, lignocellulosic biomass constitutes the most abundant and economically accessible resource. For the transformation of this lignocellulosic biomass, the production of furfural (FFR), furfuryl alcohol (FA), and 5-hydroxymethyl-furfural (HMF) provides versatile sustainable and valuable substitutes for petrochemical building blocks.[1] HMF is regarded by the scientific community as a versatile building block platform and is considered to be one of the "Top 14" bio-based building blocks listed by the US Department of Energy.[2] The direct transformations of HMF close derivatives into cyclopentenones, and more generally (C5-substituted-2-furyl)carbinols have scarcely been explored.

In recent years, we have undertaken a research program devoted to the valorization of HMF as a bio-based feedstock for the synthesis of 4-hydroxy- and 4-aminocyclopentenone derivatives *via* Piancatelli rearrangements. The most significant outcomes of this work will be presented.[3]



[1] Chen, S.; Wojcieszak, R.; Dumeignil, F.; Marceau, E.; Royer, S. *Chem. Rev.* **2018**, *118*, 11023-11117.
[2] Bozell, J. J.; Petersen, G. R. *Green Chem.* **2010**, *12*, 539-554.
[3] Cacheux, F.; Le Goff, G.; Ouazzani, J.; Bignon, J.; Retailleau, P.; Marinetti, A.; Voituriez, A.; Betzer, J.-F. *Org. Chem. Front.* **2021**, *8*, 2449-2455. Cyclopentenones Derivatives and Their Use as Antibiotics. Ouazzani, J.; Le Goff, G.; Dallery, J.-F. ; Betzer, J.-F.; Voituriez, A.; Marinetti, A.; Cacheux, F. WO 2022/122975 A1. Arcile, G.; Ouazzani, J.; Betzer, J.-F. *React. Chem. Eng.* **2022**, *7*, 1640-1649. Youssef-Saliba, S.; Mayet, C.; Elslande, E. V.; Le Goff, G.; Betzer, J.-F. *Org. Biomol. Chem.* **2025**, *23*, 2683-2690. Mayet, C.; Bignon, J.; Betzer, J.-F. *Green Chem.* **2025**, *27*, 6420-6429.

P B036

Synthesis of New Cryptophanes Molecular Hosts: Toward Xenon-MRI Biosensor and Beyond

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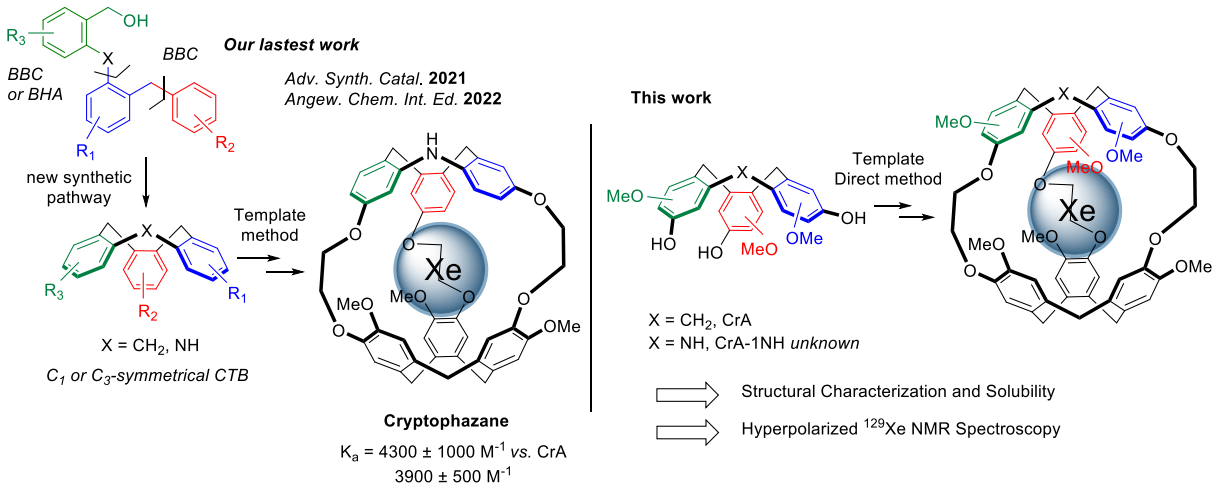
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Cryptophanes first synthesized by Collet in the early 1980s stand out due to their cage-like molecular architecture, consisting of two cyclotribenzylidene (CTB) units linked by three ether chains. This unique structure confers remarkable complexation properties with applications in chemistry, biology, and physics. Recently, particular interest has been shown as molecular probes for hyperpolarized xenon (HP ^{129}Xe) magnetic resonance imaging (MRI). However, the structural diversity of cryptophanes remains limited, largely due to the lack of versatile synthetic methodologies.

To address this challenge, our laboratory has developed a new polyfunctional approach enabling the controlled synthesis of CTBs with defined C_1 or C_3 symmetry.[1] Our project aims is to extend this strategy to access cryptophanes that have not been explored until now. This approach involves metal-free Barluenga-Boronic Coupling (BBC) for carbon-carbon bond formation, followed by palladium-catalyzed Buchwald-Hartwig Amination (BHA) to introduce heteroatom and final cyclization by electrophilic aromatic substitution (S_EAr).

In this presentation, we will focus on the synthesis of an exact analogous of cryptophane A (CrA) which could lead to unknown CrA-1NH with improved properties for detection application as biosensor molecule in ^{129}Xe MRI. To achieve this, we will use our synthetic methodology and new functional groups will be introduced on the northern crown of our cryptophazane. Finally, the host-guest properties of this cryptophane will be investigated using hyperpolarized ^{129}Xe NMR spectroscopy.



[1] (a) Vigier, C.; Fayolle, D.; El Siblani, H.; Sopkova - De Oliveira Santos, J.; Fabis, F.; Cailly, T.; Dubost, E. Synthesis and Physicochemical Properties of Cryptophazane—A Soluble and Functionalizable C_1 -Symmetrical Cryptophane. *Angew Chem Int Ed* **2022**, *61* (46), e202208580. (b) Vigier, C.; Fossé, P.; Fabis, F.; Cailly, T.; Dubost, E. Controlled Access to C_1 -Symmetrical Cyclotriveratrylenes (CTVs) by Using a Sequential Barluenga Boronic Coupling (BBC) Approach. *Adv Synth Catal* **2021**, *363* (15), 3756–3761.

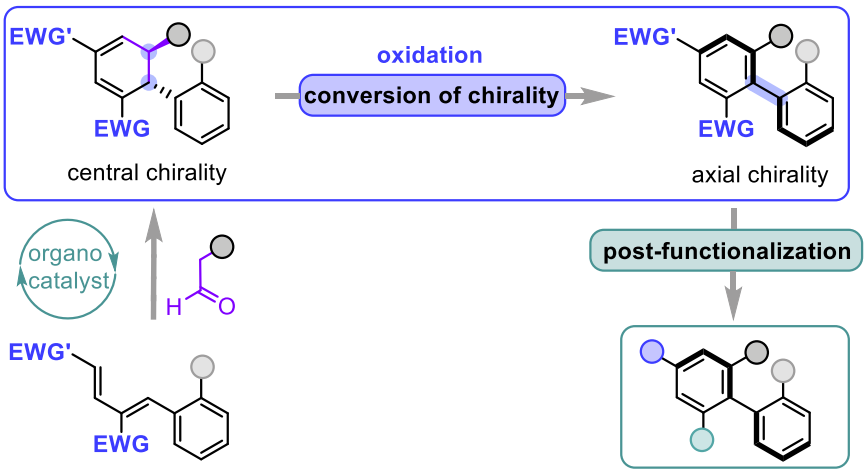
P B037

Synthesis of biaryl-atropisomers by central-to-axial chirality conversion

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Atropisomers represent a unique class of axially chiral molecules whose chirality originates from a restricted rotation around a single bond, leading to the existence of stable rotamers.[1] Thanks to their structural features, atropisomers play a key role across diverse fields such as enantioselective catalysis, pharmaceuticals, natural products, or materials.[1] The growing interest for atropisomeric compounds highlights the necessity to develop new atroposelective synthetic strategies. Organocatalysis is particularly well suited for this purpose since it offers a broad range of enantioselective transformation under mild conditions, which is necessary to preserve the stereochemical integrity of these sensitive molecules.[1]

In our approach, we combine the well-established control of central chirality offered by organocatalysis and the advantages of central-to-axial chirality conversion to access biaryl atropisomers stereoselectively.[1,2,3] Specifically, our method involves the synthesis of enantioenriched aryl-substituted cyclohexadienes via the condensation of Michael acceptors (bearing two identical or distinct electron-withdrawing groups) with enolisable aldehydes.[4] Subsequently, the controlled oxidative aromatization of the diene core affords atropoenriched molecules. Finally, these atropisomeric frameworks can be further diversified through post-functionnalization, enabling the access to a wide variety of structures.



[1] Wang, Y.-B.; Tan, B. Construction of Axially Chiral Compounds via Asymmetric Organocatalysis. *Acc. Chem. Res.* **2018**, *51* (2), 534–547. https://doi.org/10.1021/acs.accounts.7b00602.

[2] Lemaitre, C.; Perulli, S.; Quinonero, O.; Bressy, C.; Rodriguez, J.; Constantieux, T.; García Mancheño, O.; Bugaut, X. Enantioselective Synthesis of Atropisomers by Oxidative Aromatization with Central-to-Axial Conversion of Chirality. Molecules 2023, 28 (7), 3142. https://doi.org/10.3390/molecules28073142.

[3] PhD thesis of Clément Lemaitre under the supervision of Xavier Bugaut and Thierry Constantieux, **2021**, https://theses.fr/2021AIXM0640.

[4] Hammer, N.; Leth, L. A.; Stiller, J.; Jensen, M. E.; Jørgensen, K. A. Oxadendralenes in Asymmetric Organocatalysis for the Construction of Tetrahydroisochromenes. Chem. Sci. 2016, 7 (6), 3649–3657. https://doi.org/10.1039/C6SC00185H.

P B038

Au(III)-Catalyzed Domino Cyclization / Functionalization Reactions: an Efficient Entry to Heterocycles

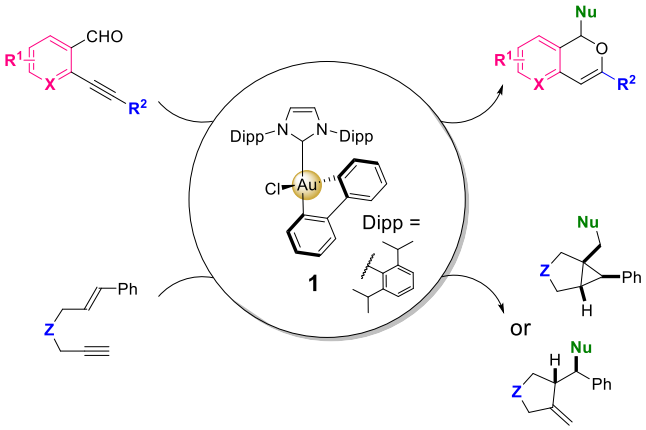
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Accessibility of highly functionalized polyheterocyclic compounds with efficient catalytic methods represents a long-standing challenge for organic chemists. The use of transition metal catalysts and the recent development of gold(III) complexes open new opportunities. [1–4] We herein report a straightforward gold(III)-catalyzed domino cyclization / functionalization reaction to access scaffolds of biological interest. The methodology developed here is applied to the synthesis of isochromene derivatives through cyclofunctionalization of 2-ethynyl(hetero)arylaldehyde derivatives, and to the cycloisomerization of 1,6-enynes into (poly)heterocyclic compounds.[5–8] Precedents in the literature using gold(III) for such transformations are scarce.[4,9,10] The NHC type gold(III) catalyst showed high tolerance to functional groups along with superior reactivity compared to gold(I), highlighting the potential of such gold(III) complexes to catalyze a variety of synthetic transformations.[11,12]



[1] Hashmi, A. S. K. Gold-Catalyzed Organic Reactions. *Chem. Rev.* **2007**, *107* (7), 3180–3211. [2] Gorin, D. J.; Toste, F. D. Relativistic Effects in Homogeneous Gold Catalysis. *Nature* **2007**, *446* (7134), 395–403. [3] Ranieri, B.; Escofet, I.; M. Echavarren, A. Anatomy of Gold Catalysts: Facts and Myths. *Org. Biomol. Chem.* **2015**, *13* (26), 7103–7118. [4] Rocchigiani, L.; Bochmann, M. Recent Advances in Gold(III) Chemistry: Structure, Bonding, Reactivity, and Role in Homogeneous Catalysis. *Chem. Rev.* **2021**, *121* (14), 8364–8451. [5] Mariaule, G.; Newsome, G.; Toullec, P. Y.; Belmont, P.; Michelet, V. Silver-Catalyzed Domino Hydroarylation / Cycloisomerization Reactions of Ortho-Alkynylbenzaldehydes: An Entry to Functionalized Isochromene Derivatives. *Org. Lett.* **2014**, *16* (17), 4570–4573. [6] Bontemps, A.; Mariaule, G.; Desbène-Finck, S.; Helissey, P.; Giorgi-Renault, S.; Michelet, V.; Belmont, P. Silver-Catalyzed Domino Hydroarylation/Cycloisomerization Reactions of 2-Alkynylquinoline-3-Carbaldehydes: Access to (Hetero)Arylpyranoquinolines. *Synthesis* **2016**, *48*, 2178–2190. [7] Abreu, M. D.; Tang, Y.; Brachet, E.; Selkti, M.; Michelet, V.; Belmont, P. Silver-Catalyzed Tandem Cycloisomerization/Hydroarylation Reactions and Mechanistic Investigations for an Efficient Access to 1,2-Dihydroisoquinolines. *Org. Biomol. Chem.* **2021**, *19* (5), 1037–1046. [8] Truchon, A.; Dupeux, A.; Olivero, S.; Michelet, V. Au- and Pd-Catalyzed Cyclization Processes: Synthesis of Polyfunctionalized Cyclopropanes. *Org. Chem. Front.* **2024**, *11* (15), 4070–4076. [9] Bohan, P. T.; Toste, F. D. Well-Defined Chiral Gold(III) Complex Catalyzed Direct Enantioconvergent Kinetic Resolution of 1,5-Enynes. *J. Am. Chem. Soc.* **2017**, *139* (32), 11016–11019. [10] Tomás-Mendivil, E.; Heinrich, C. F.; Ortuno, J.-C.; Starck, J.; Michelet, V. Gold-Catalyzed Access to 1H-Isochromenes: Reaction Development and Mechanistic Insight. *ACS Catal.* **2017**, *7* (1), 380–387. [11] Wu, C.-Y.; Horibe, T.; Jacobsen, C. B.; Toste, F. D. Stable Gold(III) Catalysts by Oxidative Addition of a Carbon–Carbon Bond. *Nature* **2015**, *517* (7535), 449–454. [12] Tang, Y.; Benaissa, I.; Huynh, M.; Vendier, L.; Lugan, N.; Bastin, S.; Belmont, P.; César, V.; Michelet, V. An Original L-Shape, Tunable N-Heterocyclic Carbene Platform for Efficient Gold(I) Catalysis. *Angew. Chem., Int. Ed.* **2019**, *58* (24), 7977–7981.

P B039

Total synthesis of alkaloids extracted from *Pandanus amaryllifolius*

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In the context of synthetic innovation and atom economy, this research program focuses on the development of new synthetic methodologies to access heterocycles of interest featuring a spiro quaternary center, a motif commonly found in numerous natural products. More generally, these frameworks represent indispensable structural motifs in numerous pharmaceutical agents that exhibit a wide range of biological activities, making the development of a synthetic pathway to access this structural class particularly relevant for biological tests and the design of new drug candidates. The aim of this project is to achieve a straightforward total synthesis of pandamarine,[1] pandanusine A, and pandanusine B,[2] alkaloids isolated from the plant *Pandanus amaryllifolius*, bearing (*N,N*)-spiroketal moiety.

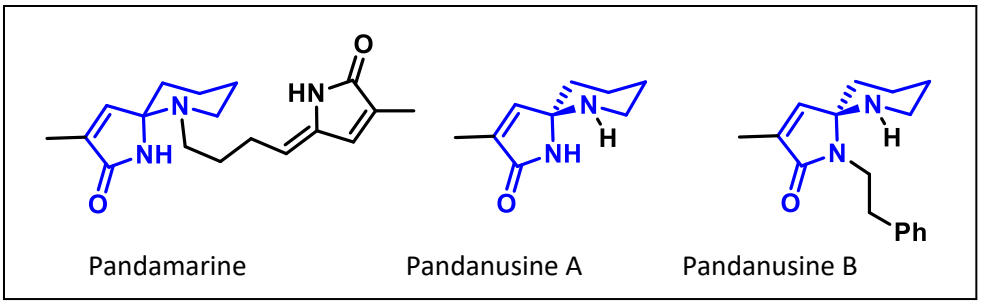


Figure 1: Structures of natural products

[1] Byrne, L.; Guevara, B.; Patalinghug, W.; Recio, B.; Ualat, C.; White, A. *Aust. J. Chem.* **1992**, *45*, 1903-1908.
[2] Cheng, Y.-B.; Hu, H.-C.; Tsai, Y.-C.; Chen, S.-L.; El-Shazly, M.; Nonato, M. G.; Wu, Y.-C.; Chang, F.-R. *Tetrahedron* **2017**, *73*, 3423–3429.

P B040

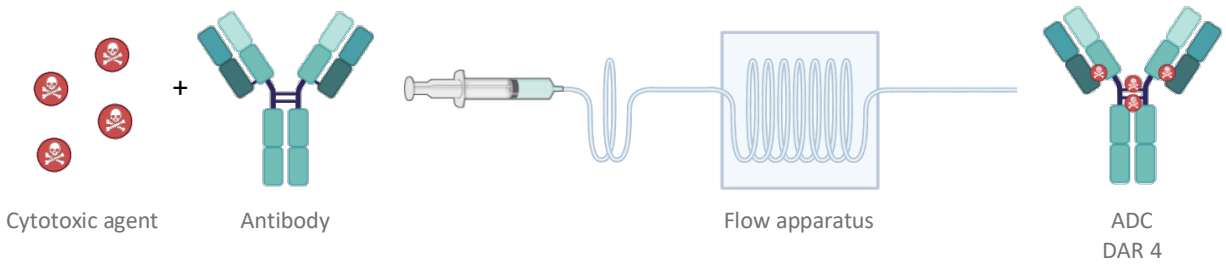
Synthesis of Antibody Drug Conjugates by flow chemistry

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Antibody–drug conjugates (ADCs) are bioconjugates that combining the targeting specificity of monoclonal antibodies with the cytotoxic activity of small drugs. They are used in targeted therapies, particularly for cancer treatment.
Controlling the conjugation of the antibody to the cytotoxic payload, as well as the characterization and analysis of the resulting products, remain major challenges in ADC development. Current bioconjugation methods primarily target lysine or cysteine residues on the antibody, but often fall short in precisely controlling the number of drug molecules conjugated per antibody (drug-to-antibody ratio, DAR). This leads to heterogeneous ADC mixtures difficult to purify and exhibiting variable pharmacokinetic and biological properties.[1,2]

The development of innovative efficient methods for antibody functionalization is therefore critical for the design of homogeneous ADCs. In this project, we propose to adapt an existing bioconjugation strategy to continuous-flow chemistry in order to establish reproducible and safe processes suitable for large-scale production, while allowing precise control over the DAR.[3]

Our approach involves the re-bridging of the interchain disulfide bonds of IgG1 antibodies with dibromopyridazinedione derivatives functionalized with the cytotoxic agent of interest. This method enables the formation of four disulfide bonds while preserving the antibody's structural integrity, resulting in homogeneous and stable ADCs with a defined maximum DAR of 4.[4]



[1] Fan, Q.; Chen, H.; Wei, G.; Wei, D.; Wang, Z.; Zhang, L.; Wang, J.; Zhu, M. A Review of Conjugation Technologies for Antibody Drug Conjugates. *Antibody Therapeutics* **2025**, *8* (2), 157–170. https://doi.org/10.1093/abt/tbaf010.
[2] Chen, T.; Chen, Y.; Stella, C.; Medley, C. D.; Gruenhagen, J. A.; Zhang, K. Antibody-Drug Conjugate Characterization by Chromatographic and Electrophoretic Techniques. *Journal of Chromatography B* **2016**, *1032*, 39–50. https://doi.org/10.1016/j.jchromb.2016.07.023.
[3] Nakahara, Y.; Mendelsohn, B. A.; Matsuda, Y. Antibody–Drug Conjugate Synthesis Using Continuous Flow Microreactor Technology. *Org. Process Res. Dev.* **2022**, *26* (9), 2766–2770. https://doi.org/10.1021/acs.oprd.2c00217.
[4] Robinson, E.; Nunes, J. P. M.; Vassileva, V.; Maruani, A.; Nogueira, J. C. F.; Smith, M. E. B.; Pedley, R. B.; Caddick, S.; Baker, J. R.; Chudasama, V. Pyridazinediones Deliver Potent, Stable, Targeted and Efficacious Antibody–Drug Conjugates (ADCs) with a Controlled Loading of 4 Drugs per Antibody. *RSC Adv.* **2017**, *7* (15), 9073–9077. https://doi.org/10.1039/C7RA00788D.

P B041

Control of Dynamic Chirality in Donor-Acceptor Fluorophores

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Very recently, the control of dynamic chirality has emerged as a powerful strategy to design chiral functional materials.[1] In this context, we will present a molecular design in which configurationally stable chiral unit (BINOL) efficiently controls the dynamic chirality of donor-acceptor fluorophores, involving diverse indolocarbazoles as electron donors and terephthalonitrile as an electron acceptor (see figure 1).[2]

The high conformational discrimination in such a molecular system suggested by density functional theory calculations is experimentally probed using electronic and vibrational circular dichroism and confirmed by the crystallization of these chiral molecules in gel and their single crystal X-ray diffraction analysis. In addition to extending the scope of dynamic chirality control to donor-acceptor fluorophores, this work also highlights the positive effect of the configurationally stable chiral unit on the magnitude of the dissymmetry factors of the active dynamically chiral fluorophores, both in ground and excited states, through chiral perturbation.

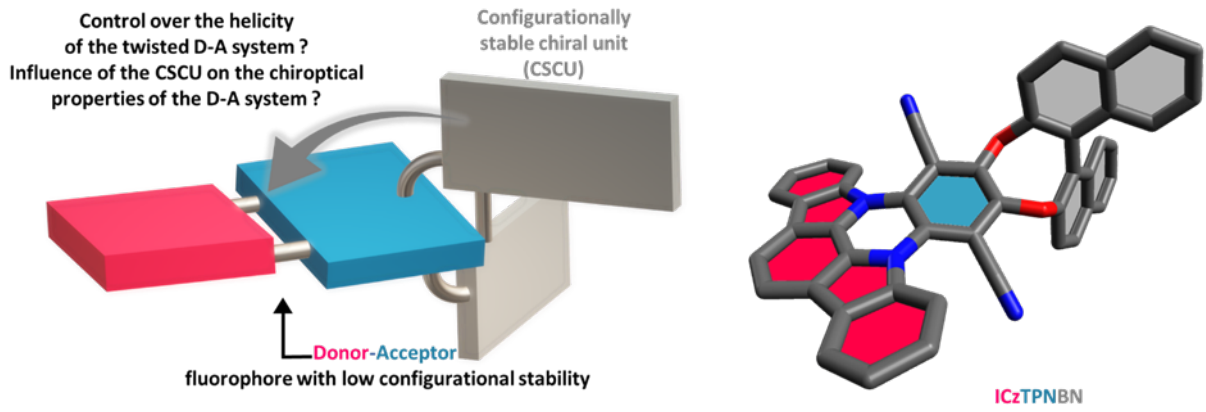


***Figure 1**. The molecular design presented in this talk*

[1] a) R. K. Dubey, M. Melle-Franco, A. Mateo-Alonso, *J. Am. Chem. Soc.* **2022**, *144*, 2765; b) S. T. Bao, H. Jiang, C. Schaack, S. Louie, M. L. Steigerwald, C. Nuckolls, Z. Jin, *J. Am. Chem. Soc.* **2022**, *144*, 18772; c) A. Swain, K. Radacki, H. Braunschweig, P. Ravat, *Chem. Sci.* **2024**, 15, 11737; d) P. Jiang, A. S. Mikherdov, H. Ito, M. Jin, *J. Am. Chem. Soc.* **2024**, *146*, 12463; e) G. Ouyang, J. Rühe, Y. Zhang, M.-J. Lin, M. Liu, F. Würthner, *Angew. Chem. Int. Ed.* **2022**, *61*, e202206706

[2] M. Coehlo, L. Frédéric, L. Poulard, N. Ferdi, L. Estaque, A. Desmarchelier, G. Clavier, J-P Dognon, L. Favereau, M. Giorgi, J-V Naubron, *Angew. Chem. Int. Ed.* **2025**, e202414490

P B042

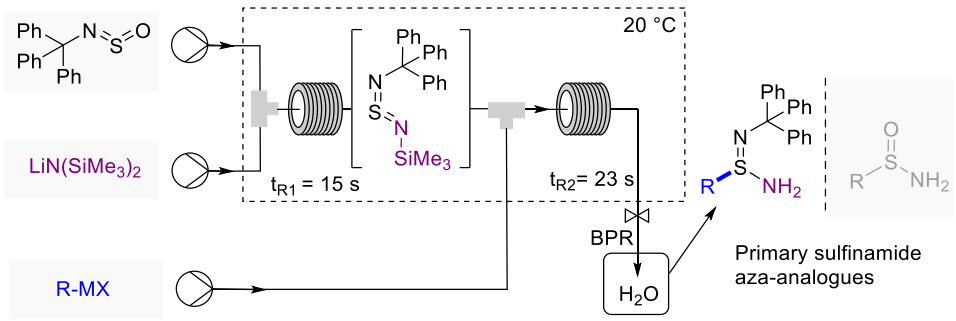
Multistep Continuous Flow Synthesis of Isolable NH_2-Sulfinamidines

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The synthesis of bioactive molecules containing new sulfur-based pharmacophores is a major focus in the pharmaceutical industry. The structural diversity of sulfur derivatives has led to significant progress in the preparation of some sulfur S(II) and S(VI) motifs. S(IV) derivatives on the other side remain rather underexplored, particularly sulfinamidines, the aza-analogues of sulfinamides.[1]

In this context, a multistep continuous flow synthesis of NH_2-sulfinamidines has been developed (Scheme 1).[2] This methodology relies on the nucleophilic addition of various organometallic reagents on an *in situ* generated unsymmetrical sulfurdiimide (Tr=N=S=N=TMS). The reaction can be performed under mild conditions, at room temperature, by generating the organometallic species *in situ* via a halogen–lithium exchange using aryl bromides and iodides with *n*-butyllithium. This work led to the successful isolation of 32 NH_2-sulfinamidines, with yields ranging from 42% to 96%. Following these results, *N*-functionalization of the sulfinamidines enabled access to new S(IV) analogues of known drugs, including celecoxib and tasisulam, highlighting the potential of this methodology for medicinal chemistry applications.



Scheme 1. Flow synthesis of sulfinamidines

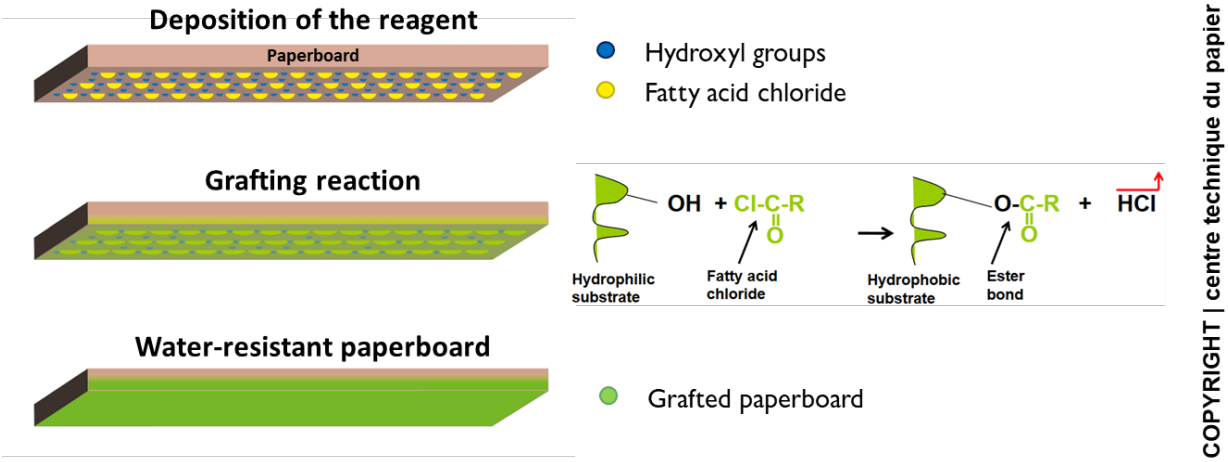
[1] Scott, K. A.; Njardarson, J. T. Analysis of US FDA-Approved Drugs Containing Sulfur Atoms. *Top. Curr. Chem.* **2018**, *376* (1), 5.
[2] Andresini, M.; Carret, S.; Degennaro, L.; Ciriaco, F.; Poisson, J.-F.; Luisi, R. Multistep Continuous Flow Synthesis of Isolable NH2-Sulfinamidines via Nucleophilic Addition to Transient Sulfurdiimide. *Chem. Eur. J.* **2022**, *28* (59), e202202066.

P B043

Development of water-resistant paperboard via Chromatogeny grafting reaction

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Paper and cardboard are now a truly viable bio-based, recyclable, and biodegradable alternative to plastics, particularly in the packaging sector. Their mechanical properties make them an attractive solution. However, their barrier resistance, especially to water, remains limited. To achieve performance levels comparable to those of plastics, barrier layers are currently applied to the surface of paper and cardboard materials. Nevertheless, most of the available solutions are derived from fossil resources, are difficult to recycle, or may pose health risks to users.
In this context, hydrophobic bio-based paperboard, free from plastic and fluorine derivatives, represents a promising alternative, with demand expected to double by 2050. One innovative technique addressing this challenge is Chromatogeny (*Scheme 1*). It provides a material with a good barrier to water by grafting biocompatible organic molecules to coated or uncoated paperboard.[1] This project will therefore provide a sustainable and safer alternative to currently available commercial packaging solutions.



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Scheme 1 : Chromatogeny process principle

[1] Stinga, C.; Samain, D.; Guerin, D. Film Having Liquid-Water, Grease, Gas and Water-Vapour Barrier Properties. *WO2009083525A1.* **2007**.

P B044

Synthesis and RNA Binding Properties of Novel Azaspirocycles

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Spirocycles, found in natural and synthetic products,[1] have recently gained attention in medicinal chemistry due to their unique 3D structure and favorable physicochemical properties, such as enhanced solubility, reduced lipophilicity, and improved metabolic stability.[2] Their rigidity also facilitates better binding element orientation, boosting efficacy and selectivity, making them valuable compounds for drug development.[3]

In this study, we present diverse synthetic pathways for the preparation of novel azaspirocycles, starting from bicyclic hydrazines functionalized at their bridgehead carbon atoms. Key reactions leading to the desired spirocyclic cores include double reductive amination, intramolecular cyclization, and N−N bond cleavage. [4]

As stated above, the resulting molecules show promise in medicinal chemistry. With increasing interest in nucleic acid targeting as a complementary strategy to protein-directed approaches for developing new bioactive compounds, we explored the applicability of the different azaspirocycles as RNA binders. As a proof of concept, select compounds demonstrated strong affinity for HIV-1 TAR RNA and effectively inhibited Tat/TAR interactions, suggesting their potential relevance for therapeutic development.[5]

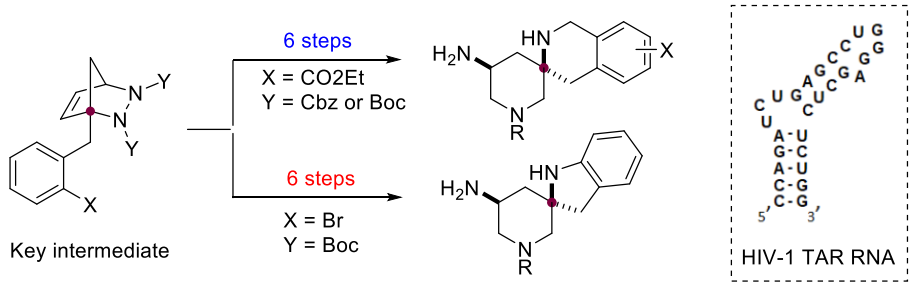


Figure 1. *Access to novel azaspirocycles*

[1] Moss, G. P. *Pure Appl. Chem.* **1999**, *71*, 531.

[2] Benedetti, E. Micouin, L. *Expert Opin. Drug Discov.* **2024**,

[3] Talele, T. T. *J. Med. Chem.* **2020**, *63*, 13291.

[4] Fleurisson, C. Graidia, N. Foricher, Y. Benedetti, E. Micouin, L. *Org. Biomol. Chem.* **2023**, *21*, 3542.

[5] Fleurisson, C. Graidia, N. Azzouz, J. Di Giorgio, A. Gaysinski, M. Foricher, Y. Duca, M. Benedetti, E. Micouin, L. *Chem. Eur. J.* **2024**, e202403518.

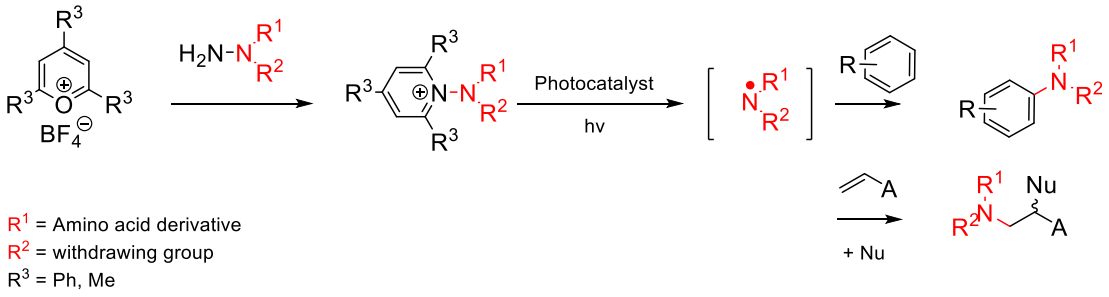
P B045

N-aminopyridiniums, new photo-chemical tools: Synthesis and reactivity

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Photoredox catalysis has recently emerged as a powerful tool for carrying out radical reactions under particularly mild and eco-friendly conditions (ambient temperature, numerous compatible solvents including water, catalytic amount of photocatalyst, etc.), using visible light as the sole energy source.[1] These conditions help to explain why photoredox catalysis is increasingly used to functionalize highly complex substrates at a late stage of synthesis.[2] Photocatalysis therefore appears to be a method of choice for functionalizing very complex molecules such as peptides of interest.

N-aminopyridiniums are becoming highly attractive new tools for the formation of amidyl radicals.[3] Due to their *N-N* bond being photoreducible using an electron transfer from the excited state of an appropriate photocatalyst under very mild conditions, these salts are ideal suppliers of nitrogen-centered radicals to perform amination of aromatic/unsaturated molecules. However, substrates incorporating amino acids have never been synthesized nor used. Our main objective is to synthesize these new amino acids with aminopyridinium moieties in order to enable their incorporation into peptides of therapeutic interest.
The pyridinium moiety will thus enable photocatalyzed coupling of amino acids, and in further steps peptides onto aromatic or unsaturated active molecules.



[1] Yoon, T. P.; Ischay, M. A.; Du, J. Visible Light Photocatalysis as a Greener Approach to Photochemical Synthesis. *Nat. Chem.* **2010**, *2*, 527–532.
[2] Bellotti, P.; Huang, H.-M.; Faber, T.; Glorius, F. Photocatalytic Late-Stage C–H Functionalization. *Chem. Rev.* **2023**, *123*, 4237–4352.
[3] Roychowdhury, P.; Samanta, S.; Tan, H.; Powers, D. C. N-Amino Pyridinium Salts in Organic Synthesis. *Org. Chem. Front.* **2023**, *10*, 2563–2580.

P B046

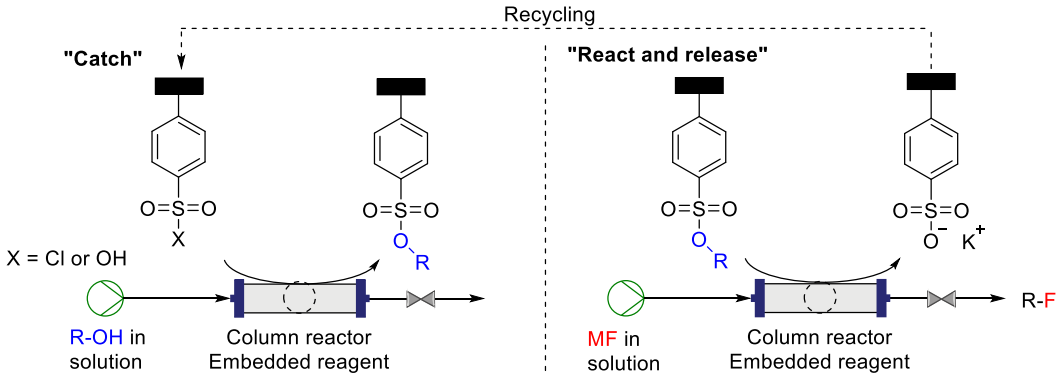
A continuous flow supported deoxyfluorination strategy

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Formation of carbon-fluorine (C-F) bonds in organic molecules is highly desired due to their ability to significantly modify the chemical and physical properties of organic compounds and materials.[1] Therefore, there is an increasing demand for new sustainable and scalable fluorination strategies. A strategy of particular interest is deoxyfluorination as it leverages the availability of commercially or naturally sourced alcohol derivatives. Despite major advancements in the development of deoxyfluorination reagents,[2] these strategies still suffer from poor atom economy and recyclability of the reagent. In parallel, significant advances have been made using cheap and available alkali fluoride salts for the fluorination of activated substrates.[3] However, alkali fluoride salts usually require the use of a stoichiometric amount of phase transfer agent which leads to difficult purification processes. Only few continuous flow alternatives were developed to improve the selectivity and efficiency of these reactions.[4] This project aims to merge the advancements of both fields of fluorination towards an eco-compatible deoxyfluorination strategy. During the catch step, the alcohol reacts with the embedded reagent. Then, during the react and release step, the obtained supported sulfonate ester is submitted to fluorination conditions using alkali fluoride salts (MF). The supported reagent can be potentially recycled back for another cycle of "catch, react and release". With this strategy we want to combine the use of supported reagents with flow chemistry for enhanced efficiency and selectivity, easier reagent recycling and product recovery, and as a tool towards eco-compatible fluorination chemistry.



[1] Liang, T.; Neumann, C. N.; Ritter, T. Introduction of fluorine and fluorine-containing functional groups. *Angew. Chem. Int. Ed.* **2013**, *52* (32), 8214 – 8264. DOI: 10.1002/anie.201206566

[2] Jelen, J.; Tavčar, G. Deoxyfluorination: A detailed overview of recent developments *Synthesis* **2025**, *57*, 1517-1541. DOI: 10.1055/a-2412-1398

[3] Khandelwal, M.; Pemawat, G.; Khangarot, R. K. Recent developments in nucleophilic fluorination with potassium fluoride (KF): a review. *Asian J. Org. Chem.* **2022**, *11* (9), e202200325. DOI: 10.1002/ajoc.202200325

[4] Lee, T. C.; Tong, Y.; Fu, W. C. Advances in continuous flow fluorination reactions. *Chem. - Asian J.* **2023**, *18*, e202300423. DOI: 10.1002/asia.202300723

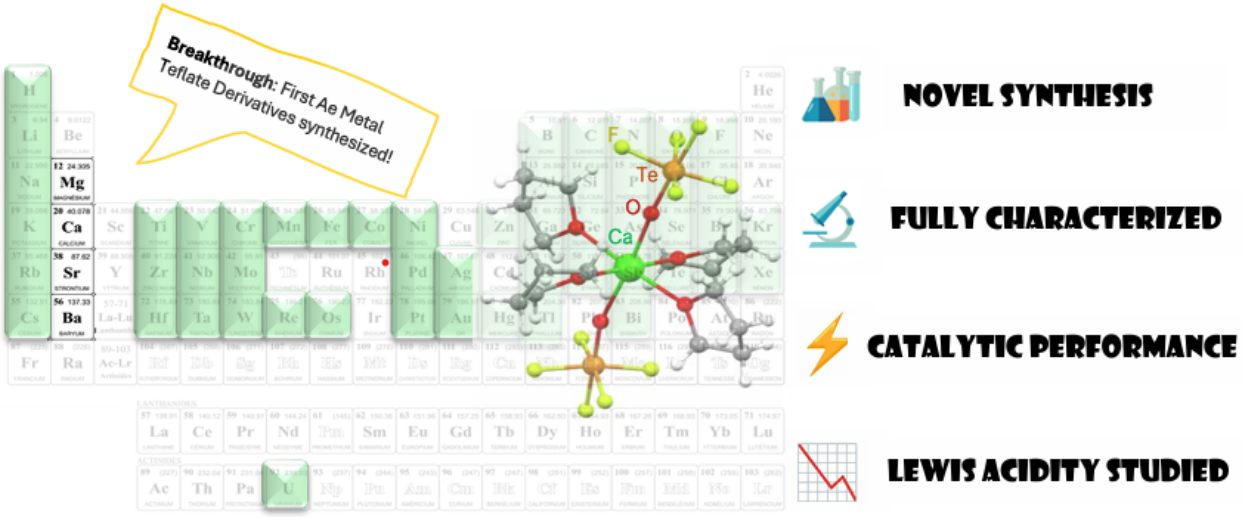
P B047

Synthesis of New Alkaline Earth Metal(II)-Teflate Salts

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While various metal-teflate derivatives ($M(OTeF_5)_n$) have been reported,[1] alkaline earth metal teflate salts have remained unexplored. Given the catalytic relevance of alkaline earth metals such as Mg, Ca, Sr, and Ba, due to their abundance, low toxicity, and Lewis acidity, we synthesized and characterized a new series of teflate complexes. These include THF-adducts of $Mg(OTeF_5)_2(THF)_4$, $Ca(OTeF_5)_2(THF)_4$, $Sr(OTeF_5)_2(THF)_5$, and a THF-free $Ba(OTeF_5)_2$. The complexes were synthesized through reactions between commercial salts (e.g., $MgCl_2$, $CaCl_2$, SrI_2, $BaCl_2$) and either teflic acid or chloro teflate. Characterization was performed using ^{19}F NMR, IR spectroscopy, DFT-calculated IR, and single crystal X ray crystallography. Catalytic tests in the aza-Piancatelli rearrangement showed superior reactivity compared to the $Ca(NTf_2)_2$ analogue, even without Lewis acid adducts.[2] Acidity of the corresponding complexes was evaluated by the Gutmann-Beckett method, with additional methods (Child's method, MeCN IR shifts, π-acidity tests in progress).[3]



In addtion, reactions with $B(OTeF_5)_3$ afforded novel heteroleptic Mg and Ca teflate complexes with weakly coordinating borate anions. These results advanced relatively unexplored field of alkaline earth metal teflate chemistry and open avenues for their broader application in catalysis and coordination chemistry.

[1] a) K. Seppelt, *Angew. Chem. Int. Ed. Engl.* **1982**, *21*, 877; b) A. Pérez-Bitrián, et al., *Chem.Eur. J.* **2022**, *28*, e202202016.
[2] a) D. Lebœuf, et al., *Org. Lett*. **2014**, *16*, 6464; b) X. Chen, et al., *Adv. Synth. Catal.* **2025**, *367*, e202401085.
[3] a) M. A. Beckett, et al., *Polym*. **1996**, *37*, 4629; b) R. F. Childs, et al., *Can. J. Chem.,* **1982**, *60*, 801.

P B048

Antibody Pretargeting as a Flexible Tool for In-Vivo Imaging: Application to Brown Adipose Tissue

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Brown adipose tissue (BAT), recently identified in adult humans, plays a crucial role in thermoregulation and metabolism.[1] Accurate in-vivo quantification of BAT is essential for detecting metabolic dysfunctions, but current methods lack precision and specificity.[2]

The work proposes using a bioconjugate of an anti-BAT antibody with an ^{18}F-containing probe in a new selective labeling method for BAT via positron emission tomography (PET). Phosphonium trifluoroborate was selected as the ^{18}F scaffold due to its stability and easy ^{18}F labeling by isotope exchange.[3]

To maximize *in vivo* ^{18}F labeling, a pretargeting methodology will be employed.[4] An anti-BAT antibody modified with trans-cyclooctene will bind to its target, to this ^{18}F-phosphonium trifluoroborate-tetrazine probes will bind *in vivo* through a rapid bioorthogonal click reaction.

Optimizations in the synthesis of both Phosphonium trifluoroborate and tetrazines allowed for good yields even at gram scale. This, combined with a telescoped synthesis approach, allowed for the synthesis of a library of Phosphonium trifluoroborate-tetrazines probes, which will be evaluated to optimize selectivity, sensitivity and imaging contrast.

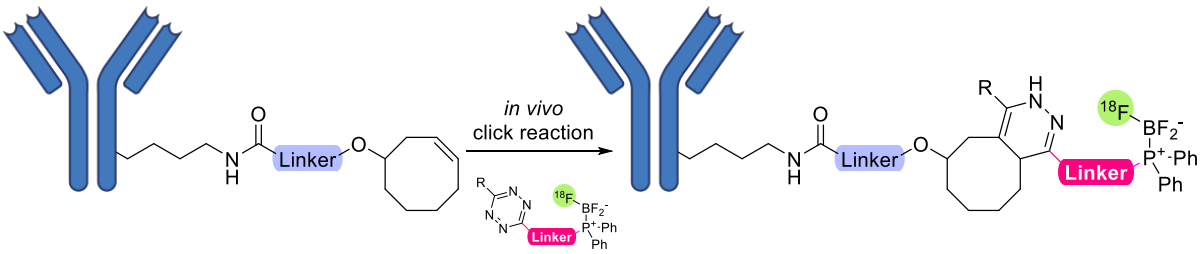


Figure 3: in vivo bioconjugation of Phosphonium trifluoroborate-tetrazines probes and trans-cyclooctene pretargeted antibody

[1] Becher, T.; Palanisamy, S.; Kramer, D. J.; *et al.* Brown Adipose Tissue Is Associated with Cardiometabolic Health. *Nat. Med.* **2021,** *27* (1), 58–65. https://doi.org/10.1038/s41591-020-1126-7

[2] Kwok, T. C.; Stimson, R. H. Human Brown Adipose Tissue Function: Insights from Current in Vivo Techniques. *J. Endocrinol.* **2023,** *259* (1). https://doi.org/10.1530/JOE-23-0017.

[3] Li, Z.; Chansaenpak, K.; Liu, S.; *et al.* Harvesting 18F-Fluoride Ions in Water via Direct 18F–19F Isotopic Exchange: Radiofluorination of Zwitterionic Aryltrifluoroborates and in Vivo Stability Studies. *MedChemComm* **2012,** *3,* 1305–1308. https://doi.org/10.1039/c2md20105d

[4] Stéen, E. J. L.; Jørgensen, J.; Denk, C.; *et al.* Lipophilicity and Click Reactivity Determine the Performance of Bioorthogonal Tetrazine Tools in Pretargeted In Vivo Chemistry. *ACS Pharmacol. Transl. Sci.* **2021,** *4* (2), 824–833. https://doi.org/10.1021/acsptsci.1c00007.

P B049

Pairing *O-labeled singlet oxyen and substituted cyclopentadienes for [*O_2]oxylipins synthesis

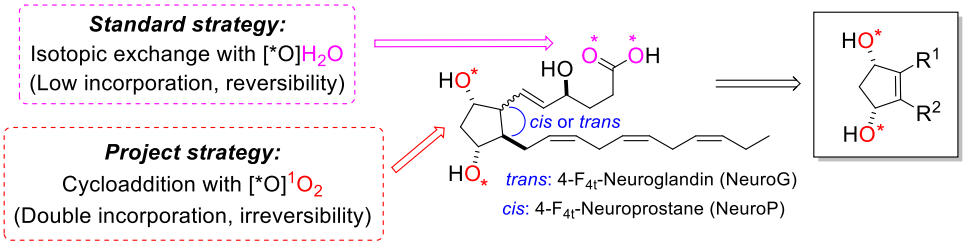
Gabriel Coulombe,[1] Marc-Antoine Delannoy,[1] Camille Oger,[2] Philippe Hermange[1]

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Oxylipins are oxidized metabolites of polyunsaturated fatty acids (PUFAs) with various biological applications. For example, 4-F4t-neuroprostane is a racemic non-enzymatic metabolite that was proven to play a key role in the stabilization of ryanodine receptors implicated in arrhythmias and diaphragm disorders.[1] However, whereas its deuterated analogue has been synthesized as analytic standard, there is no *O-labeled analogue described, despite the great benefits offered by such compounds. For example, while the ^{17}O isotope, with a 5/2 spin, is directly suitable for NMR studies or may be detected *in vitro*/*in vivo* by NMR/MRI techniques, $^{18}O/^{17}O$ can be used for their isotopic differences within the natural non-labeled NeuroP in mass spectrometry studies to monitor its *in vivo* metabolism.[2] The standard strategy for *O-labeling, i.e. isotopic exchange on the carboxylic group, could be envisioned, but it has typically low incorporation, it is reversible and the labeling can be lost during metabolization (*β* oxidations). Moreover, it does not correspond to the O atoms introduced by dioxygen oxidation in the biosynthetic pathways. On the contrary, using a method recently developed in the laboratory,[3] we will investigate a new strategy that will be devoid of all these problems by enabling the dual labeling of the cyclopentenediol core by cycloaddition of $^1O_2$ with cyclopentadienyls and *in situ* reduction.



*Scheme : Strategies for the syntheses of *O-labelled oxylipins*

[1] Roy, J.; Oger, C.; Thireau, J.; Roussel, J.; Mercier-Touzet, O.; Faure, D.; Pinot, E.; Farah, C.; Taber, D. F.; Cristol, J.-P.; Lee, J. C. Y.; Lacampagne, A.; Galano, J.-M., Durand, T.; Le Guennec, J.-Y. *Free Radic. Biol. Med.*, **2015**, *86*, 269.

[2] Picket, W. C.; Murphy, R. C. *Anal. Biochem.*, **1981**, *111*, 115.

[3] Doussot, A.; Bakaï, M.-F.; Fouquet, E.; Hermange, P. *Org. Lett.* **2023**, *25,* 4661-4665.

P B050

Synthesis and Study of Bridged Cyclodextrin Regioisomers for Chiral Recognition and Organocatalysis

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This project aims to develop inherently chiral artificial catalysts inspired by nature's ability to achieve high enantioselectivity through the accurate shaping of cavities of protein structures made of only L-aminoacids.[1,2,3,4] We want to draw inspiration from Nature by designing *D*-sugar-based cyclodextrins (CDs) with asymmetrical bridging[5] using tris(2-aminoethyl)amine (tren), leading to compounds with mirror-image cavities (**Figure 1**). Two regioisomers with inherent chiral patterns on the primary rim (ABE and ABD) will be synthesized through a regioselective deprotection of the benzyl ethers on the primary rim. These two structures are expected to direct the formation of opposite enantiomers from the same substrate, mimicking the selectivity of enzymes. The resulting tren-functionalized CDs will be further complexed with metal ions (e.g., Cu(II), Zn(II), Fe(III)) or non-metal ions (e.g., phosphorus) and tested in enantioselective catalysis (e.g., Henry reaction[6]) and chiral molecular recognition (e.g., amino acids). This approach circumvents the tedious synthesis of *L*-sugar-based CDs,[7] opening new avenues for designing asymmetric catalysts with enzyme-like selectivity.

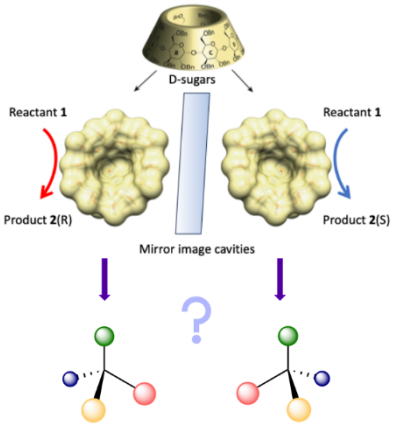


Figure 1. Reshaping of cavities of CDs to achieve enantioselectivity.

[1] Breslow,R. Biomimetic Chemistry and Artificial Enzymes: Catalysis by Design. *Acc. Chem. Res*. **1995**, *28*,146-153.
[2] Robescu, M. S.; Cendon, L.; Bacchin, A.; Wagner, K.; Reiter, T.; Janicki, I.; Merusic, K.; Illek, M.; Aleotti, M.; Bergantino, E.; Hall, M. Asymmetric Proton Transfer Catalysis by Stereocomplementary Old Yellow Enzymes for C═C Bond Isomerization Reaction. *ACS Catalysis,* **2022**, *12* (12), 7396-7405.
[3] Botha, F.; Budka, J.; Eigner, V.; Hudeček, O.; Vrzal, L.; Císařová, I.; Lhoták, P. Recognition of chiral anions using calix[4]arene-based ureido receptor in the 1,3-alternate conformation. *Tetrahedron,* **2014**, *70*, 477-483.
[4] Bouchet, A.; Brotin, T. ; Linares, M.; Ågren, H.; Cavagnat, D.; Buffeteau, T. Enantioselective Complexation of Chiral Propylene Oxide by an Enantiopure Water-Soluble Cryptophane. *J. Org. Chem.* **2011**, *76*, 4178-4181.
[5] Guieu, S.; Sollogoub, M. Multiple Homo- and Hetero-functionalizations of α-Cyclodextrin through Oriented Deprotections *J. Org. Chem*., **2008**, *73 (7)*, 2819-2828.
[6] (a)Henry, L. Formation synthétique d'alcools nitrés" [Synthetic formation of nitrated alcohols]. *Comptes rendus*, **1895**, *120*, 1265–1268. (b)Li, J. J. Name Reactions: A Collection of Detailed Mechanisms and Synthetic Applications. *Springer International Publishing*, Cham, **2021**.
[7] Wu, Y.; Aslani, S.; Han, H.; Tang, C.; Wu, G.; Li, X.; Wu, H.; Stern, C. L.; Guo, Q.-H.; Qiu, Y.; Chen, A. X.-Y.; Jiao, Y.; Zhang, R.; David, A. H. G.; Armstrong, D. W.; Fraser Stoddart, J. Mirror-image cyclodextrins. *Nat. Synth*. **2024**, *3*, 698-706.

P B051

Synthesis of novel polysubstituted 2-pyridones by *N*-heterocycles

Emma Caillet,[1] Pr. Sabine Berteina-Raboin,[1] Pr. Isabelle Gillaizeau[1]

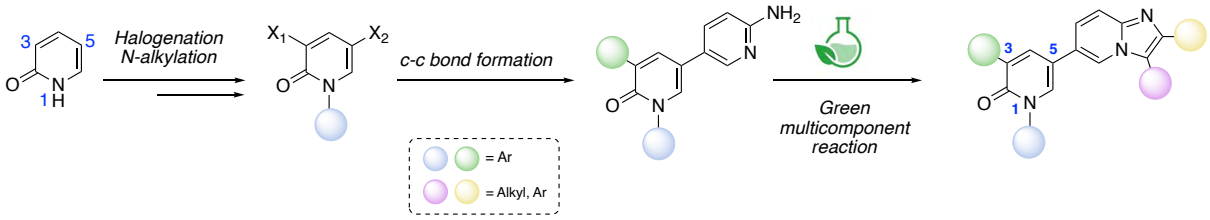
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Epilepsy is a common neurological disorder affecting 50 million people worldwide. Although several treatments are available, patients treated with antiepileptic drugs (AEDs) may become pharmacoresistant or suffer from significant side effects. It is therefore important to develop new drugs. Over the past decade, the Food and Drug Administration (FDA) has approved a new molecule. Perampanel[1] is the first and only AMPA receptor antagonist on the market. Its structure is a simple tri-substituted 2-pyridone core.
Thanks to our expertise in the synthesis of 2-pyridones and *N*-heterocycles using green solvents[2], our goal is to synthesize new polysubstituted 2-pyridones through coupling reactions and multicomponent reactions.

In this study, we propose two synthetic pathways: the first involves the multiple-step synthesis of 1,5-disubstituted 2-pyridone cores with an imidazo[1,2-*a*]pyridine scaffold; the second involves the synthesis of 2-pyridones tri-substituted in positions 1, 3, and 5. We exploit the reactivity of 2-pyridones to produce polyhalogenated molecules capable of undergoing coupling reactions such as Suzuki–Miyaura, Buchwald–Hartwig and Ullmann reactions. The imidazo[1,2-*a*]pyridine scaffold is finally obtained by the Groebke–Blackburn–Bienaymé (GBB) multicomponent reaction (MCR), which was optimized in our laboratory using sustainable conditions[3].

More than 30 molecules have been synthesized and their cytotoxicity and activity in the central nervous system will be evaluated.



[1] Hibi, S.; Uneo, K.; Nagato, S.; Kawano, K.; Ito, K.; Norimine, Y.; Takenaka, O.; Hanada, T.; Yonaga, M., *J. Med. Chem.* **2012**, *55* (23), 10584-10600.
[2] Campos, J.F.; Scherrmann, M.-C.; Berteina-Raboin, S. *Green Chem*. **2019**, *21* (6), 1531-1539.
[3] El Qami, A.; Messire, G.; Bouchery, G.; Caillet, E.; Steiner, S.; Berteina-Raboin, S., *Eur J Org Chem* **2025**, 2500343.

P B052

Electrochemical reactions involving CO_2

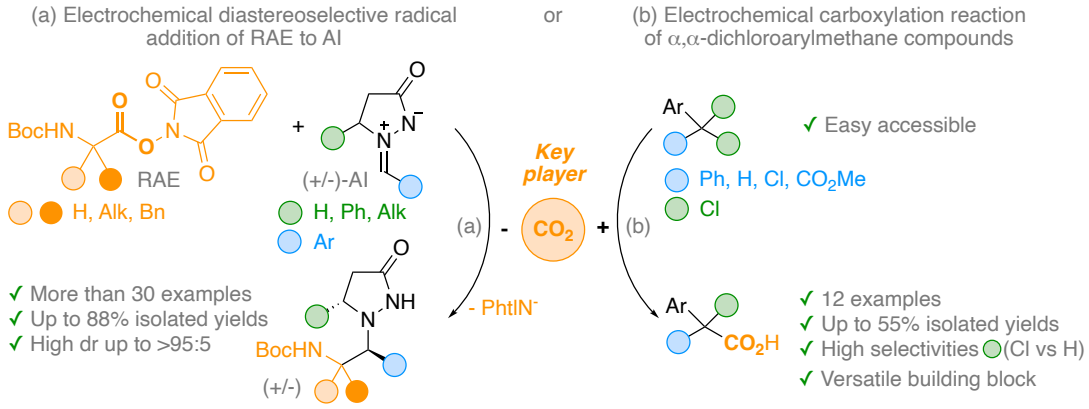
Ludovic Leleu,[1] Thomas Martzel,[1] Arona Fall,[1] Corentin Maret,[1] Nicolas David,[1] David Pierrot,[1] Eric Léonel,[2] Vincent Levacher,[1] Jean-François Brière,[1] Sylvain Oudeyer[1]

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Carbon dioxide is well-known to be one of main by-product of the fossil fuel combustion making it a cheap and abundant molecule that has found many applications in organic chemistry.[1] The development of "modern" electricity was concomitant to industrial revolution and was rapidly applied to organic chemistry by Faraday in 1830s.[2] Although electrosynthesis has known its golden age during the end of the last century, it remained a niche domain mainly due to reproducibility issues arising from the use of homemade electrochemical setup. This main issue was solved few years ago by Baran and the IKA company thus contributing to the democratization of electrosynthesis within the organic chemists' community.[3] Thus, this is not surprising to encounter carbon dioxide as both by-product or C1-synthon in many electro-organic reactions. In this context, we are pleased to share our recent contributions in the field electrochemical reactions involving carbon dioxide either as a by-product in the diastereoselective decarboxylative radical addition of *N*-hydroxyphthalimide redox active esters (RAE) to azomethine imines (AI)[4] (Fig 1a) or as a C1-synthon in the carboxylation of α,α-dichloroarylmethane compounds[5] (Fig 1b).



[1] Artz, J.; Müller, T. E.; Thenert, K.; Kleinekorte, J.; Meys, R.; Sternberg, A.; Bardow, A.; Leitner, W. Sustainable Conversion of Carbon Dioxide: An Integrated Review of Catalysis and Life Cycle Assessment. *Chem. Rev.* **2018**, *118*, 434–504.

[2] Yan, M.; Kawamata, Y.; Baran, P. S. Synthetic Organic Electrochemical Methods Since 2000: On the Verge of a Renaissance. *Chem. Rev.* **2017**, *117*, 13230–13319.

[3] Yan, M.; Kawamata, Y.; Baran, P. S. Synthetic Organic Electrochemistry: Calling All Engineers. *Angew. Chem. Int. Ed.* **2018**, *57*, 4149–4155.

[4] Leleu, L.; Martzel, T.; Fall, A.; Sanselme, M.; Levacher, V.; Oudeyer, S.; Brière, J.-F. Diastereoselective addition of redox active esters to azomethine imines by electrosynthesis. *Chem. Commun.* **2022**, *58*, 6100–6103.

[5] Maret, C. David, N.; Pierrot, D.; Léonel, E.; Levacher, V.; Brière, J.-F.; Oudeyer, S. Synthesis of α-Chloroarylacetic Acid via Electrochemical Carboxylation of α,α-Dichloroarylmethane Derivatives. *Molecules* **2023**, *28*, 6704–6716.

P B053

Targeting the different binding sites on SARS-CoV-2 with self-assembling β-cyclodextrins

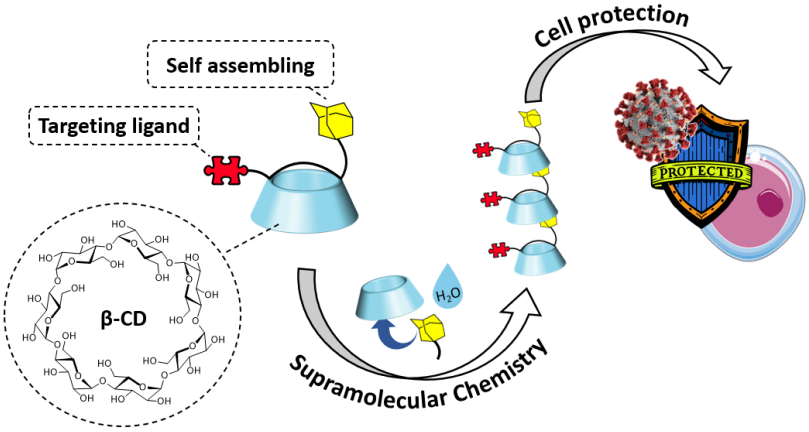
Pedro J. Hernando,[1] Laora Boulo,[1] Mickaël Ménand,[1] Elisa Teyssou,[2] Vincent Calvez,[2] Matthieu Sollogoub[1]

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Despite the awareness risen by the global pandemic caused by SARS-CoV-2, there is still a lack of over-the-counter tools to prevent the transmission of this and other respiratory viruses. To fight the infection caused by SARS-CoV-2, the main approach is to target its spike protein, which serves as a point of attachment to the host cells through two binding domains: the glycan- and the receptor-binding domain (GBD and RBD, respectively). Literature has shown examples of both GBD- and RBD-targeting inhibitors to prevent the infection by SARS-CoV-2, taking advantage of their affinity for different carbohydrates[1,2] or peptides[3]. In our laboratory, we have synthesised a system based on β-cyclodextrins decorated with an adamantane unit to promote a thermodynamically favoured self-assembly in water.[4] Now, we have designed and synthesised a library of ligands targeting both the GBD and RBD of SARS-CoV-2, which provides specificity to the scaffold to protect Vero E6 cells against viral infection. This research has provided encouraging results on the development of antiviral therapies against SARS-CoV-2 targeting either or both of its binding domains, informing a toolset of self-assembling cyclodextrins with potential to inhibit the infection not only by SARS-CoV-2, but also by other respiratory viruses.



[1] S. J. L. Petitjean, *et al*., *Nat. Commun.* **2022**, *13*, 2564. DOI: 10.1038/s41467-022-30313-8.
[2] S. E. Guimond, *et al., ACS Cent. Sci*. **2022**, *8*, 527-545. DOI: 10.1021/acscentsci.1c01293.
[3] P. Karoyan, *et al., Commun. Biol*. **2021**, *4*, 197. DOI: 10.1038/s42003-021-01736-8.
[4] D. B. Tran, *et al*., *Org. Chem. Front*. **2014**, *1*, 703-706. DOI: 10.1039/C4QO00104D.

P B054

Diastereo- and Enantioselective Palladium-Catalyzed Cycloadditions of 5-Vinyloxazolidine-2,4-diones with Isatins

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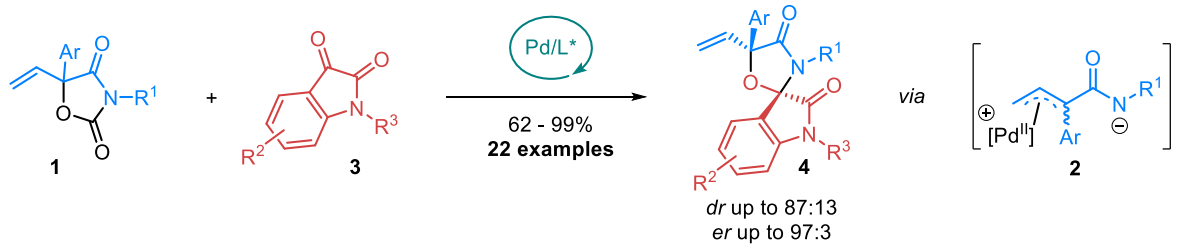
[1] *Laboratoire de Synthèse Organique, UMR 7652, CNRS, Ecole Polytechnique, ENSTA, Institut Polytechnique de Paris, 91128 Palaiseau CEDEX, France*

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Nitrogen-containing heterocycles are ubiquitous scaffolds in pharmaceutical compounds due to their ability to interact easily with biological targets, making them highly valuable in drug discovery.[1] Among available synthetic strategies, cycloadditions represent a powerful approach to rapidly construct complex heterocyclic frameworks.[2] In particular, dipolar cycloadditions of transient zwitterionic π-allylpalladium(II) complexes have emerged as a reliable strategy for the stereocontrolled formation of carbo- and heterocycles.[3] In this context, our research group and others have recently disclosed 5-vinyloxazolidine-2,4-diones **1** (VOxD) as a promising substrate.[4] Under palladium-catalyzed conditions, VOxD **1** undergo ring-opening by oxidative addition and decarboxylation, leading to key intermediates **2** able to react with an electrophilic cycloaddition partner.

Herein, we describe a diastereo- and enantio-controlled palladium-catalyzed synthesis of various oxazolidinones **4** *via* a (3+2) cycloaddition between VOxD **1** and isatins **3**. After a careful screening of reaction conditions, the spiro-oxindole cycloadducts have been obtained with a high degree of substrate tolerance.



[1] Marshall, C. M.; Federice, J. G.; Bell, C. N.; Cox, P. B.; Njardason J. T. An Update on the Nitrogen Heterocycle Compositions and Properties of U.S. FDA-Approved Pharmaceuticals (2013−2023). *J. Med. Chem.* **2024**, *67*, 11622−11655.

[2] Jørgensen, K. A.; Kobayashi, S. *Cycloaddition Reactions in Organic Synthesis;* Wiley-VCH: Weinheim, **2001**.

[3] For a review: Niu, B.; Wei, Y.; Shi, M. Recent advances in annulation reactions based on zwitterionic π-allyl palladium and propargyl palladium complexes. *Org. Chem. Front*. **2021**, *8*, 3475–3501.

[4] For selected publications: a) Sculiller, A.; Casaretto, N.; Archambeau, A. Diastereo- and Enantioselective (3+2) Cycloaddition of a New Palladium-Aza-Oxyallyl Intermediate *J. Org. Chem*. **2023**, *88*, 9941−9945. b) Li, K.; Zhen, S.; Wang, W.; Du, J.; Yu, S.; Wi, Y.; Guo, H. Fungicide-inspired precursors of π-allylpalladium intermediates for palladium-catalyzed decarboxylative cycloadditions *Chem. Sci.* **2023**, *14*, 3024–3029. c) Roblin, A.; Casaretto, N.; Archambeau, A. Diastereo- and Enantioselective Palladium-Catalyzed Cycloadditions of 5-Vinyloxazolidine-2,4-diones with Electrophilic Imines. *Org. Lett.* **2023**, *25*, 6453–6458. d) Busicchia, M.; Roblin, A.; Dubois, C.; Mekranter, N.; Casaretto, N.; Archambeau, A. Cycloadditions of 5-Vinyloxazolidine-2,4-diones: A Straightforward Access to the (thio)Hydantoin Scaffold. *J. Org. Chem.* **2024**, *89*, 12370–12377.

P B055

Activation of small molecules thanks to non-metallic radical complexes

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In modern catalysis, the activation of small molecules such as H_2, O_2, and CO_2 is most commonly achieved with transition metals. Although effective, these metals are toxic, scarce, and expensive. In recent years, metal-free strategies based on main-group elements have emerged as powerful tools, with Frustrated Lewis Pairs (FLPs) representing a key breakthrough for small-molecule activation and reduction of unsaturated substrates.[1]

More recently, a radical-based approach has been introduced: Frustrated Radical Pairs (FRPs).[2] Operating through open-shell pathways, FRPs can lower activation barriers and unlock reactivity distinct from classical FLPs.[3]

Our project focuses on developing a novel FRP system combining a Lewis base with a persistent, sterically hindered radical that remains reactive after hydrogen cleavage. In addition, we will investigate how the electronic and steric properties of different Lewis base scaffolds influence the stability and reactivity of these radical pairs under various conditions.

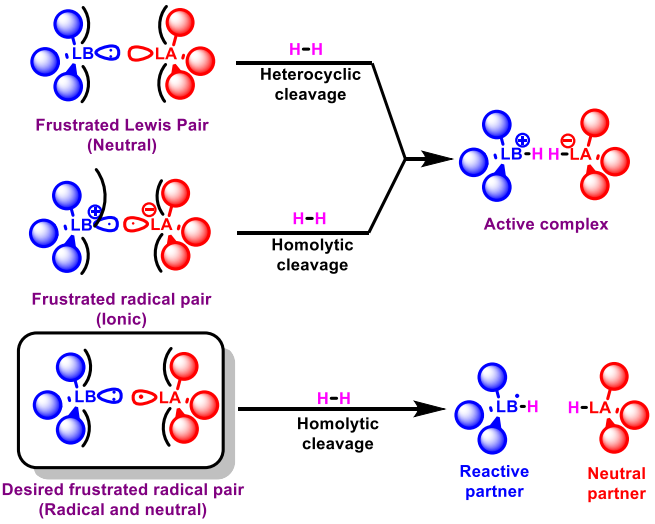


Figure 4: Comparison of classical hydrogen activation by FLPs and the proposed FRP strategy

[1] Welch, G. C.; San Juan, R. R.; Masuda, J. D.; Stephan, D. W. *Science*, **2006**, *314*, 1124–1126.

[2] Liu, L. L.; Cao, L. L.; Shao, Y.; Ménard, G.; Stephan, D. W. *Chem* **2017**, *3*, 259–267.

[3] Ju, M.; Lu, Z.; Novaes, L. F. T.; Martinez Alvarado, J. I.; Lin, S. *J. Am. Chem. Soc.*, **2023**, *145*, 19478–19489.

P B056

Chalcogen bonding interactions of telluronium salts and crown ethers

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Chalcogen bonding (ChB) results from an attractive interaction between electropositive regions of a chalcogen atom, known as sigma holes, with a donor of electron density (e. g., Lewis acids)[1]. Geometrically speaking, these sigma holes are located at the opposite end of the Ch-R sigma bonds, allowing for highly directional interactions (Figure 1, A). The study of ChBs has revealed several potential applications in various fields such as noncovalent catalysis[2], crystal engineering[3] and analytical chemistry. As previously described by our groups, trivalent telluronium cations bearing electron-withdrawing substituents exhibit an enhanced capacity to form three ChBs with various Lewis bases, such as phosphine oxides.[4] In order to extend our studies to polydentate ligands with telluronium cations, we focused on their interactions with crown ethers, potentially capable of simultaneously occupying several sigma holes. Therefore, we explored the formation of telluronium-crown ether adducts both in solution and in the solid state. In this study, the crystallization of 1:1 adducts between a tri-aryl telluronium salt $TeAr_3^+ * BArF_{24}^-$ (Figure 1B, red) and a series of 5 crown ethers of variable size and structure was performed. A crystallographic study of such structures, coupled with a thermodynamic characterization of the interactions in solution was carried out by isothermal titration calorimetry (ITC).

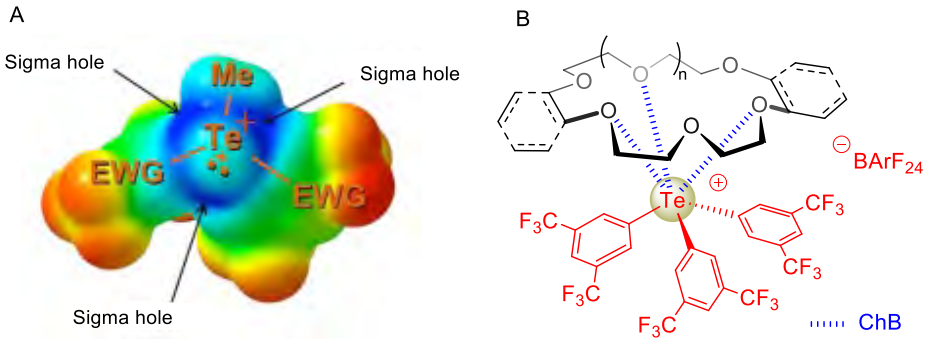


Figure 1. Electrostatic potential isosurfaces in a telluronium cation and the corresponding sigma holes (A). Representation of a chalcogen bond (ChB) interaction between the $TeAr_3^+$telluronium and a crown ether (B).

[1] Vogel, L.; Wonner, P.; Huber, S. M. Chalcogen Bonding: An Overview. *Angew. Chem. Int. Ed.* **2019**, *58* (7), 1880–1891. https://doi.org/10.1002/anie.201809432.

[2] Pale, P.; Mamane, V. Chalcogen Bonding Catalysis: Tellurium, the Last Frontier? *Chem. Eur. J.* **2023**, *29* (69), e202302755. https://doi.org/10.1002/chem.202302755.

[3] Dhaka, A.; Jeon, I.-R.; Fourmigué, M. Selective Activation of Chalcogen Bonding: An Efficient Structuring Tool toward Crystal Engineering Strategies. *Acc. Chem. Res.* **2024**, *57* (3), 362–374. https://doi.org/10.1021/acs.accounts.3c00674.

[4] Groslambert, L.; Cornaton, Y.; Ditte, M.; Aubert, E.; Pale, P.; Tkatchenko, A.; Djukic, J.; Mamane, V. Affinity of Telluronium Chalcogen Bond Donors for Lewis Bases in Solution: A Critical Experimental-Theoretical Joint Study. *Chem. Eur. J.* **2024**, *30* (7), e202302933. https://doi.org/10.1002/chem.202302933.

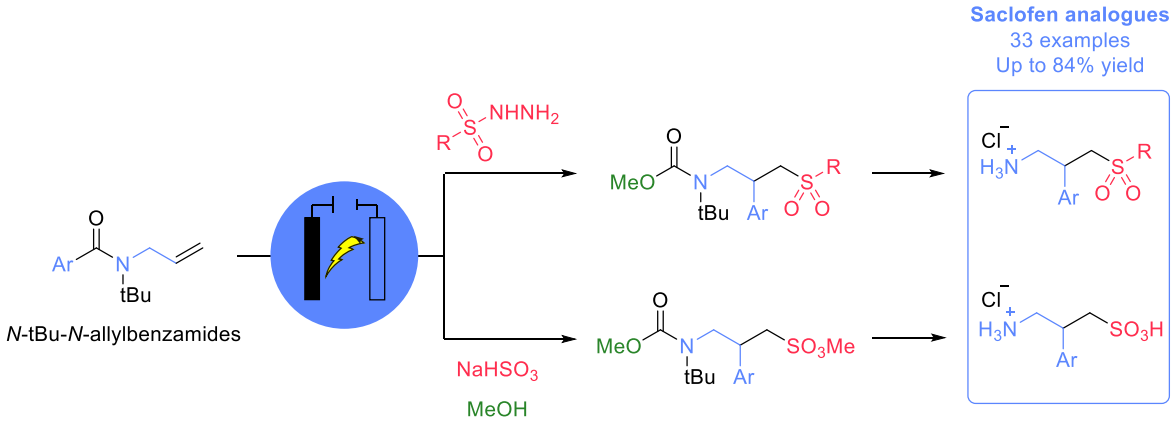
P B057

Electricity-driven radical Truce-Smiles rearrangement for the synthesis of γ-sulfonylated β-arylethylamines

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The β-arylethylamine scaffold is present in a large variety of bioactive molecules, from the neurotransmitters to different families of drugs. Hence, there is great interest among synthetic chemists in developing new ways to access this privileged pharmacophore.[1] Among the reported procedures, the radical Truce-Smiles rearrangements of readily available benzamides represent an attractive approach. However, these methods have some limitations, such as the use of harsh reaction conditions (e.g., excess oxidants and reagents) or the production of unfunctionalized β-arylethylamines. To overcome these drawbacks, our group recently described an electricity-driven radical trifluoromethylation/Truce-Smiles rearrangement of *N*-allylbenzamides to synthesize fluorinated β-arylethylamines under mild and oxidant-free conditions.[2]

Here we propose an extension of this methodology to produce sulfone- and sulfonate ester-containing β-arylethylamines. Radical sulfonylation of the *N*-allylbenzamides triggers the 1,4-aryl migration to deliver various γ-sulfonylated β-arylethylamines in good to high yields, employing readily accessible reagents.[3] Importantly, by simply removing the *N*-protecting groups and hydrolyzing the sulfonate ester moiety, we demonstrate the synthetic potential of this process through the straightforward production of Saclofen analogues, a compound known as a $GABA_B$ receptor antagonist.



[1] Pozhydaiev, V.; Muller, C.; Moran, J.; Lebœuf, D. Catalytic Synthesis of β-(Hetero)Arylethylamines: Modern Strategies and Advances. *Angew. Chem., Int. Ed.* **2023**, *62*, e202309289.
[2] Derat, E.; Masson, G.; Claraz, A. Electrochemically-Driven 1,4-Aryl Migration via Radical Fluoromethylation of *N*-Allylbenzamides: A Straightforward Access to Functionalized β-Arylethylamines. *Angew. Chem., Int. Ed.* **2024**, *63*, e202406017.
[3] Meyer, S.; Neuhut, A.; Claraz, A. Electrochemical Sulfonylation/Truce–Smiles Rearrangement of *N*-Allylbenzamides: Toward Sulfone-Containing β-Arylethylamines and Saclofen Analogues. *Org. Biomol. Chem.* **2024**, *22*, 8102–8108.

P B058

Access to dihydrochalcones from lignin-related aryl-3-hydroxypropanones

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Dihydrochalcones (1,3-diphenylpropan-1-ones) are molecular scaffolds that can be found in many natural products, many of these exhibiting interesting pharmaceutical properties. The use of petroleum resources in organic chemistry poses an environmental issue on a long term because they are becoming scarce and they take a substantial part in global warming through CO_2 emissions. For applications in fine chemistry, lignocellulosic biomass can be seen as a sustainable alternative carbon source.[1] Though the cellulose part has already been extensively studied through the valorization of carbohydrates and important derivatives such as furfural,[2] the lignin part of lignocellulose has been less studied. Several chemical methods of degradation have already been developed but they remain in most cases harsh and hardly controllable. Through a collaboration with Prof. A. Schallmey from TU Braunschweig in Germany, we were interested in enzymatic degradation methods to get access to aromatic synthons. Although often only feasible on a smaller scale up to now, these are milder and offer an access to more functionalized molecules than chemical degradation methods. Through our collaborative work, three synthons were studied, namely synrigyl-, guaiacyl-and *p*-hydroxyphenyl-3-hydroxypropanones (SHP, GHP, and HHP respectively).[3] Within this work, we show how we can valorize these synthons for the synthesis of relevant dihydrochalcones using a simple and scalable procedure.

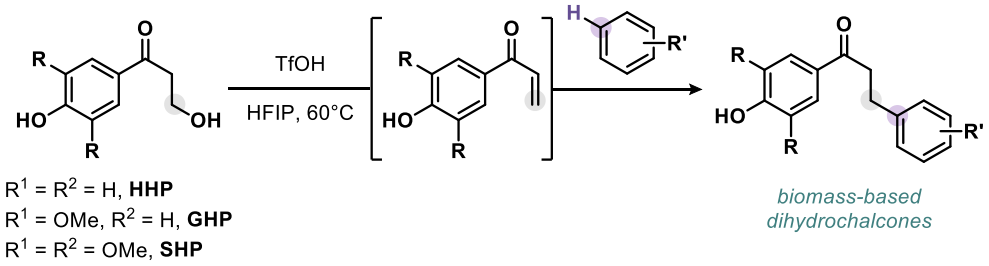


Figure 1. *Accessing dihydrochalcones from biomass-based synthons.*

[1] Austin, A. T.; Ballaré, C. L. Dual role of lignin in plan litter decomposition in terrestrial ecosystems. *Proc. Natl. Acad. Sci. USA* **2010**, *107*, 4618.

[2] Mori, A.; Curpanen, S.; Pezzetta, C.; Perez-Luna, A.; Poli, G.; Oble, J. C-H Activation Based Functionalization of Furfural Derivatives. *Eur. J. Org. Chem.* **2022**, *2022*, e202200727.

[3] Husarcíková, J.; Voß, H.; Domínguez de María, P.; Schallmey, A. Microbial β-etherases and glutathione lyases for lignin valorisation in biorefineries: current state and future perspectives. *Appl. Microbiol. Biotechnol.* **2018**, *102*, 5391.

P B059

One-pot solvent free 1,2,4-triazole synthesis

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Triazole scaffolds are found in many drugs.[1] Reported synthesis rely mainly on acidic one-pot conditions or via multi-step pathways using intermediates such as imidoyl chlorides, thioamide or imidate prepared, from phosphonyl or thionyl chlorides, butane-ethoxytetrafluoro-λ^5-borane or Lawesson's reagent, respectively.[2-4] We wanted to develop a fast and one-pot synthesis in basic conditions to avoid deprotection of acid-labile protective groups often used in medicinal chemistry such as *t*-butyl carbamate (Boc), isopropylidene, *t*-butyldimethylsylil ether (TBDMS) or tetrahydropyranyl ether (THP). Here, we report a methodological study to develop a solvent-free, fast and robust conditions for the one-pot synthesis of 1,2,4-triazole derivatives under basic conditions. This work involved systemic parameter optimisation and exemplification.

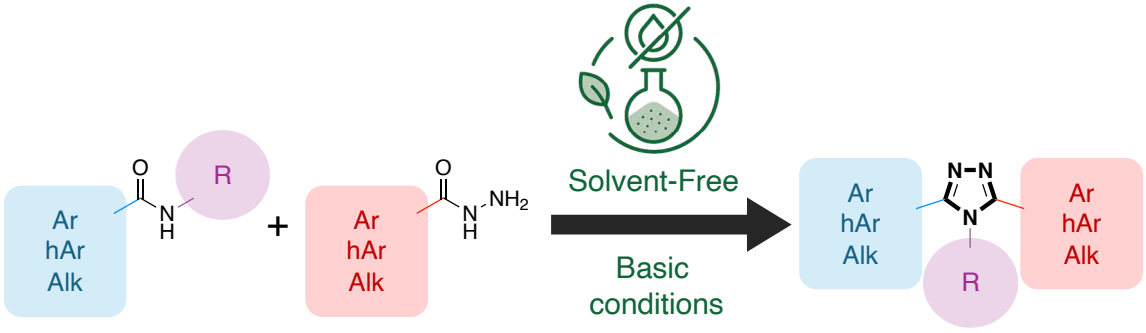


Figure 1: *Substrates and conditions for 1,2,4-triazole moiety synthesis.*

[1] Morais, P. A. B.; Javarini, C. L.; Valim, T. C.; Francisco, C. S.; Ferreira, L. C. de F.; Bottocim, R. R. T.; Neto, Á. C.; Júnior, V. L. Triazole: A New Perspective in Medicinal Chemistry and Material Science. *Curr. Org. Chem. 26* (18), 1691–1702. https://doi.org/10.2174/1385272827666221213145147.

[2] Zhu, Y.; Olson, S. H.; Graham, D.; Patel, G.; Hermanowski-Vosatka, A.; Mundt, S.; Shah, K.; Springer, M.; Thieringer, R.; Wright, S.; Xiao, J.; Zokian, H.; Dragovic, J.; Balkovec, J. M. Phenylcyclobutyl Triazoles as Selective Inhibitors of 11β-Hydroxysteroid Dehydrogenase Type I. Bioorg. Med. Chem. Lett. 2008, 18 (11), 3412–3416. https://doi.org/10.1016/j.bmcl.2008.04.014.

[3] DEAN, D. K.; MUNOZ-MURIEDAS, J.; SIME, M.; STEADMAN, J. G. A.; THEWLIS, R. E. A.; TRANI, G.; WALTER, D. S. 5,6,7,8-Tetrahydro[1,2,4]Triazolo[4,3-a]Pyrazine Derivatives as p2X7 Modulators. WO 2010/125102 A1.

[4] BÜRLI, R.; DOYLE, K.; STOTT, A. Diaryl Diazole and Diaryl Triazole Derivatives for Use in Treating a Disease Associated with KCNK13 Activity. WO 2024/095005 A1.

P B060

Coordination chemistry of pyridine allenes with Platinum and Ruthenium

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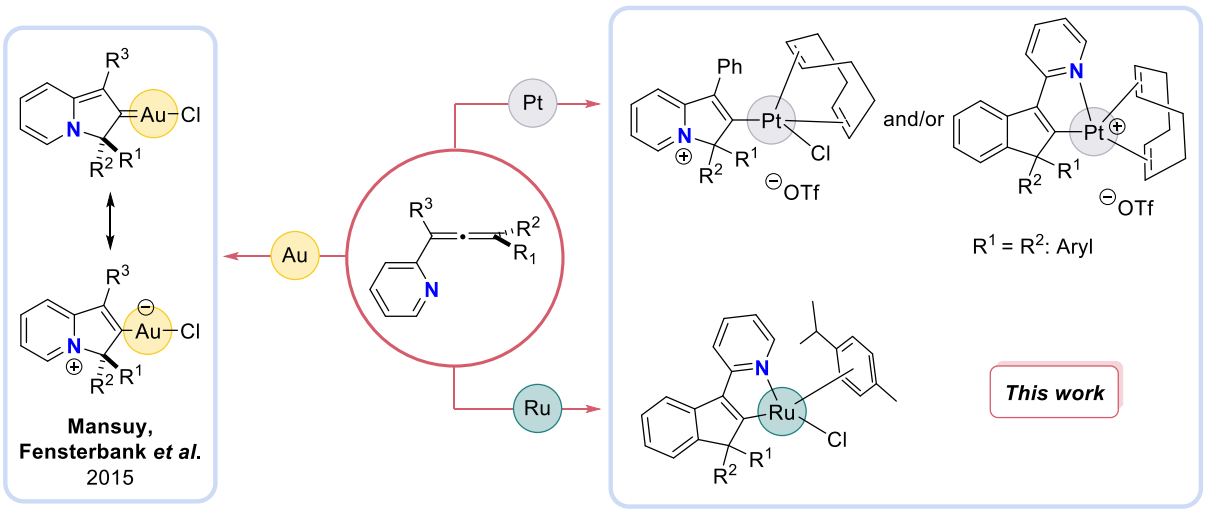
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Tetrasubstituted pyridine-allenes are molecules of remarkable reactivity. Owing to the presence of an activatable π-system combined with the nucleophilic character of the pyridine moiety, they undergo cycloaddition reactions in the presence of appropriate Lewis acid. Mansuy and Fensterbank[1] were the first to report the cyclization of tetrasubstituted pyridine-allenes, leading to the formation of novel indolizine–gold complexes. Although these ligands have never been isolated, they exhibit a dual nature, behaving both as carbenes and as zwitterionic ligands, and have proven effective in enantioselective gold catalysis[2].

We have succeeded in extending this reactivity to Pt^{II} and Ru^{II}, thereby broadening the scope of transition metals capable of promoting cyclization and complex assembly of tetrasubstituted pyridine-allenes. Notably, special attention was devoted to the divergent product distribution of these metals, which afforded either indolizine complexes or cyclometallated species.



[1] Vanitcha, A.; Gontard, G.; Vanthuyne, N.; Derat, E.; Mouriès-Mansuy, V.; Fensterbank, L. Synthesis of Allenes Bearing Phosphine Oxide Groups and Investigation of Their Reactivity toward Gold Complexes. *Adv Synth Catal* **2015**, *357*, 2213–2218.

[2] Martinez, T.; Vanitcha, A.; Troufflard, C.; Vanthuyne, N.; Forté, J.; Gontard, G.; Lemi, G. Indolizy Carbene Ligand. Evaluation of Electronic Properties and Applications in Asymmetric Gold(I) Catalysis. Angew. Chem. Int. Ed. **2021**, *63*, .19879-19888.

P B061

Design and synthesis of bisubstrate inhibitors of DOT1L containing original adenosine mimics

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Epigenetics refers to the modulation of gene expression without altering the DNA sequence[1],[2]. One of the major modifications is the methylation of histones[3] catalyzed by histone methyltransferases (HMTs). However abnormal methylation pattern or activity of these enzymes has been reported in various diseases, including cancer and infections[4].

The catalytic site of HMTs consists of two distinct pockets: one for the binding the *S*-Adenosyl-L-Methionine (SAM) cofactor, which donates the methyl group, and one for binding the histone substrate (arginine (R) or lysine (K)). Bisubstrate-type inhibitors that simultaneously target both pockets offer higher selectivity and potency compared to inhibitors that only compete with either SAM or the substrate[5].

We employ this strategy to generate a chemical library of inhibitors targeting DOT1L, an HMT responsible for the methylation of H3K79. DOT1L plays a crucial role in the development of MLL rearranged leukemia, making it a particularly promising therapeutic target[6]. The failure of Pinemetostat, developed by Epizyme, in clinical trial (PhaseI) due to poor pharmacological properties emphasize the need of new potent inhibitor of DOT1L for the treatment of MLLr[7,8].

In this study, we designed and synthesized bisubstrate-type inhibitors based on the incorporating of new adenosine mimics covalently linked to a second substrat derived from Pinemetostat. The resulting compounds were subsequently evaluated for their biological activity.

[1] Berger, S. L.; Kouzarides, T.; Shiekhattar, R.; Shilatifard, A. An Operational Definition of Epigenetics.

[2] Barbachowska, M.; Arimondo, P. B. To Target or Not to Target? The Role of DNA and Histone Methylation in Bacterial Infections. *Epigenetics* **2023**, *18* (1), 2242689. https://doi.org/10.1080/15592294.2023.2242689.

[3] Biterge, B. A Mini Review on Post-Translational Histone Modifications. *MOJ Cell Sci. Rep.* **2016**, *3* (1). https://doi.org/10.15406/mojcsr.2016.03.00047.

[4] Marzochi, L. L.; Cuzziol, C. I.; Nascimento Filho, C. H. V. D.; Dos Santos, J. A.; Castanhole-Nunes, M. M. U.; Pavarino, É. C.; Guerra, E. N. S.; Goloni-Bertollo, E. M. Use of Histone Methyltransferase Inhibitors in Cancer Treatment: A Systematic Review. *Eur. J. Pharmacol.* **2023**, *944*, 175590. https://doi.org/10.1016/j.ejphar.2023.175590.

[5] Bon, C.; Halby, L.; Arimondo, P. B. Bisubstrate Inhibitors: The Promise of a Selective and Potent Chemical Inhibition of Epigenetic 'Writers.' *Epigenomics* **2020**, *12* (17), 1479–1482. https://doi.org/10.2217/epi-2020-0203.

[6] Yi, Y.; Ge, S. Targeting the Histone H3 Lysine 79 Methyltransferase DOT1L in MLL-Rearranged Leukemias. *J. Hematol. Oncol.J Hematol Oncol* **2022**, *15* (1), 35. https://doi.org/10.1186/s13045-022-01251-1.

[7] Daigle, S. R.; Olhava, E. J.; Therkelsen, C. A.; Basavapathruni, A.; Jin, L.; Boriack-Sjodin, P. A.; Allain, C. J.; Klaus, C. R.; Raimondi, A.; Scott, M. P.; Waters, N. J.; Chesworth, R.; Moyer, M. P.; Copeland, R. A.; Richon, V. M.; Pollock, R. M. Potent Inhibition of DOT1L as Treatment of MLL-Fusion Leukemia. *Blood* **2013**, *122* (6), 1017–1025. https://doi.org/10.1182/blood-2013-04-497644.

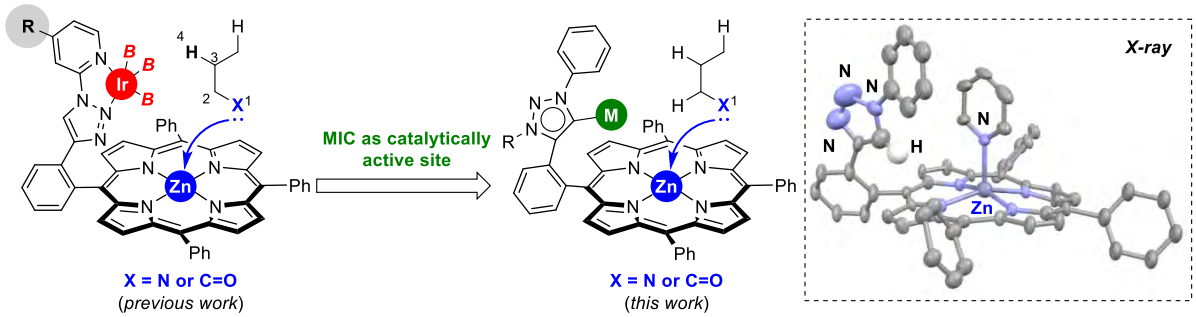
[8] Stein, E. M.; Garcia-Manero, G.; Rizzieri, D. A.; Tibes, R.; Berdeja, J. G.; Savona, M. R.; Jongen-Lavrenic, M.; Altman, J. K.; Thomson, B.; Blakemore, S. J.; Daigle, S. R.; Waters, N. J.; Suttle, A. B.; Clawson, A.; Pollock, R.; Krivtsov, A.; Armstrong, S. A.; DiMartino, J.; Hedrick, E.; Löwenberg, B.; Tallman, M. S. The DOT1L Inhibitor Pinometostat Reduces H3K79 Methylation and Has Modest Clinical Activity in Adult Acute Leukemia. *Blood* **2018**, *131* (24), 2661–2669. https://doi.org/10.1182/blood-2017-12-818948.

P B062

Merging mesoionic NHC-carbenes with metalloporphyrins for supramolecular catalysis

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Incorporating molecular recognition features in the second coordination sphere of transition metal catalysts mimics the action mode of highly active and selective natural metalloenzymes.[1] Hydrogen bonding and ion pairing have proven beneficial for such purposes enabling substrate selection and reaching pre-organization that leads to exquisite of levels of selectivity in challenging organic transformations.[2] In this context, our laboratory has designed supramolecular iridium catalysts displaying remote weak coordination bonds between zinc-porphyrins and substrates containing electron lone pairs from nitrogen or oxygen (Zn…N or Zn…O=C).[3,4] Such supramolecular iridium catalysts enabled C-H borylation of pyridine derivatives and carbonyl-containing benzene substrates at a precise four-chemical bond distance from the molecular recognition site.[5,6] In order to expand such approach to systems compatible with first-row transition metals, we present herein a strategy that leads to zinc-porphyrins comprising mesoionic NHC carbenes (**MIC**). NHC carbenes are known coordinating units to first-row transition metal ions, such as copper, and their catalytic behavior has been documented although with limited success for nitrogen substrates due to the poisoning effect (over-coordination) of the nitrogen lone pair towards the metal active species.[7] Herein, we will present the synthesis and preliminary coordination chemistry studies as well as initial catalytic tests for new bond-forming processes.



[1] Olivo,G. ; Capocasa, G.; Del Giudice, D.; Lanzalunga, O.; Di Stefano, S. *Chem. Soc. Rev.* **2021**, *50*, 7681.
[2] Trouvé, J.; Gramage-Doria, R. *Chem. Soc. Rev.* **2021**, *50*, 3565.
[3] Trouvé, J.; Zardi, P.; Al-Shehimy, S.; Roisnel, T.; Gramage-Doria, R. *Angew. Chem. Int. Ed.* **2021**, *60*, 18006.
[4] Trouvé, J.; Delahaye, V.; Tomasini, M.; Rajeshwaran, P.; Roisnel, T.; Poater, A.; Gramage-Doria, R. *Chem. Sci.* **2024**, *15*, 11794.
[5] Trouvé, L.; Rajeshwaran, P.; Tomasini, M.; Perennes, A.; Roisnel, R.; Poater, A.; Gramage-Doria, R. *ACS Catal.* **2023**, *13*, 7715.
[6] Tomasini, M.; Caporaso, L.; Trouvé, J.; Poater, J.; Gramage-Doria, R.; Poater, A. *Chem. Eur. J.* **2022**, *28*, e202201970.
[7] Zhao, Q.; Meng, G.; Nolan, S. P.; Szostak, M. *Chem. Rev.* **2020**, *120*, 1981.

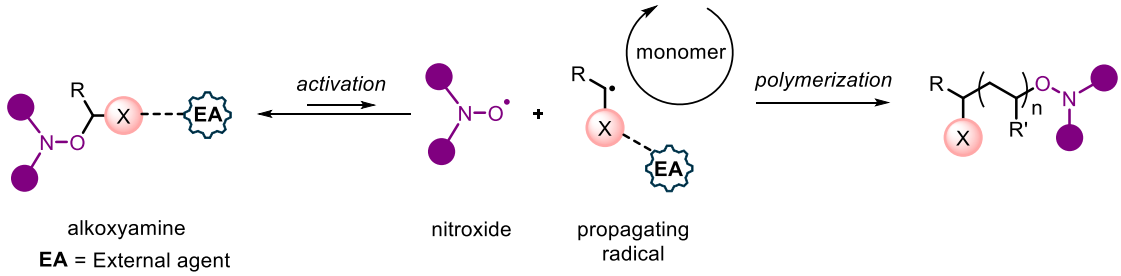
P B063

Impact of external agent on C-ON bond homolysis in alkoxyamines and on the nitroxide-mediated polymerization

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Radical-based polymerization is the more broadly applicable polymerization method in industry (around 50% of the polymeric materials) with the advantages of rapid reaction rates, mild reaction conditions and functional group, reagent/solvent impurities tolerance. To reach a forming material with predetermined molecular weight and low polydispersity, controlled-radical polymerization (CRP) seems the best method.[1] This technique is useful for several application and permits to reduce the instantaneous concentration of radical chains to limit the irreversible termination reactions. Indeed, the radical active species were trapped with a controlling agent to form a dormant specie. Among the known CRP methods, our laboratory is focus on nitroxyde-mediated polymerization (NMP).[2]

We investigate the initiation step specially the chemical activation of the dormant specie, the alkoxyamine. In order to better manage NMP (mild and tolerant reactions conditions), we examine in this context how non-covalent interactions between external agents and a series of alkoxyamines affect the C-ON bond homolysis (initiation step). The polymerization results will be presented on this poster.



Non-covalent interaction effect on NMP - mild polymerizations conditions

[1] Shanmugam, S. ; Matyjaszewski, K. Reversible Deactivation Radical Polymerization: State-of-the-Art in 2017 *ACS Symposium Series* **2018**, *1284*, 1-39.
[2] Gigmes, D.; Marque, S.R.A. Nitroxide mediated polymerization and its applications, in Encyclopedia of Radicals in Chemistry, Biology, and Materials, ed. by C. Chatgilialoglu, A. Studer (Wiley, 2012).

P B064

3-Alkyl-1,2,4-triazines as Heterocyclic Platforms for Organocatalytic Enantioselective Benzylic C-H Functionalization

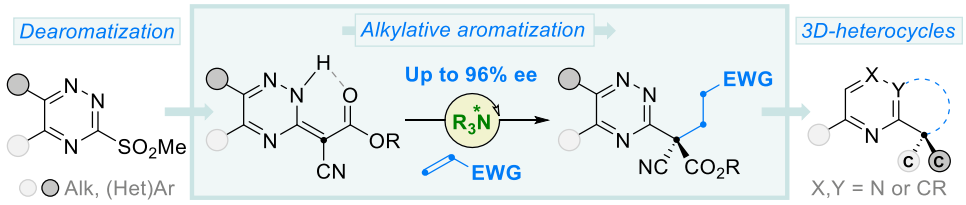
Anthony Lapray,[1] Marie-Aude Hiebel,[2] Sylvain Oudeyer,[1]
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Azaarenes connected to an α-stereogenic center are valuable three-dimensional (3D) heterocyclic substructures of medicinally relevant bioactive molecules, among which the pyridine ring motif and derivatives stand out. In that domain, the catalytic enantioselective benzylic C-H functionalization of 2-alkylazaarenes has emerged as a powerful asymmetric method for building chemical diversity, while also affording great opportunities for reactivity investigations.[1]



In that context, in line with our interest in 1,2,4-triazine chemistry and organocatalysis,[2] we are pleased to highlight the α-3-(1,2,4-triazine)-α-cyanoacetate derivatives, which exhibit a unique and well-defined dearomatized structure and undergo efficient organocatalytic aromatization-alkylation sequences with Michael acceptors in order to construct an all-carbon tetrasubstituted stereocenter with high ees.[3] These new players in the field of enantioselective catalytic formal benzylic C-H functionalization afford versatile molecular platforms towards the construction of valuable 3D-heterocycles.[4]

[1] For insightful reviews, see: (a) Best, D.; Lam, H. W., C═N-Containing Azaarenes as Activating Groups in Enantioselective Catalysis. *J. Org. Chem.* **2014**, *79*, 831; (b) Meazza, M.; Rios, R., Enantioselective Synthesis of Alkyl Azaarenes. Asian *J. Org. Chem.* **2019**, *8*, 1800.

[2] Lapray, A.; Martzel, T.; Hiebel, M. A.; Oudeyer, S.; Suzenet, F.; Brière, J. F., Domino Transformations of 3-Fluoro-1,2,4-Triazine Derivatives towards Spirocyclic and Fused Pyridines. *Adv. Synth. Catal.* **2024**, *366*, 316, and references 8 cited therein.

[3] Lapray, A.; Hiebel, M.-A.; Oudeyer, S.; Lohier, J.-F.; Suzenet, F.; Brière, J.-F., 3-Alkyl-1,2,4-triazines as Heterocyclic Platforms for Organocatalytic Enantioselective Benzylic C–H Functionalization. *Org. Lett.* **2025**, *27*, 1504.

[4] For insightful reviews, see: (a) Foster, R. A. A.; Willis, M. C., Tandem inverse-electron-demand hetero-/retro-Diels–Alder reactions for aromatic nitrogen heterocycle synthesis. *Chem. Soc. Rev.* **2013**, *42*, 63. (b) Zhang, J.; Shukla, V.; Boger, D. L., Inverse Electron Demand Diels–Alder Reactions of Heterocyclic Azadienes, 1-Aza-1,3-Butadienes, Cyclopropenone Ketals, and Related Systems. A Retrospective. *J. Org. Chem.* **2019**, *84*, 9397. (c) Zhang, F.-G.; Chen, Z.; Tang, X.; Ma, J.-A., Triazines: Syntheses and Inverse Electron-demand Diels–Alder Reactions. *Chem. Rev.* **2021**, *121*, 14555.

P B065

Hydrogen deuterium exchange via an iterative continuous-flow deuteration process

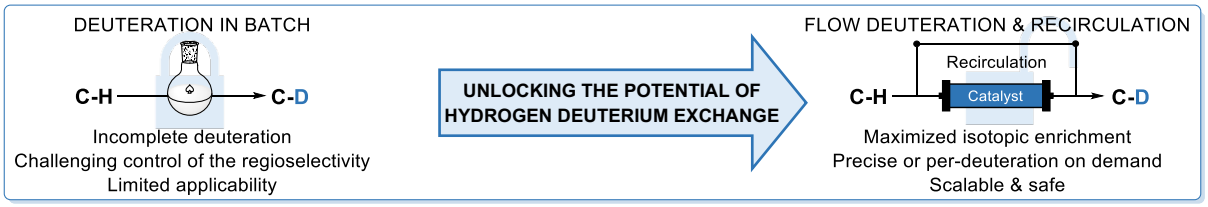
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Compounds labelled with hydrogen isotopes are essential in numerous fields such as pharmacy, diagnostics, biology, toxicology and advanced materials.[1] Selectively deuterated molecules are particularly valuable in drug development, where the kinetic isotope effect might improve metabolic stability and enhance pharmacokinetic profiles.

For years, hydrogen deuterium exchange (HDE) methods have emerged as powerful tools for the one-step late-stage preparation of deuterium-labelled compounds, but conventional batch approaches often suffer from harsh conditions, limited selectivity, and poor scalability.

In 2015, Noël et al. reported the first direct isotope exchange reactions under continuous flow conditions, which was followed by further developments from several research groups.[2-5]

In this context, we describe an iterative continuous-flow deuteration process using commercial apparatus (H-Cube Pro™ system) and catalyst (Ru/C) allied with the in-situ generation of D_2. The iterative circulation of the substrate is the key for a precise deuteration and gradual incorporation of deuterium atoms.[6] For example, the flexibility of the process could lead to either selective deuteration (99% enrichment at 30°C of dimethylamine for instance) or complete deuteration in two hours at 100°C. The system is also robust, with the catalytic cartridge remaining active for at least 15 consecutive cycles. Moreover, continuous flow's modularity ensures straightforward scalability from milligram to grams quantities, making it highly attractive for industrial use.



[1] Atzrodt, J.; Derdau, V.; Kerr, W. J.; Reid, M. Deuterium- and Tritium-Labelled Compounds: Applications in the Life Sciences. *Angew. Chem. Int. Ed.* **2018**, *57* (7), 1758–1784. https://doi.org/10.1002/anie.201704146.
[2] Habraken, E. R. M.; Haspeslagh, P.; Vliegen, M.; Noël, T. Iridium(I)-Catalyzed Ortho-Directed Hydrogen Isotope Exchange in Continuous-Flow Reactors. *J. Flow Chem.* **2015**, *5* (1), 2–5. https://doi.org/10.1556/JFC-D-1400033.
[3] Park, K.; Ito, N.; Sajiki, H. Efficient Continuous-Flow HD Exchange Reaction of Aromatic Nuclei in D2O/2-PrOH Mixed Solvent in a Catalyst Cartridge Packed with Platinum on Carbon Beads. *Bull. Chem. Soc. Jpn.* **2021**, *94* (2), 600–605. https://doi.org/10.1246/BCSJ.20200325.
[4] Minya, F.; Raji, M.; Sipos, G. Raney Nickel-Catalyzed Deuterium Labeling of Nitrogen Containing Heterocycles and Pharmaceuticals under Continuous Flow Conditions. *Adv. Synth. Catal.* **2025**, *367* (7), e202400168. https://doi.org/10.1002/adsc.202400168.
[5] Sakurada, N.; Sasaki, D.; Ono, M.; Yamada, T.; Ikawa, T.; Sajiki, H. Development of Site- and Stereoselective Continuous Flow Deuterium Labelling Method for Carbohydrates Using High Dispersion Effect towards Ru/C of Hydrogen Flow. *React. Chem. Eng.* **2025**, *10* (4), 777–781. https://doi.org/10.1039/D5RE00026B.
[6] Tatoueix, K.; Pieters, G.; Feuillastre, S. et al. Unlocking the Potential of Hydrogen Deuterium Exchange via an Iterative Continuous-Flow Deuteration Process. *Nat. Commun.* **2025**, *16* (1), 1314. https://doi.org/10.1038/s4146702556600-8.

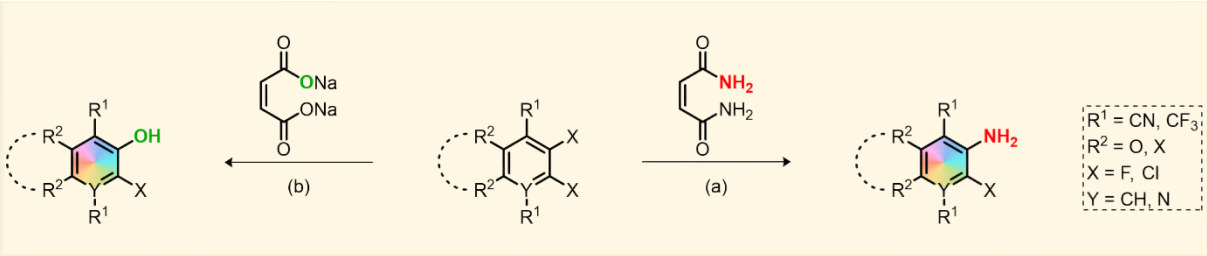
P B066

From Benzene to Brightness: Easy Access to Tunable Single-Benzene Fluorophores

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Single-benzene fluorophores (SBFs) represent a unique class of minimalistic emitters, capable of absorbing and emitting visible light with only one benzene ring as the aromatic core.[1] Despite their structural simplicity, SBFs may exhibit remarkable emission properties, such as a large Stokes shift and high quantum yields. Their unusual photophysical behavior, rationalized by DFT calculations through excited-state antiaromaticity, highlights the importance of molecular design around the benzene core.[2]

In this work, we present a synthetic methodology for the preparation of new SBF derivatives through the introduction of amino and hydroxy groups as versatile donor substituents, by using either maleamide **(a)** or a maleic acid derivative **(b)** respectively. Our approach relies on the systematic substitution of electron-poor halogenoaromatic ring, enabling straightforward access to a library of functionalized SBFs including chiral ones, efficiently emitting circularly polarized fluorescence.[3] The developed protocol provides a robust and modular route to tune emission properties of SBFs family while preserving the minimal benzene skeleton.



• Robust and modular • Tunable photophysical properties • Efficient and reproducible • • DFT studies • Valuable fluorophore compounds •

The resulting amino- and hydroxy-substituted SBFs are expected to expand the scope of SBFs, offering new opportunities for the design of low molecular weight and color-tunable emitters. This methodology opens the way toward systematic structure-property studies and potential applications in optoelectronics and bioimaging.

[1] Kim, J.-H.; Jung Hyub Oh; Kim, D. Recent Advances in Single-Benzene-Based Fluorophores: Physicochemical Properties and Applications. *Organic and Biomolecular Chemistry* **2021**, *19* (5), 933–946.
[2] Kim, H.; Kim, Y.; Lee, D. Small Is Beautiful: Electronic Origin and Synthetic Evolution of Single-Benzene Fluorophores. *Accounts of Chemical Research* **2023**, *57* (1), 140–152.
[3] Coehlo, M.; Thuéry, P.; Pieters, G. Chiral Perturbation on Single Benzene-Based Fluorophores: A Structure/(Chir)Optical Activity Relationship Study. *Chirality* **2023**, *35* (11), 796–804.

P B067

Strategies to Build Fluorinated Molecules

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Due to the unique physicochemical properties of the fluorine atom,[1] fluorinated compounds occupy a prominent position in the fields of pharmaceuticals, agrochemicals, and advanced materials.[2] The incorporation of fluorine atoms or fluorinated functional groups into organic molecules has profound effects on their physico-chemical properties and biological activity.[3] As a result, the development of efficient strategies for the synthesis of fluorinated compounds, and in particular for the selective introduction of fluorinated motifs, represents a central and rapidly evolving area of contemporary chemistry. In this poster will be presented our latest contributions in the field.[4]

[1] O'Hagan, D.; Deng, H. Enzymatic Fluorination and Biotechno-logical Developments of the Fluorinase. *Chem. Rev*. **2015**, *115*, 634−649.

[2] (a) Inoue, M.; Sumii, Y.; Shibata, N. Contribution of Organofluorine Compounds to Pharmaceuticals. *ACS Omega* 2020, *5*, 10633−10640; [b] Wang, J.; Sánchez-Roselló, M.; Aceña, J. L.; del Pozo, C.; Sorochinsky, A. E.; Fustero, S.; Soloshonok, V. A.; Liu, H. Fluorine in Pharmaceutical Industry: Fluorine-Containing Drugs Introduced to the Market in the Last Decade (2001−2011) *Chem. Rev.* 2014, *114*, 2432−2506; (c) Zhou, Y.; Wang, J.; Gu, Z.; Wang, S.; Zhu, W.; Aceña, J. L.; Soloshonok, V. A.; Izawa, K.; Liu, H. Next Generation of Fluorine-Containing Pharmaceuticals, Compounds Currently in Phase II−III Clinical Trials of Major Pharmaceutical Companies: New Structural Trends and Therapeutic Areas. *Chem. Rev.* 2016, *116*, 422−518.

[3] (a) O'Hagan, D. Understanding Organofluorine Chemistry. An Introduction to the C−F bond. *Chem. Soc. Rev*. **2008**, 37, 308−319; (b) O'Hagan, D. The Role of Fluorine in Medicinal Chemistry. *J. Fluor. Chem.* **2010**, *131* (9), 1071−1081 ; (c) Hagmann, W. K. The Many Roles for Fluorine in Medicinal Chemistry. *J. Med. Chem.* **2008**, *51* (15), 4359−4369 ; (d) Purser, S.; Moore, P. R.; Swallow, S.; Gouverneur, V. Fluorine in Medicinal Chemistry. *Chem. Soc. Rev.* **2008**, *37* (2), 320−330 ; (e) Wang, J.; Sánchez-Roselló, M.; Aceña, J. L.; del Pozo, C.; Sorochinsky, A. E.; Fustero, S.; Soloshonok, V. A.; Liu, H. Fluorine in Pharmaceutical Industry: Fluorine-Containing Drugs Introduced to the Market in the Last Decade (2001−2011). *Chem. Rev.* **2014**, *114* (4), 2432−2506. (f) Gillis, E. P.; Eastman, K. J.; Hill, M. D.; Donnelly, D. J.; Meanwell, N. A. Applications of Fluorine in Medicinal Chemistry. *J. Med. Chem.* **2015**, *58* (21), 8315−8359.

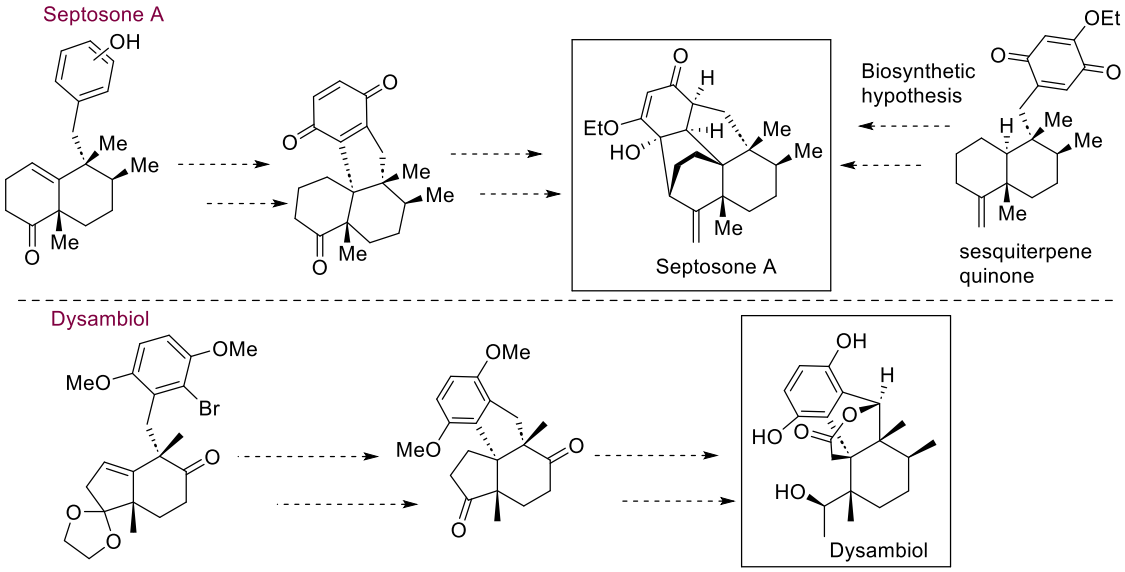
[4] Herrera, V.; Bertrand, X.; Garcia Mancheño, O.; Besset, T. Unpublished results

P B068

Synthetic Studies towards Total Synthesis of Septosone A and Dysambiol

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Septosone A and Dysambiol are structurally complex marine-derived terpene natural products that exhibit promising anti-inflammatory activity.[1-3] Septosone A is characterized by a distinctive pentacyclic skeleton, and its biosynthesis is proposed to proceed through the cyclization of a sesquiterpene quinone. Inspired by this hypothesis, we have designed a retrosynthetic strategy that employs a similar precursor. A key step involves an intramolecular cyclization of an internal trisubstituted alkene with a phenol via a metal-hydride hydrogen atom transfer (MHAT) process to construct the crucial five-membered ring.[4] For Dysambiol, it features an unprecedented secomeroterpene framework containing a rare lactone bridge and six contiguous stereocenters. Our synthetic plan relies on an intramolecular Heck reaction between an internal trisubstituted alkene and an aryl bromide to establish its key five-membered ring.



[1] Gui, Y.-H.; Jiao, W.-H.; Zhou, M.; Zhang, Y.; Zeng, D.-Q.; Zhu, H.-R.; Liu, K.-C.; Sun, F.; Chen, H.-F.; Lin, H.-W. *Org. Lett*. **2019**, *21*, 767–770.
[2] Robert A, H.; Andrew, S. *Nat. Prod. Rep*. **2023**, *40*, 1590-1594.
[3] Jiao, W.-H.; Li, J.-X.; Liu, H.-Y.; Luo, X.-C.; Hu, T.-Y.; Shi, G.-H.; Xie, D.-D.; Chen, H.-F.; Cheng, B.-H. Lin, H.-W. *Org. Lett*. **2023**, *25*, 6391–6395.
[4] Schoenn, G.; Kouklovsky, C.; Guillot, R.; Magauer, T.; Vincent, G. *Angew. Chem. Int. Ed*. **2025**, *64*, e202505270.

P B069

Cycloadditions of 5-Vinyloxazolidine-2,4-diones: A Straightforward access to the (Thio)hydantoin Scaffold

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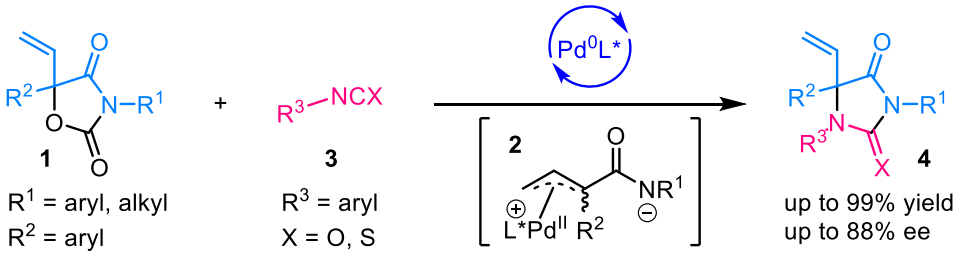
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Hydantoins are ubiquitous heterocycles in medicinal chemistry, and their imidazolidine-2,4-dione skeleton is encountered in natural products and many small-molecule drugs displaying a variety of biological activities such as mephenytoin (anticonvulsant), dantrolene (muscle relaxant), or sorbinil (aldose reductase inhibitor).[1a] Several synthetic pathways have been described for the formation of this moiety, but few strategies display the formation of enantioenriched hydantoins.[1b] Cycloaddition of transient zwitterionic π-allylpalladium^{II} complexes[2] could be a reliable strategy to access these important scaffolds.

Recently, our group and others have reported the synthetic potential of 5-vinyloxazolidine-2,4-diones (VOxD).[3] As a synthetic equivalent of the C-(C=O)-N synthon, VOxDs are a promising family of molecules to form the hydantoin skeleton. In the presence of a palladium catalyst, an oxidative addition and ring opening of VOxD **1** occurs, followed by a decarboxylation leading to the zwitterionic π-allylpalladium^{II} complex **2**, now able to react with an electrophilic cycloaddition partner. Herein, we describe a palladium-catalyzed cycloaddition between VOxD **1** and (thio)isocyanates **3** as electrophilic partner, allowing the enantioselective preparation of various hydantoin and thiohydantoin heterocycles **4**.[4]



[1] (a) Cho, S.; Kim, S.-H.; Shin, D. Recent Applications of Hydantoin and Thiohydantoin in Medicinal Chemistry. *Eur. J. Med. Chem.* **2019**, *164*, 517-545. (b) Konnert, L.; Lamaty, F.; Martinez, J.; Colacino, E. Recent Advances in the Synthesis of Hydantoins: The State of the Art of a Valuable Scaffold *Chem. Rev.* **2017**, *117*, 13757-13809.

[2] Niu, B.; Wei, Y.; Shi, M. Recent advances in annulation reactions based on zwitterionic π-allyl palladium and propargyl palladium complexes *Org. Chem. Front.* **2021**, *8*, 3475-3501.

[3] For selected publications: (a) Sculiller, A.; Casaretto, N.; Archambeau, A. Diastereo- and Enantioselective (3+2) Cycloaddition of a New Aza-π-Allylpalladium Zwitterionic Intermediate *J. Org. Chem.* **2023**, *88*, 9941-9945. (b) Roblin, A.; Casaretto, N.; Archambeau, A. Diastereo- and Enantioselective Palladium-Catalyzed Cycloadditions of 5-Vinyloxazolidine-2,4-diones with Electrophilic Imines *Org. Lett.* **2023**, *25*, 6453-6458. (c) Li, K.; Zhen, S.; Wang, W.; Du, J.; Yu, S.; Wi, Y.; Guo, H. Fungicide-inspired precursors of π-allylpalladium intermediates for palladium-catalyzed decarboxylative cycloadditions *Chem. Sci.* **2023**, *14*, 3024-3029.

[4] Busicchia, M.; Roblin, A.; Dubois, C.; Mekranter, N.; Casaretto, N.; Archambeau, A. Cycloadditions of 5-Vinyloxazolidine-2,4-diones: A Straightforward access to the (Thio)hydantoin Scaffold *J. Org. Chem.* **2024**, *89*, 12370-12377.

P B070

Synthesis of fluorescent probes targeting VGLUT3 for in vivo pharmacological studies

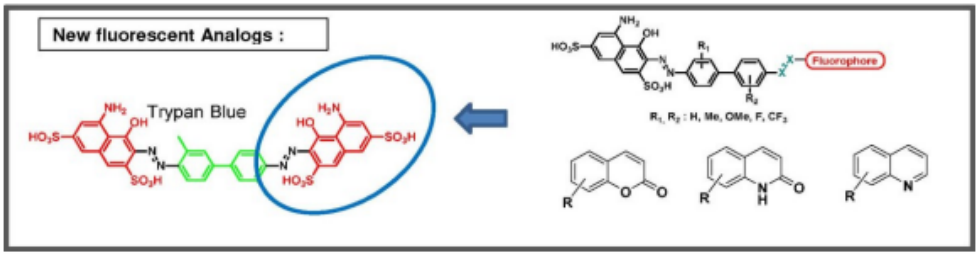
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Vesicular glutamate transporters (VGLUTs) were once regarded as exclusive markers of glutamatergic excitatory transmission. However, the discovery of VGLUT3 two decades ago challenged this simplified view. VGLUT3 is strategically expressed in various populations of glutamatergic, cholinergic, serotonergic, and even GABAergic neurons.[1] These expressions in neurons initially characterized as "non-glutamatergic" reveal an unexpected complexity. Our team has shown that VGLUT3 has a dual function in these bilingual neurons: first, it enables these neurons to use glutamate as a neurotransmitter, and second, its colocalization with other vesicular transporters in synaptic vesicles induce a vesicular synergy. This process allows the regulation of neurotransmission through an overaccumulation of acetylcholine or monoamines in synaptic vesicles that co-express VGLUT3.[1]

Recent studies indicate the significant impact of VGLUT3-dependent glutamate co-transmission on brain functions and dysfunctions. Advances in the neuropharmacology of VGLUT3 have the potential to improve treatments for various conditions such as Parkinson's disease, addiction, eating disorders, anxiety, presbycusis, and pain.[2]

This project focuses on VGLUT3 and its vesicular mechanism, as well as potential approaches for targeting this unique transporter in future theranostic interventions. Additionally, fluorescent compounds mimicking glutamate will be used as imaging biomarkers to study glutamatergic co-neurotransmission in physiological and pathological contexts. [3]

Our work focuses on incorporating fluorophore scaffolds into our lead compounds, such as coumarin and quinoline, to replace the Trypan Blue naphthyl moiety and create fluorescent dye analogs. The synthesis will involve various types of chemistry, including classical organocoupling reactions (such as Sonogashira, Suzuki or Huisgen coupling) as well as organic synthesis methods (such as protection and diazotization).[4] The next step will involve vectorizing the compounds into the brain to facilitate in vivo experiments.



[1] a)El Mestikawy, S.,et al. From glutamate co-release to vesicular synergy: vesicular glutamate transporters. Nat Rev Neurosci 12, 204–16 (2011). b)Gras, C. et al. A third vesicular glutamate transporter expressed by cholinergic and serotoninergic neurons. J Neurosci 22, 5442–51 (2002).

[2] Gras, C. et al. A third vesicular glutamate transporter expressed by cholinergic and serotoninergic neurons. J Neurosci 22, 5442–51 (2002).

[3] a) Poirel, O., et al. LSP5-2157 a new inhibitor of vesicular glutamate transport. 2021. Neuropharmacology. b) Pereira, D. B. et al. Fluorescent false neurotransmitter reveals functionally silent dopamine vesicle clusters in the striatum. Nature Neuroscience 19, 578–586 (2016).

[4] Bernard, V., et al. Patent : Fluorescent Ligand specifically targeting VGLUTs for super resolution imaging. WO2023094734

P B071

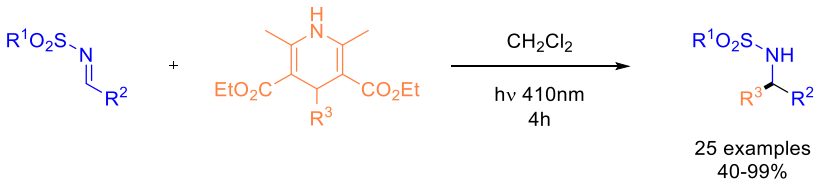
Photocatalyst-free alkylation of imines using 4-Alkyl DHPs

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Mannich-type reactions between imines and nucleophilic radicals, generated using light, have emerged as a powerful tool in organic chemistry thanks to the development of photocatalytic processes. These reactions combine the operational simplicity of the Mannich reaction with the high reactivity of photogenerated radicals, allowing the synthesis of highly substituted scaffolds under mild conditions. This approach thus represents an attractive strategy for the eco-compatible synthesis of α-disubstituted secondary amines.

Among common radical precursors, alkyl-dihydropyridines (DHPs) play a significant role. Whereas they were initially used as hydride donors in photochemical reaction[1], they have been more recently used as alkyl donors. Very recently DHPs were found to be efficient reaction partners in a Mannich type reaction with N-aryl imines[2]. However, their use relies on the combined utilisation of both a photocatalyst and a Lewis-acid catalyst under blue LED irradiation.

In this communication, we report a novel photocatalyst-free reaction between 4-Alk-DHPs and imines. Interestingly, this transformation is built on the use of N-sulfonyl imines and provides an efficient and straightforward entry to diverse α-disubstituted sulfonamides in good yields. This methodology significantly improves the eco-compatibility of such syntheses while simplifying the experimental procedure. We anticipate this approach can be further extended to a multicomponent version with *in situ* generated imines, as well as to a broader substrate scope encompassing both N-aryl and N-alkyl imines.



Scheme 1: Photochemical synthesis of -disubstituted N-sulfonyl amines

[1] Chen Y. Generation of Alkoxyl Radicals by Photoredox Catalysis Enables Selective C(sp3)-H Functionalization under Mild Reaction Conditions. *Angew. Chem. Int. Ed.* **2016**, *55*, 1872-1875

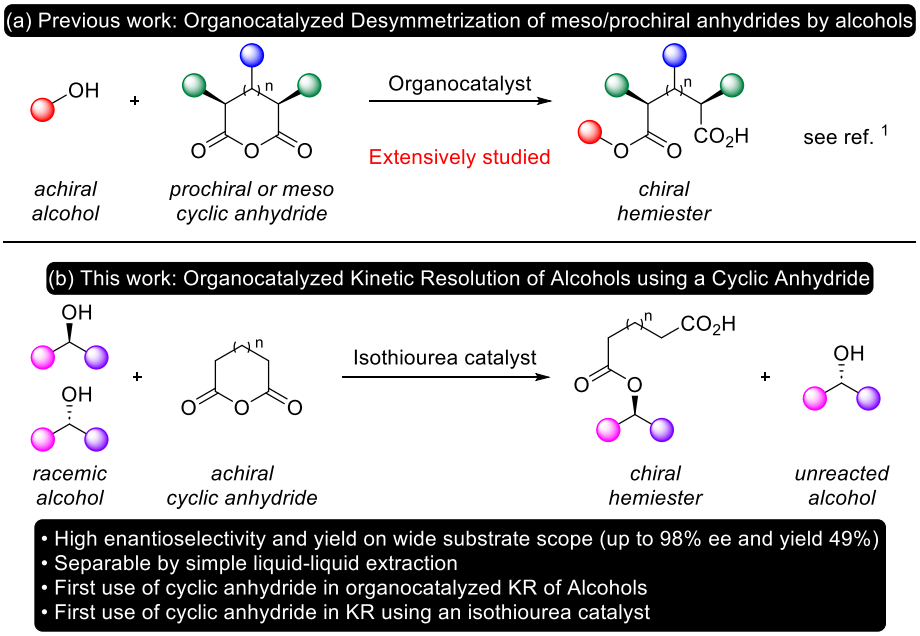
[2] Feng-X; Liu-X. Visible-Light-Promoted Enantioselective Acylation and Alkylation of Aldimines Enabled by 9-Fluorenone Electron-Shuttle Catalysis. *J. Am. Chem. Soc*. **2024**, *146*, 20401−20413

P B072

Isothiourea-catalyzed Kinetic Resolution of Alcohols with Cyclic Anhydrides

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In the present study, the kinetic resolution (KR) of different racemic alcohols was explored using cyclic anhydrides as acylating agents catalyzed by an easily accessible chiral isothiourea. This methodology demonstrated to be quite general on a wide substrate scope with excellent level of enantioselectivity and yields (ee up to 98% and yield 49%). The enantioselective formation of hemiester is of great interest due to the possibility to recover the unreacted alcohol by simple liquid-liquid extraction. To the best of our knowledge, this is the first use of cyclic anhydride in organocatalyzed KR of alcohols[1] and the first use of cyclic anhydride in KR using an isothiourea catalyst[2].



[1] For a review on desymmetrization of cyclic anhydride, see : a) Chen, Y.; McDaid, P.; Deng, L. Asymmetric Alcoholysis of Cyclic Anhydrides. *Chem. Rev.* **2003**, *103*, 2965–2984. b) Villegas, M. D. D. de; Gálvez, J. A.; Etayo, P.; Badorrey, R.; López-Ram-de-Víu, P. Recent Advances in Enantioselective Organocatalyzed Anhydride Desymmetrization and Its Application to the Synthesis of Valuable Enantiopure Compounds. *Chem. Soc. Rev.* **2011**, *40*, 5564–5587.
[2] For a review on isothiourea catalysis, see : Merad, J.; Pons, J.-M.; Chuzel, O.; Bressy, C. Enantioselective Catalysis by Chiral Isothioureas. *European Journal of Organic Chemistry* **2016**, *34*, 5589–5610.

P B073

Synthesis of non-natural bi- poly and heteroaryl amino-acids derivatives via Nickel-catalyzed Suzuki-Miyaura coupling

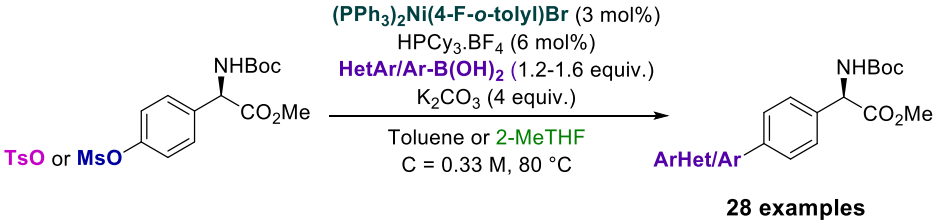
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Enantiomerically active non natural amino-acids derivatives are useful tools for the elaboration of peptidomimetics or as intermediates for the synthesis of pharmaceuticals. In this field, derivatives of phenyl glycine were recently proved to be potent dual inhibitors of Palsmodium Falcoparum M1 and M17 aminopeptidases[1] or a-mannosidase inhibitors.[2]
Despite interesting features, there are only a few examples of compounds that have been synthesized through Suzuki-Miyaura cross-coupling, classically using palladium catalysis and a substrate bearing a trifluoromethanesulfonyloxy group. Moreover, conducting this coupling in an enantioselective manner is very challenging due to the possible epimerization at the carbon a to the amino ester. Finally, even scarcer examples of this coupling involve nickel catalysts, and in this latter case, the catalytic charge remains high and the conditions require the use of a glovebox.[3]

Here we describe our methodology for the nickel catalyzed Suzuki-Miyaura cross-coupling of methyl 2-((tert-butoxycarbonyl)amino)-2-(4-((methylsulfonyl)oxy)phenyl)acetate for an easy access to enantiomerically active biaryl/polyaryl or heteroaryl derivatives using an air-stable nickel catalyst with a low catalyst loading.



The reaction is scalable up to 5 mmols and allows access to 28 unnatural amino acids with a good functional group tolerance and good enantiomeric excesses in most cases (25 examples > 81% ee).

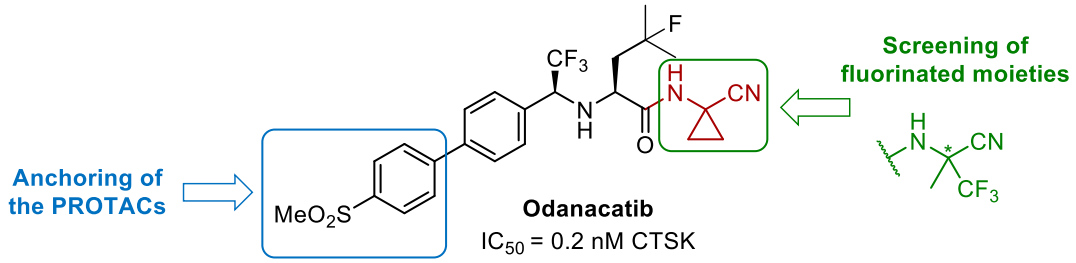
[1] N. Drinkwater, N. B. Vinh c, 1, S. N. Mistry, R. S. Bamert, C. Ruggeri, J. P. Holleran, S.Loganathan, A. Paiardini, S. A. Charman, A. K. Powell, V. M. Avery, S. McGowan, P. J. Scammells, *Eur. J. Med. Chem*. **2016**, *110*, 43-64.
[2] C. Bello, Mi. Cea, G. Dal Bello, A. Garuti, I. Rocco, G. Cirmena, E. Moran, A. Nahimana, M. A. Duchosal, F. Fruscione, P. Pronzato, F. Grossi, F. Patrone, A. Ballestrero, M. Dupuis, B. Sordat, A. Nencioni, P. Vogel, *Bioorg. Med. Chem*. **2010**, *18*, 3320-3334.
[3] H. Ueda, I. Kurimoto (2003), EP 1 481 967 A1, *Process for the preparation of biaryl compounds* EP Patent WO 2003/074478

P B074

Development of inhibitors and degraders targeting cathepsin K as potential tools in cancer therapy

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Cathepsin K (CTSK) is a lysosomal cysteine protease mostly expressed in osteoclasts. It plays a crucial role in bone tissue resorption by degrading components of the extracellular matrix (ECM), particularly type I collagen.[1] This enzyme has become a promising therapeutic target for the treatment of osteoporosis, a disease characterized by decreased bone mineral density. Recently, CTSK has been shown to be overexpressed in tumor cells, contributing to the development of various cancers, including breast and prostate cancers.[2] Several CTSK inhibitors have been developed, among which Odanacatib (ODN) was identified as the most relevant inhibitor of CTSK. ODN generated considerable interest before being withdrawn due to safety concerns arising from significant side effects observed in some patients.[3] The first aim of this project is to rationally explore the impact of fluorine atoms incorporation in CTSK inhibitors warhead to enhance their biological profile. The second goal is to develop a CTSK targeting PROTAC[4] to study its biology and its involvement in different diseases and as a potential tool in cancer therapy. PROTACs are small heterobifunctional molecules that enable the catalytic and targeted degradation of enzymes via the ubiquitin-proteasome system (UPS). In this presentation we report different approaches to the synthesis of amino nitrile based inhibitors warhead, inspired by the Strecker-type reaction developed in the laboratory.[5]



[1] Aguda, A. H.; Panwar, P.; Du, X. *Proc Natl Acad Sci U S A* **2014**, *111* (49), 17474–17479.
[2] Qian, D.; He, L.; Zhang, Q. *Curr Oncol* **2022**, *29* (8), 5963–5987.
[3] Gauthier, J. Y.; Chauret, N.; Cromlish, W. *Bioorg Med Chem Lett* **2008**, *18* (3), 923–928.
[4] Li, K.; Crews, C. M. *Chem. Soc. Rev.* **2022**, *51* (12), 5214–5236.
[5] Chaume, G.; Lensen, N.; Caupène, C. *European Journal of Organic Chemistry* **2009**, *2009* (33), 5717–5724.

P B075

Access to Cyclic Tetrazanes by Intramolecular Oxidative Coupling of Tethered-bishydrazines

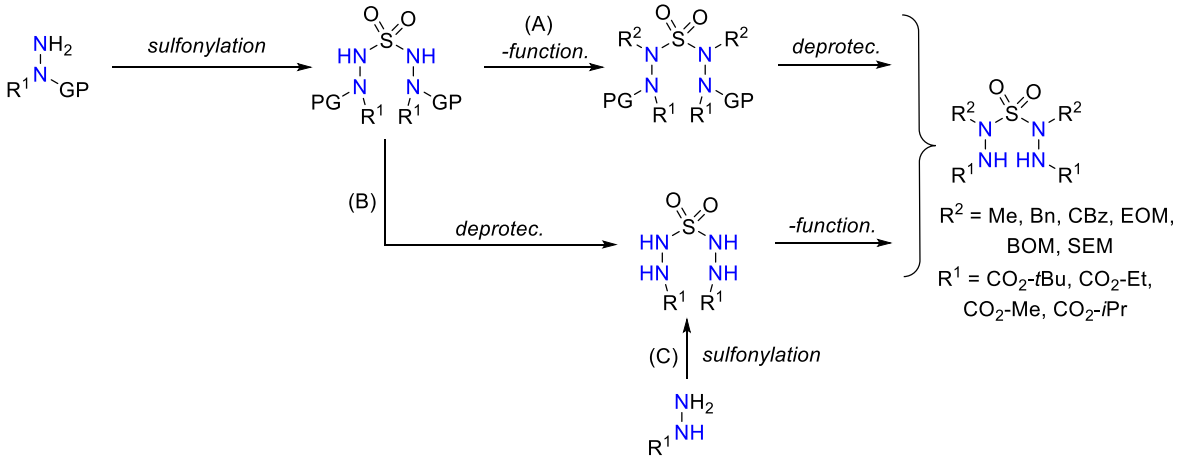
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Compared to the much more stable N–N triple bond, N–N single bonds are significantly weaker due to increased electronic repulsion between the two lone pairs. As a result, simple N–N bonds are less common, and methods for their formation are correspondingly limited.[1,2] This challenge becomes even more pronounced when dealing with higher-order catenated polyazanes, even though this largely unexplored chemical space may hold valuable reactivity potential.[3]

This work explores the synthesis of thiatetrazolidines, heterocycles with 4 sigma-bonded nitrogen atoms in their structure, obtained via the oxidative coupling of two hydrazines tethered by a sulfonyl moiety. Three complementary synthetic routes to install diverse substituents at the R positions are first presented. functionalization of bi-substituted hydrazines (Route A), selective activation of the α-nitrogen (Route B), and direct access via mono-substituted hydrazines (Route C) were employed, with an emphasis on optimizing yields and minimizing the need for protecting groups. In addition, we explored the cyclization of bis-hydrazines to form tetrazanes core using different oxidants.



[1] E. Schmitz, S. Schramm, H. Simon, *Angew. Chem. Int. Ed.* **1966**, *5*, 578–579.

[2] G. Li, S. P. Miller, A. T. Radosevich, *J. Am. Chem. Soc.* **2021**, *143*, 14464–14469.

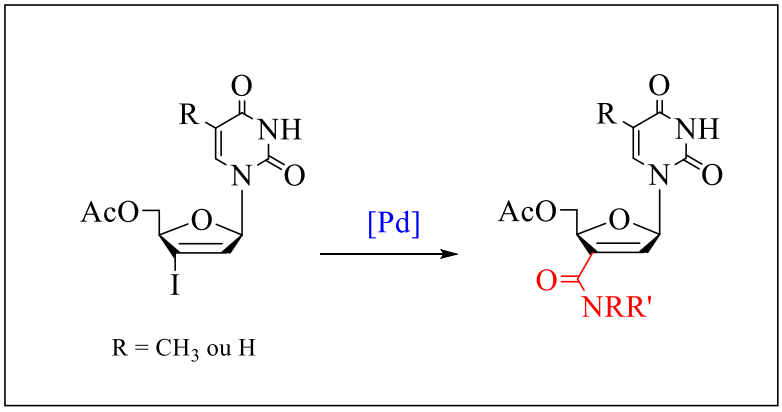
[3] O. T. O'Sullivan, M. J. Zdilla, *Chem. Rev.* **2020**, *120*, 5682–5744.

P B076

Development of palladium-catalyzed aminocarbonylation reaction on the position 3’ of unsaturated nucleosides

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Nucleosides represent a ubiquitous family of biomolecules involved in many key processes in biology. Given their importance, it is not surprising that this class of molecules is emerging as prototypes for the discovery of bioactive compounds. In particular, the development of non-natural mimics is an important area of research.[1] The modification of the position 3’ of the furanoside ring is particularly interesting since it is the location of the phosphate link in DNA/RNA. The AZT drug bearing an azido group in this position attests to the importance of such derivatives. However, the modulation of the C3’ position is synthetically difficult by the current ways. This project deals thus with the development of a direct and efficient synthesis of 3'-amidonucleosides *via* an aminocarbonylation reaction between unsaturated nucleosides[2] and various amines in the presence of CO a source. The compatibility of this method has been successfully extended to variously functionalized amines, including aliphatic, cyclic, aromatic, benzylic, and even hydrazine amines and to (U) and (T) nucleosides. Deprotection and post-functionalization steps are planned in order to obtain nucleoside mimics. This method constitutes a new route for accessing non-natural nucleoside analogues possessing a C–C bond at the C3' position.



[1] A. Salihovic, A. Taladriz-Sender, G. A. Burley, *Chem. Sci*. **2025**, *16*, 11700.
[2] H. Kumamoto, S. Onuma, H. Takana, G. Dustschman, Y. Chenget . *Antivir. Chem. Chemother*. **2006**, *17*, 225

P B077

Breaking the symmetry in chiral supramolecular receptors: from hemicryptophanes to cyclodextrins

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Nature design highly effective catalysts, possessing a wide range of reactivity and specificity, namely the enzymes, made of a pool of *L*-aminoacids only. One key feature of enzymes is their ability to achieve high enantiomeric excess in enantioselective catalysis. The structures of enzymes is often of low symmetry, which enable both their high selectivities and catalytic activities. In order for enzymes to catalyze the same reaction but with opposite enantiomeric excess, nature has to create mirror-image active sites. To do so, nature can switch the location of biding sites and/or the locations of key catalytic groups leading to enantiocomplementary enzymes.[1]

In contrast, synthetic receptors such as cyclodextrins,[2] calixarenes,[3] pillararenes,[4] possess high symmetry because they are much easier to access. With the aim to obtain supramolecular compounds with better selectivity, chemists must devise molecules with a lower degree of symmetry. Here, we show how we can lower the symmetry of usually high symmetrical, namely the hemicrytophanes[5] and the cyclodextrins. In the case of cyclodextrins, we show how two synthetic pathways leading to two compounds with inherently chiral patterns on the primary rim of the cyclodextrins but which are regioisomers. (Figure 1). We show how the symmetry of the hemicryptophane hosts impacts their recognition properties toward sugars.[5]

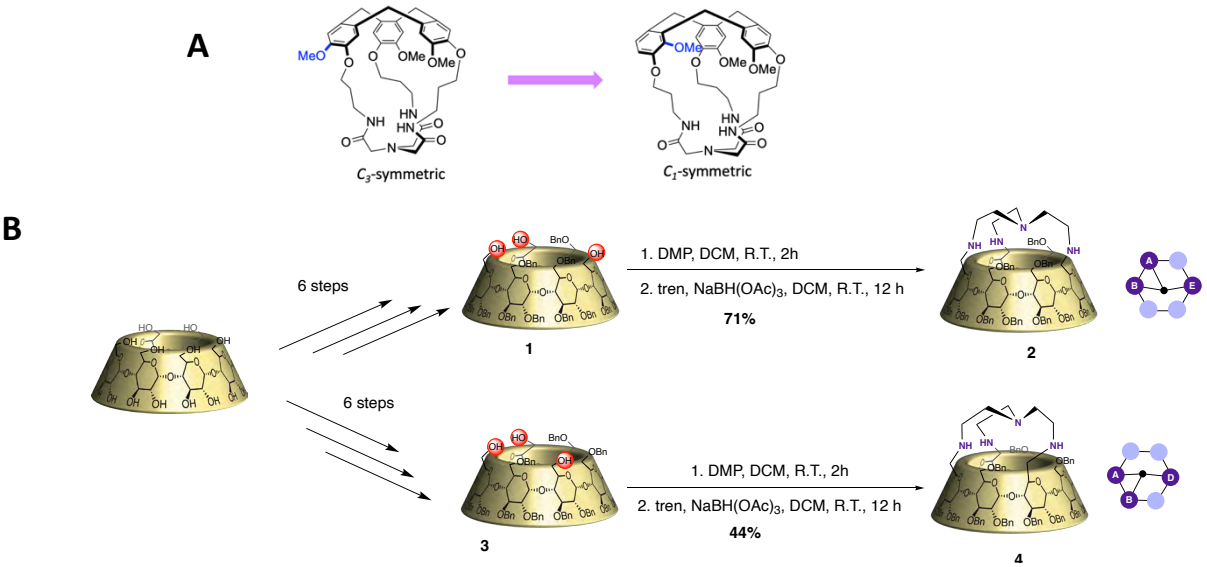


Figure 5. **A** : structures of the hemicryptophane hosts with different symmetry; **B :** synthetic pathways leading to regioisomeric compounds

[1] P. F. Mugford, U. G. Wagner, Y. Jiang, K. Faber, R. J. Kazlauskas, *Angew. Chemie. Int. Ed.* **2008**, 47, 8782-8793.
[2] G. Crini, *Chem. Rev.* **2014**, *114*, 10940-10975
[3] Gutsche. Calixarenes – An Introduction, The Royal Society of Chemistry, **2008**.
[4] J.-F. Chen, J.-D.Ding, T.-B. Wei, *Chem. Commun*., **2021**,*57*, 9029-9039.
[5] A.-D. Manick, C. Li, El. Antonetti, M. Albalat, Y. Cotelle, P. Nava, J.-P. Dutasta, B. Chatelet, A. Martinez *Chem. Eur. J.* **2022**, *29*, e202203212.

P B078

Hypervalent Iodanes-based Strategy for Atroposelective C-N Cross-Coupling

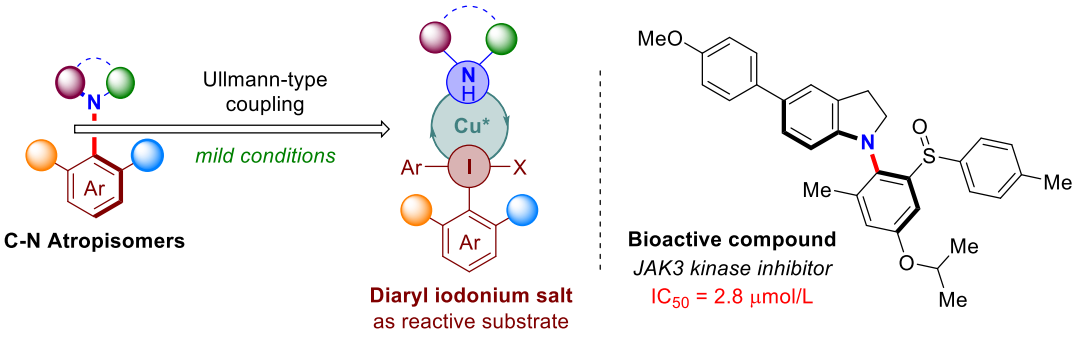
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Atropisomerism represents an important subclass of axially chiral compounds. This type of chirality arises from restricted rotation around a single bond (*e.g.* BINAP ligands). While the synthesis and use of biaryls with a fixed C(sp2)-C(sp2) bond have been widely developed in the past decades, their analogues including at least one heteroatom are less studied. However, C-N bonds in particular are privileged scaffolds in many bioactive molecules.[1]

Among the strategies developed to access such compounds, the direct formation of the axial C-N bond is the most interesting from a retrosynthetic point of view. However, few examples are found in the literature, due to the dilemma between the need for sufficient hindrance of the product to ensure atropostability and the energy required to couple encumbered substrates.

To overcome this challenge, innovative catalytic systems have recently emerged. The design of chiral organic catalysts or specific chiral ligands[2] could efficiently support bulky coupling reactions under mild conditions. On the other hand, our group has developed unprecedented methodology for copper-catalyzed atropodia- and enantioselective Ullmann-type cross-couplings, using diaryl iodonium salts as highly reactive substrates at low temperatures.[3]

Thereafter, it will be interesting to extend the scope of this strategy, in particular by accessing more general conditions that would allow the use of simple and accessible aryl halides.



[1] Basilaia M.; Chen M. H.; Secka J.; Gustafson J. L. Atropisomerism in the Pharmaceutically Relevant Realm. *Acc. Chem. Res.* **2022**, *55*, 2904−2919. DOI: 10.1021/acs.accounts.2c00500

[2] (a) Sun: Wang T.; An S.; Sun J. Organocatalytic Atroposelective C-H Amination of Arenes with Indolines. *Eur. J. Org. Chem.* **2025**, *28*, e202401070. DOI: 10.1002/ejoc.202401070. (b) Thönnißen, V.; Westphäling, J.; Atodiresei, I. L.; Patureau, F. W. Atroposelective Chan-Evans-Lam Amination. *Chem. Eur. J.* **2024**, *30*, e202304378. DOI: 10.1002/chem.202304378

[3] (a) Rae, J.; Frey J.; Jerhaousi S.; Choppin S.; Wencel-Delord J.; Colobert F. Synthesis of Axially Chiral C−N Scaffolds via Asymmetric Coupling with Enantiopure Sulfinyl Iodanes. *ACS Catal.* **2018**, *8*, *4*, 2805–2809. DOI: 10.1021/acscatal.7b04343. (b) Frey, J.; Malekafzali, A.; Delso, I.; Choppin, S.; Colobert, F.; Wencel-Delord, J. Enantioselective Synthesis of N–C Axially Chiral Compounds by Cu-Catalyzed Atroposelective Aryl Amination. *Angew. Chem. Int. Ed.* **2020**, *59*, 8844-8848. DOI: 10.1002/anie.201914876

P B079

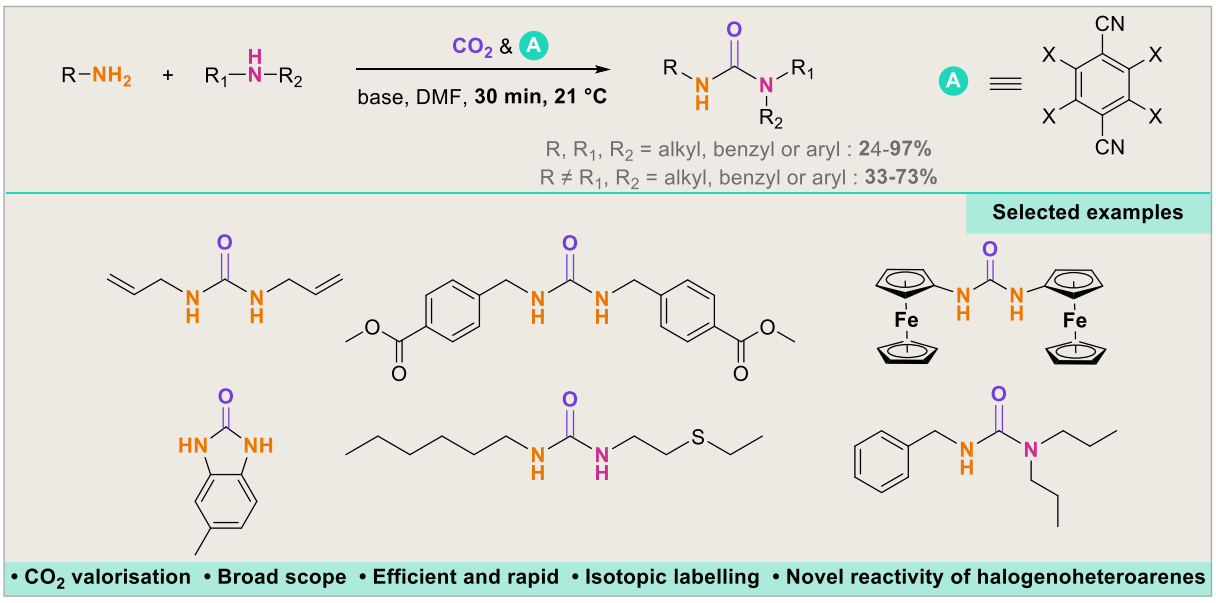
Ureas Synthesis from CO_2 Mediated by Electron-Deficient Halogenoarenes

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Given their broad applications, spanning from agrochemicals to pharmaceuticals, the development of sustainable, efficient, and cost-effective methodologies for urea synthesis is of paramount importance. During the past few years, several innovative synthetic approaches of ureas using catalysts,[1] ionic liquids,[1] Mitsunobu[2] and Aza-Wittig conditions[3] have been developed. However these methods operate under elevated pressures/temperatures or required the synthesis of precursors. By contrast, this presentation will outline an efficient, rapid, and broadly applicable method for the synthesis of ureas. This operationally simple and robust approach proceeds efficiently at room temperature, affording various type of ureas in good to excellent yields by employing CO_2 as a carbonyl source and electron-deficient halogenoarenes as coupling agents. The protocol features a broad substrate scope, enabling the synthesis of both symmetrical and asymmetrical ureas in good to very high yields within remarkably short reaction times (less than 30 min). Furthermore, the methodology has been successfully adapted for the incorporation of the stable carbon isotope ^{13}C, and, owing to its short reaction time and the relatively low CO_2 equivalents required, it holds strong potential for the preparation of ^{14}C- and ^{11}C-labeled ureas. This method, unveiling a novel reactivity of heterohalogenoarenes, addresses key industrial challenges in urea synthesis, while also providing a direct route to labeled ureas of interest.



[1] Wang, H.; Xin, Z.; Li, Y. Synthesis of Ureas from CO_2. *Top. Curr. Chem. (Z)* **2017**, *375* (2), 49. https://doi.org/10.1007/s41061-017-0137-4.

[2] Haji Dheere, A. K.; Yusuf, N.; Gee, A. Rapid and Efficient Synthesis of [^{11}C]Ureas via the Incorporation of [^{11}C]CO_2 into Aliphatic and Aromatic Amines. *Chem. Commun.* **2013**, *49* (74), 8193. https://doi.org/10.1039/c3cc44046j.

[3] Del Vecchio, A.; Caillé, F.; Chevalier, A.; Loreau, O.; Horkka, K.; Halldin, C.; Schou, M.; Camus, N.; Kessler, P.; Kuhnast, B.; Taran, F.; Audisio, D. Late-Stage Isotopic Carbon Labeling of Pharmaceutically Relevant Cyclic Ureas Directly from CO_2. *Angew Chem Int Ed* **2018**, *57* (31), 9744–9748. https://doi.org/10.1002/anie.201804838.

P B080

Selective Pd-catalyzed C(sp^3)–H functionalization of 2-aminocyclobutane-1-carboxylic acids (ACBCs)

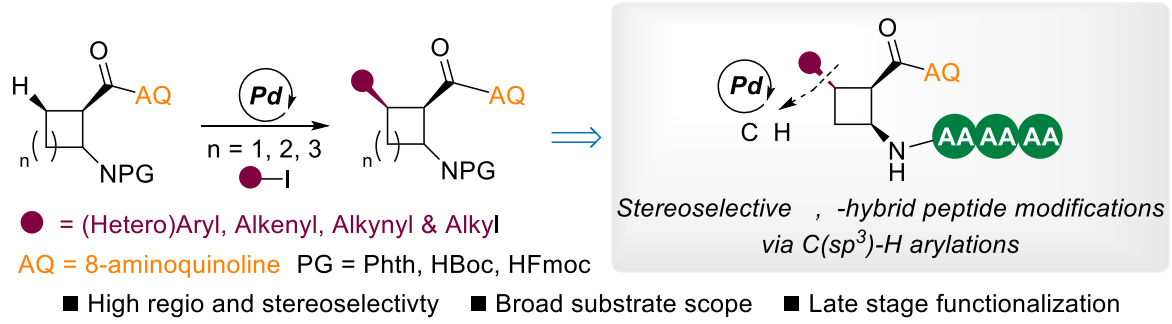
Vincent Oreve,[1] Imane Traboulsi,[1] Louise Ruyet,[2] David J. Aitken,[2] Yvan Ramondenc,[1] Thomas Boddaert,[2] Cédric Schneider[1]

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In the area of foldamer science, enantiopure *cis*- and *trans*-cyclobutane β-amino acid (ACBC)[1] derivatives are building blocks particularly attractive as monomer units for the preparation of peptidomimetic architectures due to their resistance to proteolysis and displaying structural mimicry.[2,3]Although there is an increasing demand for their synthetic access, developing an efficient, selective, and step and atom economical approach to functionalize their peripheral sites remains challenging.[4] In particular, the selective Pd-catalyzed auxiliary-directed C(sp^3)-H functionalization to derivatize amino acids (AAs) side-chains has emerged as an efficient and straightforward method of extending the range of non-proteinogenic AAs available for increasing the structural diversity of the peptides.[5] Surprisingly, β-AAs have received very scant attention,[6] and as far as we know, no example of Pd-catalyzed C(sp^3)–H functionalization of exocyclic β-AAs has been reported. Herein, I will present you our recent research and development on the **regio- and stereoselective Pd-catalyzed *syn* vicinal direct C(sp^3)-H functionalization of *cis*- and *trans*-ACBCs**. A large scope of substituted ACBCs (arylated, alkynylated, alkenylated and alkylated) at the peripheral C_4 position will be presented. The extension of our methodology to other **exocyclic β-AA derivatives** (ACPC (n = 2) & ACHC (n = 3)) as well as **the late-stage C(sp^3)-H functionalization of hybrid peptides** containing ACBCs will also be discussed.



[1] (a) V. Declerck, D. J. Aitken *Amino Acids* **2011**, *41*, 587. (b) M. Martin-Vila, C. Minguillon, R. M. Ortuño, *Tetrahedron: Asymmetry* **1998**, *9*, 4291.

[2] (a) F. Fülöp, T. A. Martinek, G. K. Toth *Chem. Soc. Rev.* **2006**, *35*, 323. (b) P. G. Vasudev, S. Chatterjee, N. Shamala, P. Balaram *Chem. Rev.* **2011**, *111,* 657.

[3] C. Cabrele, T. A. Martinek, O. Reiser, L. Berlicki *J. Med. Chem.* **2014**, *57*, 9718.

[4] (a) Z. Chang, F. Boyaud, R. Guillot, T. Boddaert, D. J. Aitken *J. Org. Chem.* **2018**, *83*, 527. (b) Z. Chang, R. Guillot, T. Boddaert, D. J. Aitken *J. Org. Chem.* **2019**, *84*, 10518.

[5] A. F. Noisier, M. A. Brimble *Chem. Rev*. **2014**, *114*, 8775.

[6] (a) D. Antermite, D. P. Affron, J. A. Bull *Org. Lett*. **2018**, *20*, 3948. (b) S. Chowhurry, R. Vaishnav, N. Panwar, W. Haq *J. Org. Chem*. **2019**, *84*, 2512. (c) Z. Wang, Y. Fu, H. Liu, J. Wang *J. Org. Chem.* **2020**, *85,* 7683.

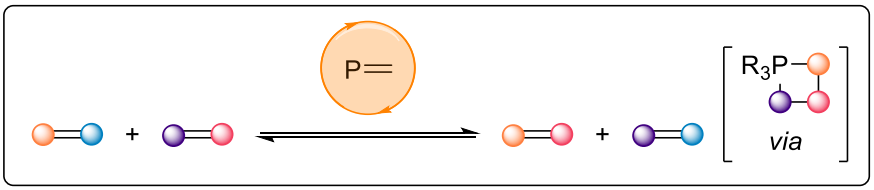
P B081

Towards metal-free olefin metathesis through phosphorus ylide-mediated alkylidene exchange

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Olefin metathesis is a pivotal reaction in organic chemistry, allowing the creation of carbon-carbon bonds *via* an alkylidene exchange.[1] Despite the great popularity of this reaction, the use of transition metal-based catalysts remains a concern due to their cost, their limited robustness[2] or the difficulty to purify metal residues in final products.[3] To overcome these challenges, some methods of metal-free olefin metathesis have been reported in the literature in the last decades; however, they are limited in substrate scope or applications.[4-8] Therefore, a general alternative to transition metal carbene complexes would be desirable.

We were then interested in the development of a metal-free olefin metathesis alternative using phosphorus ylides as alkylidene donors. It appeared that this concept was already validated, although barely, using two stabilized phosphorus ylides and two electron-poor olefins.[9,10] Our work focused in extending the scope of this almost untouched reaction.



[1] Grubbs, R. H.; Wenzel, A. G.; O'Leary, D. J.; Khosravi, E. *Handbook of Metathesis*, 2nd ed.; Wiley, 2015. DOI: https://doi.org/10.1002/9783527674107. [2] Jawiczuk, M.; Marczyk, A.; Trzaskowski, B. Decomposition of Ruthenium Olefin Metathesis Catalyst. *Catalysts* **2020**, *10*, 887. DOI: https://doi.org/10.3390/catal10080887. [3] Vougioukalakis, G. C. Removing Ruthenium Residues from Olefin Metathesis Reaction Products. *Chem. Eur. J.* **2012**, *18*, 8868–8880. DOI: https://doi.org/10.1002/chem.201200600. (4) Miura, T.; Kim, S.; Kitano, Y.; Tada, M.; Chiba, K. Electrochemical Enol Ether/Olefin Cross-Metathesis in a Lithium Perchlorate/Nitromethane Electrolyte Solution. *Angew. Chem. Int. Ed.* **2006**, *45*, 1461–1463. DOI: https://doi.org/10.1002/anie.200503656. (5) Maeta, N.; Kamiya, H.; Okada, Y. Probing Intramolecular Electron Transfer in Redox Tag Processes. *Org. Lett.* **2019**, *21*, 8519–8522. DOI: https://doi.org/10.1021/acs.orglett.9b02808. (6) Lu, P.; Kensy, V. K.; Tritt, R. L.; Seidenkranz, D. T.; Boydston, A. J. Metal-Free Ring-Opening Metathesis Polymerization: From Concept to Creation. *Acc. Chem. Res.* **2020**, *53*, 2325–2335. DOI: https://doi.org/10.1021/acs.accounts.0c00427. (7) Quach, P. K.; Hsu, J. H.; Keresztes, I.; Fors, B. P.; Lambert, T. H. Metal-Free Ring-Opening Metathesis Polymerization with Hydrazonium Initiators. *Angew Chem Int Ed* **2022**, *61*, e202203344. DOI: https://doi.org/10.1002/anie.202203344. (8) Wang, S.; Feng, H.; Li, B.; Lim, J. Y. C.; Rusli, W.; Zhu, J.; Hadjichristidis, N.; Li, Z. Knoevenagel C═C Metathesis Enabled Glassy Vitrimers with High Rigidity, Roughness, and Malleability. *J. Am. Chem. Soc.* **2024**, *146*, 16112-16118. DOI: https://doi.org/10.1021/jacs.4c03503. (9) McClure, J. D. Phosphacyclobutane as a Possible Intermediate in the Reaction of Carbethoxymethylenetriphenylphosphorane with Acrylonitrile. *Tetrahedron Letters* **1967**, *8*, 2407–2410. DOI: https://doi.org/10.1016/S0040-4039(00)71616-9. (10) Klabunde, U.; Tebbe, F. N.; Parshall, G. W.; Harlow, R. L. Methylene Exchange Reactions Catalyzed by Alkylidene Derivatives of Titanium and Phosphorus. *J. Mol. Catal.* **1980**, *8*, 37–51. DOI: https://doi.org/10.1016/0304-5102(80)87004-0.

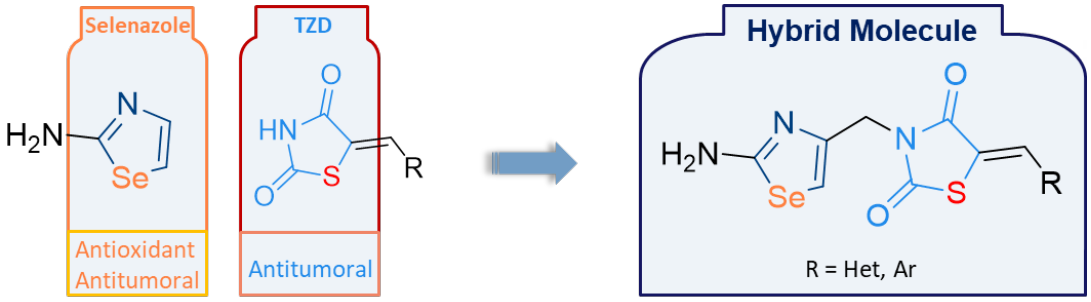
P B082

Design of Selenium-Containing Hybrid Molecules as Promising Therapeutics Against Leishmaniasis

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Leishmaniasis is a poorly controlled disease recognized as one of the six priorities in its Tropical Diseases Research program by WHO. Current treatments suffer from high cost, inconvenient administration, resistance, and severe side effects,[1] highlighting the need for safer and more effective drugs. Notably, molecules with anticancer activity and their derivatives have attracted interest as antiprotozoal agents. Parasites and cancer cells share diverse biochemical pathways,[2] supporting the repurposing of anticancer scaffolds for parasitic infections. Recently, hybrid molecules that integrate multiple pharmacophores into a single scaffold have gained attention,[3] with thiazole and thiazolidinedione (TZD) scaffolds standing out for their broad biological activities.[4]

Our group has previously synthesized TZD derivatives with antileishmanial and anti-breast tumor activities.[5] Recent studies further indicate that elevated plasma selenium may protect against *Leishmania*,[6] stimulating interest in selenium-containing compounds such as selenazolidine-2,4-dione and selenazole derivatives. Building on these insights, this study seeks to develop selenium-based hybrids that integrate bioactive scaffolds. Comparative structure–activity relationship analyses between selenium- and sulfur-containing analogues will guide the optimization of these molecules for antileishmanial and anti-breast cancer applications.



[1] Roatt, B.M.; de Oliveira Cardoso, J.M.; De Brito, R.C.F. *et al.* Recent advances and new strategies on leishmaniasis treatment. *Appl Microbiol Biotechnol* **2020**, *104*, 8965–8977.

[2] Fuertes, M.A.; Nguewa, P.A.; Castilla, J. *et al.* Anticancer Compounds as Leishmanicidal Drugs: Challenges in Chemotherapy and Future Perspectives. *Curr. Med. Chem* **2008**, *15*, 433–439.

[3] Shaveta; Mishra, S.; Singh, P. Hybrid molecules: the privileged scaffolds for various pharmaceuticals. *Eur. J. Med. Chem* **2016**, *124*, 500–536.

[4] Naim, M.J.; Alam, M.J.; Ahmad, S. *et al*. Therapeutic journey of 2, 4-thiazolidinediones as a versatile scaffold: An insight into structure activity relationship. *Eur. J. Med. Chem* **2017**, *129*, 218–250.

[5] Sinicropi, M.S.; Ceramella, J.; Vanelle, P. *et al.* Novel thiazolidine-2,4-dione-trimethoxybenzene-thiazole hybrids as human topoisomerases inhibitors. *Pharmaceuticals* **2023**, *16*, 946.

[6] Culha, G.; Yalin, A.E.; Sanguen, K. Alterations in serum levels of trace elements in Cutaneous leishmaniasis patients in endemic region of Hatay (Antioch). *Asian J. Chem* **2008**, *20*, 3104–3108.

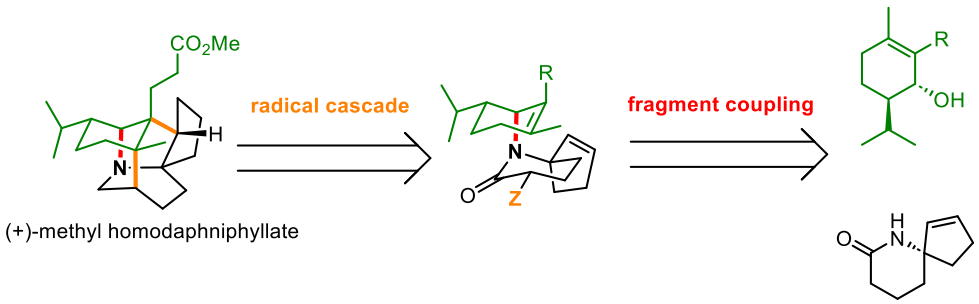
P B083

Toward a Total Synthesis of *Daphniphyllum* Alkaloids: A unified fragment-based approach

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The large and complex family of *Daphniphyllum* alkaloids (more than 300 compounds) is now a classic target for synthetic chemists. These natural products have shown activities against cancer, HIV and other diseases. [1] Their high skeleton complexity and diversity result from the divergence in their biosynthetic pathway. In 1986, Heathcock and coworkers achieved a pioneer total synthesis based on a biomimetic approach,[2] and then more than 40 total syntheses have been done by many synthetic groups using different strategies.

In our project, we wish to develop a unified fragment-based synthetic strategy compatible with a third of the *Daphniphyllum* alkaloid structures, using a radical cyclization key step respecting atom and step economy. [3] To do so, a common fragment from the pool chiral will be associated with an aza fragment, which is specific to the subfamily targeted, followed by a radical cascade that will allow to reach the complexity. [4] We first synthetized the common fragment. In addition, we designed a model fragment to test the radical cascade, and we are currently searching for conditions to get the desired skeletons. Our progress toward the synthesis of the common fragment and the models will be discussed in this presentation, as well as the study of the radical cascade reactions.



(+)-methyl homodaphniphyllate

[1] Chattopadhyay A. K.; Hannessian S.; Recent Progress in the Chemistry of *Daphniphyllum* Alkaloids. *Chemical Reviews* **2017**, *117*, 4104−4146; Zhong J.; Wang H.; Zhang Q.; Gao S.; Chapter Two - The chemistry of *Daphniphyllum* alkaloids. *The Alkaloids* **2021**, *85*, 113-176.
[2] Heathcock C. H.; Davidsen S. K.; Mills S.; Sanner M. A.; Total Synthesis of (+)-Methyl Homodaphniphyllate. *Journal of the American Chemical Society* **1986**, *108*, 5650-5651.
[3] Tomanik M.; Hsu I. T.; Herzon S. B.; Fragment Coupling Reactions in Total Synthesis That Form Carbon–Carbon Bonds via Carbanionic or Free Radical Intermediates. *Angewandte. Chemie International Edition* **2021**, *60*, 1116–1150.
[4] Nicolaou K. C.; Edmonds D. J.; Bulger P. G.; Cascade Reactions in Total Synthesis. *Angewandte. Chemie. International Edition* **2006**, *45*, 7134 –7186; Hung K.; Hu X.; Maimone T. J.; Total synthesis of complex terpenoids employing radical cascade processes. *Natural Product Reports* **2018**, *35*, 174-202.

P B084

Metallomimetism with Simple Phosphines: C–F Bond Activation and Beyond

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Metallomimetic main group reactivity has gained major interest as a sustainable alternative to scarce and toxic precious metals.[1] Its appeal lies in the ability of main group elements to undergo reversible two-electron redox events such as oxidative addition (OA) and reductive elimination (RE). Yet, efficient redox cycling remains rare, since the stability gaps between accessible oxidation states often favor rapid OA or RE while hindering the reverse step, limiting catalytic turnover. Within this context, pnictogens (Pn) emerge as privileged candidates: they access stable species in multiple oxidation states, and their reactivity can be tuned by enforcing planar geometries that alter frontier orbital energies. Such design principles have enabled Pn-based systems to mediate hydrodefluorination (HDF) catalysis.[2] Crucially, OA, transmetallation (TM), and RE—all fundamental steps of transition-metal catalysis—have now been evidenced with main group centers. Here, we present a simple catalytic platform using commercially available alkyl phosphines and silanes that promotes HDF across a broad range of perfluoroarenes, demonstrating that constrained geometries are not always necessary to access metallomimetic chemistry (Figure 1).[3] We will also discuss preliminary evidence that P(V) species may undergo α-H abstraction to form ylides, paralleling early transition-metal alkyl chemistry that led to the discovery of Schrock's carbenes.[4]

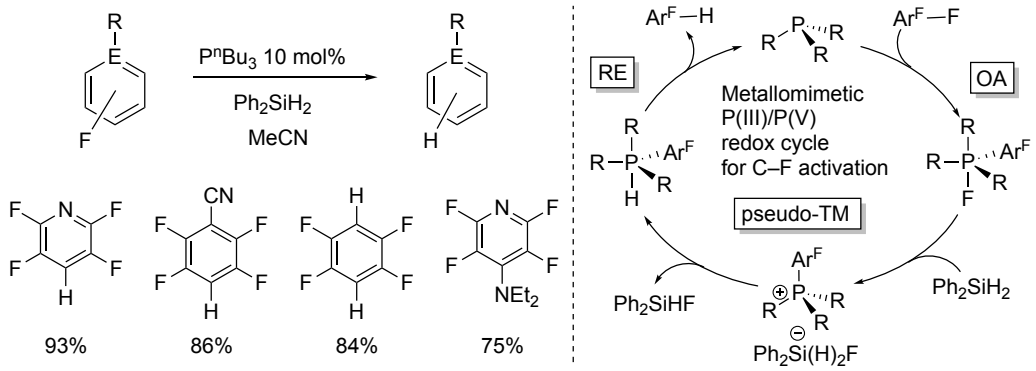


Figure 1 *Catalytic HDF by redox-cycling of simple & cheap phosphines.*

[1] Power, P. P. *Nature* **2010**, *463*, 171–177.
[2] (a) Lim, S.; Radosevich, A. T. *J. Am. Chem. Soc.* **2020**, *142*, 16188–16193. (b) Pang, Y.; Leutzsch, M.; Nöthling, N.; Katzenburg, F.; Cornella, J. *J. Am. Chem. Soc.* **2021**, *143*, 12487–12493. (c) Chulsky, K.; Malahov, I.; Bawari, D.; Dobrovetsky, R. *J. Am. Chem. Soc.* **2023**, *145*, 3786–3794.
[3] Bonfante, S.; Lorber, C.; Lynam, J. M.; Simonneau, A.; Slattery, J. M. *J. Am. Chem. Soc.* **2024**, *146*, 2005–2014.
[4] Schrock, R. R. *J. Am. Chem. Soc.* **1974**, *96*, 6796–6797.

P B085

A convenient methodology for the hydrophosphorylation of exo-glycals via EDA complex

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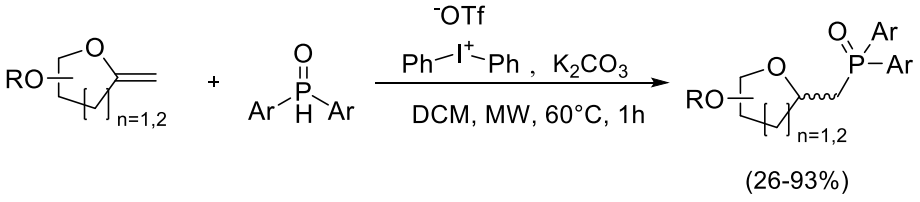
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C-glycosides are a class of compounds constituted of a carbohydrate unit linked to an aglycon through a C-C linkage. They constitute powerful mimics of *O*-glycosides and so numerous examples of successful *C*-glycosides as therapeutic agents appeared, confirming the importance of their development.[1] One efficient way to access *C*-glycosides is by reduction of a C-glycosylidene, often known as *exo-glycal* and multiple methods were developed to functionalize glycals[2], one of them being by forming a radical glycosyl species[3].
This work reports a simple and original method for the direct hydrophosphorylation of *exo*-glycals as a way to synthesize *C*-glycosides. The reaction takes advantage of easily created P-centered radicals, obtained in presence of diphenyliodonium salt and potassium carbonate from secondary phosphine oxides[4]. These radicals are added onto a range of glycals in moderate to excellent isolated yields. The method presents mild conditions, broad substrate scope on both partners and good functional group tolerance. The mechanism of the reaction was determined and turned out to be catalytic, as another benefit of this reaction. Regiochemistry and stereochemistry are well to fully controlled in this reaction.

Stereochemistry of the products was fully determined through NMR studies and XRD. One product was successfully deprotected and submitted to biological tests and was shown to display small but selective inhibitory activity towards β-galactosidase.



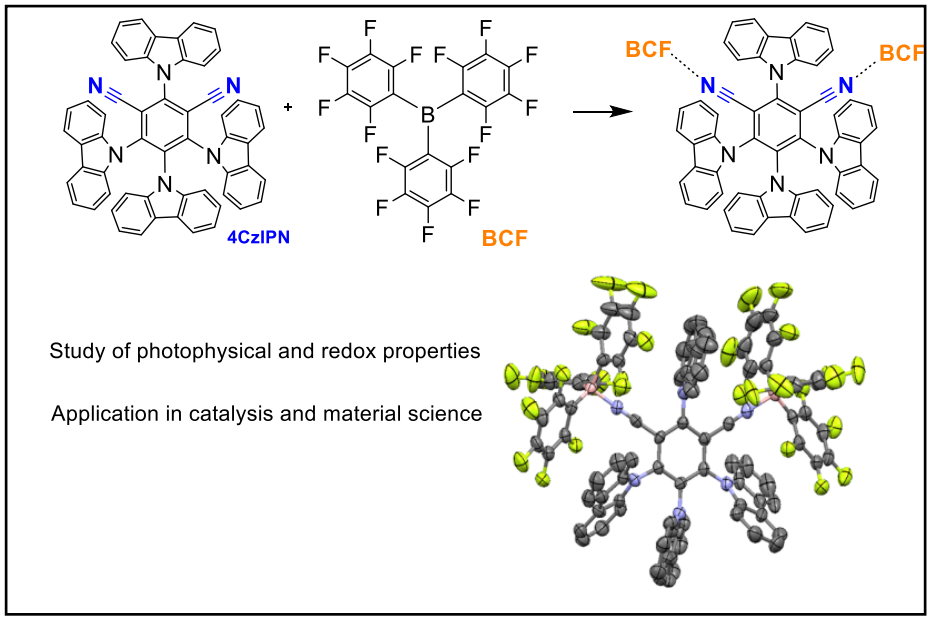
[1] Levy, D. E.; Tang, C. *The Chemistry of C-Glycosides*, 1. ed.; Tetrahedron Organic chemistry series; Pergamon: Oxford, 1995.
[2] Taillefumier, C.; Chapleur, Y. Synthesis and Uses of *Exo* -Glycals. *Chem. Rev.* **2004**, *104* (1), 263–292.
[3] Herpin, T. F.; Motherwell, W. B.; Roberts, B. P.; Roland, S.; Weibel., J.-M. Free Radical Chain Reactions for the Preparation of Novel Anomeric Carbohydrate Difluoromethylene -Phosphonates and -Phosphonothioates. *Tetrahedron* **1997**, *53* (44), 15085–15100.
[4] Pal, S.; Gaumont, A.-C.; Lakhdar, S.; Gillaizeau, I. Diphenyliodonium Ion/Et_3 N Promoted Csp2-H Radical Phosphorylation of Enamides. *Org. Lett.* **2019**, *21* (14), 5621–5625.

P B086

How can Strong Lewis Acids affect the Photophysical Properties of Cyanoarene-Based Photocatalysts?

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1,2,3,5-Tetrakis(carbazol-9-yl)-4,6-dicyanobenzene (**4CzIPN**) is a benchmark organic photocatalyst widely applied in photoredox chemistry. While structural modifications have traditionally been employed to expand its redox window, our work demonstrates a distinct and powerful strategy: Lewis acid complexation. By binding 4CzIPN with tris(pentafluorophenyl)borane (**BCF**), we observed a significant modulation of its photophysical and electrochemical properties, including an expanded redox window and altered excited-state behaviour. These changes translate into a distinct catalytic reactivity profile, unlocking access to transformations that are otherwise challenging under standard 4CzIPN catalysis. Beyond synthetic applications, the tunability of this Lewis adduct also points to potential uses in material science, where controlled photophysical properties are highly desirable. This study thus highlights Lewis acid coordination as a simple yet powerful tool to tailor photocatalysts for advanced applications.



P B087

Radical Photochemical Difluorosulfoximination of Alkenes and Propellanes

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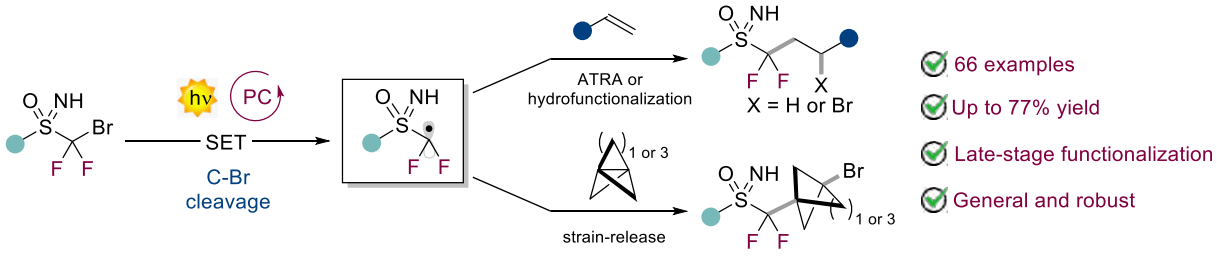
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Sulfoximines are promising moieties for their bioisosteric replacement of sulfones.[1] Theses compounds possess interesting properties such as high chemical stability, increased solubility in water and multiple hydrogen bond donor/acceptor sites. Further, the N-atom adds value to the structure from a sulfone by adding intrinsic chirality and the possibility to explore the 3D-chemical space with exit vectors. On the other hand, the unique effect of the fluorine atom on physical and biological properties of chemicals, organofluorine chemistry holds a central role in various areas, with many applications in materials, agrochemical, and medicinal chemistry. Especially in medicinal sciences, the fluorine atom shown in many cases, an increasing bioavailability with respect to their original non fluorinated versions.[2] We thus may hypothesize that S-perfluoroalkylated sulfoximines would have a dual advantage in terms of properties. However, the installation of the sulfoximine unit into a substrate in one pot is quite challenging and not very explored in literature.

Here, we report for the first time, a new method of sulfoximination by C-C bond of olefins and propellanes enabled by a metal-free photocatalysts. The process is general, robust and tolerates diverse functional groups, including esters, ketones, double bond, silyl groups and boronic esters. The rationalization of divergent reaction mechanism performing Stern-Volmer quenching and EPR experiments revealed the key activity of a difluoroalkyl sulfoximine radical.



Scheme 1. *Light-driven difluorosulfoximination of alkenes and propellanes*

[1] Baldon, S.; Paut, J.; Anselmi, E.; Dagousset, G.; Tuccio, B.; Pelosi, G.; Cuadros, S.; Magnier, E.; Dell'Amico, L. Radical Photochemical Difluorosulfoximination of Alkenes and Propellanes. *Chem. Sci.* **2025**, *16* (16), 6957–6964. https://doi.org/10.1039/D5SC01068C.

P B088

Formation of TSB Honeycomb Networks on Graphene For Application in Supported Asymmetric Catalysis

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Heterogeneous catalysis has remained an under developed field in organic chemistry, particularly in its asymmetric version. Nevertheless, it stands as a powerful tool, enabling the easy recyclability of the catalysts. However, ensuring optimal efficacy and cooperativity in such system remains a challenge in modern chemistry. The objective of this work is to develop a new heterogeneous catalytic system for the asymmetric hydrolysis of small meso epoxides using salen complexes. As shown in various studies, the cooperativity between two salen units enhances the enantioselectivity of the reaction and reduces the reaction time[1]. Our aim here is to replicate this cooperativity using salen complexes deposited onto an organized surface. To achieve this, we propose to take advantage of the ability of the 3,5-TSB (tri-(*E*)-styrylbenzene) to self-assemble onto graphene, creating a 2D monolayer as a honeycomb-like molecular sieve[2]. The pores formed in this system can host polyaromatic molecules[3], therefore, we intend to non-covalently deposit pyrene tagged catalysts[4] inside the pores. We will thus control the spacing between the catalysts as shown in figure 1, ensuring a good cooperativity between the active moieties.

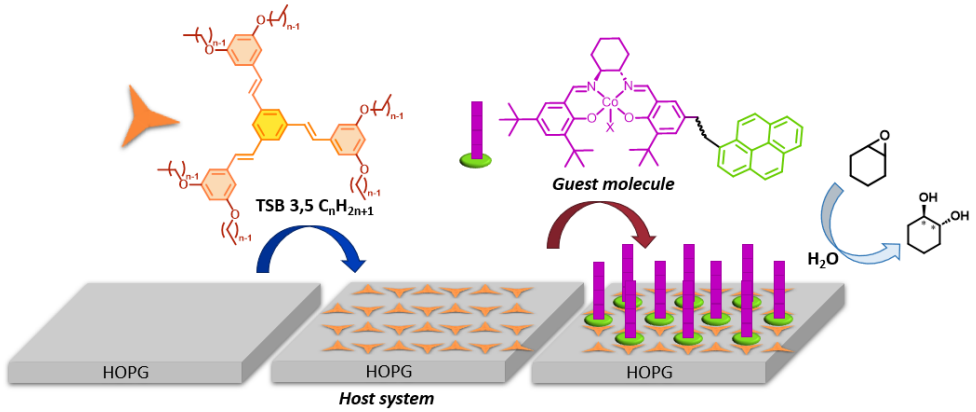


***Figure 1**. Hosting of pyrene-tagged Co-salen catalyst into the pores of the honeycomb system formed by the self assembly of TSB on graphene*

[1] Ready, J. M.; Jacobsen, E. N. 2001 Jacobsen Highly Active Oligomeric (Salen)Co Catalysts for Asymmetric Epoxide Ring-Opening Reactions. *J. Am. Chem. Soc.* **2001**, *123* (11), 2687–2688. https://doi.org/10.1021/ja005867b.
[2] Bléger, D.; Kreher, D.; Mathevet, F.; Attias, A.-J.; Schull, G.; Huard, A.; Douillard, L.; Fiorini-Debuischert, C.; Charra, F. Surface Noncovalent Bonding for Rational Design of Hierarchical Molecular Self-Assemblies. *Angew. Chem. Int. Ed.* **2007**, *46* (39), 7404–7407. https://doi.org/10.1002/anie.200702376.
[3] Schull, G.; Douillard, L.; Fiorini-Debuisschert, C.; Charra, F.; Mathevet, F.; Kreher, D.; Attias, A.-J. Selectivity of Single-Molecule Dynamics in 2D Molecular Sieves. *Adv. Mater.* **2006**, *18* (22), 2954–2957. https://doi.org/10.1002/adma.200600683.
[4] Abd El Sater, M.; Mellah, M.; Dragoe, D.; Kolodziej, E.; Jaber, N.; Schulz, E. Chiral Chromium Salen@rGO as Multipurpose and Recyclable Heterogeneous Catalyst. *Chem. – Eur. J.* **2021**, *27* (36), 9454–9460. https://doi.org/10.1002/chem.202101003.

P B089

Graphitic Carbon Nitride as a Heterogeneous Photocatalyst for the Decarboxylative C(sp^2)–C(sp^3) Coupling via Nickel Catalysis

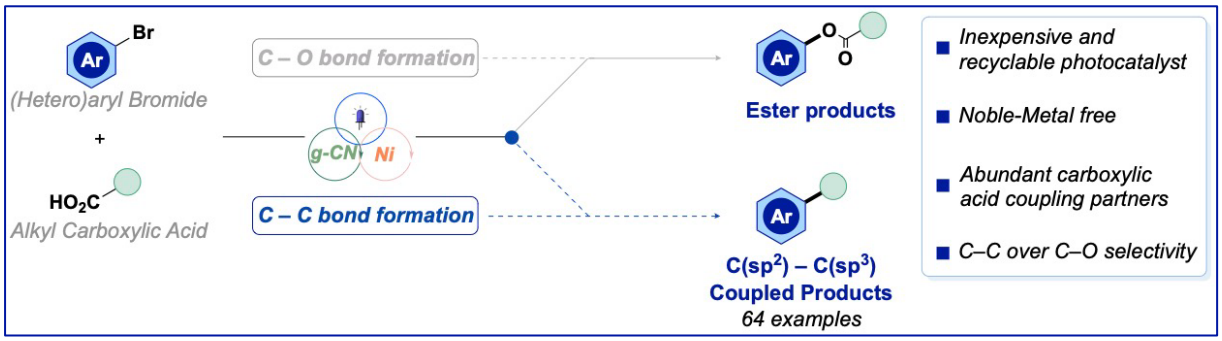
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Photoredox catalysis has become a crucial tool in organic synthesis, enabling selective transformations under mild conditions using visible light. While initially driven by noble transition metal complexes (*e.g.*, ruthenium, iridium), concerns about their cost have increasingly motivated the search for more suitable alternatives. Heterogeneous photocatalysts offer compelling advantages, including low cost, recyclability, and robustness, making them promising candidates for diverse photochemical transformations[1,2].

Although photoredox catalysis has demonstrated its utility in forming C(sp^3)–C(sp^3) bonds, the development of comparable methods for constructing C(sp^2)–C(sp^3) bonds remains largely unexplored, particularly for the expansion of structurally diverse scaffolds in drug discovery and development. While significant advances towards this goal have been achieved, this work presents the use of a commercially available heterogeneous semiconductor, graphitic carbon nitride (gCN), as photocatalyst, combined with nickel catalysis, for the cross-coupling between aryl halide and carboxylic acid coupling partners[3]. gCN has been shown to engage in single-electron-transfer (SET) and energy-transfer (EnT) processes for the formation of C–R bonds (R = C, O, N, S)[4]. The present study overcomes previous limitations to furnish C–C over C–O bonds using carboxylic acids as starting material. This methodology was applied to a broad scope of both aryl halides and carboxylic acids while also demonstrating the recyclability of the heterogeneous photocatalyst.



[1] A. Savateev, I. Ghosh, B. König, M. Antonietti; *Angew. Chem. Int. Ed.*, **2018**, *57*, 15936 – 15947.
[2] S. Gisbertz, B. Pieber; *ChemPhotoChem*, **2020**, *4*, 456 – 475.
[3] F. Lukas, M. T. Findlay, M. Fillols, J. Templ, E. Savino, B. Martin, S. Allmendinger, M. Furegati, T. Noël; *Angew. Chem. Int. Ed.*, **2024**, *63*, e202405902.
[4] O. Savateev, J. Zhuang; *ChemPhotoChem*, **2024**, *8*, e202300306.

P B090

N-heterocyclic Carbene (NHC) Catalyzed C-O Bond Formation Under "On-Water" Conditions

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Traditionally, organic solvents are the first choice as a reaction medium to carry out various organic transformations and further post-reaction purification operations. Even though being greener and sustainable in many aspects than organic solvents, water is generally deemed incompatible with organic reactions and avoided unless it does not interfere with the reaction and is required to dissolve certain reactants or catalysts. Chemists often hesitate to use water due to the poor solubility and moisture sensitivity of many organic compounds. This is particularly the case concerning *N*-heterocyclic Carbene (NHC) organocatalyzed processes. However, water is not often as unfriendly as it is portrayed, and even improves the reaction output in terms of kinetics and selectivity, as seen in many cases.[1] Organic reactions accelerated at the water-organic biphasic interphase or in the presence of water are one of the most fascinating yet less explored areas of synthetic organic chemistry. This distinctive influence of bulk water on enhanced reaction rate and yield is referred to as an "on-water" reaction.

Following previous work of the group on NHC organocatalyzed Stetter reaction in aqueous medium[2], we report (NHC) catalyzed oxidative esterification of aldehyde under "on-water" like reaction conditions. We demonstrate that the rate of reaction in the presence of bulk water is considerably higher than that of the reaction in traditional organic solvents. The reaction accelerates at the interface of the water-organic phase formed by poorly soluble organic compounds and NHC precursor emulsion in water. This study provides a foundation for future exploration of "on-water" type NHC-catalyzed more sustainable reactions.

[1] Narayan, S.; Muldoon, J.; Finn, M. G.; Fokin, V. V.; Kolb, H. C.; Sharpless, K. B. "On Water": Unique Reactivity of Organic Compounds in Aqueous Suspension. *Angew. Chem., Int. Ed.* **2005**, *44*, 3275−3279.

[2] Debiais, M.; Hamoud, A.; Drain, R.; Barthélémy, P.; Desvergnes, V. Bioinspired NHC-organocatalyzed Stetter reaction in aqueous conditions. *RSC Adv.* **2020**, *10*, 40709−40718.

P B091

Development of functionalized self-assembled cyclodextrins for anti-viral purposes

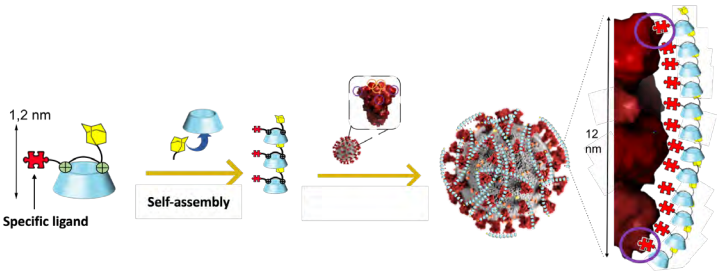
Marcel Annereau,[1] Mickaël Ménand,[1] Matthieu Sollogoub,[1] Anne-Geneviève Marcelin,[2] Vincent Calvez[2]

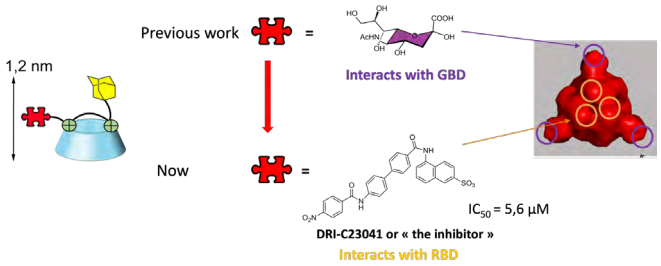
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In order to treat and prevent SARS-CoV-2 infection, several strategies have been developed in recent years, such as vaccination and antiviral drugs. Within the group, we have proposed an alternative strategy by developing cyclodextrin (CD)-based anti-adhesive agents. These modified CDs have an adamantane function on the primary ring that allows them to self-assemble through a hydrophobic effect and form fibers.[1] In this context, the general approach is to exploit the ability of functionalized CDs to self-assemble and form fibers by covering the virus after attaching to an anchor point, which in this case is the Spike protein. The spike protein is a trimeric protein responsible for the recognition and internalization of the virus by cells. It is composed of two binding domains, the receptor binding domain (RBD) and the glycan binding domain (GBD).[2] Previously, we synthesized a library of functionalized CDs targeting the GBD by placing sialic acid derivatives on the side chain, and biological studies were conducted, yielding very encouraging results that show antiviral activity. In this work, we proposed changing the anchoring function by replacing it with an inhibitor that will target the RDB.[3] In addition, a new family of difunctionalized CDs with two sialic acids was developed to increase antiviral activity.





[1] M. Sollogoub et al, *Angew. Chem. Int. Ed Engl.* **2018**, *57* (26), 7753–7758.

[2] Sun, *Glycobiol.*, **2021**, *31*, 1245 –1253

3 P. Buchwald et al. ACS Infect. Dis. 2021, 7, 1519−1534

P B092

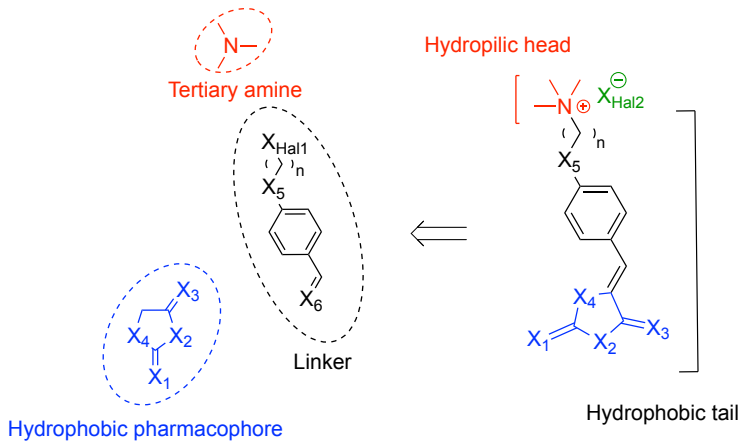
Dual functional cationic surfactants for biocidal water treatment processes

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The development of multifunctional surfactants represents a promising strategy for optimizing biocidal water treatment processes. In this work, we report the design and synthesis of novels amphiphilics molecules, combining a cationic trimethylalkylammonium(1) head with a hydrophobic heterocyclic unit linked by an alkyl chain, thereby inducing additional biological activity. This dual-functional architecture provides an innovative approach to limiting the proliferation of undesirable organisms in aquatic environments. Our findings demonstrate that the hybridization of cationic surfactants with heterocyclic motifs opens new avenues for the development of multifunctional agents in water treatment.



Scheme 1. *Retrosynthesis of a new serie of dual functional cationic surfactant*

[1] Lu, Z.; Mahony, A. K.; Arnold, W. A.; Marshall, C. W.; McNamara, P. J. *Quaternary Ammonia Compounds in Disinfectant Products: Evaluating the Potential for Promoting Antibiotic Resistance and Disrupting Wastewater Treatment Plant Performance*. *Environ. Sci.: Adv.* **2024**, *3*, 208–226.

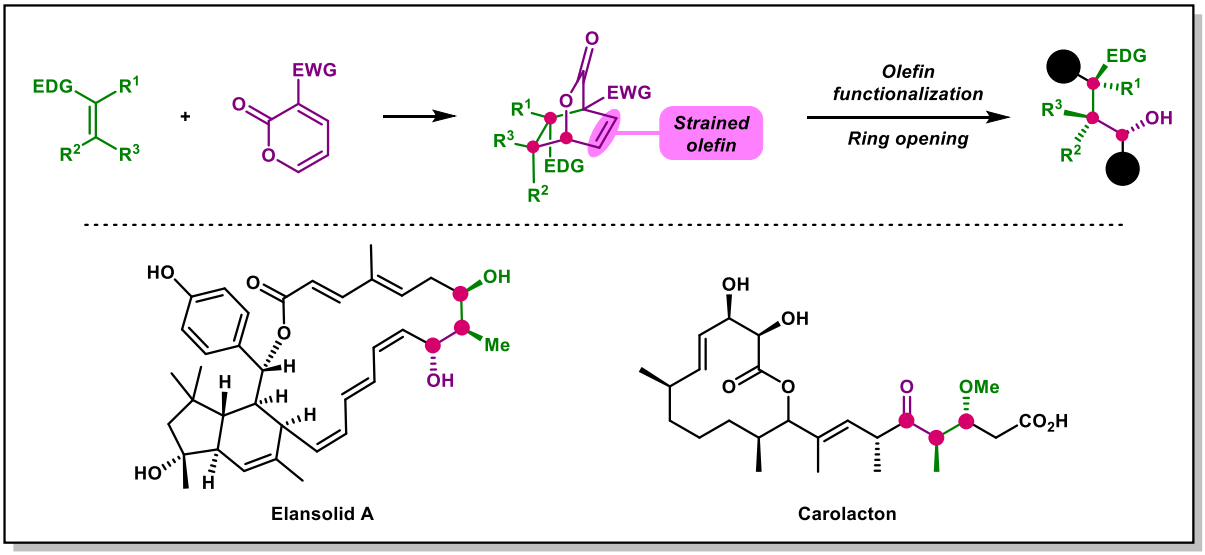
Conceptualization : R. Messedaa

P B093

Functionalization of strained olefins in bicyclic lactones

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Enantioselective synthesis of acyclic molecules remains a major challenge due to conformational flexibility, especially when building quaternary stereocenters. These motifs are key features in many natural products and pharmaceuticals, yet their controlled construction is still difficult.
Our approach uses Inverse Electron Demand Diels–Alder (IEDDA) reactions to generate bicyclic lactones[1] as versatile intermediates. While previous studies mainly exploited the lactone functionalization,[2-3] we focus on the underexplored strained alkene in the bicyclic scaffold. This reactivity opens new strategies for the stereocontrolled synthesis of complex acyclic targets, such as natural compounds including polypropionates units.[4]



[1] Huang, G.; Guillot, R.; Kouklovsky, C.; Maryasin, B.; de la Torre, A. *Diastereo- and Enantioselective Inverse-Electron-Demand Diels–Alder Cycloaddition between 2-Pyrones and Acyclic Enol Ethers. Angew. Chem. Int. Ed.* **2022**, *61* (42), e202208185.
[2] Jung, Y.-G.; Lee, S.-C.; Cho, H.-K.; Darvatkar, N. B.; Song, J.-Y.; Cho, C.-G. Total Syntheses of (±)-α-Lycorane and (±)-1-Deoxylycorine. Org. Lett. 2013, 15, 132–135.
[3] Wang, N.; Du, S.; Li, D.; Jiang, X. Divergent Asymmetric Total Synthesis of (+)-Vincadifformine, (-)-Quebrachamine, (+)-Aspidospermidine, (-)-Aspidospermine, (-)-Pyrifolidine, and Related Natural Products. *Org. Lett.* 2017, *19*, 3167–3170.
[4] Liu, Z.; Liu, H.; Zhang, W. *Natural Polypropionates in 1999–2020: An Overview of Chemical and Biological Diversity.* ***Mar. Drugs*** **2020**, *18* (11), 569.

P B094

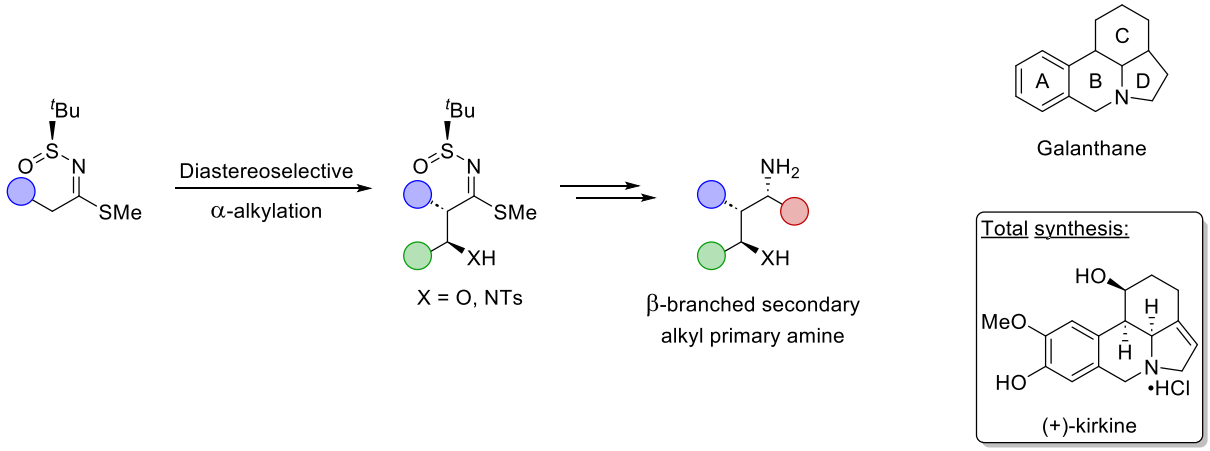
Thioimidates as new key intermediates: application to the total synthesis of (+)-kirkine

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Lycorine-type alkaloids, extracted from plants of the *Amaryllidaceae* family, are distinguished by their unique structures and significant biological activities.[1] Their low natural abundance, the scarcity of asymmetric syntheses, and the frequent structural misassignments of congeners[2] underscore the need for novel synthetic studies and approaches to this challenging class of natural products. In this context, our team has developed an unprecedented *N*-sulfinylthioimidate intermediate, which can undergo diastereoselective α-alkylation, thereby providing potential access to a wide range of β-branched secondary alkyl primary amines. This strategy enabled the first asymmetric total synthesis of (+)-kirkine via construction of the Galanthane skeleton, showcasing its potential for the efficient synthesis of amine-containing natural products (**Scheme 2**).[3]



Scheme 2 : *N*-sulfinylthioimidate as a key intermediate for the synthesis of β-branched alkyl primary amines and kirkine

[1] Lamoral-Theys, D.; Andolfi, A.; Van Goietsenoven, G.; Cimmino, A.; Le Calvé, B.; Wauthoz, N.; Mégalizzi, V.; Gras, T.; Bruyère, C.; Dubois, J.; Mathieu, V.; Kornienko, A.; Kiss, R.; Evidente, A. Lycorine, the Main Phenanthridine Amaryllidaceae Alkaloid, Exhibits Significant Antitumor Activity in Cancer Cells That Display Resistance to Proapoptotic Stimuli: An Investigation of Structure−Activity Relationship and Mechanistic Insight. *J. Med. Chem.* **2009**, *52*, 6244.

[2] Biechy, A.; Hachisu, S.; Quiclet-Sire, B.; Ricard, L.; Zard, S. Z. The Total Synthesis of (±)-Fortucine and a Revision of the Structure of Kirkine. *Angew. Chem. Int. Ed.* **2008**, *47*, 1436.

[3] *Publications in progress*.

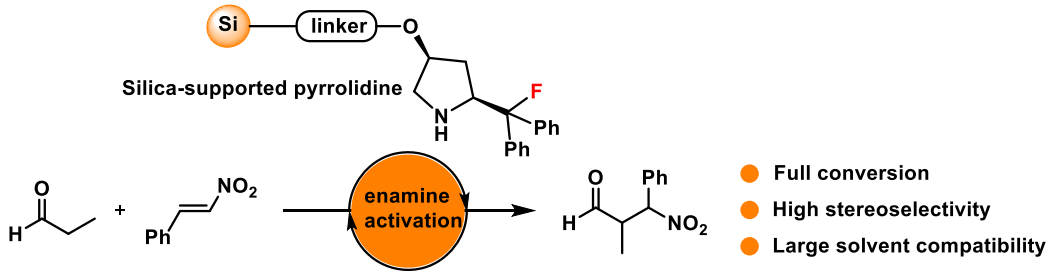
P B095

A Silica-Immobilized *Cis*-Disubstituted Pyrollidine Organocatalyst for Stereoselective Transformations

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Low-molecular-weight chiral organocatalysts provide an efficient, metal-free alternative to transition metal complexes, enabling the synthesis of chiral compounds without costly metals, ligands, or metal contamination[1]. Among them, chiral pyrrolidine derivatives, readily derived from inexpensive proline, represent one of the most important classes of asymmetric organocatalysts. However, the high loading and poor recyclability of these organocatalysts remain contentious issues, making their immobilization a subject of considerable attention. A common strategy involves the synthesis of polymer-supported chiral pyrrolidines. These heterogenous reagents enable facile catalyst and product recovery from the reaction mixture via simple filtration[2]. To date, the development of solid-supported chiral pyrrolidine catalysts remains highly attractive for achieving both superior catalytic performance and excellent reusability in sustainable synthesis.[3]

While significant progress has been made, several challenges remain concerning the application (solvent compatibility), stability and recyclability and of these heterogeneous organocatalysts. Inspired by previous reports on the structure-activity-relationship of pyrrolidine organocatalysts,[4] we designed and synthesized a novel pyrrolidine scaffold incorporating a cis-configured structure and fluorine atom for enhanced stereoselectivity and stability. This chiral pyrrolidine was then grafted onto silica as a heterogeneous support of choice due to its large solvent compatibility and robustness.[5] This heterogeneous catalyst was successfully used for the asymmetric Michael reaction of propanal and trans-β-nitrostyrene.
Current work is focused on expanding the substrate scope and exploring downstream transformations of the Michael addition products.



[1] List, B. Introduction: Organocatalysis. *Chem. Rev*. **2007**, *107* (12), 5413–5415. DOI: 10.1021/cr078412e
[2] Susam, Z. D; Tanyeli, C. Recyclable Organocatalysts in Asymmetric Synthesis. *Asian J. Org. Chem*. **2021**, *10* (6), 1251-1266. DOI: 10.1002/ajoc.202100165
[3] Hayashi, Y; Gotoh, H; Hayashi, T; Shoji, M. Diphenylprolinol Silyl Ethers as Efficient Organocatalysts for the Asymmetric Michael Reaction of Aldehydes and Nitroalkenes. Angew. *Chem. Int. Ed*. **2005**, *44* (27), 4212−4215. DOI: 10.1002/anie.200500599
[4] Aufiero, M; Gilmour, R. Informing Molecular Design by Stereoelectronic Theory: The Fluorine Gauche Effect in Catalysis. *Acc. Chem. Res*. **2018**, *51* (7), 1701-1710. DOI: 10.1021/acs.accounts.8b00192
[5] Billault, I; Launez, R; Scherrmann, M.-C. Cupreine grafted onto silica as an enantioselective and recyclable catalyst for the 1,4-addition of malonate to trans-β-nitrostyrene. *RSC Adv*. **2015**, *5* (37), 29386-29390. DOI: 10.1039/C5RA02292D

P B096

Substrate-Controlled Divergent Syntheses of Polycyclic Tetrahydropyrimidinones and Oxazinanediones from Dihydroisoquinolines and Meldrum's Acid

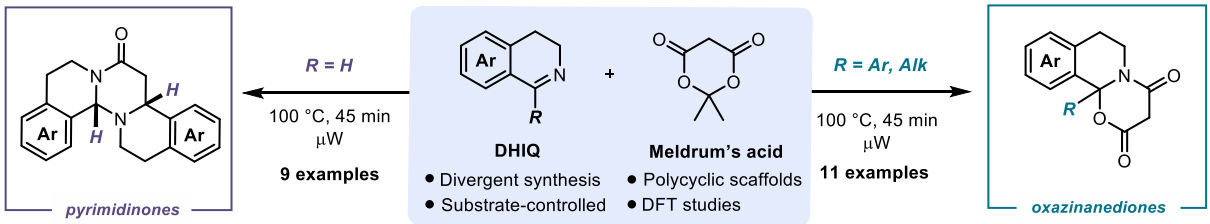
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Tetrahydroisoquinoline (THIQ) is a prevalent structural motif found in numerous natural products and synthetic pharmaceuticals.[1] Bioactive compounds containing THIQ often feature fused polycyclic frameworks, in which the C–N bond serves as a key linkage. A powerful strategy for constructing such THIQ-based fused polycycles involves harnessing the reactivity of dihydroisoquinolines (DHIQs) – stable, readily accessible imine building blocks that function as 2π synthons in both stepwise and concerted cycloaddition processes.[2] Meanwhile, Meldrum's acid is a versatile reagent known for its diverse reactivity and extensive application in synthetic chemistry.[3] Despite its widespread use, the reactivity of DHIQs with Meldrum's acid remains surprisingly underexplored. The few existing studies have revealed an extreme sensitivity of this reaction system, where subtle structural or experimental changes can unpredictably shift the outcome toward different molecular scaffolds.[4]



In this work, we present our findings on the reactivity of functionalized DHIQs with Meldrum's acid, leading to the discovery of a chemoselective pathway that produces rare THIQ-derived polycyclic pyrimidinones and oxazinanediones in a single step.[5] The underlying mechanism of this divergent reactivity was uncovered through experimental and computational studies, resolving the aforementioned predictability issues while providing access to architecturally unique THIQ-containing compounds.

[1] Recent review: Kim, A. N.; Ngamnithiporn, A.; Du, E.; Stoltz, B. M. *Chem. Rev.* **2023**, *123*, 9447.
[2] Iwanejko, J.; Wojaczyńska, E. **2018**, ***16***, 7296.
[3] Recent review: Brosge, F.; Singh, P.; Almqvist, F.; Bolm, C. *Org. Biomol. Chem.* **2021**, *19*, 5014.
[4] a) Pemberton, N.; Jakobsson, L.; Almqvist, F. *Org. Lett.* **2006**, *8*, 935–938; b)Makowiec, S.; Najda, E.; Janikwoska, K. *J. Heterocyclic Chem*. **2015**, *52*, 205.
[5] M. Hoole, Z. Long, A. Deboës, G. Goujon, C. Romain, B. Laroche, *J. Org. Chem.* **2025**, 90, 11237.

P B097

Robust Screening Cascade Process for Accelerating Innovation in Biocatalysis

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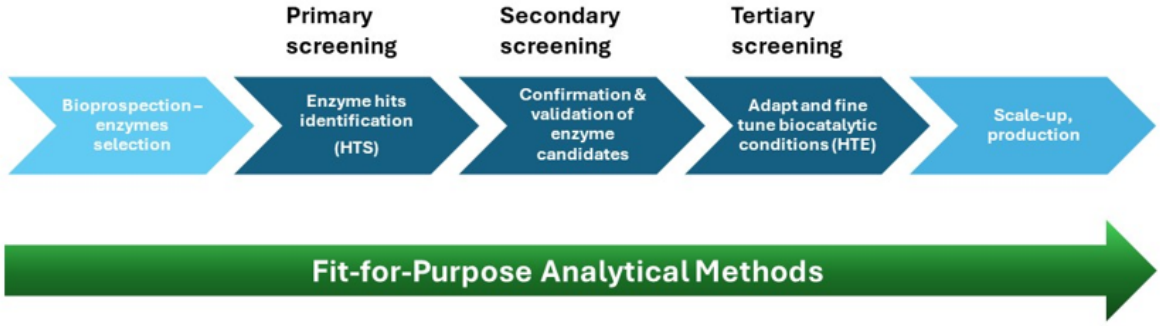
[1] *SEQENS, 2 – 8 rue de Rouen 78440 Porcheville, FRANCE*

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Automated laboratories are progressively reshaping the field of chemical process development by enabling faster, more reliable, and more efficient discovery routes.[1] Among the emerging strategies, **High Throughput Screening (HTS)** and **High Throughput Experimentation (HTE)** stand out as transformative approaches, as they allow the rapid execution of a large number of experiments in parallel. Rather than reducing the experimental load, these technologies multiply it while increasing speed and reliability, thereby accelerating discovery and optimization cycles. [2]

In the context of biocatalysis, these methods are particularly valuable for enzyme discovery, engineering, and process development. Our strategic workflow integrates automation, analytics, and computational tools to streamline the transition from genomic exploration to robust enzymatic process implementation. At the foundation of this cascade lies the development of fit-for-purpose analytical methods, ensuring precision and reproducibility across all steps.[3] Altogether, HTS and HTE create a synergistic methodology that not only increases experimental throughput but also strengthens decision-making in biocatalytic process development.[4] By implementing standardized workflows and data analysis protocols, our strategy accelerates innovation, reduces costs, and opens new perspectives for industrial scale biosolutions.



Simplified and standardized workflow from discovery to enzymatic process development

[1] (a) J. A. Selekman *et al*., Annuv Rev Chem Biomol Eng., **2017**, *8*, 525 – 527 (b) SM Mennen *et al*., Org. Process. Res. Dev., **2019**, *23*, 1213-1242.

[2] G. Wuitschik *et al*., Org. Process. Res. Dev. **2024**, *28*, 2875 – 2884.

[3] L. Ye *et al*., Appl. Microbiol. Biotechnol., **2018**, *102*, 559 – 567.

[4] A. O'Connell *et al*., Chem. Soc. Rev. **2024**, *53,* 2828 – 2850.

P B098

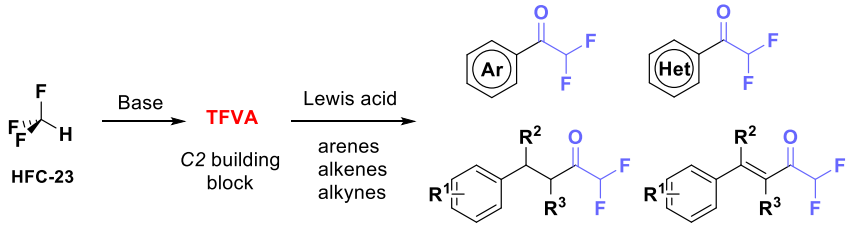
Upcycling Fluoroform (HFC-23) to Trifluorovinylamine: a C2 Reagent for the Preparation of Difluoromethylated Molecules

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The valorisation of fluorinated waste for the synthesis of high-added value non-PFAS fluorinated molecules presents a significant challenge. Fluoroform (HFC-23), an extremely potent waste greenhouse gas produced in multi-tons quantities, has traditionally been incinerated or utilized as a C1 building block.[1] In this study, we report its application in the synthesis of trifluorovinylamine (TFVA), an original C2 building block. TFVA exhibits unique reactivity, functioning as a difluoroacylium surrogate. This distinctive reactivity facilitates the efficient formation of α,α-difluoromethyl ketones via electrophilic aromatic substitution (SEAr) and enables the discovery of the hydrodifluoroacetylation reaction.[2] The development of this new class of reagents not only introduces novel chemical reactivity but also offers innovative pathways for the valorisation of HFC-23, advancing the synthesis of non-PFAS fluorinated compounds.



[1] (a) Prakash, G. K. S.; Jog, P. V.; Batamack, P. T. D.; Olah, G. A. Taming of fluoroform: direct nucleophilic trifluoromethylation of Si, B, S, and C centers. *Science* **2012**, *338*, 1324-1327. (b) Zanardi, A.; Novikov, M. A.; Martin, E.; Benet-Buchholz, J.; Grushin, V. V. Direct Cupration of Fluoroform. *J. Am. Chem. Soc.* **2011**, *133*, 20901-20913. (c) Novak, P.; Lishchynskyi, A.; Grushin, V. V. Highly Enantioselective Copper-Catalyzed Electrophilic Trifluoromethylation of β-Ketoesters. *J. Am. Chem. Soc.* **2012**, *134*, 16167-16170. (d) Musio, B.; Gala, E; Ley, S. V. Real-Time Spectroscopic Analysis Enabling Quantitative and Safe Consumption of Fluoroform during Nucleophilic Trifluoromethylation in Flow. *ACS Sustainable Chem. Eng.* **2018**, *6*, 1489-1495. (e) For a C2 application see for example: Köckinger, M.; Ciaglia, T.; Bersier, M.; Hanselmann, P.; Gutmann, B; Kappe, C. O. Utilization of fluoroform for difluoromethylation in continuous flow: a concise synthesis of α-difluoromethyl-amino acids. *Green. Chem.* **2018**, *20*, 108-112.

[2] (a) Ivashkin, P.; Decaens, J.; Poisson, T.; Jubault, P. Nouvelles trifluorovinylamines et leur procédés de preparation. PCT **2024**/051749. (b) Publication submitted.

P B099

Immobilized Chiral Organic Catalysts for Heterogeneous Acylative Kinetic Resolution

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Immobilizing catalysts on surfaces has emerged as a valuable strategy in organic chemistry.[1] In terms of sustainability, heterogeneous supports offer a convenient way for recycling, an important factor in green chemistry, although issues such as catalyst leaching and recycling efficiency still should be addressed. Previous studies have shown that π–π interactions with carbon supports can improve catalyst stability and recyclability, providing a strong basis for this work.[2] A chiral modified BTM catalyst functionalized by a pyrene moiety via click chemistry was synthesized and immobilized on multi-walled carbon nanotubes (MWNTs) as well as on reduced graphene oxide (RGO) via π–π stacking. These catalysts were applied for the acylative kinetic resolution of secondary alcohols to provide valuable β-nitro alcohol derivatives in high enantiomeric excesses,[3] and the recycling of acylation under heterogeneous conditions is currently under investigation.

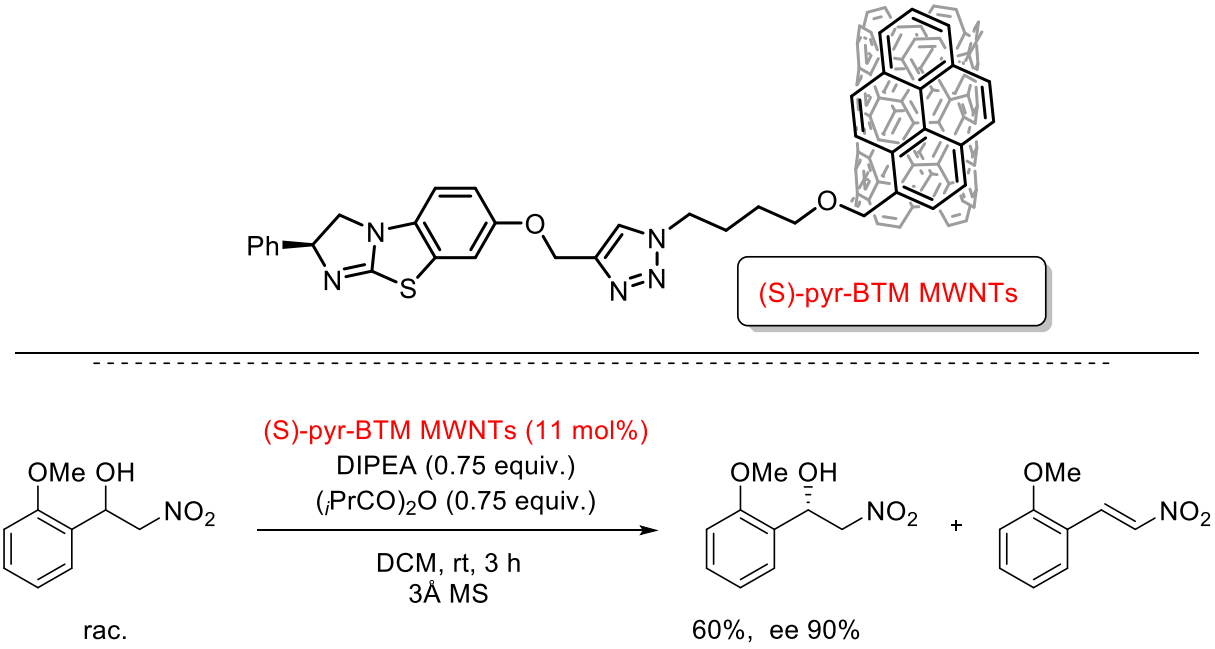


Figure 1. Heterogeneous Acylative Kinetic Resolution

[1] Ibos, L.; Schulz, E. Non-covalent interactions in supported asymmetric catalysis: a brief account. *Comptes Rendus Chim.* **2024**, *27*, 57–83.

[2] Yuan, Y. C.; Abd El Sater, M.; Mellah, M.; Jaber, N.; David, O. R. P.; Schulz, E. *Org. Chem. Front.* **2021**, *8*, 4693–4699.

[3] Li, X.; Jiang, H.; Uffman, E. W.; Guo, L.; Zhang, Y.; Yang, X.; Birman, V. B. *J. Org. Chem.* **2012**, *77*, 172–187.

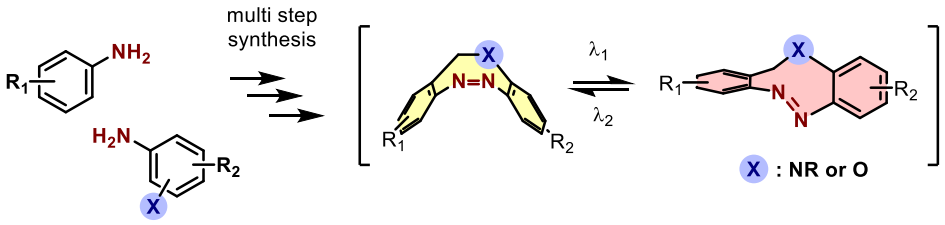
P B100

Synthesis and evaluation of the biological activity of photoswitchable monoamine oxidase inhibitors in the treatment of osteoarthritis

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Osteoarthritis (OA) is a widespread degenerative joint disease with a growing public health burden and no disease-modifying pharmacological treatments.[1] Monoamine oxidase B (MAO-B), a mitochondrial enzyme involved in neurotransmitter metabolism, has recently emerged as a promising therapeutic target due to its overexpression and role in oxidative stress in OA-affected tissues.[2]

To enable precise control over MAO-B inhibition, this project focuses on the design of photoswitchable inhibitors based on heteroatom-bridged diazocines, a class of rigid cyclic azobenzene analogues with superior photoisomerization properties.[3] We developed and optimized synthetic strategies to access O-, and N- bridged diazocine scaffolds, exploring diazonium coupling, intramolecular cyclization, and substitution-based routes.



These approaches were adapted to incorporate multiple chemical functions, for example donor–acceptor patterns, facilitating bathochromic shifts for improved tissue penetration. The implementation of these strategies will allow the synthesis of multiples of O-, and N- diazocines analogues, thereby enabling a deeper understanding of the impact of structural modulation from both photophysical and photochemical perspectives. These insights will be essential to guide the development of future more complex, biologically active scaffolds targeting MAO-B, paving the way for light-controlled therapeutics with improved selectivity and reduced side effects.

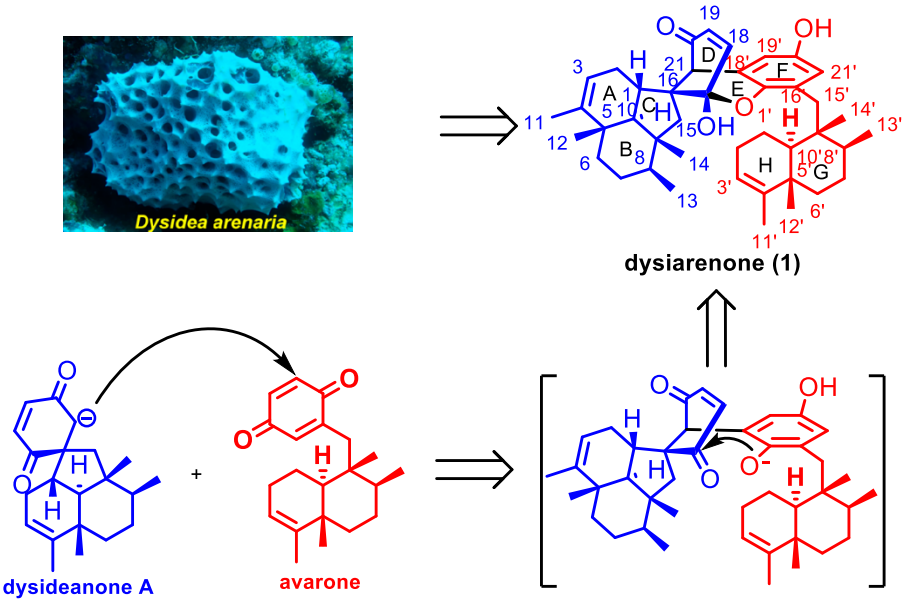
[1] Coutaux, A. Traitements antalgiques de l'arthrose. Douleurs : Evaluation - Diagnostic - Traitement **2005**, *6* (1), 22–27.
[2] Bauernfeind, F.; Bartok, E.; Rieger, A.; Franchi, L.; Núñez, G.; Hornung, V. Cutting Edge: Reactive Oxygen Species Inhibitors Block Priming, but Not Activation, of the NLRP3 Inflammasome. *The Journal of Immunology* **2011**, *187* (2), 613–617.
[3] Herges, R.; Lentes, P. Diazocines: Photoswitches with Excellent Photophysical Properties and Inverted Stabilities. In *Molecular Photoswitches*; Pianowski, Z. L., Ed.; Wiley, 2022; pp 65–81.

P B101

Total Synthesis of dysiarenone (1)

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Sponges are significant multicellular organisms characterized by remarkable diversity and broad distribution [1]. Sponge-derived diterpenoids possess a broad spectrum of biological activities, including antibacterial, antifungal, antiviral, and antiparasitic effects[2]. Dysiarenone (1), a dimeric C_{21} meroterpenoid, it was first isolated from Dysidea arenaria and reported by Lin's group in 2018[3]. Through retrosynthetic analysis, dysiarenone (1) would be obtained by dysideanone A and avarone via a tandem cycloaddition aromatization reaction. So far, only the total synthesis of the diastereomer of dysideanone A has been reported. [4].Dysideanone A and dysiarenone (1) have not been successfully to synthesized to date.



[1] Van Soest, R. W. M.; Boury-Esnault, N.; Vacelet, J.; Dohrmann, M.; Erpenbeck, D.; De Voogd, N. J.; Santodomingo, N.; Vanhoorne, B.; Kelly, M.; Hooper, J. N. A. Global Diversity of Sponges (Porifera). PloS one **2012**, 7 (4), e35105.
[2] Xia, J.; Chen, X.; Li, G.; Qiu, P.; Wang, W.; Shao, Z. A Review of Sponge-Derived Diterpenes: 2009–2022. Marine Drugs **2024**, 22 (10), 447–447.
[3] Jiao, W.-H.; Cheng, B.-H.; Chen, G.-D.; Shi, G.-H.; Li, J.; Hu, T.-Y.; Lin, H.-W. Dysiarenone, a Dimeric c21 Meroterpenoid with Inhibition of COX-2 Expression from the Marine Sponge Dysidea Arenaria. Organic Letters **2018**, 20 (10), 3092–3095.
[4] Guillaume Schoenn; Cyrille Kouklovsky; Guillot, R.; Magauer, T.; Vincent, G. Total Synthesis of Dactyloquinone a and Spiroetherone a via a Metal-Hydride Hydrogen Atom Transfer (MHAT) Process and a Quinol–Enedione Rearrangement. Angewandte Chemie International Edition **2025**.

P B102

Regiodivergent functionalization of cyclobutadiene iron complexes

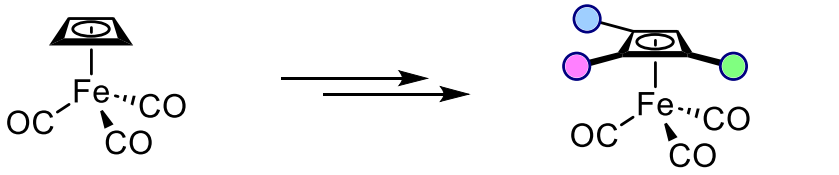
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The iron–cyclobutadiene tricarbonyl complex, first introduced by Pettit in 1962, has established itself as a key platform for stabilizing the antiaromatic cyclobutadiene (CBD) motif and enabling its use in synthesis.[1] Over the years, these complexes have proven valuable in total synthesis, as well as in cycloaddition chemistry, and their regioselective metalation has highlighted opportunities for direct functionalization.[2]

In this context, our group is investigating the regiodivergent functionalization of cyclobutadiene iron complexes. As a first step, we developed a new synthetic route to substituted cyclobutadienes, addressing the limitations of previously reported methods that suffered from poor yields and required costly, highly toxic reagents[3]. Building on this strategy, we have prepared mono-, di- and trifunctionalized CBD–$Fe(CO)_3$ derivatives, bearing a wide range of chemical groups not reported to date. The availability of these unprecedented derivatives now enables us to push the chemistry of cyclobutadienes further, particularly by engaging them in new cycloaddition pathways leading to structures that remain inaccessible by other methods.



new synthesis *trifunctionalized CBD-Fe*

[1] Pettit, R. The Cyclobutadieneiron Tricarbonyl Complex. *J. Am. Chem. Soc.* **1962**, *84*, 2585–2586.

[2] (a) Limanto, J.; Khuong, K. S.; Houk, K. N.; Snapper, M. L. Intramolecular Cycloadditions of Cyclobutadiene with Dienes: Experimental and Computational Studies of the Competing (2 + 2) and (4 + 2) Modes of Reaction. *J. Am. Chem. Soc.* **2003**, *125* (52), 16310–16321. (b) Williams, M. J.; Deak, H. L.; Snapper, M. L. An Effective Strategy for the Asymmetric Syntheses of Pleocarpenone and Pleocarpenene via an Intramolecular Cycloaddition. *J. Am. Chem. Soc.* **2007**, *129* (3), 486–487. (c) Bunz, U. H. F. Direct Lithiation of (Cyclobutadiene)Tricarbonyliron and ((Trimethylsilyl)cyclobutadiene)Tricarbonyliron with sec-Butyllithium: Selective para Metalation. *Organometallics* **1993**, *12* (9), 3594–3597.

[3] Pettit, R.; Henery, R. L.; Barton, T. J. *Cyclobutadieneiron Tricarbonyl from Cyclooctatetraene. J. Am. Chem. Soc.* **1965**, *87* (20), 5048–5049.

P B103

Synthesis and characterization of bioinks for 3D bioprinting of a mini bone organ from human stem cells

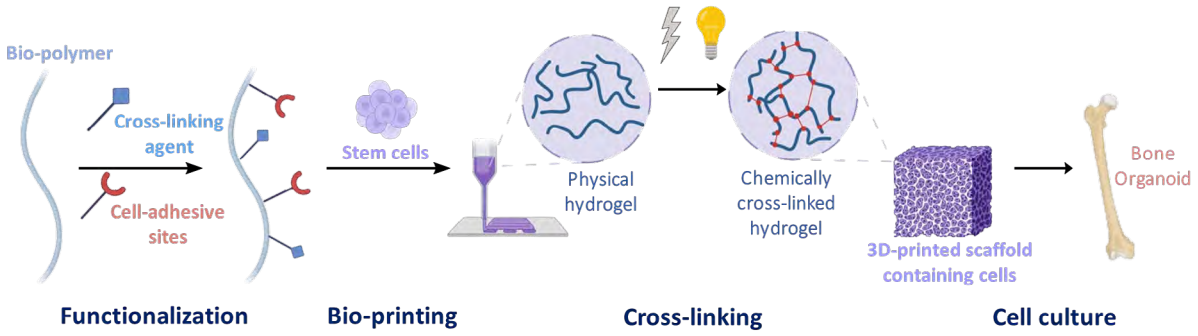
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As complex organs, bones are composed of mineralized extracellular matrix that have the ability to constantly renew itself by the action of specific cell types. Throughout our lives, our bones are exposed to shocks and diseases, leading to fracture or altered bone quality. In those cases, the natural production and resorption of bone cells are not sufficient to repair the damage, and an external intervention is required, such as tissue engineering. In order to differentiate and build into a functional organ, cells have to grow in a 3D environment. Bioprinting is a promising way to recreate a tridimensional medium. Hydrogels, based on biopolymers, can be promising as bioinks for cell development due to their printability, but they have to be functionalized to promote cross-linking and cell adhesion. The aim of our project is to prepare innovative hydrogels leading to light-induced and radical-initiator free cross-linking for total biocompatibility and use it in cell culture, starting from human mesenchymal stem cells, in order to recreate the complex bone environment.



P B104

Innovative Photocatalytic Strategies for Trifluoromethylation and Difluoromethylation of exo-Glycals with Novel Fluorinating Reagents

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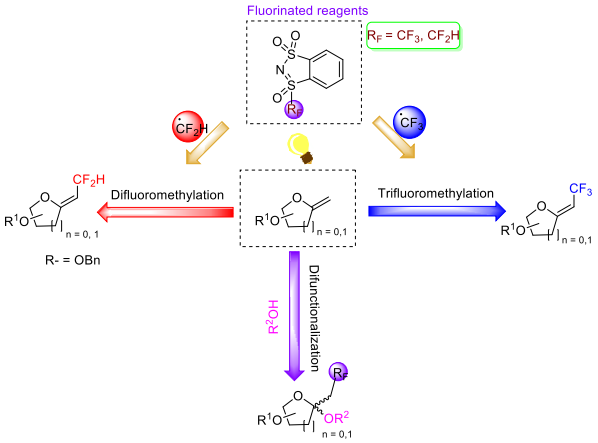
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Fluorine incorporation into organic molecules profoundly influences their chemical reactivity and biological activity, making fluorinated motifs, especially $–CF_3$ and $–CF_2H$ groups, highly valuable in pharmaceutical and materials chemistry.[1-3] Here, we report a visible-light-driven photocatalytic strategy for the selective trifluoromethylation and difluoromethylation of exo-glycals using a novel fluorinated reagent [4-5]. This operationally simple protocol enables regioselective mono- and di-functionalization of the double bond under mild conditions, affording structurally diverse fluorinated exo-glycals in moderate to good yields. The methodology displays broad substrate scope, covering methylene exo-glycals derived from both pyranoses and furanoses. These transformations proceed efficiently under photoredox catalysis without the need for additives or harsh conditions.



[1] David. O'H, Understanding organofluorine chemistry. An introduction to the C–F bond. *Chem. Soc. Rev.* **2008**, *37*, 308-319.

[2] Qian . W, Yeping. B, Gagan. D, Wei. Z, Alexander. E.S, Ata. M, FDA approved fluorine-containing drugs in 2023. *Chinese Chem Lett,* **2024**, *15*, 109780.

[3] Johan F. A. P, Emiel R, Jona M, Marek J. N, Willem H. C. T, Nienke E, Raisa V, Paul B. W, Dirk J. L, Thomas J. B. Fluorinated rhamnosides inhibit cellular fucosylation, *Nat. commun*, **2021**, *12*, 7024.

[4] Duhail, T.; Messaoudi, S.; Dagousset, G.; Marrot, J.; André-Barrès, C.; Magnier, E.; Anselmi, E. Benzodithiazoles-Sulfoximines: Preparation, Properties and Reactivities as Radical Perfluoroalkylating Agents. *Adv. Synth. Catal.* **2023**, *365*, 2392-2399.

[5] Goujon, G.; Briand, M.; Leclerc, N.; Pégot, B.; Dagousset, G.; Anselmi, E.; Magnier; E. Multigram-Scale Synthesis and Study of Reactivity of Two Difluoromethylating Reagents Based on Sulfoximine Skeletons. *Org. Process Res. Dev.* **2025**, *29*, 1831-1836.

P B105

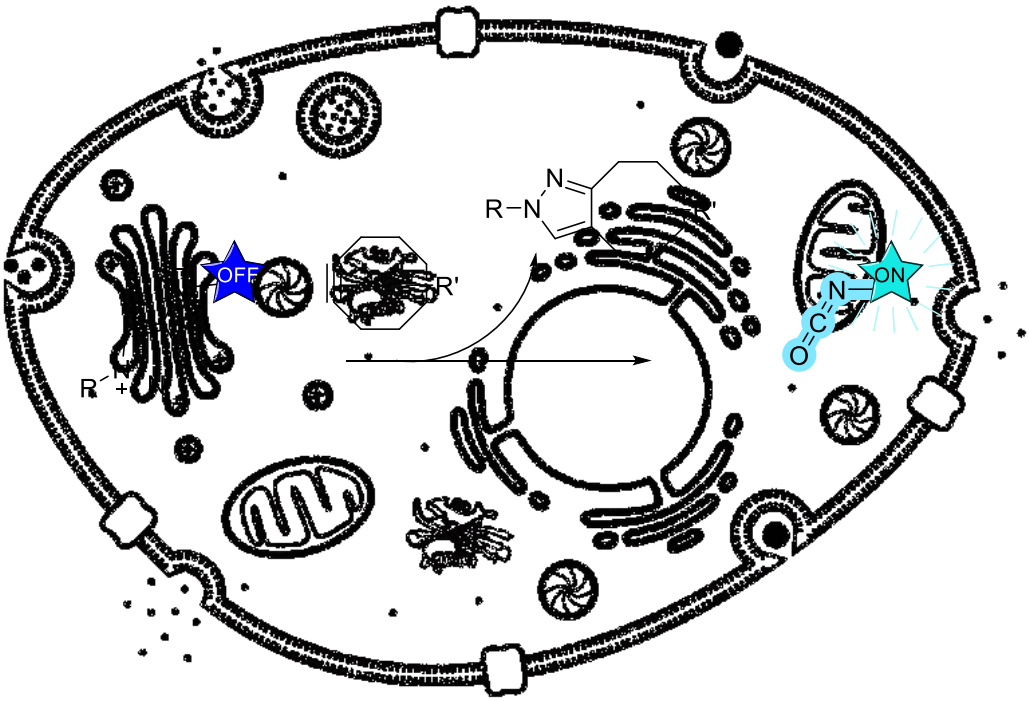
Bioorthogonal Fluorogenic release of isocyanates in cells

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Sydnonimines belong to the mesoionic family, closely related to sydnones with the key distinction of containing a nitrogen atom at position 6. Discovered in the 1950s[1] and further developed in the 1970s for their biological properties, some of them have been approved as drugs.[2] Renewed interest in sydnonimines has recently emerged due to their ability to undergo chemoselective cycloaddition reactions with strained alkynes, termed SPSIC (for Strained Promoted SydnonImine Cyclooctyne Cycloaddition).[3] We developed sydnonimine probes allowing the release of fluorescent aromatic isocyanates inside living cells, upon addition of cyclooctynes.[4] These fluorogenic probes allowed the permanent, irreversible fluorescent labeling of cells which can be exploited in several cell imaging technologies.



[1] P. Brookes and J. Walker, *J. Chem. Soc.*, **1957**, 4409–4416

[2] E. Y. Khmel'nitskaya, V. I. Levina, L. A. Trukhacheva, N. B. Grigoriev, V. N. Kalinin, I. A. Cherepanov, S. N. Lebedev and V. G. Granika, *Russ. Chem. Bull.*, **2004**, *53*, 2840–2844.

[3] S. Bernard, D. Audisio, M. Riomet, S. Bregant, A. Sallustrau, L. Plougastel, E. Decuypere, S. Gabillet, R. A. Kumar, J. Elyian, M. N. Trinh, O. Koniev, A. Wagner, S. Kolodych and F. Taran, *Angew. Chem., Int. Ed.*, **2017**, *56*, 15612–15616.

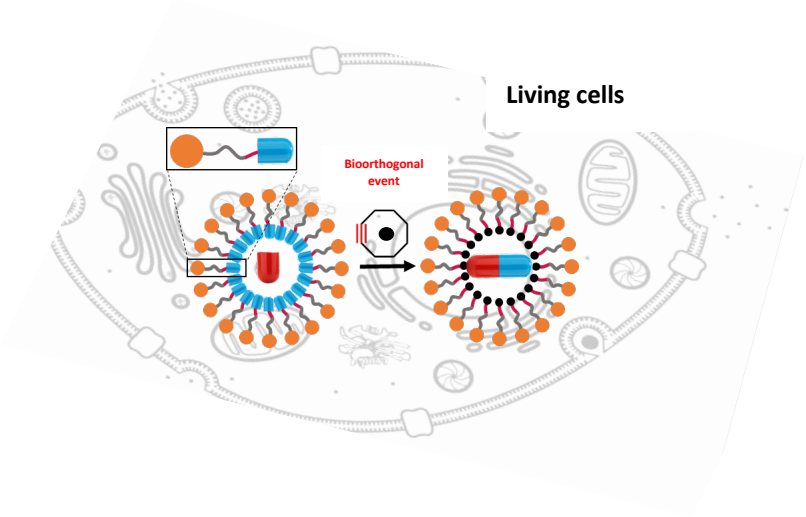
[4] J. Baudet, E. Lesur, M. Ribéraud, A. Chevalier, T. D'Anfray, P. Thuéry, D. Audisio and F. Taran, *Chem. Commun.*, **2024**, *60*, 3657.

P B106

"Click-and-Release Formation of Urea Bonds in Living Cells Enabled by Micelle Nanoreactors"

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The development of innovative strategies enabling chemical reactions in living systems is of great interest for exploring and manipulating biological processes. Herein, we present a pioneering approach based on both biorthogonal[1] and confined chemistry for intracellular drug synthesis. Exploiting a click-to-release[2] reaction, we engineered nanoparticles[3] capable of synthesizing drugs within cellular environments through b12iorthogonal reactions with cyclooctynes, a reaction called Strain-Promoted SydnonImine-Cycloalkine cycloaddition reaction (SPSIC)[4]. Proof of concept experiments showed that this new approach could be successfully applied to the synthesis of the FDA approved Sorafenib within cancer cells. The integration of 12biorthogonal and confined chemistry not only offers exciting prospects for advancing therapeutic strategies but also opens up new avenues for exploring non-natural reactions within living systems. This innovative approach represents a fundamental extension of the biorthogonal chemistry concept and holds great promise for pioneering developments in therapeutic applications[5].



[1] a) Hang HC et al., *Proc Natl Acad Sci U S A*. **2003** 100(25), 14846-14851.; b) Sletten, E. M. et al.; *Angew Chem Int Ed* **2009**, *48* (38), 6974–6998. c) Prescher, J. A. et al.; *Nat Chem Biol* **2005**, 1 (1), 13–21.
[2] a) Neumann K., *Chem. Sci.,* **2018**, (9), 7198; b) Xingyue J. et al., *Chem. Soc. Rev*. **2019**, 48, 1077-1094.
[3] Wang W. et al. *Adv. Drug Delivery Rev.* **2021**, 176, 113893-113910.
[4] a) Bernard S. et al., *Angew. Chem. Int. Ed.* **2017**, 56, 15612-15616, b) Ribéraud M. et al., *J. Am. Chem. Soc*. **2023**, 145, 4, 2219-2229.
[5] Schauenburg, D. et al.; *Advanced Science* **2024**, 11 (8), 2303396.

P B107

Incarceration of Biaryl-Phosphines into Polymeric Structures via Rh(I)-Catalyzed C–H Bond Activation

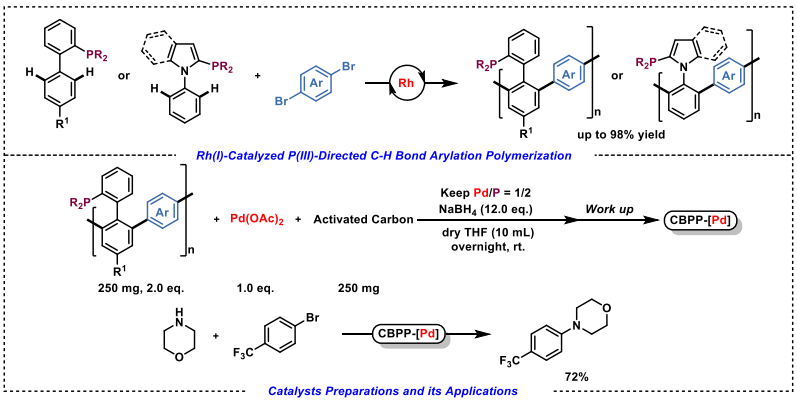
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The advancement of transition-metal catalysis is closely linked to the development of innovative ligand architectures.[1] Among these, biaryl-phosphines, developed by Buchwald, have emerged as privileged ligands in palladium catalysis.[2] Their unique structural features allow the palladium center to alternate between highly reactive 12- or 14-electron states, depending on whether the metal interacts with the biaryl backbone.[3] This electronic flexibility dramatically accelerates oxidative addition – a key step in cross-coupling reactions.

Despite their broad success, the immobilization of biarylphosphines onto solid supports remains a significant challenge, limiting their recyclability and practical deployment in industrial settings. Traditionally, strategies to incorporate phosphines into polymeric materials rely either on post-functionalization of polystyrene supports via alkylation (Merrifield resin)[4] or on the copolymerization of styrene-containing phosphine ligands (Sawamura's method).[5] These approaches, however, often suffer from low control, limited functional group tolerance, or complex multi-step synthesis.

Here, we present a novel, one-step strategy to access linear phosphine-containing polymers via Rh(I)-catalyzed, P(III)-directed C–H activation/arylation[6] using dibromoarenes as coupling partners. This method enables direct and modular introduction of aryl groups onto the phosphorus-bearing backbone, offering broad functional group tolerance and moderate to excellent yields.

Furthermore, the resulting phosphine polymers were successfully coordinated with $Pd(OAc)_2$ and immobilized, affording a new class of heterogeneous catalysts. These materials demonstrated excellent performance in Buchwald–Hartwig amination reactions, delivering the desired C–N coupled products in good yields.



[1] X. Qiu, M. Wang, Y. Zhao, Z. Shi, Angew. Chem. Int. Ed. 2017, 56, 7233-7237.
[2] D. W. Old, J. P. Wolfe, S. L. Buchwald, J. Am. Chem. Soc. 1998, 120, 9722-9723.
[3] R. Martin, S. L. Buchwald, Acc. Chem. Res. 2008, 41, 1461-1473.
[4] E. Ullah, J. Mcnulty, M. Sliwinski, A. Robertson, Tetrahedron Lett. 2012, 53, 3990-3993.
[5] H. Matsumoto, T. Iwai, M. Sawamura, Y. Miura, Chempluschem 2024, 89, e202400039.
[6] X. Qiu, M. Wang, Y. Zhao, Z. Shi, Angew. Chem. Int. Ed. 2017, 56, 7233-7237.

P B108
New near infrared boron-substituted Xanthene dyes for bioimaging and in-vivo applications

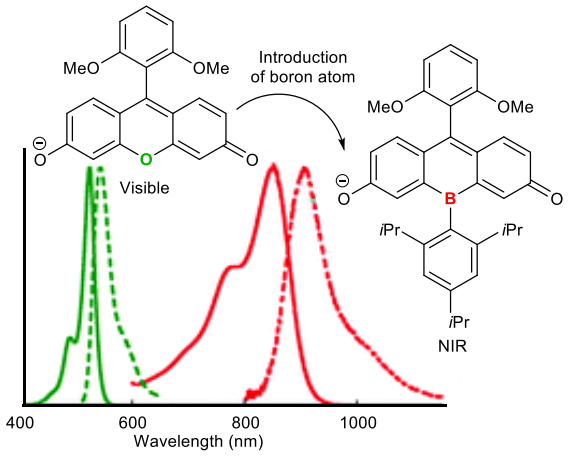
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Xanthene dyes such as fluoresceins and rhodamines have been intensively studied since their first respective synthesis in 1871 and 1887.[1] An interesting way of increasing their absorption and emission wavelengths is to substitute the central oxygen by a group 14, 15 or 16 element such as Si, P, C or Se.[2] Boron-substituted xanthenes have already been synthesised but are yet to be furtherly investigated. Tricoordinated boron-fluoresceines displayed the largest wavelength shifts amongst other studied heteroatoms, allowing emission in the near-infrared range, despite low fluorescence quantum yields.[3] The vacant p orbital of the tricoordinated boron atom allows p-π* interactions, greatly stabilising the LUMO, which results in an increase of the wavelength. This is needed to enter the range of the therapeutic window, where light can penetrate deeper into living tissues, allowing the use of less powerful LASERs and thus reducing the cytotoxicity of the process.

Improving the synthesis, increasing the quantum yields and extending the process to rhodamines and rhodols opens a path towards several applications such as bioimaging or in-vivo imaging, TADF, pH sensors...
In this poster, we will present the advances in the synthesis of new boron-substituted xanthene dyes.



Shift induced by the replacement of oxygen by boron in fluorescein, adapted from [3]

[1] a) Baeyer, A. *Ber. Dtsch. Chem. Ges.* **1871**, *4* (2), 555.; b) Ceresole, M. D.R. Patent No. 44002, 1887
[2] a) Grimm, J. B. *ACS Chem. Biol.* **2013**, *8* (6), 1303.; b) Koide, Y. *ACS Chem. Biol.* **2011**, *6* (6), 600.; c) Zhou, X. *Chem. Commun.* **2016**, *52* (83), 12290.; Kryman, M. W. *Organometallics* **2014**, *33* (10), 2628
[3] Ando, N.; Soutome, H.; Yamaguchi, S. *Chem. Sci.* **2019**, *10* (33), 7816

P B109

The Versatility of Diazirines: Properties, Synthetic and Modern Applications

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Diazirines are three-membered heterocycles containing two nitrogen atoms connected by a double bond. They are mainly known for their use in photoaffinity labelling (PAL), due to their stability and easy photolysis for the on-demand generation of carbene species. However, diazirines possess a multifaceted reactivity that also holds great potential for organic synthesis. This is what this communication will illustrate: it will serve as an introductory guide for new users of diazirines.[1]

After briefly summarizing the main synthetic approaches to these derivatives, we will highlight some of their most important characteristics and properties before describing the different modes of activation for carbene generation, some of which have only been discovered in the last decade. We will then review some of the many modern uses of diazirines, highlighting their underestimated versatility (Figure 1): as carbene precursors in synthesis, but also as electrophilic nitrogen donors or molecular tools in materials science.

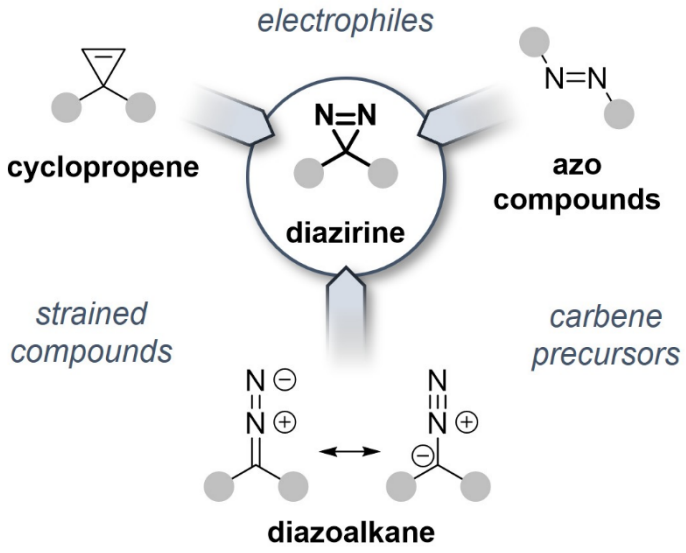


Figure 1 : Diazirines combine features and properties of several structurally related motifs.

[1] Lepage, M. L.; Gras, E. The Versatility of Diazirines: Properties, Synthetic and Modern Applications. *Chem. Eur. J.* **2025**, *31* (43), e202500414.

P B110

"High pressure enhances selectivity in Diels-Alder cycloaddition – towards the synthesis of lannotinidine A"

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Our synthetic target lannotinidine A was first discovered in 2005 in extracts of the clubmoss *Lycopodium annotinum*[1] and has been poorly studied since. Consequently, our research group has developed a retrosynthetic strategy partially inspired by the modified Julia reaction developed in our laboratory. [2]

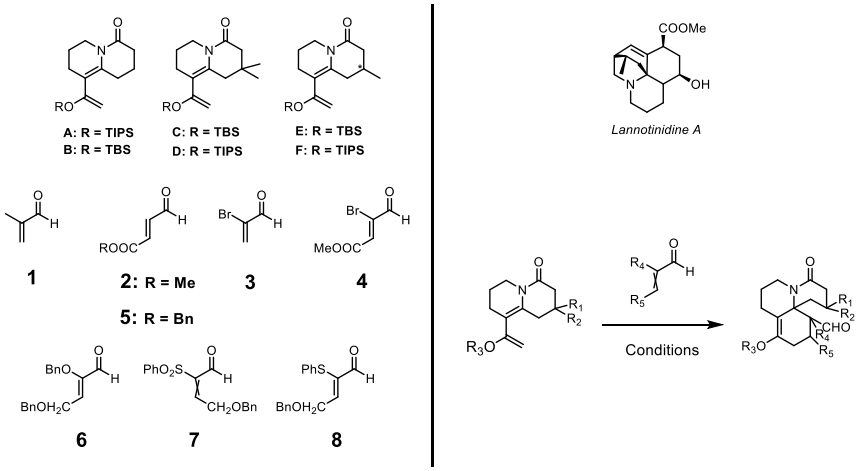


Figure 1. Top to bottom left: dienes and dienophiles screened. Top to bottom right: lannotinidine A structure, reaction scheme

The Key Diels-Alder step has been extensively studied. We have focused on optimizing conditions for several dienes and dienophiles (Fig. 1). For this transformation, different conditions were screened, including thermal activation and organocatalysis. However, only chiral Lewis acid catalysis - based on the work from Rawal and coworkers[3,4] – yielded workable results. It was found that the presence or absence of methyl(s) on the ring had a great impact on reactivity and selectivity. The treatment of nor-methyl diene **A**/**B** with dienophiles **2** and **5** gave rise to a competing Hetero Diels-Alder pathway, which is almost completely absent in the reaction between **C** and **5**. Nonetheless the overall selectivity was far from ideal, as mixtures of isomeric adducts were always obtained. Moreover, the products were not fully separable from the crude reaction mixtures, and rather unstable. Therefore, reverse-phase chromatography was employed, allowing us to access cleaner mixtures. Notably, treating a mixture of diene and dienophile under 16 mPa pressure for 16 hours significantly improved both chemo- and stereoselectivity.

[1] K. Koyama, H. Morita *et. al.* Lannotinidines A–G, new alkaloids from two species of Lycopodium. *Tetrahedron* **2005**, *61, 3681-3690*

[2] B. Raison, N. Dussart, L. Levy, P. G. Goekjian, and D. Gueyrard. Synthesis of Substituted Indolizidines and Quinolizidines by Regioselective Intramolecular Modified Julia Olefination of Imides. *J. Org. Chem.* **2020**, *85*, (2), *864–875*

[3] Y. Huang, T. Iwama, and V. H. Rawal. Highly Enantioselective Diels–Alder Reactions of 1-Amino-3-siloxy-dienes Catalyzed by Cr(III)-Salen Complexes. *JACS* ***2000*** *122 (32), 7843-7844*

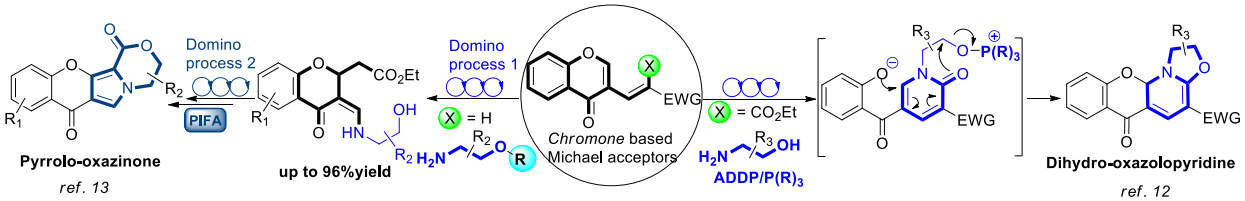
P B111

DOS strategy involving amino alcohols and chromone-based Michael acceptors to access new heterocycles

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Owing to its pivotal role in drug discovery over the past decade, access to molecular diversity through Diversity-Oriented Synthesis (DOS) has gained considerable interest among the synthetic chemistry community. [1] New strategies have therefore emerged to tackle this substantial challenge, such as substrate-based folding[2] and branching[3] pathways, the Build/Couple/Pair[4,5] (B/C/P) approach, or Single Reactant Replacement (SRR) in numerous multicomponent reactions.[6] Powerful tools like domino processes, currently known for their remarkable ability to create architectural complexity,[7,8] remain underused in this research field. However, quite recently, such processes have demonstrated their high potential to generate molecular diversity from common substrates, by ingeniously influencing the course of the concerned reaction sequences.[9,10]

Our research group recently reported access to diverse 2-pyridones starting from a platform of chromone-based Michael acceptors, reacting with various primary amines in a domino process.[11] Building on this work, I will focus this communication on how the heterocyclic structural diversity can be achieved by modifying the courses of the domino process involving amino alcohols and chromone-based Michael acceptors (Scheme 1).[12,13]



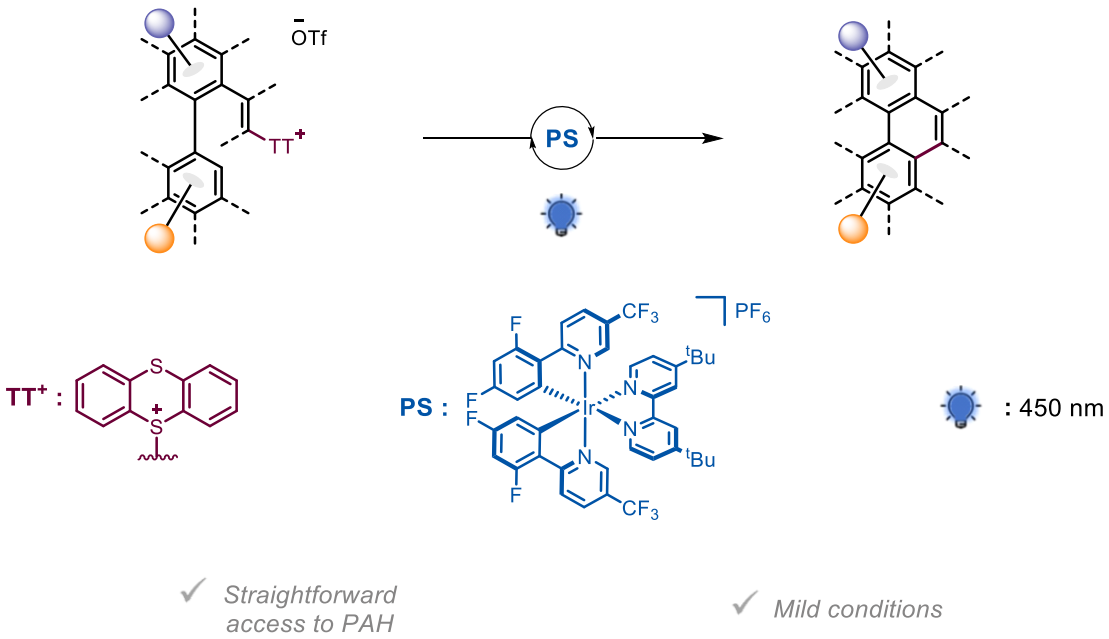
[1] Garcia-Castro, M.; Zimmermann, S.; Sankar, M. G.; Kumar, K. *Angew. Chem. Int. Ed.* **2016**, *55*, 7586
[2] a) Burke, M. D.; Berger, E. M.; Schreiber, S. L. *J. Am. Chem. Soc.* **2004**, *126*, 14095. b) Oguri, H.; Schreiber, S. L. *Org. Lett.* **2005**, *7*, 47
[3] Wyatt, E. E.; Fergus, S.; Galloway, W. R. J. D.; Bender, A.; Fox, D. J.; Plowright, A. T.; Jessiman, A. S.; Welch, M.; Spring, D. R. *Chem. Commun.* **2006**, 31, 3296
[4] Kumagai, N.; Muncipinto, G.; Schreiber, S. L. *Angew. Chem. Int. Ed.* **2006**, *45*, 3635
[5] Nielsen, T. E.; Schreiber, S. L. *Angew. Chem. Int. Ed.* **2008**, *47*, 48
[6] Ganem, B. *Acc. Chem. Res.* **2009**, *42*, 463
[7] Giorgi, G.; Miranda, S.; López-Alvarado, P.; Avendaño, C.; Rodriguez, J.; Menéndez, J. C. *Org. Lett.* **2005**, *7*, 2197
[8] Tietze, L. F. *Chem. Rev.* **1996**, *96*, 115
[9] Liu, W.; Khedkar, V.; Baskar, B.; Schürmann, M.; Kumar, K. *Angew. Chem. Int. Ed.* **2011**, *50*, 6900
[10] Bansode, A. H.; Chimala, P.; Patil, N. T. *ChemCatChem* **2017**, *9*, 30
[11] Pintiala, C.; Lawson, A. M.; Comesse, S.; Daïch, A. *Tetrahedron Lett.* **2013**, *54*, 2853
[12] Lepitre, T.; Denhez, C.; Sanselme, M.; Othman, M.; Lawson, A. M.; Daïch, A. *J. Org. Chem.* **2016**, *81*, 8837
[13] Lepitre, T.; Denhez, C.; Moncol, J.; Othman, M.; Lawson, A. M.; Daïch, A. *J. Org. Chem.* **2017**

P B112

Light-induced annulative π extension enabled by thianthrenium salts

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Polycyclic aromatic compounds (PAC) are of key importance in the field of materials science and bioimaging.[1] However, their lengthy and demanding synthesis impede the full extent of their abilities. To be able to modify and tune their properties on-demand, there is a need for a straightforward access to complex scaffolds. So far, the sulfonium salts chemistry was mainly employed in aromatic C–H functionalization reactions, offering a powerful strategy for the late-stage modification of complex arenes.[2] Its use in photocatalytic conditions is yet to be explored to its full potential. In this context, we investigated the use of sulfonium salts for the photo-induced formation of new C(sp^2)–C(sp^2) bonds, aiming to construct extended π-conjugated systems. Our strategy involves the use of the less explored styryl feedstock[3] to access PAC via the formation of the corresponding vinyl thianthrenium salts. This two-step sequence shows great promise, offering access to a variety of planar and non-planar PAC in a short reaction time.



[1] (a) Müllen, K. *et al., J. Am. Chem Soc.* **2022**, 144, 11499. (b) Wong, W. S., Stępień, M. *et al.*, *Trends in Chem*. **2022**, 573.
[2] (a) Berger, F., Plutschack, M.B., Riegger, J. *et al., Nature* **2019**, 567, 223. (b) Itami, K., Ito, H. *et al.*, *Chem. Sci.*, **2025**, 16, 8262. (c) Dumele, O. *et al.*, *Org. Lett.*, **2025**, DOI: 10.1021/acs.orglett.5c02903.
[3] Graham K. Murphy *et al.*, *Canadian Journal of Chemistry* **2022**, 100, 606.

P B113

Synthesis of photoactivatable molecules for the spatiotemporal control of cell motility with light

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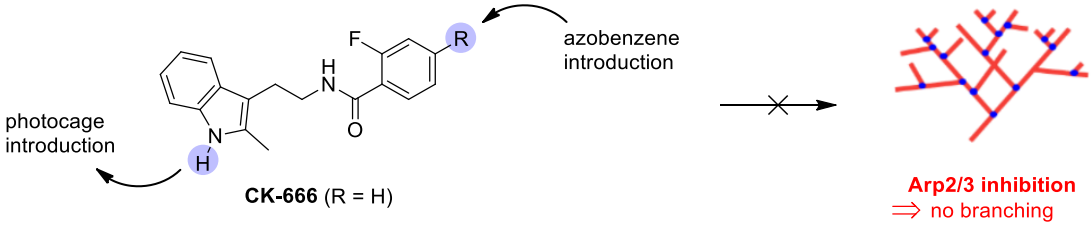
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The actin cytoskeleton governs key cellular processes,[1] making its regulatory proteins attractive targets for small molecules. CK-666 and (–)-blebbistatin[2,3] are widely used inhibitors of Arp2/3 complex and non-muscle myosin II motors, but lack spatiotemporal precision. Thus, we are developing a synthetic toolbox of photo-responsive chemical inhibitors, enabling a light-controlled modulation of actin networks in cells.[4] Photoswitchable CK-666 derivatives were synthesized and characterized, displaying remarkable photochemical properties. Using total internal reflection fluorescence microscopy assays, we demonstrated that these compounds selectively modulate Arp2/3-mediated branching with striking *(E)/(Z)* photoisomer-dependent activity (4- to 7- fold variation). These results provide a proof-of-concept for the photochemical control of Arp2/3 activity, providing a powerful means to decipher the interplay between actin cytoskeletal architecture and cell migration dynamics with unprecedented spatiotemporal resolution. Finally, we optimized the synthetic route toward (–)-blebbistatin,[5] improving the overall yield, resulting in a more robust pathway paving the way for the development of photo-responsive blebbistatin analogues.



[1] Dominguez, R.; Holmes, K. C. Actin Structure and Function. *Annu Rev Biophys* **2011**, *40*, 169–186.

[2] Nolen, B. J.; Tomasevic, N.; Russell, A.; Pierce, D. W.; Jia, Z.; McCormick, C. D.; Hartman, J.; Sakowicz, R.; Pollard, T. D. Characterization of Two Classes of Small Molecule Inhibitors of Arp2/3 Complex. *Nature* **2009**, *460* (7258), 1031–1034; Hetrick, B.; Han, M. S.; Helgeson, L. A.; Nolen, B. J. Small Molecules CK-666 and CK-869 Inhibit Actin-Related Protein 2/3 Complex by Blocking an Activating Conformational Change. *Chem Biol* **2013**, *20* (5), 701–712.

[3] Straight, A. F.; Cheung, A.; Limouze, J.; Chen, I.; Westwood, N. J.; Sellers, J. R.; Mitchison, T. J. Dissecting Temporal and Spatial Control of Cytokinesis with a Myosin II Inhibitor. *Science* **2003**, *299* (5613), 1743–1747.

[4] Gamet, A.; Ciss, I.; Courtois, A.; Joyeux, B.; Gautreau, A. M.; Romero, S.; Clainche, C. L.; Nay, B. Total Synthesis of Photoswitchable Latrunculin B Enables Reversible Inhibition of Actin Polymerization and Cell Migration. ChemRxiv August 1, 2025.

[5] Képiró, M.; Várkuti, B. H.; Végner, L.; Vörös, G.; Hegyi, G.; Varga, M.; Málnási-Csizmadia, A. Para-Nitroblebbistatin, the Non-Cytotoxic and Photostable Myosin II Inhibitor. *Angew Chem Int Ed Engl* **2014**, *53* (31), 8211–8215; Roman, B. I.; Verhasselt, S.; Stevens, C. V. Medicinal Chemistry and Use of Myosin II Inhibitor (*S*)-Blebbistatin and Its Derivatives. *J Med Chem* **2018**, *61* (21), 9410–9428.

P B114

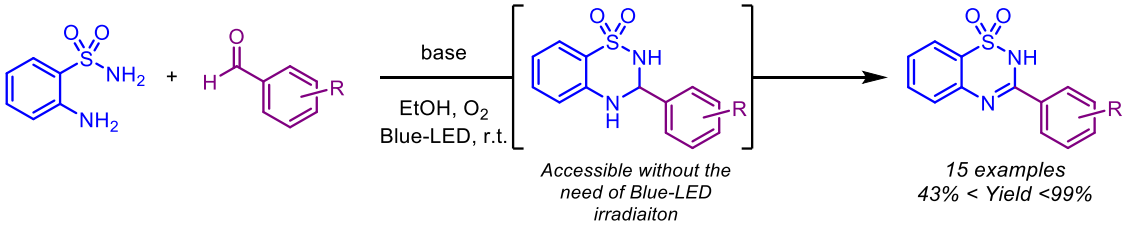
Use of visible-light toward an easy access to 1,2,4-benzothiadiazine-1,1-dioxide scaffold

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N-heterocycles represent an important common structural feature in many developed pharmaceuticals. Among them, 1,2,4-benzothiadiazine-1,1-dioxide proved to be an interesting skeleton. Indeed, molecules containing this motif exhibit a diversity of biological activities such as antimicrobial, antiviral, antidiabetic or anticancer, among others.[1] Many synthetic methods have been developed to access this structure, with the most reported one being transition-metal based.[2] Visible-light mediated transformation has emerged these last two decades as an interesting sustainable approach for the construction of several C-C and C-X (X= O, N, S) bonds, enabling sophisticated transformations upon photo-excitation of either the substrate or a sensitizer called photocatalyst. Nevertheless, application of such method for the formation of 1,2,4-benzothiadiazine-1,1-dioxide core is significantly scarce.[3] Moreover, the published photo-mediated procedures require either the use of energetic UV light at high temperature, or the use an HAT agent in combination with a photocatalyst to enable the formation of the key intermediate, a α-hydroxyl-carbon radical. We developed a photocatalyst free approach for the formation of benzothiadiazine under visible-light irradiation. Starting from *o*-aminobenzenesulfonamide, a condensation reaction with aldehydes occurring without the need for thermal activation lead to the formation of *2H*,*4H*-dihydro-1,2,4-benzothiadiazine 1,1-dioxide which is then oxidized to the targeted compound under visible-light irradiation.



The developed reaction conditions allowed the access to 15 examples with good substrate tolerance.

[1] *Chemistry*, **2020**, *2*, 674-690

[2] *Green Chem.*, **2023**, *25*, 3021; *Adv. Synth. Catal.*, **2024**, *366*, 717-724; *J. Comb. Chem.*, **2009**, *11*, 653-657; *ChemistrySelect*, **2019**, *4*, 5200-5205; *J. Org. Chem.* **2024,** *89*, 2494-2504; *Org Lett* **2020,** *22*, 8842-8845; *RSC Advances* **2014,** *4*, 8-17; *J. Org. Chem.* **2022,** *87*, 14738-14752

[3] *J. Heterocyclic Chem.*, **2023**, *60*, 1738-1759; *Org. Lett.*, **2022**, *24*, 8158-8163; *Chem. Commun.*, **2023**, *59*, 10299-1030; *Green Chem.*, **2023**, *25*, 2840-2845; *Org. Biomol. Chem.*, **2024**, *22*, 4172-4178;Tet Lett., 2018, 59, 2099-2102

P B115

Direct Reduction of Atmospheric CO_2 by Copper Complexes

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Given our long-term dependence on carbon-based products and the need to reduce CO_2 emissions, it will be crucial to capture carbon in the form of dilute CO_2 from the atmosphere and transform it into useful molecules. However, the current technologies for the direct capture of CO_2 from the air (DAC) are being developed separately from those for CO_2 conversion.[1] Thereby, in order to create an integrated reactive CO_2 capture system and producing sustainable molecules with the highest frugality, we are developing molecular catalyst capable of converting this CO_2 in very dilute environments.

Our strategy is to directly reduce dilute CO_2 from the atmosphere trough a reaction of hydrosilylation, accelerated by the addition of a catalyst. In this reaction, the CO_2 can be selectively reduced at different oxidation states by using hydrosilane as reductant, due to their attractive thermodynamic and kinetic properties.[2]

Previously described as highly active for this reaction, the [(dppbz)CuH] catalyst has been reproduced and studied in presence of different hydrosilanes.[3] While working with CO_2 gradually diluted in inert gas (100% → 1%), we have been able to achieve high and fast conversion of the CO_2 with a tunable selectivity at different levels of reduction.

In future work, we will further study this reduction at even lower concentration of CO_2 (≈430 ppm) and in the presence of additional constraints, such as the oxygen.

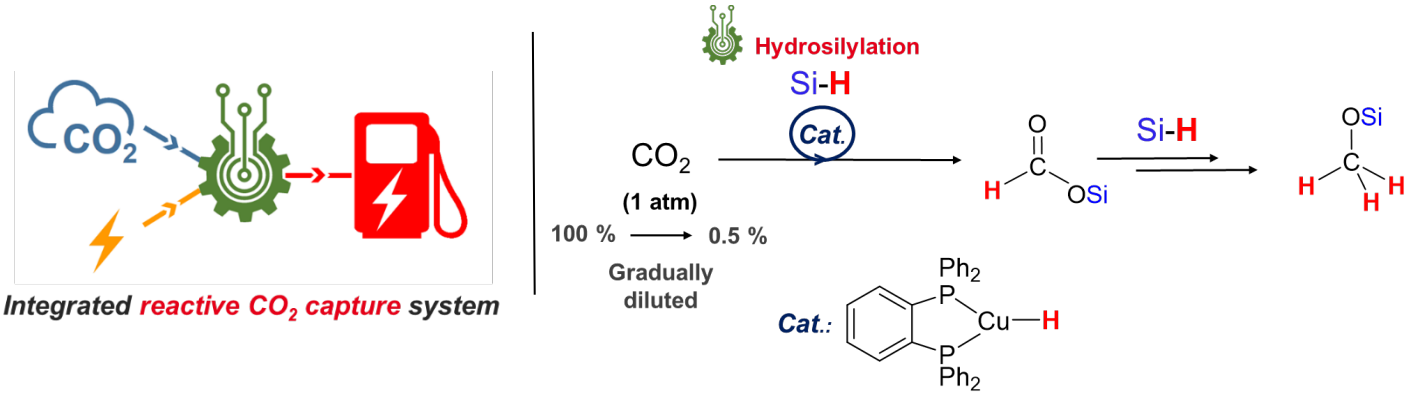


Figure: Direct Reduction of CO_2 with hydrosilane catalyzed by [(dppbz)CuH].

[1] A. Sodiq, Y. Abdullatif, B. Aissa, A. Ostovar, N. Nassar, M. El-Naas, A. Amhamed, A review on progress made in direct air capture of CO_2, *Environ. Technol. Innovation* **2023**, *29*, 102991.

[2] C. Chauvier, T. Cantat, A viewpoint on chemical reductions of carbon–oxygen bonds in renewable feedstocks including CO_2 and biomass, *Acs Catalysis* **2017**, *7*, 2107-2115.

[3] K. Motokura, D. Kashiwame, N. Takahashi, A. Miyaji, T. Baba, Highly active and selective catalysis of copper diphosphine complexes for the transformation of carbon dioxide into silyl formate, *Chem. Eur.J.* **2013**, *19*, 10030-10037.

P B116

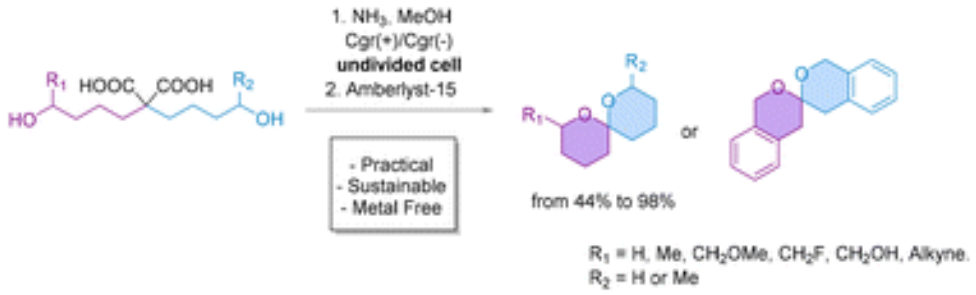
*e*Spiro: A scalable and sustainable electrosynthetic route to spiroketals via anodic oxidation of malonic acids

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Spiroketals are important structural motifs found in natural products, pharmaceuticals, and agrochemicals. However, their synthesis often requires hazardous reagents and harsh conditions, limiting their accessibility. Here, we present eSpiro, a novel electrosynthetic method for the efficient and sustainable synthesis of spiroketals via anodic oxidation of malonic acids. This approach offers a metal- and mercury-free alternative to conventional acid-catalysed or transition metal-mediated cyclisations. The reaction proceeds through a sequential Hofer-Moest decarboxylation, followed by Brønsted acid-mediated cyclisation, achieving high yields with broad functional group tolerance. We further explore the reaction scope and demonstrate its scalability, achieving up to 98% yield in batch. Additionally, we investigate a flow electrolysis setup, highlighting key challenges such as substrate stability, in-line solvent system switch and gas evolution, and also demonstrating preliminary success in integrating electrochemical oxidation with downstream acid-catalysed cyclisation. This work provides a practical and eco-friendly route to spiroketals, with potential for industrial applications in organic synthesis. [1]



[1] Triacca, M.; Reens, C. D.; Stephen, H.; Lam, K. eSpiro: A Scalable and Sustainable Electrosynthetic Route to Spiroketals via Anodic Oxidation of Malonic Acids. Green Chem. 2025, 27 (25), 10345–10352. https://doi.org/10.1039/D5GC01767J

P B117

Enantioselective Synthesis of Benzopyrane Atropisomers

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Atropisomers are of utmost interest due to their prevalence in natural products,[1] but also for their biological relevance[2] and their numerous applications as chiral materials,[3] ligands[4] and organocatalysts.[5] Among them, biaryl and heterobiaryl atropisomers are the most common ones and many synthetic approaches are available.[6] Non-biaryl atropisomers constitutes another family of these axially chiral molecules with less synthetic approaches and consequently are less represented in the literature.[7] Within this family, the highly challenging enantioselective construction benzopyrane atropisomers still constitutes a daunting challenge of modern organic synthesis.[8] Enantioselective halogenation reaction is a useful reaction for the production of atropisomers in enantioenriched form, via a dynamic kinetic resolution (DKR) of substrates presenting low enantiomerization barriers.[9] Therefore, we propose to exploit this approach for the atroposelective synthesis of axially chiral benzopyranes. While non-catalyzed version of the reaction has allowed to produce several examples of chiral benzopyranes in racemic form, encouraging enantiomeric excesses have been obtained with the use of a chiral phosphoric acid derivative and further investigations are currently undergoing in our laboratory.

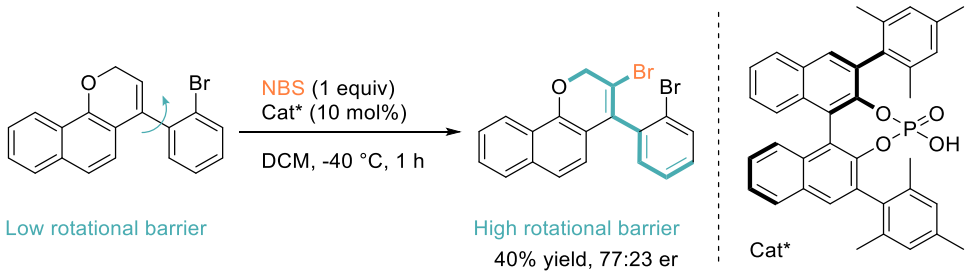


Figure 2: Bromination reaction scheme

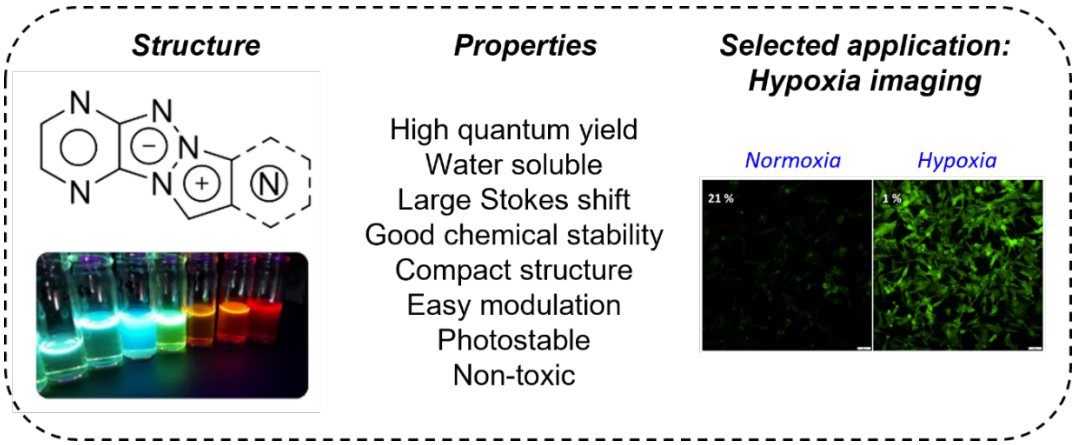
[1] Tajudden, N.; Feineis, D.; Ihmels, H.; Bringmann, G. *Acc. Chem. Res.*, **2022**, *55*, 2370.
[2] Basilaia, M.; Chen, M. H.; Secka, J.; Gustafson, J. L. *Acc. Chem. Res.*, **2022**, *55*, 2904.
[3] Collins, B. S. L.; Kistemaker, J. C. M.; Otten, E.; Feringa, B. L. *Nat. Chem.*, **2016**, *8*, 860.
[4] Tang, W.; Zhang, X. *Chem. Rev.*, **2003**, *103*, 3029.
[5] Akiyama, T.; Mori, K. *Chem. Rev.*, **2015**, *115*, 9277.
[6] Cheng, J. K.; Xiang, S.-H.; Li, S.; Ye, L.; Tan, B. *Chem. Rev.*, **2021**, *121*, 4805.
[7] Kumarasamy, E.; Raghunathan, R.; Sibi, M.P.; Sivaguru, J. *Chem. Rev.*, **2015**, *115*, 11239.
[8] Gou, B-B.; Tang, Y.; Lin, Y.-H.; Yu, L.; Jian, Q.-S.; Sun, H.-R.; Chen, J.; Zhou, L. *Angew. Chem. Int. Ed.*, **2022**, *61*, e202208174.
[9] Wada, Y. ; Matsumoto, A.; Asano, K.; Matsubara, S. *RSC Adv.*, **2019**, *9*, 31654.

P B118

From explosives to fluorophores: synthesis, properties and applications of pyrazino-triazapentalenes (PyTAPs)

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Fluorescence-based imaging techniques are invaluable tools for investigating biological events at the molecular level.[1] In this context, fluorescent small molecules are particularly attractive as their optical properties can be finely tuned using modern organic chemistry.[2] A myriad of synthetic fluorophores are known, but the field is dominated by a few major players: xanthene derivatives (rhodamines, fluoresceins), (aza)-BODIPYs and cyanins. None of these dyes are ideal as issues such as solubility, stability and photobleaching can hamper their use in a biological context. While initially focusing on energetic materials, we serendipitiously discovered a new fluorescent scaffold, pyrazino-1,3a,6a-triazapentalene (PyTAP).[3] This fluorophore is synthesized in a few steps from commercially available material and its luminescent properties can be easily modulated.[4] We will present our latest developments regarding the PyTAP scaffold with a special focus on its successful use as an hypoxia probe.[5,6]



The PyTAP scaffold: structure, properties and applications

[1] L. D. Lavis, R. T. Raines, Bright Ideas for Chemical Biology, *ACS Chem. Biol.* **2008**, *3*, 142.
[2] J. V. Jun, D. M. Chenoweth, E. J. Petersson, Rational Design of Small Molecule Fluorescent Probes for Biological Applications**,** *Org. Biomol. Chem.* **2020**, *18*, 5747.
[3] D. Sirbu, J. Diharce, I. Martinić, N. Chopin, S. V. Eliseeva, G. Guillaumet, S. Petoud, P. Bonnet, F. Suzenet, An Original Class of Small Sized Molecules as Versatile Fluorescent Probes for Cellular Imaging, *Chem. Commun.* **2019**, *55*, 7776.
[4] D. Sirbu, N. Chopin, I. Martinić, M. Ndiaye, S. V. Eliseeva, M.-A. Hiebel, S. Petoud, F. Suzenet, Pyridazino-1,3a,6a-Triazapentalenes as Versatile Fluorescent Probes: Impact of Their Post-Functionalization and Application for Cellular Imaging, *Int. J. Mol. Sci.* **2021**, *22*, 6645.
[5] E. Janczy-Cempa, O. Mazuryk, D. Sirbu, N. Chopin, M. Żarnik, M. Zastawna, C. Colas, M.-A. Hiebel, F. Suzenet, M. Brindell, Nitro-Pyrazinotriazapentalene Scaffolds – Nitroreductase Quantification and *in vitro* Fluorescence Imaging of Hypoxia, *Sens. Actuator B-Chem.* **2021**, *346*, 130504.
[6] E. Janczy-Cempa, A. Kwiatkowska, O. Mazuryk, N. Chopin, M.-A. Hiebel, F. Suzenet, M. Brindell, Bioconjugation of Holo-transferrin with Hypoxia-enhanced Fluorescent Sensor for the Selective Imaging of Cancer Cells *Sens. Actuator B-Chem.* **2023**, *394*, 134450.

P B119

Synthesis of N-Trifluoroethyl and N-Difluoroethyl Azapeptides and Azapeptoids

Dimitra Kyrko,[1] Tingting Cao,[1] Pascal Retailleau,[2] Julia Kaffy,[1] Benoît Crousse[1,*]

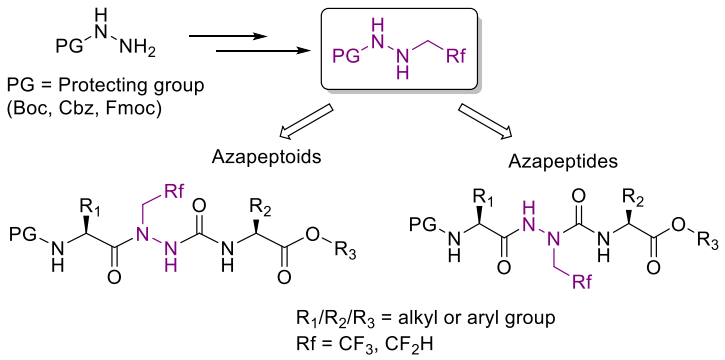
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Fluorine has become increasingly prominent in medicinal chemistry due to its particular physicochemical properties, which enhance the therapeutic potential of drug candidates and serve as effective ^{19}F NMR probes. A promising approach to harness fluorine's potential is its incorporation into peptide-based drugs, such as azapeptides and azapeptoids. This class of peptidomimetics, characterized by aza-amino acids in which the α-carbon is replaced by nitrogen, are particularly valuable for optimizing structural and conformational properties in biomedical[1] and biomaterial applications.[2] Notably, the synthesis of RfCH2N-substituted azapeptides and azapeptoids remains unexplored.

Our research focuses on the synthesis of novel peptidomimetics incorporating CF_3CH_2NH- and CF_2HCH_2NH- groups. The initial phase of this study involved the synthesis of fluorinated, functionalized dipeptides through the coupling of fluorinated hydrazines with natural amino acids. The notably low nucleophilicity of the nitrogen bearing the $RfCH_2$- chain required optimization of the coupling conditions. The resulting motifs were further extended in solution using different synthetic approaches to obtain the desired fluorinated peptidomimetics with alkyl and aryl side chains (Scheme 1). NMR and X-ray crystallography analyses were performed to evaluate the influence of fluorinated groups on peptidomimetic conformation.



Scheme 1. *CF_3CH_2NH- and CF_2HCH_2NH-substituted azapeptides and azapeptoids*

[1] Proulx, C.; Zhang, J.; Sabatino, D.; Chemtob, S.; Ong, H.; Lubell, W. D. Synthesis and Biomedical Potential of Azapeptide Modulators of the Cluster of Differentiation 36 Receptor (CD36). *Biomedicines* **2020**, *8*, 241.

[2] Melton, S. D.; Brackhahn, E. A. E.; Orlin, S. J.; Jin, P.; Chenoweth, D. M. Rules for the Design of Aza-Glycine Stabilized Triple-Helical Collagen Peptides. *Chem. Sci.* **2020**, *11*, 10638–10646.

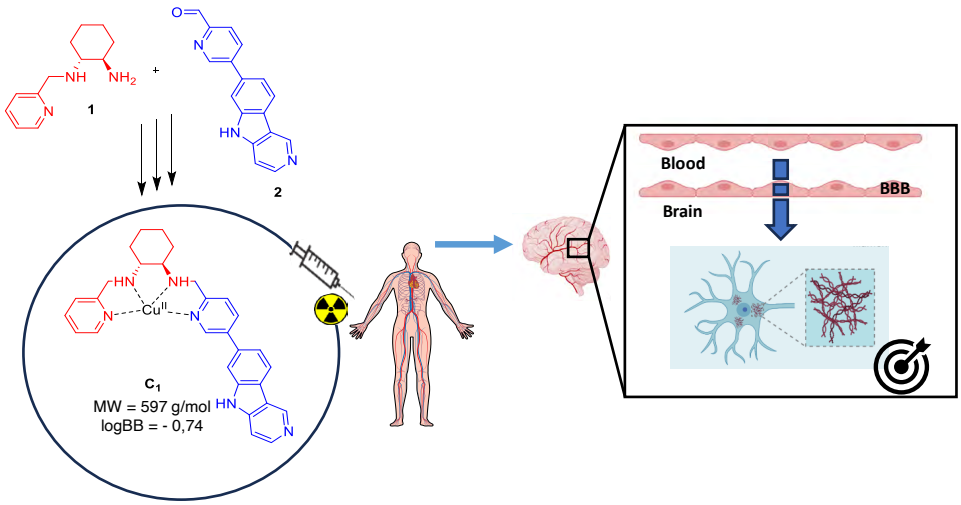
P B120

Synthesis of novel copper complexes for potential use in the diagnosis of Alzheimer's disease

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Predicting Alzheimer's disease is the focus of many research projects. In the literature, the potential of PET-tau to predict cognitive decline and the development of brain atrophy in Alzheimer's patients has been proposed.[1,2] In our laboratory, we are developing new copper complexes for PET-tau imaging in the diagnosis of this disease. With a longer lifetime than radiotracers already in use, copper complexes appear to be an innovative solution.[3]

Previous work in our laboratory led to the synthesis of new copper complexes targeting amyloid plaques, yielding promising results. The aim of the present study is to synthesize a series of new copper complexes designed for tau protein aggregates.



These complexes will be derived from [^{18}F]-Flortaucipir and [^{18}F]-RO948, two molecules able to recognize tau.[1] The key step in this synthetic strategy is a reductive amination between a diamine and a molecule capable of targeting tau. The synthesis of the ligand that will allow the preparation of the first complex involves Suzuki couplings followed by reductive cyclisation. Due to solubility problems, the ligand synthesis pathway had to be adapted by adding an indole ring protection/deprotection step. As a result, one of the ligands was successfully synthesized in 6 steps. The other ligands are still being synthesized using the same strategy.
We have synthesized a new ligand designed to develop a novel copper complex that may be able to specifically target tau protein aggregates and contribute to the development of new strategies in the diagnosis of Alzheimer's disease.

[1] Uzuegbunam et al, *Molecules* **2020**, *25*, 977
[2] Okamura et al, *Curr Neurol Neurosci Rep*. **2014**, *14*, 500
[3] Hickey et al, *J. Am. Chem. Soc*. **2013**, *135* (43), 16120–16132

P B121

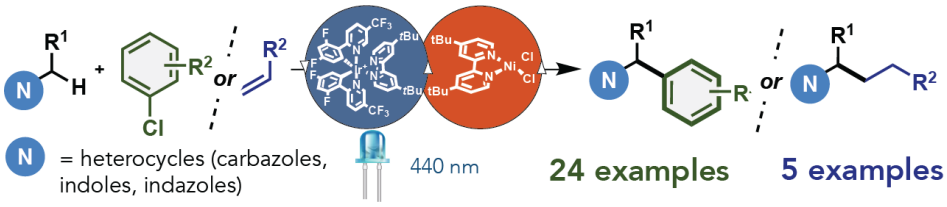
Ir/Ni Metallaphotoredox Catalysis for α-C(sp³)–H Functionalization of *N*-Alkyl Heterocycles

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[1] *CSB2D, i-CleHS, CNRS, Chimie ParisTech, PSL University, 75005 Paris, France*
fangying.ling@chimieparistech.psl.eu

The selective functionalization of C(sp³)–H bonds adjacent to nitrogen atoms remains a longstanding challenge in organic synthesis due to the low reactivity and ubiquitous nature of these bonds.[1-4] In this work, we disclose an efficient dual Ir/Ni metallaphotoredox strategy for the α-arylation and alkylation of *N*-alkyl heterocycles, including carbazoles, indoles, and indazoles.[5]

This method enables the direct activation of unactivated C(sp³)–H bonds under visible light irradiation, combining a photoredox catalyst and a nickel complex to achieve regioselective cross-coupling with aryl chlorides or alkenes. Importantly, the process tolerates a wide range of functional groups and operates under mild conditions.

Mechanistic investigations support a single-electron transfer (SET) pathway involving α-amino radicals, as confirmed by radical trapping and Stern–Volmer quenching experiments.



Acknowledgments: F.L. acknowledge the China Scholarship Council (CSC) for her Ph.D. grant (202308330074).

[1] D. T. Ahneman, A. G. Doyle, *Chem. Sci.* **2016**, *7*, 7002-7006.
[2] (a) J. E. Spangler, Y. Kobayashi, P. Verma, D.-H. Wang, J.-Q. Yu, *J. Am. Chem. Soc.* **2015**, *137*, 11876-11879; (b) P. Jain, P. Verma, G. Xia, J.-Q. Yu, *Nat. Chem.* **2017**, *9*, 140-144.
[3] Y.-Y. Gui, Z.-X. Wang, W.-J. Zhou, L.-L. Liao, L. Song, Z.-B. Yin, J. Li, D.-G. Yu, *Asian J. Org. Chem.* **2018**, *7*, 537-541.
[4] Y. Shen, T. Rovis, *J. Am. Chem. Soc.* **2021**, *143*, 16364-16369.
[5] B. Lv, F. Ling, J.-F. Soulé, *Chem. Eur. J.*, **2025**, e202500938.

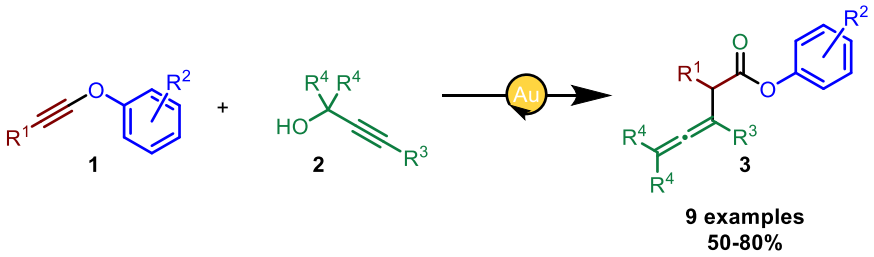
P B122

Rapid access to highly substituted β-allenoate through gold(I)-catalyzed domino reaction

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β-Allenoates are highly valuable building blocks in modern organic synthesis owing to their highly functionalized structure as well as for the presence of two stereogenic elements—an axial and a central stereocenter—.[12] Unfortunately, no method exists to the synthesis of a wide range of β-allenoates. Moreover, gold catalysis has opened new avenues for the functionalization of alkynes with a wide range of nucleophiles, affording access to highly functionalized molecules. The use of heteroatom-substituted alkynes in gold-catalyzed reactions represents a powerful strategy for controlling regioselectivity.[3,] While nitrogen-substituted alkynes (ynamides) are well established in the literature, oxygen-substituted alkynes (ynol ethers) remain far less explored despite their higher intrinsic reactivity. Their limited study is largely due to the relatively few synthetic methods available, yet they hold remarkable potential for the rapid construction of molecular complexity.[4,5]

Herein, we report a rapid and efficient method for the synthesis of β-allenoate **3,** starting from ynol ether **1** and propargylic alcohol **2** in the presence of a gold catalyst under mild conditions. The transformation proceeds through nucleophilic addition of the alcohol to the gold-activated triple bond, followed by a [3,3]-propargylic Claisen rearrangement. After optimization of the reaction conditions, the scope of the methodology was explored by systematically varying both reaction partners, namely the ynol ether and the propargylic alcohol.



[1] Liu, Z.; Wasmuth, A. S.; Nelson, S. G. Au(I)-Catalyzed Annulation of Enantioenriched Allenes in the Enantioselective Total Synthesis of (−)-Rhazinilam. *J. Am. Chem. Soc.* **2006**, *128* (32), 10352–10353.
[2] Brummond, K. M.; Painter, T. O.; Probst, D. A.; Mitasev, B. Rhodium(I)-Catalyzed Allenic Carbocyclization Reaction Affording δ- and ε-Lactams. *Org. Lett.* **2007**, *9* (2), 347–349. https://doi.org/10.1021/ol062842u.
[3] Dutta, S.; Mallick, R. K.; Sahoo, A. K. Regioselective Difunctionalization and Annulation of Ynamide. *Angew Chem Int Ed* **2023**, *62* (30), e202300816.
[4] Minehan, T. G. Tandem Bond-Forming Reactions of 1-Alkynyl Ethers. *Acc. Chem. Res.* **2016**, *49* (6), 1168–1181.
[5] Teng, M.; Xu, Y.; Zhu, X.; Zhou, B.; Ye, L. Catalytic Cycloaddition Reactions of Ynol and Thioynol Ethers. *Chin. J. Chem.* **2024**, cjoc.202400607

P B123

Enantioselective Synthesis of Biologically-Relevant 4-Arylpyridine Atropisomers

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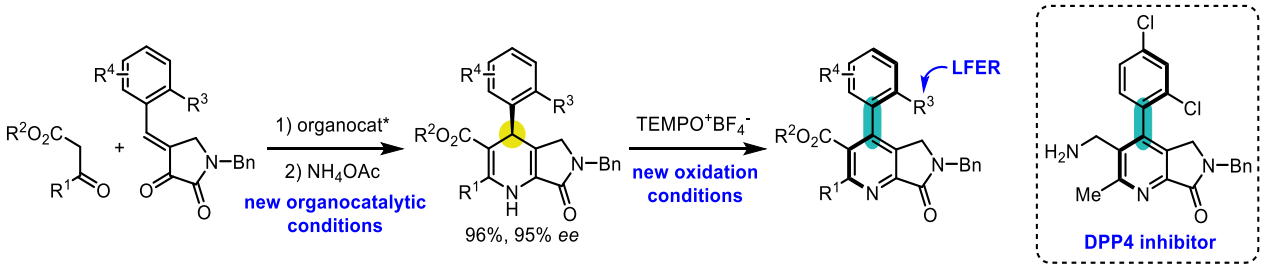
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Atropisomers are very important scaffolds with numerous applications in various fields, such as medicinal chemistry and catalyst design.[1] Some time ago, we have developed a strategy inspired by Hantzsch pyridine synthesis to prepare enantioenriched 4-arylpyridine atropisomers.[2] It combines enantioselective organocatalysis to prepare centrally chiral 4-aryl-1,4-dihydropyridine and an oxidative aromatization with central-to-axial conversion of chirality.[3]

We now disclose the application of this strategy to a new family of 4-aryl-1,4-dihydropyridine, allowing us to prepare enantioenriched 4-aryl-7-azaisoindolin-1-one atropisomers.[4] This study features the implementation of new organocatalytic and oxidation conditions, the identification of a linear free-energy relationship (LFER) between steric parameters and the aromatization stereospecificity, along with an application to the synthesis of a known DPP4 inhibitor.[5]



[1] Lassaletta, J. M. *Atropoisomerism and Axial Chirality*; World Scientific: Singapore, 2019.

[2] Quinonero, O.; Jean, M.; Vanthuyne, N.; Roussel, C.; Bonne, D.; Constantieux, T.; Bressy, C.; Bugaut, X.; Rodriguez, J. Combining Organocatalysis with Central-to-Axial Chirality Conversion: Atroposelective Hantzsch-Type Synthesis of 4-Arylpyridines *Angewandte Chemie International Edition* **2016**, *55*, 1401. https://onlinelibrary.wiley.com/doi/abs/10.1002/anie.201509967

[3] Lemaitre, C.; Perulli, S.; Quinonero, O.; Bressy, C.; Rodriguez, J.; Constantieux, T.; García Mancheño, O.; Bugaut, X. Enantioselective Synthesis of Atropisomers by Oxidative Aromatization with Central-to-Axial Conversion of Chirality *Molecules* **2023**, *28*, 3142. https://www.mdpi.com/1420-3049/28/7/3142

[4] For the synthesis in racemic series and the biological evaluations: Wang, W.; Devasthale, P.; Wang, A.; Harrity, T.; Egan, D.; Morgan, N.; Cap, M.; Fura, A.; Klei, H. E.; Kish, K.; Weigelt, C.; Sun, L.; Levesque, P.; Li, Y.-X.; Zahler, R.; Kirby, M. S.; Hamann, L. G. 7-Oxopyrrolopyridine-derived DPP4 inhibitors-mitigation of CYP and hERG liabilities via introduction of polar functionalities in the active site *Bioorg. Med. Chem. Lett.* **2011**, *21*, 6646. https://www.sciencedirect.com/science/article/pii/S0960894X11013187?via%3Dihub

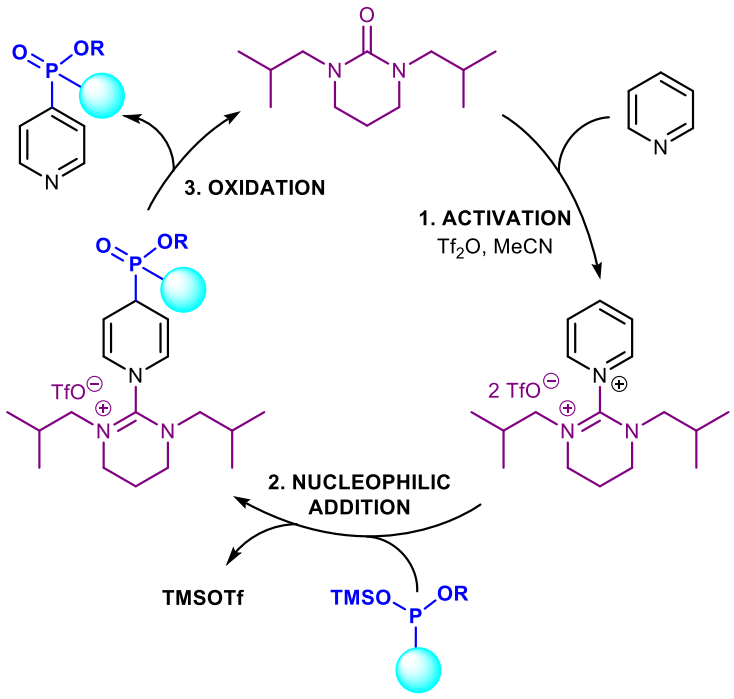
[5] Manuscript in preparation.

P B124

Development of new methodologies for the regioselective synthesis of nitrogen heterocycles functionalized with phosphorus groups

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Phosphorus compounds play a prominent role in many fields such as medicinal chemistry, agrochemistry and catalysis. Consequently, the development of new methodologies allowing for the selective and straightforward functionalization of complex molecules, such as nitrogen-containing heterocycles, through C-P bond formation represents a crucial challenge in organic chemistry. [1,2]



In this work, we are developping a new methodology for the synthesis of phosphonate-functionalized nitrogen heterocycles. These compounds can be obtained via the nucleophilic addition of a wide range of diversely substituted silyl phosphites to electrophilic nitrogen heterocycles, followed by an aromatization step.[3] This highly versatile methodology offers an attractive alternative to commonly employed palladium-catalyszed strategies, which require heterocyclic substrates with suitable pre-functionalization.

[1] J. Dussart et al. *Org. Biomol. Chem*. **2018**, *16*, 6969-6979
[2] N. Ayadi et al. *Molecules*, **2023**, *28*, 6226
[3] H. Liu et al. *Chem. Sci*., **2024**, *15*, 12442-12450

P B125

Regioselective Direct Arylation of Pyrazino[1,3a,6a]triazapentalenes: Impact on Their Fluorescent Properties

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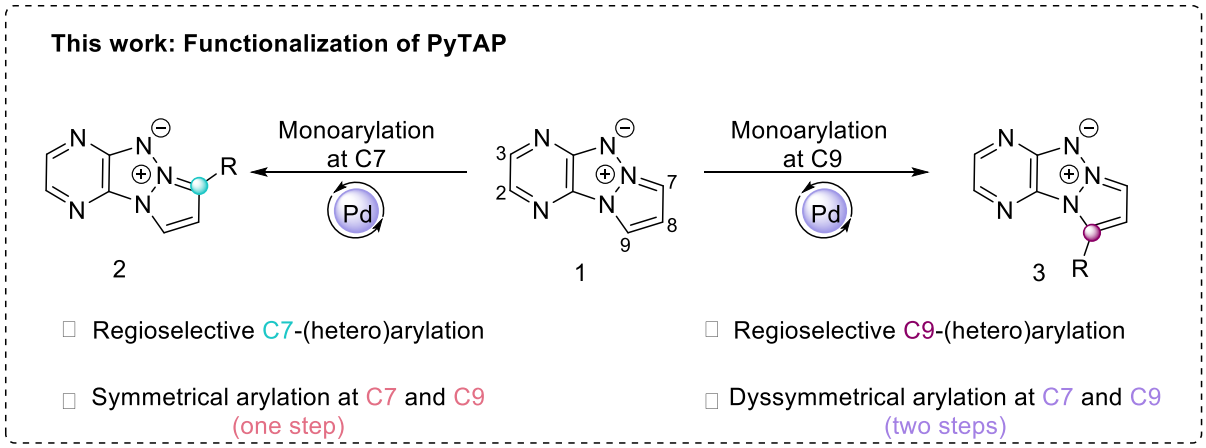
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1,3a,6a-Triazapentalenes (TAP) fused with heteroaromatic ring, especially pyrazine (PyTAP), are an important class of [6-5-5] tricyclic scaffolds, which exhibit interesting fluorescence properties.[1] In order to expand their functional diversity and enhance their photophysical applications, several modifications were explored and among them the Suzuki–Miyaura cross coupling reaction, which was successfully developed on PyTAP at the specific C7, C8, and C2 positions.[2]

Herein, unlike the reported poor reactivity of TAP,[3] the present work underlines the efficient and regioselective direct C–H arylations on their fused analog. Optimized reaction conditions allow us to reach a highly selective monoarylation at position C7 and at the more challenging position C9. Symmetrical and dissymmetrical arylation at positions C7 and C9 of PyTAPs was also developed by using various aryl halide compounds. These obtained arylated derivatives have shown promising fluorescent properties.



Keywords: Pyrazino[1,3a,6a]triazapentalene; CH arylation; palladium catalysis; fluorescence; photophysical properties.

[1] Sirbu, D.; Diharce, J.; Martinić, I.; Chopin, N.; Eliseeva, S. V.; Guillaumet, G.; Petoud, S.; Bonnet, P.; Suzenet, F. An Original Class of Small Sized Molecules as Versatile Fluorescent Probes for Cellular Imaging. *Chem. Commun.* **2019**, *55* (54), 7776–7779. https://doi.org/10.1039/c9cc03765a.

[2] Sirbu, D.; Chopin, N.; Martinić, I.; Ndiaye, M.; Eliseeva, S. V.; Hiebel, M.-A.; Petoud, S.; Suzenet, F. Pyridazino-1,3a,6a-Triazapentalenes as Versatile Fluorescent Probes: Impact of Their Post-Functionalization and Application for Cellular Imaging. *IJMS* **2021**, *22* (12), 6645. https://doi.org/10.3390/ijms22126645.

[3] Wang, Y.; Opsomer, T.; De Jong, F.; Verhaeghe, D.; Mulier, M.; Van Meervelt, L.; Van Der Auweraer, M.; Dehaen, W. Palladium-Catalyzed Arylations towards 3,6-Diaryl-1,3a,6a-Triazapentalenes and Evaluation of Their Fluorescence Properties. *Molecules* **2024**, *29* (10), 2229. https://doi.org/10.3390/molecules29102229.

P B126

Additive-free Alkene Hydrogenation Catalyzed by a Diphoshine-supported Pentahydrido-Molybdenum Complex

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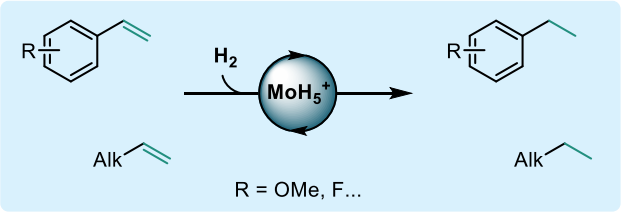
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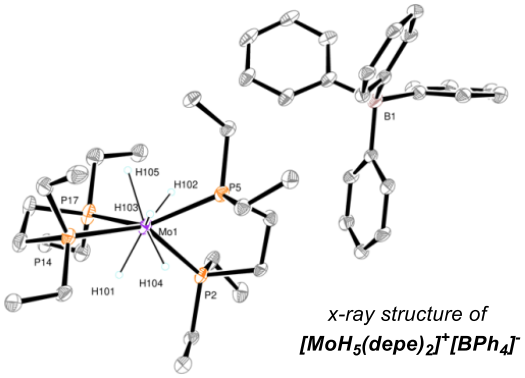
[3] *Departamento de Química Orgánica, Universidad de La Laguna, Avenida Astrofísico Francisco Sánchez, s/n, 38206 La Laguna, Tenerife, Spain*

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Homogeneous hydrogenation is a powerful tool in organic synthesis, yet its widespread implementation is dominated by platinum group metal (PGM)-based catalysts. While these systems exhibit exceptional activity and selectivity, concerns regarding their scarcity, environmental impact, and toxicity increasingly cast doubt on their long-term sustainability.[1] This has driven the search for more sustainable alternatives, particularly hydrides derived from earth-abundant metals, a field that remains underdeveloped.



* *First cationic molybdenum-catalyzed hydrogenation of alkenes*
* *Earth-abundant metal for sustainable catalysis*
* *Crucial and unusual mechanistic insights*



x-ray structure of $[MoH_5(depe)_2]^+[BPh_4]^-$

Fig. *Molybdenum-catalyzed hydrogenation of aromatic and aliphatic alkenes.*

In our group, we previously described the synthesis of a cationic molybdenum pentahydride complex, $[MoH_5(depe)_2]^+$ (depe = 1,2-bis(diethylphosphino)ethane), obtained by protonating its neutral tetrahydride precursor.[2] Herein, we report the first example of a cationic polyhydride molybdenum complex, showcasing broad alkene hydrogenation activity under relatively mild conditions. A mechanistic rationale is proposed, supported by kinetic studies, identification of key intermediates and DFT calculations, providing crucial insight into the distinct reactivity profile of this uncommon class of catalyst. These findings place molybdenum polyhydride complexes as promising, sustainable platforms for the development of next-generation hydrogenation catalysts.

[1] Osorio-Tejada, J. L.; Ferlin, F.; Vaccaro, L.; Hessel, V. The Sustainability Impact of Nobel Prize Chemistry: Life Cycle Assessment of C–C Cross-Coupling Reactions. *Green Chem*. **2023**, *25* (23), 9760–9778.

[2] Queyriaux, N.; Durvin, N.; Leon, D.; Boegli, M.; Vendier, L.; Simonneau, A. Protonation Behavior of a Tetrahydrido Molybdenum(IV) Complex with Organic and Inorganic Acids. *Eur. J. Inorg. Chem.* **2023**, *26* (33), e202300426.

P B127

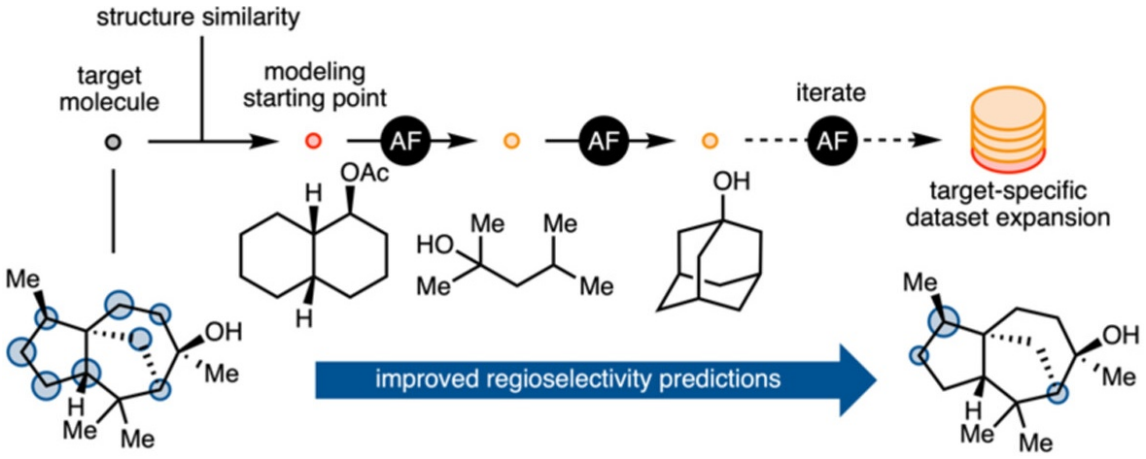
Designing Target-specific Data Sets for Regioselectivity Predictions on Complex Substrates

Jules Schleinitz,[1] Alba Carretero-Cerdán,[1,2] Anjali Gujarapu,[1] Yonathan Harnik,[3] Gina Lee,[1] Amitesh Pandey,[1] Anat Milo[3], Sarah E. Reisman[1]

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The development of machine learning models to predict the regioselectivity of C(sp^3)–H functionalization reactions is reported. A dataset for dioxirane oxidations was curated from the literature and used to generate a model to predict the regioselectivity of C–H oxidation. To assess whether smaller, intentionally designed datasets could provide accuracy on complex targets, a series of acquisition functions were developed to select the most informative molecules for the specific target. Active learning-based acquisition functions that leverage predicted reactivity and model uncertainty were found to outperform those based on molecular and site similarity alone. The use of acquisition functions for dataset elaboration significantly reduced the number of datapoints needed to perform accurate prediction, and it was found that smaller, machine-designed datasets can give accurate predictions when larger, randomly selected datasets fail. Finally, the workflow was experimentally validated on five complex substrates and shown to be applicable to predicting the regioselectivity of arene C–H radical borylation. These studies provide a quantitative alternative to the intuitive extrapolation from “model substrates” that is frequently used to estimate reactivity on complex molecules.

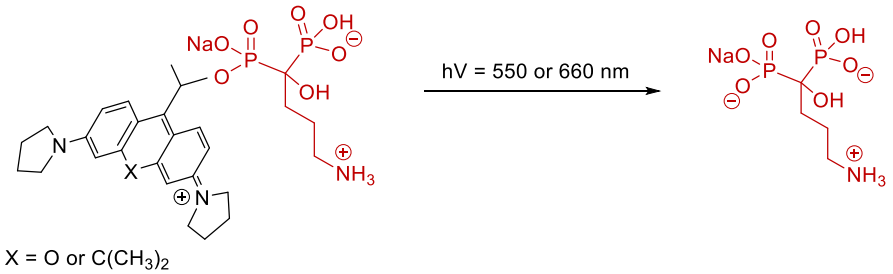


P B128

Development of visible light-sensitive tools to improve the pharmacokinetics of phosphorus molecules as part of a prodrug strategy

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Phosphorus drugs often exhibit unfavorable pharmacokinetic properties due to their hydrophilicity and negative charge at physiological pH, resulting in poor cellular internalization and rapid elimination. The prodrug approach makes it possible to temporarily mask these characteristics to improve their bioavailability. The ChemPhosBio team in the CB3S laboratory has recently developed photosensitive prodrugs that can be activated by near-UV radiation, validating their efficacy in vitro on tumor cells[1]. However, their in vivo activation requires an implantable medical device, due to the low penetration of UV through biological tissues. To overcome this limitation, we propose the design of sensitive prodrugs to visible irradiation, incorporating a fluorophore motif derived from Xanthenium[2]. This fluorophore will enable us not only to monitor their cellular localization prior to irradiation, but also to confirm drug release after photoactivation via fluorescence and HPLC analysis[3]. Finally, evaluation of their cytotoxicity in vitro on various cancer cell lines will enable us to optimize their therapeutic efficacy. We will present here the synthesis of these new photosensitive prodrugs.



[1] Descamps, A.; Arnoux, P.; Frochot, C.; Barbault, F.; Deschamp, J.; Monteil, M.; Migianu-Griffoni, E.; Legigan, T.; Lecouvey, M. Synthesis and Preliminary Anticancer Evaluation of Photo-Responsive Prodrugs of Hydroxymethylene Bisphosphonate Alendronate. *Eur. J. Med. Chem.* **2024**, *269*, 116307. https://doi.org/10.1016/j.ejmech.2024.116307.

[2] Egyed, A.; Németh, K.; Molnár, T. Á.; Kállay, M.; Kele, P.; Bojtár, M. Turning Red without Feeling Embarrassed–Xanthenium-Based Photocages for Red-Light-Activated Phototherapeutics. *J. Am. Chem. Soc.* **2023**, *145* (7), 4026–4034. https://doi.org/10.1021/jacs.2c11499.

[3] ebej, P.; Wintner, J.; Müller, P.; Slanina, T.; Al Anshori, J.; Antony, L. A. P.; Klán, P.; Wirz, J. Fluorescein Analogues as Photoremovable Protecting Groups Absorbing at ~520 Nm. *J. Org. Chem.* **2013**, *78* (5), 1833–1843. https://doi.org/10.1021/jo301455n.

P B129

The molecular hatter: capping calix[4]resorcinarenes with porphyrins

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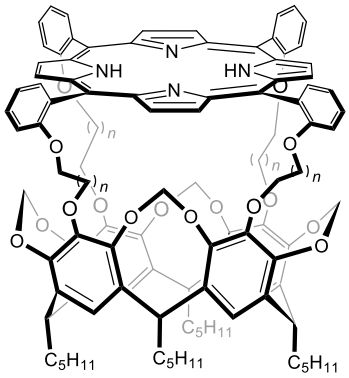
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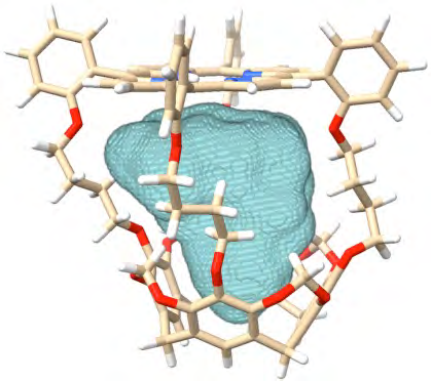
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Inspired by Nature's ability to perform specific and selective reactions using enzymes, chemists have sought to confine catalytic centers in artificial pockets. One strategy aims at using covalent molecular cages. To this end, catalytic centers have been successfully confined in cyclodextrins, calixarenes, cyclophanes and many others.[1] Among them, calix[4]resorcinarene-based cavitands have been studied for decades, mainly for their host-guest properties.[2] These cages can be functionalized, creating deeper cavities suitable for confined catalysis.[2] For this project, we decided to decorate the cavitand with porphyrins which are well known for their catalytic abilities.[3] While the usual synthesis involves the poor-yielded formation of the porphyrin on a functionalized cavitand we decided to explore other pathways to get more versatility and a broad scope of confined catalysts.[4] Tuning the linker's length between the cavitand and the porphyrin will allow the tailor-made obtention of confined catalytic pockets with precise desired cavity volumes.



Targeted porphyno-cavitand



V = 230 Å^3

[1] a) S. Roland, J. Meijide Suárez, M. Sollogoub, *Chem. Eur. J.* **2018**, *24*, 12464; b) K. Bijouard, E. Nicolas, L. Anthore-Dalion, M. Sollogoub, T. Cantat, *Chem. Eur. J.* **2025**, *31*, e202403955; c) L. Le Clainche, Y. Rondelez, O. Sénèque, S. Blanchard, M. Campion, M. Giorgi, A. Duprat, Y. Le Mest, O. Reinaud, *Comptes Rendus Académie Sci. - Ser. IIC - Chem.* **2000**, *3*, 811; d) R. Roy, A. Kar, S. Paul, S. Mohapatra, S. Gosh, *J. Org. Chem.* **2023**, *88*, 14388.

[2] a) V. Jain, P. Kanaiya, *Russ. Chem. Rev.* **2011**, *80*, 75; b) N. Natarajan, E. Brenner, D. Sémeril, D. Matt, J. Harrowfield, *Eur. J. Org. Chem.* **2017**, *41*, 6100; c) P. Delangle, J.-C. Mulatier, B. Tinant, J.-P. Declercq, J.-P. Dutasta, *Eur. J. Org. Chem.* **2001**, *19*, 3695.

[3] L. Schoepff, L. Monnereau, S. Durot, S. Jenni, C. Gourlaouen, V. Heitz, *ChemCatChem* **2020**, *12*, 5826.

[4] M. McKay, T. Cwele, H. Friedrich, G. Maguire, *Org. Biomol. Chem.* **2009**, *7*, 3958.

[5] J. Maglic, R. Lavendomme, *J. Appl. Cryst.* **2022**, *55*, 1033.

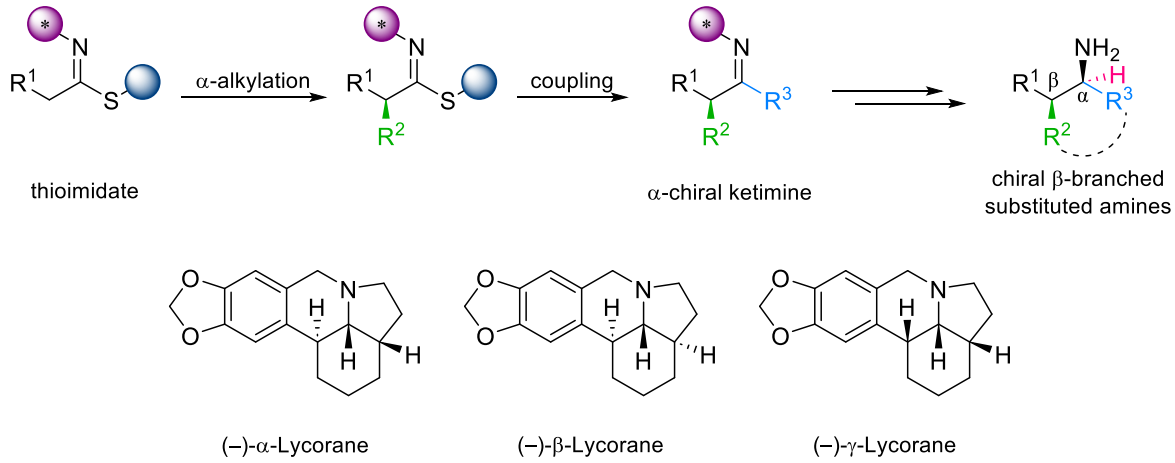
P B130

Thioimidate chemistry: a novel access to the Lycorine family

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Lycorine-type alkaloids, extracted from plants of the *Amaryllidaceae* family, are biologically active compounds with a challenging structure.[1] Their notable biological activity, low natural abundance, limited access *via* asymmetric synthesis, and frequent structural misassignments collectively underscore the need for new synthetic strategies targeting this class of natural products

The SeRCO team recently developed an original synthetic strategy that allowed the preparation of several members of the Lycorine family.[2] Our total syntheses rely on the use of a thioimidate function, allowing alkylation, reduction and coupling reactions, while controlling the diastereoselectivity. This gives an efficient access to chiral β-branched substituted amines. Followed by a key ring-closing metathesis, the strategy provides an entry to the Lycorine family trough the synthesis of (–)-α-Lycorane, (–)-β-Lycorane and (–)-γ-Lycorane (*Scheme 1*).



Scheme 1: Access to the Lycorine family from thioimidate

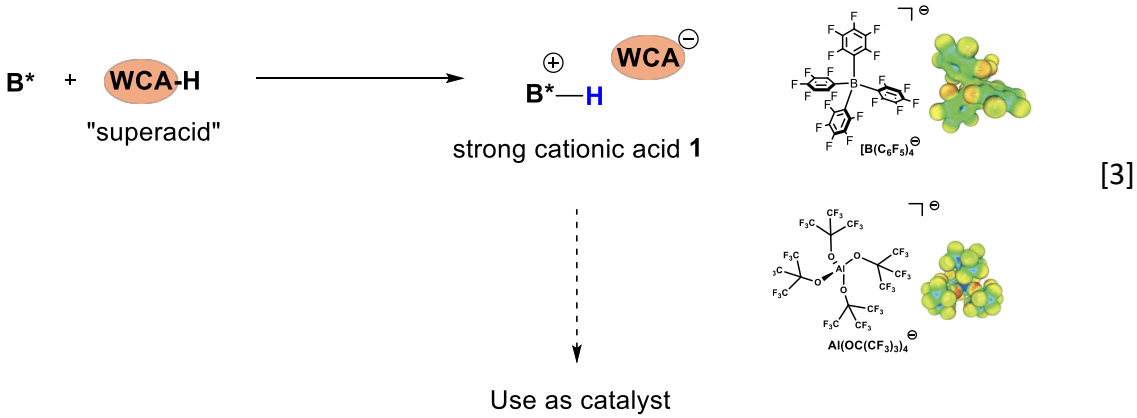
[1] Jin, Z.; Yao, G. Amaryllidaceae and Sceletium Alkaloids. *Nat. Prod. Rep.* **2019**, *36* (10), 1462–1488.
[2] Manuscript in preparation

P B131

Conception of Strong Cationic Organoacids and their Applications in Synthesis

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Systems exhibiting high acidity turned out to be of high interest due to their ability to catalyze various types of reactions containing poorly reactive substrates such as olefins, leading to valuable molecules.[1] Among them, several strong chiral Brønsted Acids demonstrating amazing performance in metal-free catalysis have recently been reported.[2] This family of catalysts has the particularity to be electronically neutral, so the catalysis is assisted by the potentially chiral anion. We have developed an efficient way to access easily handled strong cationic organoacids obtained from the protonation of various very weak bases **B*** (pk_{AH} <0). This protonation is achieved by using cheap and commercially available compounds. We are able to isolate and characterize the corresponding conjugated acids as an unprecedented new group of ionic acids of type **1** featuring weakly coordinating anions. We are now investigating their potential reactivity as Brønsted acid catalysts toward both inter and intramolecular reactions. Finally, if chiral, the chosen weak base can bring the possibility to perform asymmetric catalysis through an original enantioselective protonation process.



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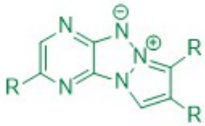
[1] Surendra, K.; Corey, E. J. Highly Enantioselective Proton-Initiated Polycyclization of Polyenes. *J. Am. Chem. Soc.* **2012**, *134* (29), 11992–11994. https://doi.org/10.1021/ja305851h.
[2] Luo, N.; Turberg, M.; Leutzsch, M.; Mitschke, B.; Brunen, S.; Wakchaure, V. N.; Nöthling, N.; Schelwies, M.; Pelzer, R.; List, B. The Catalytic Asymmetric Polyene Cyclization of Homofarnesol to Ambrox. *Nature* **2024**, *632* (8026), 795–801. https://doi.org/10.1038/s41586-024-07757-7.
[3] Riddlestone, I. M.; Kraft, A.; Schaefer, J.; Krossing, I. Taming the Cationic Beast: Novel Developments in the Synthesis and Application of Weakly Coordinating Anions. *Angew. Chem. Int. Ed.* **2018**, *57* (43), 13982–14024. https://doi.org/10.1002/anie.201710782.

P B132

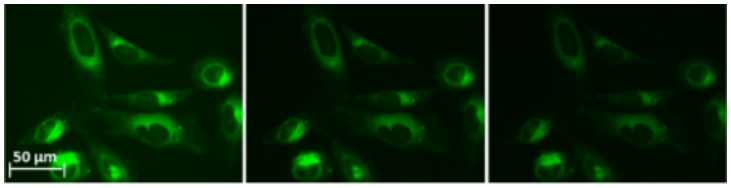
Synthesis and study of Pyrazino-1,3a,6a-TriAzaPentalenes and their fluorescence properties

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The use and interest of fluorophores for all types of applications has grown exponentially in recent years, the variety of structures of these compounds offers a large panel of photophysical properties that are exploitable in numerous fields such as in photovoltaic devices, in biomedicine or as fluorescent switches, probes and sensors.[1–3]
In this context, our research is focused on a family of compact fluorophores, the Pyrazino-1,3a,6a-TriAzaPentalenes (PyTAP) which are obtained from pyrazole derivatives. These highly compact compounds show great potential as fluorophores as they possess good fluorescence in the visible light range, large stoke shifts, solvatochromic properties and up to four functionnalizable positions.[4]
The expertise of our laboratory regarding the synthesis of PyTAPs allowed us to obtain a variety of compounds functionnalized on different sites that can already be used as fluorescent sensors and probes.[5,6] In this poster, we will describe new ways to couple PyTAPs to biomolecules to exploit their solvatochromic properties for live cell imaging.







[1] Umezawa, K.; Citterio, D.; Suzuki, K. New Trends in Near-Infrared Fluorophores for Bioimaging. *Anal. Sci.* **2014**, *30* (3), 327–349. https://doi.org/10.2116/analsci.30.327.
[2] Kong, L.; Wong, H.-L.; Tam, A. Y.-Y.; Lam, W. H.; Wu, L.; Yam, V. W.-W. Synthesis, Characterization, and Photophysical Properties of Bodipy-Spirooxazine and -Spiropyran Conjugates: Modulation of Fluorescence Resonance Energy Transfer Behavior via Acidochromic and Photochromic Switching. *ACS Appl. Mater. Interfaces* **2014**, *6* (3), 1550–1562. https://doi.org/10.1021/am404242a.
[3] Benson, S.; Fernandez, A.; Barth, N. D.; de Moliner, F.; Horrocks, M. H.; Herrington, C. S.; Abad, J. L.; Delgado, A.; Kelly, L.; Chang, Z.; Feng, Y.; Nishiura, M.; Hori, Y.; Kikuchi, K.; Vendrell, M. SCOTfluors: Small, Conjugatable, Orthogonal, and Tunable Fluorophores for In Vivo Imaging of Cell Metabolism. *Angew. Chem. Int. Ed.* **2019**, *58* (21), 6911–6915. https://doi.org/10.1002/anie.201900465.
[4] Sirbu, D.; Diharce, J.; Martinić, I.; Chopin, N.; Eliseeva, S. V.; Guillaumet, G.; Petoud, S.; Bonnet, P.; Suzenet, F. An Original Class of Small Sized Molecules as Versatile Fluorescent Probes for Cellular Imaging. *Chem. Commun.* **2019**, *55* (54), 7776–7779. https://doi.org/10.1039/C9CC03765A.
[5] Janczy-Cempa, E.; Kwiatkowska, A.; Mazuryk, O.; Chopin, N.; Hiebel, M.-A.; Suzenet, F.; Brindell, M. Bioconjugation of Holo-Transferrin with Hypoxia-Enhanced Fluorescent Sensor for the Selective Imaging of Cancer Cells. *Sens. Actuators B Chem.* **2023**, *394*, 134450. https://doi.org/10.1016/j.snb.2023.134450.
[6] Sirbu, D.; Chopin, N.; Martinić, I.; Ndiaye, M.; Eliseeva, S. V.; Hiebel, M.-A.; Petoud, S.; Suzenet, F. Pyridazino-1,3a,6a-Triazapentalenes as Versatile Fluorescent Probes: Impact of Their Post-Functionalization and Application for Cellular Imaging. *Int. J. Mol. Sci.* **2021**, *22* (12), 6645. https://doi.org/10.3390/ijms22126645.

P B133

Organic chiral radicals: from fundamental insights regarding chemical stability to potential applications

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Organic radicals hold a special place in chemistry due to their open-shell electronic configuration, providing them with specific (photo-)reactivity. This class of compounds has also received increasing attention in materials science, because of the possibility to combine electron and spin conduction in molecular electronics.

In this presentation, I would like to show our last results regarding the design of stable organic radicals in which the singly occupied molecular orbital (SOMO) is below the highest doubly occupied molecular orbital (HOMO) level (Fig. 1A).[2] These results bring new fundamental insights regarding the notion of stability for this type of compounds, while affording a promising strategy for the synthesis of polyradicals with potentially high spin state. Our investigations also provide an original design for combining the peculiar features of radical with a chiral π-conjugated system,[3] enabling specific interactions with circularly polarized (CP) light, magneto-chiral effects, and a reversible control of chirality elements (Fig. 1B).

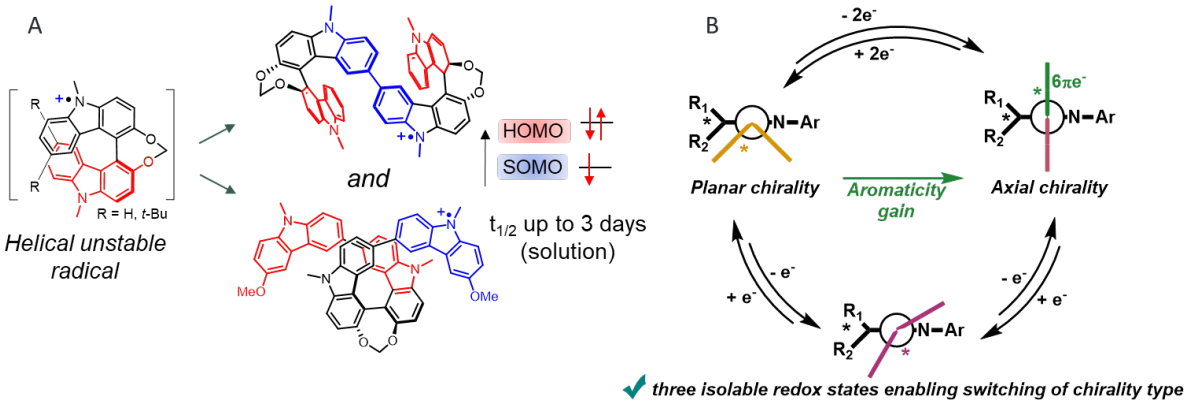


Figure 1: **A**: Helically radical cationic carbazole derivatives, with a schematic illustration of the SOMO-HOMO Inversion (SHI) present in both mono- and diradical derivatives (counter-ions are omitted for clarity reasons); **B** Schematic illustration of the redox control of chirality elements (work in collaboration with the group of G. Bertrand).

[1] Sugawara, T.; Matsushita, M. M., *J. Mater. Chem.* **2009**, *19* (12), 1738; Guo, H.; Peng, Q.; Chen, X.-K.; Gu, Q.; Dong, S.; Evans, E. W.; Gillett, A. J.; Ai, X.; Zhang, M.; Credgington, D.; et al. *Nat. Mater.* **2019**, *18*, 977.

[2] S. Kasemthaveechok, L. Abella, M. Jean, M. Cordier, T. Roisnel, N. Vanthuyne, T. Guizouarn, O. Cador, J. Autschbach, J. Crassous, L. Favereau, *J. Am. Chem. Soc*. **2020**, *142*, 20409 / **2022**, *144*, 7253; S. Kasemthaveechok, L. Abella, J. Autschbach, J. Crassous, L. Favereau, *Chem. Sci.*, **2022**, *13*, 9833.

[3] C. Shu, Z. Yang, A. Rajca, Chem. Rev., **2023**, *123*, 11954; J. Crassous, M. J. Fuchter, D. E. Freedman, N. A. Kotov, J. Moon, M. C. Beard, S. Feldmann, *Nat. Rev. Mater.*, **2023**, *8*, 365.

P B134

Nitrogen–Nitrogen Double Bond Activation by Low-Valent Ni$^{(0)}$ complexes

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Access to polynitrogen molecules is crucial for developing new energetic materials. Therefore there is a need to understand the reactivity of nitrogen-rich functions, with a view to accessing new useful structures. Over the last decade, the HCEP laboratory gained knowledge toward the synthesis of complex polynitrogen compounds *via* nucleophilic, oxidative, and photocatalytic pathways.[1]

Recently, we introduced organometallic tools to expand opportunities in the fields of N-N bonds activation and functionalization. Only a few examples in the literature deal with the activation of azo compounds with transition metal complexes,[2] while the use of aryltriazenes is well documented.[3]

Our main objectives were to develop Ni$^{(0)}$-mediated activation of small polynitrogen compounds, especially those bearing N-N double bonds such as azo and triazenes, and then to explore the reactivity of the thus formed Ni$^{(II)}$ complexes to increase molecular complexity at the metal center, and eventually to generate new polynitrogen structures.

The first results (Figure 1) showed a specific behavior of triazenes bearing electron-withdrawing groups on external nitrogen atoms. Activation by the Ni(COD)$_2$/dcype system led to a rare example of a Ni$^{(II)}$-CO$_2$R complex[4] through molecular nitrogen extrusion, whose structure was confirmed by X-ray diffraction. On the other hand, tuning the electronic properties of azo bridges allowed us to specifically steer the reactivity either toward the formation of a three-membered aza-nickellacycle or a likely five-membered complex by O-chelation.

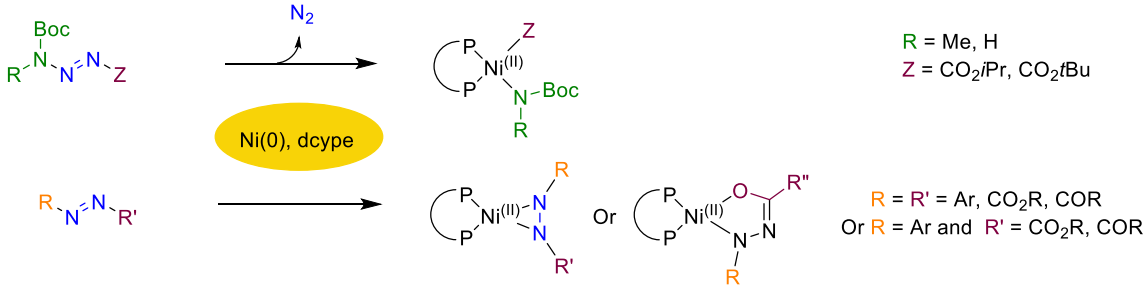


Figure 3 : Activation of N-N double bonds by Ni$^{(0)}$ complex[1]

[1] a) Glowacki, A. *et al.* C- vs. N-Oxidations of Benzyltriazanes: Selective Access to Triazones, Azimines, and Triazenes. *Synlett* **2018**, 29, 566–570 b) Renault, A. *et al.* Catalytic Aerobic Oxidation of Hydrazines into 2-Tetrazenes. *Eur. J. Org. Chem.* **2022**, e202200265 c) Gamby, E. *et al.* Mild Photocatalytic Synthesis of Azimines. *Eur. J. Org. Chem.* **2022**, e202201071.

[2] Muñiz, K. *et al.* Catalytic Activation of N-N Multiple Bonds: A Homogeneous Palladium Catalyst for Mechanistically Unprecedented Reduction of Azo Compounds. *Angew. Chem. Int. Ed.* **2006**, 45, 2305–2308.

[3] a) Wang, C. *et al.* General and Efficient Synthesis of Indoles through Triazene-Directed C–H Annulation. *Angew. Chem. Int. Ed.* **2013**, 52, 5795–5798. b) Wang, C. *et al.* Rhodium(III)-Catalyzed C-H Activation of Arenes Using a Versatile and Removable Triazene Directing Group. *Angew. Chem. Int. Ed.* **2012**, 51, 7242–7245.

[4] Otsuka, Sei. *et al.* Chemistry of Alkoxycarbonyl, Acyl, and Alkyl Compounds of Nickel(II) and Palladium(II). *J. Am. Chem. Soc.* **1973**, 95, 3180–3188.

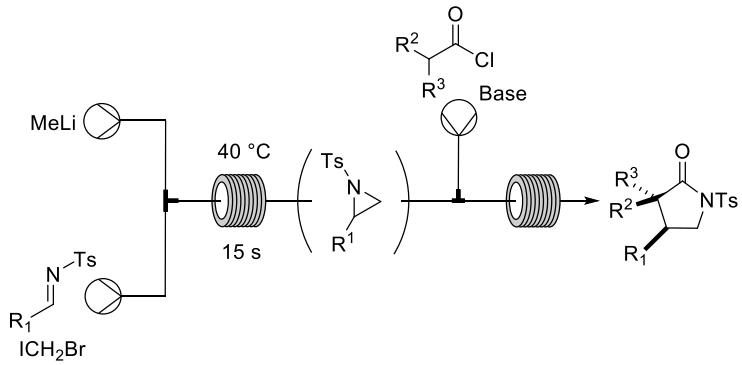
P B135

Reactivity of ketenes using flow chemistry

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With years of experience working on ketenes[1] and total synthesis of natural products,[2] the SeRCO team recently developed a formal (3+2) cycloaddition between ketenes and aziridines.[3] This transformation provides, in excellent yields, a direct synthetic route to γ-lactams—structural motifs frequently encountered in natural products. However, the high reactivity and intrinsic instability of ketenes, typically generated in situ, have so far limited the diversification of substituents on the resulting lactams. To overcome this limitation, we targeted to transpose the (3+2) cycloaddition into a continuous-flow process.

In this context, we successfully synthesised a broad range of aziridines under non-cryogenic conditions on a large scale, investigated the in-flow generation and reactivity of ketenes in cycloaddition reactions, and established a continuous-flow method for the direct synthesis of γ-lactams from imines *(Scheme 1)*.



Scheme 2

[1] Rullière, P.; Grisel, J.; Poittevin, C.; Cividino, P.; Carret, S.; Poisson, J.-F. Thermal [2 + 2]-Cycloaddition of Ketenes with Chiral Enol Ethers: Route to Densely Substituted Cyclobutanones. *Org. Lett.* **2016**, *18*, 2824–2827.
[2] Deprés, J.-P.; Delair, P.; Poisson, J.-F.; Kanazawa, A.; Greene, A. E. Diverse Natural Products from Dichlorocyclobutanones: An Evolutionary Tale. *Acc. Chem. Res.* **2016**, *49*, 252–261.
[3] Viceriat, A.; Marchand, I.; Carret, S.; Poisson, J.-F. Synthesis of γ-Lactams by Formal Cycloadditions with Ketenes. *Org. Lett.* **2021**, *23*, 2449–2454.

P B136

Synthesis of 4-phosphonyl-pyrrolidin-3-ones via [3+2] cycloaddition of nitrones with phosphonylallenes

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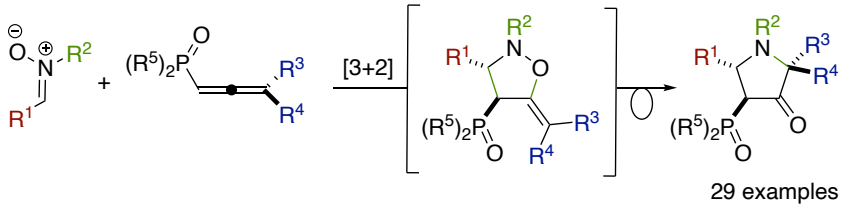
[2] *University of Carthage, Faculty of Sciences of Bizerte, Laboratory of Hetero-organic Compounds and Nanostructured Materials (LR18ES11), 7021 Jarzouna, Tunisia*

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The 1,3-dipolar cycloaddition is an efficient method for the preparation of various five-membered heterocycles, often in high yields and with excellent stereocontrol. Cycloadditions of nitrones with alkenes and alkynes are well studied and lead, depending on the nature of the substrates and the operating conditions, to isoxazolidines, isoxazolines, acylaziridines, or β-lactams.[1] Compared to these well-documented examples, only a few 1,3-dipolar cycloadditions of nitrones with allenes have been reported, usually bearing electron-withdrawing groups.[2]

In this context, we report the 1,3-dipolar cycloaddition reaction of nitrones with phosphonylallenes, leading to a new family of pyrrolidine-3-ones. The optimal operating conditions were evaluated according to several parameters (solvents, temperature: classical heating or microwave irradiation, influence of Lewis acids...). A series of 4-phosphonylpyrrolidine-3-ones was obtained in good to excellent yields and with very good diastereoselectivities (Scheme 3).[3] Some insights into the mechanism were found using DFT calculations.[4]



Scheme 3

[1] (a) Saito, T.; Yamada, T.; Miyazaki, S.; Otani, T. *Tetrahedron Lett*. **2004**, *45*, 9585-9587 (b) Cai, X.; Wang, C.; Sun, J. *Adv. Synth. Catal*. **2012**, *354*, 359-363 (c) Tangara, S.; Kanazawa, A.; Py, S. *Eur. J. Org. Chem*. **2017**, *43*, 6357-6364. (d) Tangara, S.; Aupic, C.; Kanazawa, A.; Poisson, J.-F.; Py, S. *Org. Lett.* **2017**, *19* (18), 4842–4845.

[2] (a) Padwa, A.; Bullock, W. H.; Kline, D. N.; Perumattam, J. *J. Org. Chem*. **1989**, *54*, 2862-2869.

[3] (a) Hammami, R.; Maldivi, P.; Philouze, C.; Carret, S.; Darses, B.; Touil, S.; Poisson, J. *Adv Synth Catal*. **2023**, *365*, 1385–1390. (b) Hammami, R.; Mele, L.; Touil, S.; Virieux, D.; Poisson, J.; Ayad, T.; Darses, B. *Eur J Org Chem*. **2025**, *28*, e202500390.

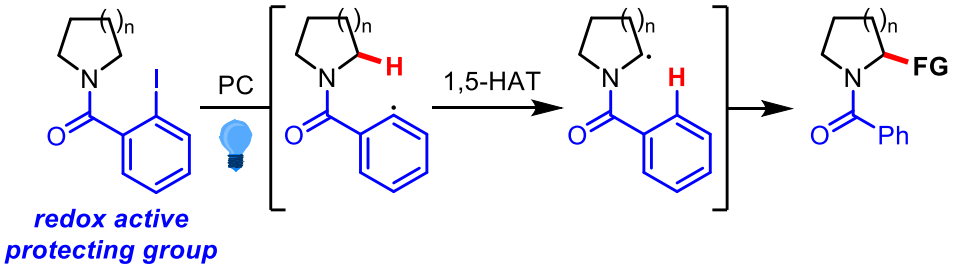
[4] Hammami, R.; Maldivi, P.; Carret, S.; Touil, S.; Poisson, J.; Darses, B. *Eur J Org Chem.* **2025**, *28*, e202500359.

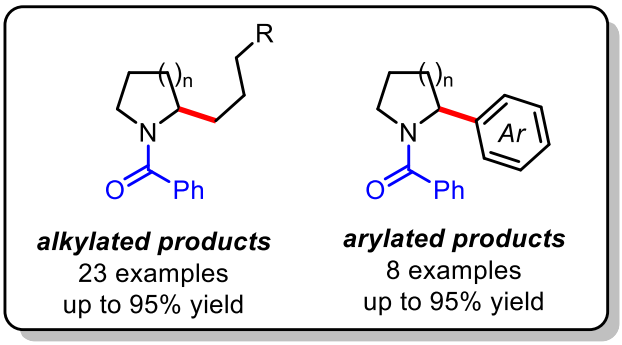
P B137

Photocatalytic C-H Functionalization of Saturated Azaheterocycles with a Redox Active Protecting Group

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Saturated nitrogen-containing heterocycles are ubiquitous structural motifs in natural products and bioactive compounds.[1] Because of their prevalence, the development of novel methods in heterocyclic chemistry is of paramount importance. In this respect, catalytic strategies targeting the C-H functionalization of azaheterocycles represents an ideal way to obtain a variety of molecularly diverse analogs starting from a single and readily available heterocyclic precursor.
Herein, we present a photocatalytic strategy for the C-H functionalization of saturated azaheterocycles under mild conditions with only one equivalent of starting material.[2] Our strategy is based on a redox active benzamide protecting group that is activated *via* a halogen-atom transfer (XAT) process to trigger the formation of an α-amino radical. This nucleophilic radical intermediate was then engaged in Giese additions and radical cross couplings to afford a range of C-H alkylated and arylated products.





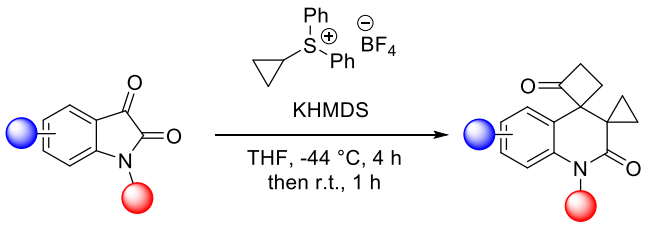
[1] Vitaku, E.; Smith, D. T.; Njardarson, J. T. Analysis of the Structural Diversity, Substitution Patterns, and Frequency of Nitrogen Heterocycles among U.S. FDA Approved Pharmaceuticals. *J. Med. Chem.* **2014**, *57*, 10257-10274.
[2] Pizzio, M. G.; Mata, E. G.; Dauban, P.; Saget, T. Photocatalytic C-H Functionalization of Nitrogen Heterocycles Mediated by a Redox Active Protecting Group. *Eur. J. Org. Chem.* **2023**, *26*, e202300616.

P B138

Skeletal Edition of Isatins towards Complex Spiroquinolinone Substrates

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The spiroannulation/rearrangement strategy pioneered by Trost, employing cyclopropyldiphenylsulfonium tetrafluoroborate, offers a robust route to the synthesis of cyclobutanone frameworks from aldehydes and ketones.[1,2] This strategy has been widely used to increase the molecular complexity and in the total synthesis of natural products.[3]
Besides, isatin derivatives are versatile scaffolds in organic synthetic chemistry — capable of various reactions towards electrophilic and nucleophilic species, and was also subjected to ring-expansion to access various interesting skeleton.[4]
Recent progress in skeletal editing of isatins, involving ring expansions to generate quinoline, quinazoline, and other heterocyclic structures, highlights the growing importance of isatin-based synthesis towards biologically important heterocyclic compounds.[5]
Herein, we describe an interesting rearrangement of isatin towards widely substituted quinolinone derivatives. Indeed, this novel reaction allows the ring expansion of the isatin motif while installing two consecutive spirocyclic carbon centers. This streamlined method furnishes spirocyclobutanone – quinoline substrates — offering rich structural diversity for future synthetic and medicinal chemistry exploration.



[1] Trost, B. M.; Bogdanowicz, M. J. New Synthetic Reactions. X. Versatile Cyclobutanone (Spiroannelation) and Gamma -Butyrolactone (Lactone Annelation) Synthesis. *J. Am. Chem. Soc.* **1973**, *95*, 5321–5334.
[2] Guérot, C.; Tchitchanov, B. H.; Knust, H.; Carreira, E. M. Synthesis of Novel Angular Spirocyclic Azetidines. *Org. Lett.* **2011**, *13*, 780–783.
[3] Puppala, M.; Gore, S.; Eyong, K. O.; Baskaran, S. Stereoselective Domino Semipinacol-Schmidt Reaction: Diastereoselective Synthesis of 7 a-Epi-(+)-Lepadiformine C and Formal Synthesis of 7 a-Epi-(−)-Lepadiformine A. *Eur. J. Org. Chem.* **2023**, *26*, e202201490.
[4] Panda, S. S.; Girgis, A. S.; Aziz, M. N.; Bekheit, M. S. Spirooxindole: A Versatile Biologically Active Heterocyclic Scaffold. *Molecules* **2023**, *28*, 618.
[5] Chandramani, R.; Nair, A. R.; Sreekumar, A.; Aerathupalathu Janardhanan, J.; Sivan, A. Single Step Upgradation of Isatin to Bioactive Fused Heterocycles via Ring Expansion Reactions. *Eur. J. Org. Chem.* **2024**, *27*, e202301000.

P B139

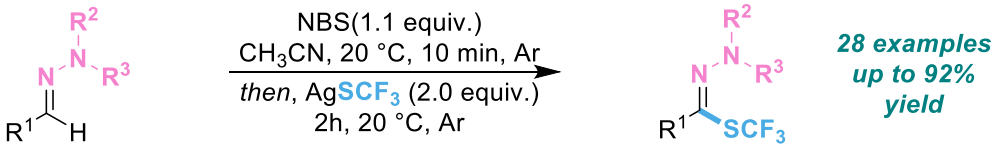
C–H Trifluoromethylthiolation of Aldehyde Hydrazones

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The fluorine atom is highly sought-after for modifying the properties of compounds, owing to its electronegativity, small size, weak polarizability and high energy of the C–F bond.[1] Today, 25% of all pharmaceuticals and 35% of agrochemicals on the market contain at least one fluorine atom.[2] The trifluoromethylthio group (SCF_3) is a prominent chemical motif in modern organic chemistry, often compared to the more widely reported trifluoromethyl (CF_3) group due to their similar physicochemical properties.[3] The SCF_3 moiety exhibits a high electron-withdrawing capacity, characterized by a Hammett substituent constant (σ) of 0.50, closely matching that of CF_3 (σ = 0.54). Notably, the SCF_3 group also displays significantly greater lipophilicity, with a Hansch constant (π) of 1.44 compared to 0.88 for CF_3,[4] making it particularly attractive in medicinal and agrochemical applications. In this context, we report a selective one-pot, two-step protocol for the C–H trifluoromethylthiolation of aldehyde hydrazones, providing access to a valuable and unprecedented class of SCF_3-containing building blocks. Starting from readily available (hetero)aromatic and aliphatic hydrazones, the transformation proceeds under mild oxidative conditions using *N*-bromosuccinimide (NBS) and commercially accessible $AgSCF_3$ as the nucleophilic reagent.[5]

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[1] (a) Smart, B. E. Fluorine substituent effects (on bioactivity). *J. Fluor. Chem.* **2001**, *109*, 3–11. (b) J.-P., Bégué, D., Bonnet-Delpon, Bioorganic and Medicinal Chemistry of Fluorine. *John Wiley & Sons, Inc.*: Hoboken, NJ, USA, **2008**. (c) O'Hagan, D. Understanding organofluorine chemistry. An introduction to the C–F bond. *Chem. Soc. Rev.* **2008**, *37*, 308–319.

[2] (a) Wang, J.; Sánchez-Roselló, M.; Acenã, J. L.; del Pozo, C.; Sorochinsky, A.; Fustero, S.; Soloshonok, V.; Liu, H. Fluorine in Pharmaceutical Industry: Fluorine-Containing Drugs Introduced to the Market in the Last Decade (2001–2011). *Chem.Rev.* **2014**, *114*, 2432–2506. (b) Britton, R.; Gouverneur, V.; Lin, J.H.; Meanwell, M.; Ni, C.; Pupo, G.; Xiao, J.C.; Hu, J. Contemporary synthetic strategies in organofluorine chemistry. *Nat. Rev. Methods Primers* **2021**, *1*, 47–69 (c) Gillis, E.; Eastman, K.; Hill, M.; Donnelly, D.; Meanwell, N. Applications of Fluorine in Medicinal Chemistry. *J. Med. Chem*. **2015**, *58*, 8315–8359; (d) Ilardi, E.; Vitaku, E.; Njardarson, J. Data-Mining for Sulfur and Fluorine: An Evaluation of Pharmaceuticals To Reveal Opportunities for Drug Design and Discovery: Miniperspective. *J. Med. Chem.* **2014,** *57*, 2832–2842.

[3] (a) Toulgoat, F.; Alazet, S.; Billard, T. Direct Trifluoromethylthiolation Reactions: The "Renaissance" of an Old Concept. *Eur J. Org. Chem.* **2014**, *12*, 2415–2428. (b) Monsigny, L.; Doche, F.; Besset T. Transition-metal-catalyzed C–H bond activation as a sustainable strategy for the synthesis of fluorinated molecules: an overview. *Beilstein J. Org. Chem.* **2023**, *19*, 448–473.

[4] (a) Hansch, C.; Leo, A.; Taft, R. W. A survey of Hammett substituent constants and resonance and field parameters. *Chem. Rev.* **1991**, *91*, 165. (b) Hansch, C.; Leo, A.; Unger, S. H.; Kim, K. H..; Nikaitani, D.; Lien, E. J. Aromatic substituent constants for structure-activity correlations. *J. Med. Chem*. **1973**, *16*, 1207–1216.

[5] Levet, V.; Balu, R.; Wang, C.; Besset, T. C–H Trifluoromethylthiolation of aldehyde hydrazones *Beilstein J. Org. Chem.* **2024**, *20*, 2883–2890.

P B140

Want to master chemoselective reduction of phthalimides? Use Samarium electrocatalysis!

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Phthalimides and their derivatives are widely used in industries as pesticides, preservatives, pigments, and pharmaceuticals.[1] However, current methods for their selective reduction often require high-pressure hydrogen and elevated temperatures, yielding low efficiency and limited scope. This drives the search for milder, more selective alternatives.
In this context, we developed Sm(II)-electrocatalytic methods for efficient C–C bond formation,[2] azobenzene synthesis from nitroarenes,[3] and selective CO_2 reduction to carboxylic acids,[4] highlighting the superior reactivity and selectivity of electrogenerated samarium species over traditional SmI_2 chemistry. Applied to the reduction of phthalimides our electrocatalytic process demonstrated very high selectivity according to the electrochemical conditions. Indeed, in presence of alcohols the catalytic reduction of phthalimides affords the corresponding 2-substituted isoindolinones.[5]
Based on these results we considered the possibility of extending this procedure to include other potential nucleophiles (Figure 1).

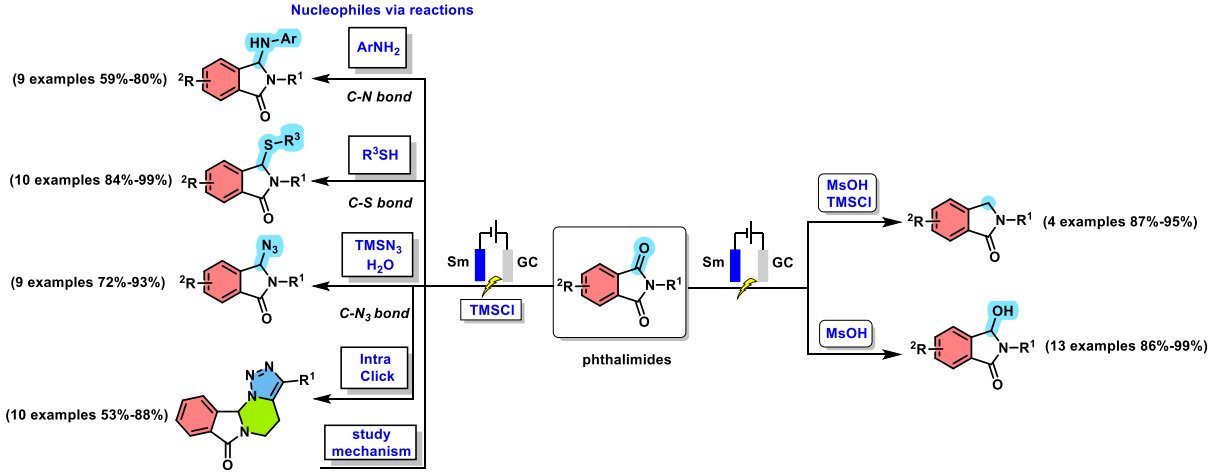


Fig. 1 Sm(II)-catalyzed selective and controlled electrochemical reduction of phthalimides

Indeed, using amines, thiols instead of alcohols led to a selective reductive amination and thiolation. In addition, the use of $TMSN_3$ in presence of water led to a selective reductive azidation, which we were able to exploit in intramolecular click chemistry reactions. Moreover, the simple modification of the electrolytic medium allows us to control the reactivity. Thus, in the presence of a proton donor such as MsOH the reaction leads exclusively to the corresponding ω-hydroxylactams and in presence of both MsOH and TMSCl the complete reduction of phthalimide into isoindolinones occurs with total selectivity.

[1] P. M. Lorz, F. K. Towae, W. Enke, R. Jäckh, N. Bhargava and W. Hillesheim, *Phthalic Acid and Derivatives, in Ullmann's Encyclopedia of Industrial Chemistry*, **2007**, *p.*131.
[2] L. Sun, K. Sahloul and M. Mellah, *ACS Catal.*, **2013**, *3*, 2568.
[3] Y.-F. Zhang and M. Mellah, *ACS Catal.*, **2017**, *7*, 8480.
[4] Bazzi, S.; Schulz, E.; Mellah, M., *Org. lett.*, **2019**, *21*, 10033.
[5] Y.-F. Zhang and M. Mellah, *Org. Chem. Front.*, **2022**, *9*, 1308.

P B141

SET- and DET-photocatalysis with super organic electron donors

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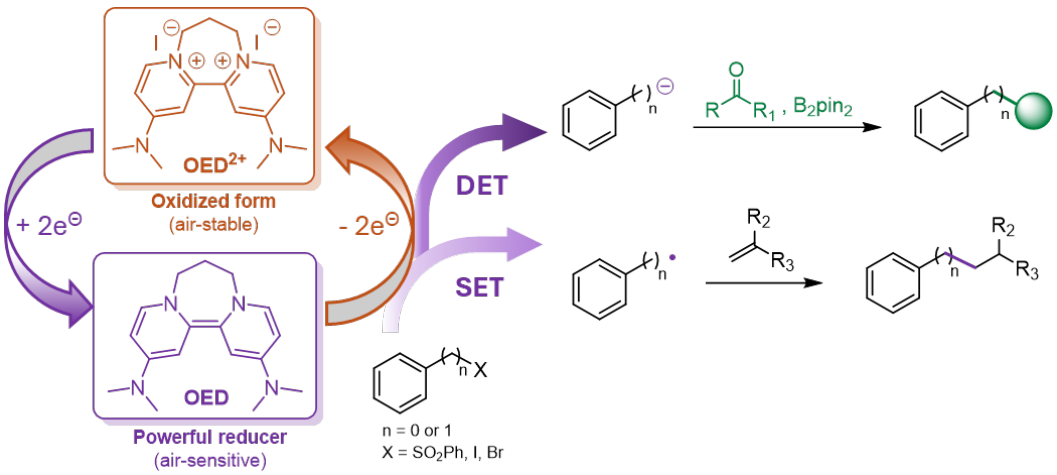
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Photocatalyzed reductive methodologies have emerged as powerful strategies for generating novel radical species under mild condition.[1] Among the different photocatalysts, organic dyes are an attractive alternative to transition-metal complexes.[2] However, their relatively low reduction potential restricts their application to single-electron transfers toward highly electron-deficient acceptors.

In the quest for innovative and selective reduction methodologies, super organic electron donors (OEDs) represent ideal eco-compatible and powerful reducing agents capable of generating radical or anionic species through single- or double-electron transfers.[3,4] However, upon electron donation, OEDs are converted into exceptionally stable cationic species. This stability precludes the regeneration of the active donor, thereby constituting a fundamental limitation to their catalytic application in redox processes.

To overcome this limitation, we developed a strategy that efficiently regenerates strongly reducing OEDs from their oxidized dicationic form (OED^{2+}), thereby enabling their use in catalytic amounts. Importantly, this approach provides catalytic access to both radical and anionic intermediates (SET- and DET-catalysis). The reduction of low-potential groups, like sulfones, aryl halides, and triflates, furnishes radical or anionic species. In particular, the generation of benzyl or aryl anions opens a novel catalytic pathway that allows their subsequent engagement in nucleophilic additions.



[1] Prier C. K.; Rankic D. A.; Macmillan D. W. C. Visible Light Photoredox Catalysis with Transition Metal Complexes: Applications in Organic Synthesis. *Chem. Rev.* **2013**, *113*, 5322−5363.

[2] Romero N. A.; Nicewicz D. A., Organic Photoredox Catalysis *Chem. Rev.*, **2016**, *116*, 10075–10166.

[3] Broggi J.; Terme T.; Vanelle P. Organic Electron Donors as Powerful Single-Electron Reducing Agents in Organic Synthesis. *Angew. Chem. Int. Ed.* **2014**, *53*, 384-413.

[4] Assani N.; Delfau L.; Smits P.; Redon S.; Kabri Y.; Tomás-Mendivil E.; Vanelle P.; Martin D.; Broggi J. A simple N-heterocyclic carbene for the catalytic up-conversion of aldehydes into stoichiometric super electron donors. *Chem. Sci*. **2024**, *15*, 14699–14704.

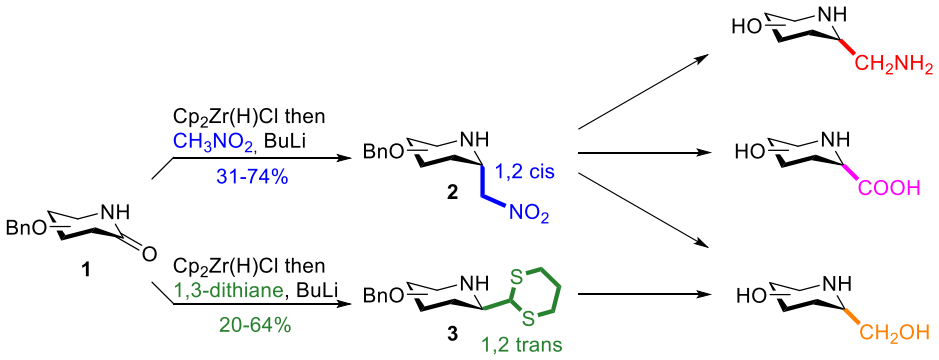
P B142

Synthesis of functionalizable iminosugar *C*-glycosides through processing of nitro and dithiane derivatives obtained from readily available sugar lactams

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Iminosugars are sugar mimetics in which endocyclic oxygen has been replaced by nitrogen. They are recognized as a relevant class of glycomimetics as they are potent glycosidase and glycosyltransferase inhibitors.[1,2] Introduction of a *C*-linked substituent at the pseudoanomeric position of iminosugars give access to iminosugar *C*-glycosides that exhibit improved enzymatic stability and selectivity. The synthesis of iminosugar *C*-glycosides remains challenging and requires the development of stereoselective strategies.[3] Amongst them, we focus on the addition of *C*-nucleophiles to cyclic imines and described recently the synthesis of a series of iminosugar *C*-methyl and *C*-difluoromethylphosphonates.[4] This synthesis exploits a Schwartz's reagent-mediated stereoselective sugar lactam to imine reduction[5] followed by nucleophilic addition of methylphosphonate anions.

Taking advantage of this strategy using cyclic imines, we present here the stereocontrolled synthesis of 1,2-*cis*-1-*C*-nitromethyl iminosugars **2** (nitro-Mannich) and 1,2-*trans*-1-*C*-1,3-dithian-2-yl iminosugars **3** (Corey-Seebach) from readily available sugar lactams **1**. These new iminosugar C-glycosides are then converted to pipecolic acids **4** and homoiminosugars **5** and **6** that could allow further functionalizations.



Scheme: General strategy to obtain functionalizable iminosugar C-glycosides

[1] Horne, G.; Wilson, F. X. Therapeutic Applications of Iminosugars: Current Perspectives and Future Opportunities. *Progress in Medicinal Chemistry* **2011**, *50*, 135-176.
[2] Conforti, I.; Marra, A. Iminosugars as glycosyltransferases inhibitors. *Org. Biomol. Chem.* **2021**, *19*, 5439-5475.
[3] Compain, P.; Chagnault, V.; Martin, O.R. Tactics and strategies for the synthesis of iminosugar C-glycosides: a review. *Tetrahedron: Asymmetry* **2009**, *20*, 672-711.
[4] Tran, T.V.; Désiré, J.; Auberger, N.; Blériot, Y. Stereoselective Synthesis of 1-C-Diethylphosphonomethyl and -difuoromethyl Iminosugars form Sugar Lactams. *J. Org. Chem.* **2022**, *87*, 7581-7585.
[5] Szcześniak, P.; Stecko, S.; Staszewska-Krajewska, O.; Furman, B. Sugar-derived cyclic imines: one-pot synthesis and direct functionalization. *Tetrahedron* **2014**, *70*, 1880-1888.

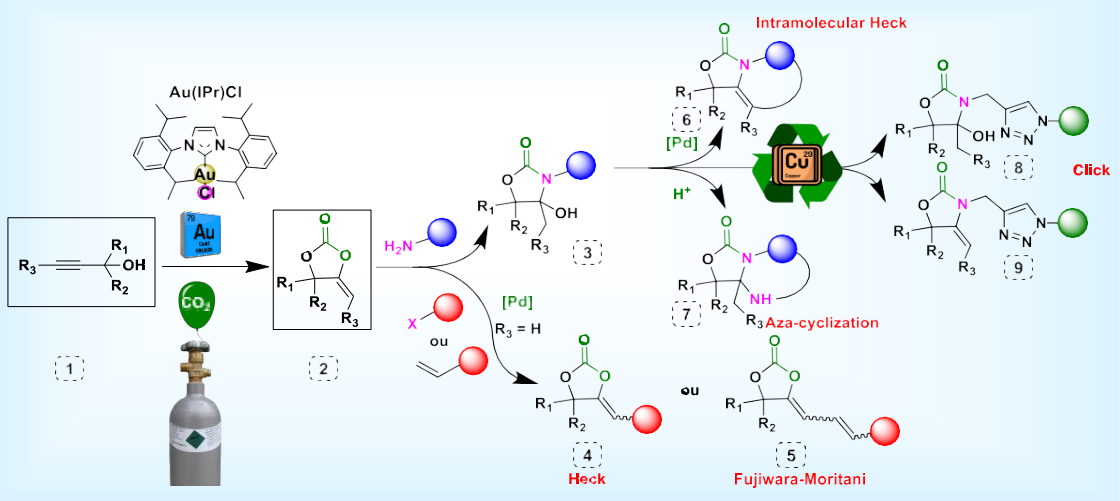
P B143

Valorization of CO_2 in synthesis through carbonates

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In the current context of sustainable chemistry development and new regulations, CO_2 emission keep increasing dramatically. This greenhouse gas, which remains untapped, can however be one of the among biggest sources of one C (*pivotal one carbon materials*) as building blocks for the chemical industry and chemical sciences. Considering its very low reactivity, it can only be activated under harsh conditions using very expensive and toxic transition metals.[1] The effective activation of CO_2 must allow access to a molecular diversity such as methane, methanol, formaldehyde and even formic acid, considered as a hydrogen reservoir. The multiplicity of these variations, even modest, would allow us to quit our dependence on burning fossil resources like charcoal, natural gas, oil and many others.



In this work, and unexplored cyclic carboxylation of propargylic alcohols[2] in **an atmospheric pressure of CO_2** through metal activation is described. Using a gold catalyst (Au(IPr)Cl), exovinylene carbonates **2** (EVC) were obtained in very high yields, which with primary amines provide a large variety of oxozolidinones **3**. With halides and olefins they furnished substituted carbonates **4** and **5** by using a Pd-coupling conditions.[3,4] The resulting hydroxylactams **3** offer, also for their part, a plenty of possibilities including cyclic enamides **6** and *N,N*-aminals **7** through an intramolecular Heck reaction and an original aza-cyclisation in acidic media respectively. Hydroxylactams **3** can also lead through click reaction, but by using catalysts supported on montmorillonite or extracted from contaminated soil, to compounds **8** and **9**.

[1] Federsel, C.; Jackstell, R.; Beller, M. *Angew. Chem. Int. Ed.* **2010**, *49*, 6254–6257.
[2] Yuan, Y.; Xie, Y.; Zeng, C.; Song, D.; Chaechuen, S.; Chen, C.; Verpoort, F. *Catal. Sci. Technol.* **2017**, *7*, 2935–2939.
[3] García-Domínguez, P.; Fehr, L.; Rusconi, G.; Nevado, C. *Chem. Sci.* **2016**, *7*, 3914–3918.
[4] Danton, F.; Najjar, R.; Othman, M.; Lawson, A. M.; Moncol, J.; Ghinet, A.; Rigo, B.; Oulyadi, H.; Daïch, A. *Adv. Synth. Catal.* **2021**, *363*, 1088–1095.

P B144

Green four-component reaction and dye adsorption studies of new ZnCoAl-LDH and ZnCoCr-LDH

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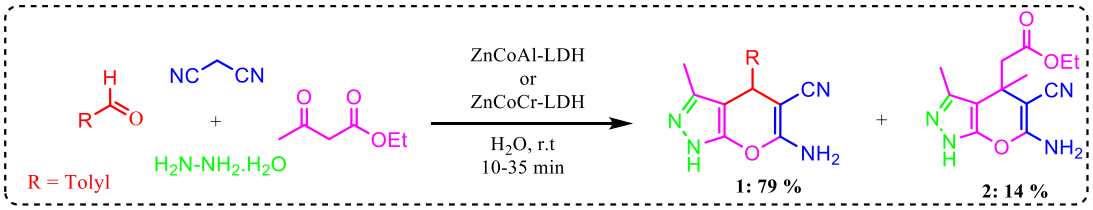
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Multicomponent reactions (MCRs)[1] have become an effective tool for the rapid and environmentally friendly creation of structurally complex and biologically significant heterocycles [2,3]. In this study, we describe a unique four-component green reaction that uses new double-layer hydroxide (LDH) materials, ZnCoAl-LDH and ZnCoCr-LDH, as nanocatalysts for the synthesis of dihydropyrano[2,3-*c*]pyrazole derivatives [2,3]. A simple co-precipitation methodology was used to elaborate these materials which were then used in a slightly conductive aqueous media. By reacting four compounds: aromatic aldehydes, ethyl acetoacetate, malononitrile, and hydrazine hydrate, two different heterocyclic products were obtained: a well-known dihydropyrano[2,3-*c*]pyrazole-5-carbonitrile **1** formed through a classic Michael addition between a pyrazolone intermediate and a Knoevenagel addition product [4], followed by intramolecular cyclization [5], and a new dihydropyrano[2,3-*c*]pyrazol-4-yl acetate **2** obtained as a result of a three-component reaction (ethyl acetoacetate, malononitrile, hydrazine) leading to an alternative condensation pathway, followed by intramolecular cyclization. This synthetic pathway has been verified experimentally, albeit the modest yield. The intermediate interactions in this MCR system were highlighted by the formation of two products **1** and **2**, which also underscore the catalytic activity of LDHs in promoting efficiency and selectivity in environmentally friendly environments. In addition, this work is a contribution to design sustainable pathways leading to bioactive heterocycles with potential pharmaceutical interest.



[1] Liandi, A. R.; Cahyana, A. H.; Kusumah, A. J. F.; Lupitasari, A.; Alfariza, D. N.; Nuraini, R.; Sari, R. W.; Kusumasari, F. C. Recent Trends of Spinel Ferrites (MFe2O4: Mn, Co, Ni, Cu, Zn) Applications as an Environmentally Friendly Catalyst in Multicomponent Reactions: A Review. *Case Stud. Chem. Environ. Eng.* **2023**, *7*, 100303.

[2] Lauria, A.; Delisi, R.; Mingoia, F.; Terenzi, A.; Martorana, A.; Barone, G.; Almerico, A. M. 1,2,3-Triazole in Heterocyclic Compounds, Endowed with Biological Activity, through 1,3-Dipolar Cycloadditions. *Eur. J. Org. Chem.* **2014**, 16, 3289–3306.

[3] Kim, S.; Durand, P.; André, E.; Carteret, C. Enhanced Photocatalytic Ability of Cu, Co Doped ZnAl Based Mixed Metal Oxides Derived from Layered Double Hydroxides. *Colloids Surf. Physicochem. Eng. Asp.* **2017**, *524*, 43-52.

[4] Adim, S.; Eddahmi, M.; Boussetta, A.; Mansori, M.; Essoumhi, A.; Bouissane, L. Green Four-Component Reaction and Dye Adsorption Studies of New ZnCoAl-LDH and ZnCoCr-LDH Materials. *J. Organomet. Chem.* **2025**, *1036*, 123719.

[5] El-Remaily, Mahmoud. A. E. Aleem. Ali. Ali. Synthesis of Pyranopyrazoles Using Magnetic Fe3O4 Nanoparticles a Efficient and Reusable Catalyst. *Tetrahedron* **2014**, *70* (18), 2971–2975.

P B145

Fate of ^{14}C-Radiolabeled Polyethylene Terephthalate Nanoplastics in mice after oral administration

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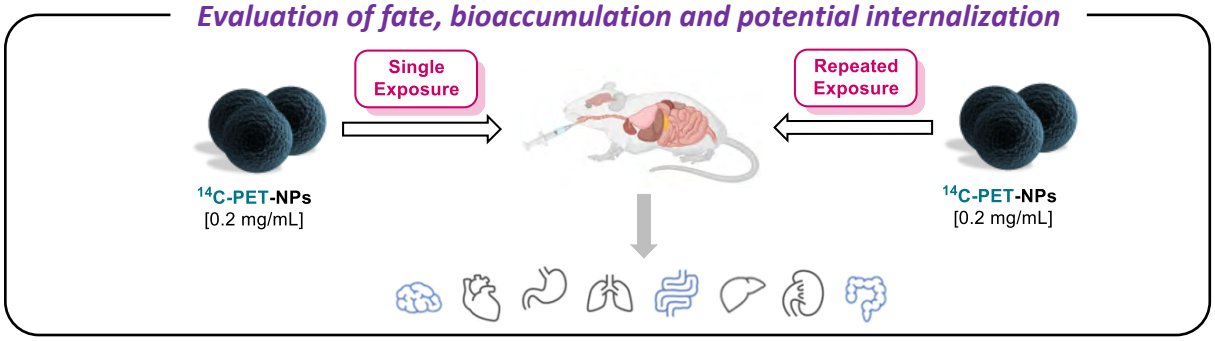
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Annual plastics production has considerably increased during the last century because of their uses in many sectors such as industry, health, research or food.[1] Among these plastics, PET (polyethylene terephthalate) is found in our daily life. It contributes to environmental pollution and represent a significant source of contamination by ingestion of micro and nano-plastics (NPLs).

More particularly, investigations on NPLs in complex biological environments are usually challenging due to the difficulty to monitor them, especially in environmentally relevant exposure concentrations.[2] Among these investigations, most of them are focused on marine organisms (oysters for example[3]) and uses fluorescence that already showed limitations. Thus, using radioactivity structurally incorporated in NPLs would circumvent these limitations and allow a more representative and quantitative assessment of their biodistribution in environmentally realistic scenarios.

This work aims to provide an evaluation of nano-plastics fate in mice after oral administration. It focuses on their fate, bioaccumulation and potential internalization. These issues will be addressed by coupling *in vitro* and *in vivo* approaches with methods for plastics synthesis, radiolabelling and highly sensitive detection and quantification, including technics.



[1] Plastics Europe: Plastics - the facts 2024, an analysis of European plastics production, demand and waste data, **2024**.
[2] Lenz R.; Enders K.; Nielsen T.G. Microplastic exposure studies should be environmentally realistic, *Proc. Natl. Acad. Sci. USA*, **2016**, *113*, E4121-E4122.
[3] Ward, J. E. & Kach, D. J. Marine aggregates facilitate ingestion of nanoparticles by suspension-feeding bivalves, *Mar. Environ. Res.*, **2009**, *68*, 137.

P B146
Electrically-triggered Coordination-Induced Spin-State-Switching

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In recent years, controlling reversible molecular motions has emerged as a promising approach to tune magnetic activities of discrete switchable architectures.[1] Stimulation can indeed induce structural changes altering the electronic structure of magnetically active metal centers.[2]
Our team has developed strategies to control the spin state of a metal by modifying its coordination number or by modulating its coupling interactions. Some recently developed systems involve large-amplitude reversible mechanical motions driven by electron transfer centered on key organic moieties. It includes the first redox-responsive tweezer-like molecule featuring a Ni^{II}-porphyrin tethered to an imidazole moiety capable of undergoing reversible folding motion in response to electrical stimulation (figure 1).[3] This movement forces the coordination of the imidazole ligand on the Ni^{II} center, changing its spin state from low spin to high spin. The driving force for the reorganization inducing magnetic switching is a π-dimerization of the two electrogenerated viologen cation radicals.[4]
In continuation of this work, we have become interested in water-soluble switchable supramolecular assemblies. In this presentation, we will focus on the obtention and properties of the previous tweezer-like system, then on the development of novel switchable magnetic assemblies incorporating viologen units as redox-reactive elements.

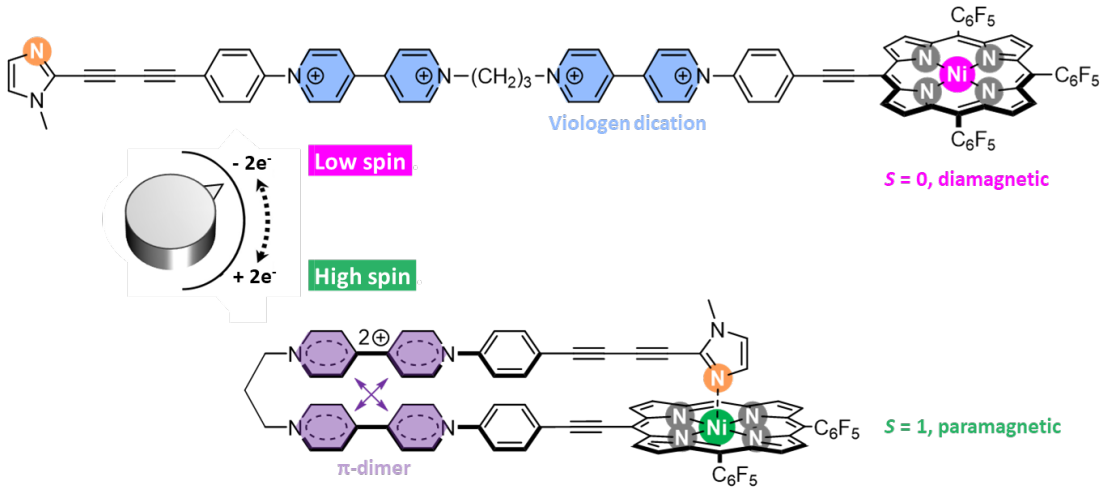


Figure 1 *- Electron-triggered spin-state switching involving coordination/dissociation of a terminal imidazole to/from a Ni^{II}-porphyrin.*

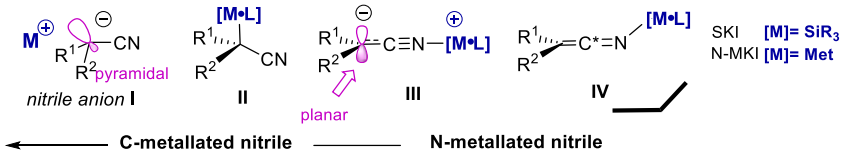
[1] L. Zhang, V. Marcos, D. Leigh, *Proc. Natl. Acad. Sci. U.S.A.* **2018**, *115*, 9397-9404.
[2] B. Doistau, L. Benda, B. Hasenknopf, V. Marvaud, G. Vives, *Magnetochemistry* **2018**, *4*, 5.
[3] S. Al Shehimy, O. Baydoun, S. Denis-Quanquin, J.-C. Mulatier, L. Khrouz, D. Frath, E. Dumont, M. Murugesu, F. Chevallier, C. Bucher, *J. Am. Chem. Soc*. **2022**, *144*, 17955-17965.
[4] C. Kahlfuss, E. Saint-Aman, C. Bucher, *Organic Redox Systems: Synthesis, Properties, and Applications* **2016** (Ed.: T. Nishinaga), Wiley, New York, 39-88.

P B147

Cationic nickel tridentate pincers for the preparation of N-metallated nitriles

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In the United States, in 2011, among the top 200 drugs sold, 21 have at least one quaternary center derived from a natural product and none of these stereocenters have been created by chemical synthesis.[1] It should be noted that the construction of two adjacent stereocenters is a major issue in organic synthesis. Therefore, the development of new strategies based on catalytic methods for the synthesis of enantiopure molecules with contiguous "all carbon" centers remains a very active area of research. In this context, α-cyanocarbanions have emerged as valuable intermediates due to their excellent reactivity as nucleophiles and the possible transformation of the nitrile group into a wide variety of other functions. In this field, methodologies based on N-silylated (SKI) or N-metalated (N-MKI) ketene imines IV (Scheme 1) have attracted particular attention as potent α-cyano carbanion equivalents, as they offer unique synthetic opportunities in asymmetric catalysis.



Scheme 1

Regarding the enantioselective elaboration of vicinal stereocenters, significant works have been published on the application of N-silyl ketene imines (SKIs)[2], in aldol and Mannich reactions. However, these reactions possess a limited field of application due to the need for a strong base in stoichiometric amounts to generate the SKI species. On the contrary, N-metallated ketene imines can be easily formed in the presence of a mild base thanks to the coordination of the nitrile to the metallic center. However, such intermediate species remain scarcely reported. Nakamura[3] and more recently Shibasaki[4] have postulated their existence in asymmetric Mannich-type reactions catalyzed by respectively, a NCN-Pd Pincer (Phebim-type) and a CCC-Ni pincer (*bis*-triazolylidene-type). Regarding the actual problematic associated with endangered noble metal such as Pd, we propose to widen the scope of more abundant and less expensive Ni derivatives by using tridentate NNN-Ni pincers in alpha-cyanoalkylation reactions involving imines.

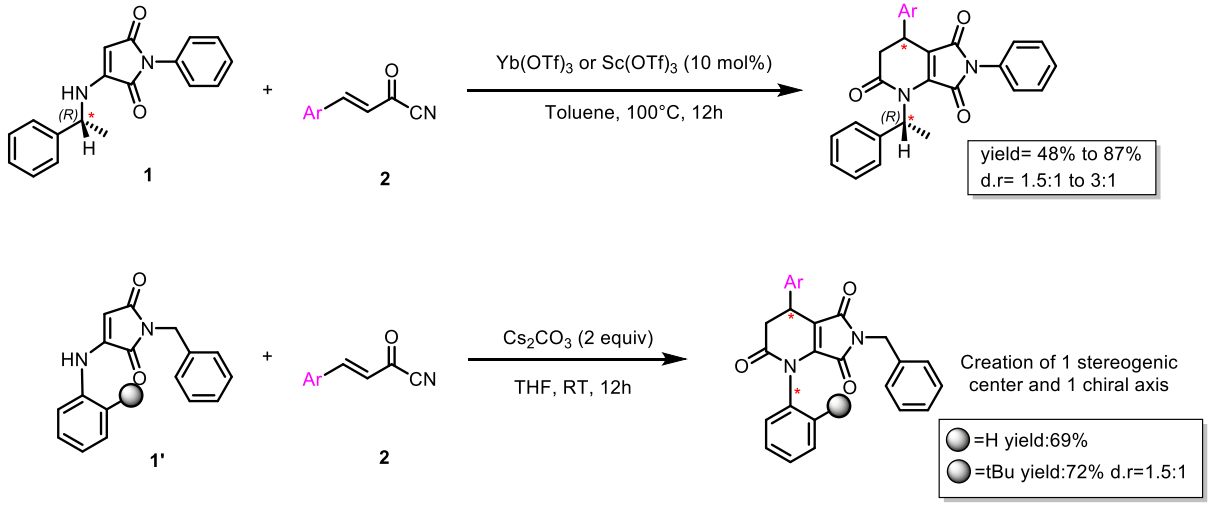
[1] Dewick, P. M. in Medicinal Natural Products 3rd Ed, Ed Wiley, **2009**. b) Bartholow, M. Top 200 drugs of 2011. Pharm. Times **2012**, 48.
[2] Silyl Ketene Imines: Highly Versatile Nucleophiles for Catalytic, Asymmetric Synthesis. S. E. Denmark, T. W. Wilson, *Angew. Chem. Int. Ed*. **2012**, *51*, 9980-9992.
[3] Catalytic Enantioselective Reaction of α-Phenylthioacetonitriles with Imines Using Chiral Bis(imidazoline)–Palladium Catalysts. M. Kondo, N. Kobayashi, T. Hatanaka, Y. Funahashi, S. Nakamura, *Chem. Eur. J*. **2015**, *21*, 9066-9070.
[4] Diastereoselective Direct Catalytic Asymmetric Mannich-Type Reactions of Alkylnitriles with a Ni(II)-Carbene Complex. S.Adachi, A. Saito, M. Shibasaki, *Org. Lett*. **2022**, *24*, 3901-3906.

P B148

[3+3] annulation of enaminomaleimides - a novel way of the utilization of the pro-nucleophilicity of maleimide

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Maleimides, or 1*H*-pyrrole-2,5-dione, represent a key electrophilic heterocyclic motif in organic chemistry. Over the past century, this five-membered heterocyclic imide core has been identified in diverse families of natural products[1], synthetic pharmaceutical molecules[2], and functional polymers[3], offering broad scientific and technological applications. These maleimides are recognized for their conjugated C=C double bond conjugated to two carbonyl groups, which confers electrophilic properties enabling Michael addition reactions (particularly with thiols) and Diels–Alder cycloadditions with dienes. However, their (pro)nucleophilic characteristics remain poorly characterized in the literature and largely unexplored. A method to probe their nucleophilicity is the utilization of their amino derivatives-enaminomaleimides, or α-aminomaleimides[4]. They are a subclass of maleimide derivatives in which an arylamino group is introduced at the α-position (or position 3). In our study, we developped the nucleophilicity of enaminomaleimides by a [3+3] annulation reaction between an enaminomaleimide **1** and an acyl cyanide **2**, which are very good electrophiles, initiated by a Lewis acid or a mineral base according to the substrate. The formed maleimide-fused dihydropyridinones serve as valuable scaffolds in pharmaceutical research[5] and are also exploited as versatile intermediates in asymmetric synthesis[6] . Moreover, this reaction has the potential to control the stereochemical configuration of newly formed chiral centers or chiral axis, offering greater possibilities for asymmetric organic synthesis.



[1] (a) Lahore, S. et al., *Tetrahedron Lett.* **2014**, *55*, 4196–4198. (b) M. Sato et al., *J. Am. Chem. Soc.* **2017**, *139*, 5317−5320.
[2] L. N. Cooney et al., *Pharmaceuticals* **2023**, *16*, 1191.
[3] (a) B.E. Kirkpatrick et al., *Polym Int* **2025**; *74*: 296–306. (b) Y. Oz and A. Sanyal, *Chem. Rec.* **2018**, *18*, 570–586.
[4] López-Francés, A.; Diop, B.; Jiang, X. et al, *Chem. Eur. J.* **2025**, e202500220.
[5] Liao, Q., Zhang, Y. Et al. , *Eur. J. Org. Chem.* **2024**, *27*, e202400195.
[6] Barik, S., Das, R. C. et al., *Org. Lett.* **2022**, *24*, 5456−5461.

P B149

Synthesis of benzo/furo/thieno-oxazepinones by iodolactonization

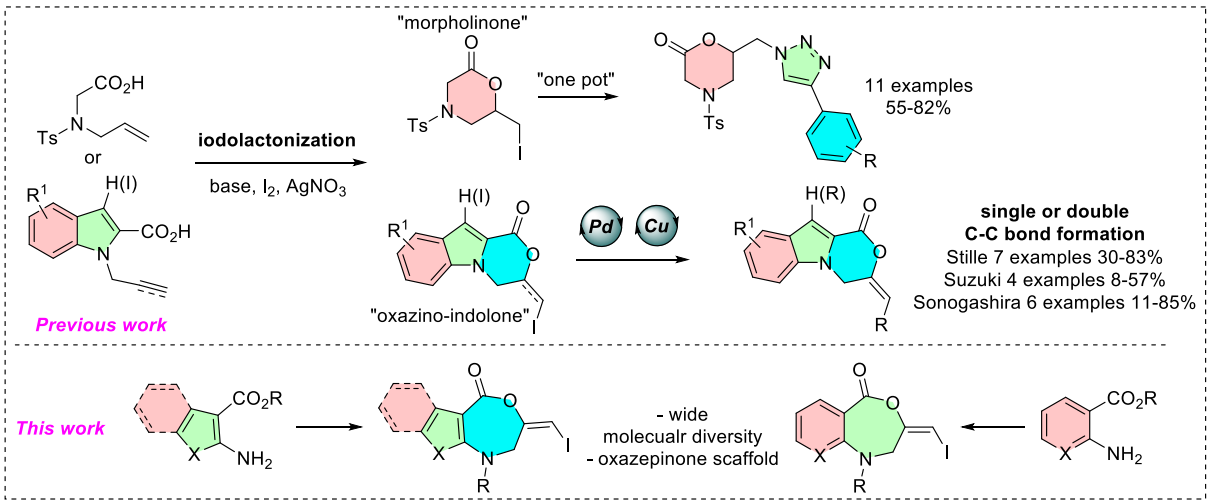
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Because of their importance in biologically active natural products and synthetic materials, the development of new methods for the synthesis of heterocyclic compounds has been and remains a key topic in organic chemistry.[1] The majority of blockbuster drugs contain heterocyclic motifs as central structural elements, underlining the key role of heterocycles in modern drug discovery.[2] Among the various *N*- and *O*-containing seven-membered heterocyclic compounds, oxazepines have received considerable attention due to their broad spectrum of biological and pharmacological activities.[3] Following previous studies, we established that the iodolactonization reaction was a reaction of choice to form a ring between an alkyne and a carboxylic acid.[4] The iodocyclization of suitably functionalized alkynes is a very important synthetic tool for the direct preparation of iodine-containing carbo-and heterocycles starting from readily available starting materials. The utility of the method is further demonstrated by the possibility to elaborate the final products through various cross-coupling reactions (such as Heck, Suzuki-Miyaura, and Sonogashira reactions). Following our recent work, we intend to take advantage of the regio- and stereoselectivity of this iodocyclization reaction between *N*-propargylated substrates and the carboxylic acid function to obtain seven-membered cyclic scaffolds.



[1] a) Armstrong, A.; Collins, J. C. *Angew. Chem. Int. Ed.* **2010**, *49*, 2282–2285. doi: 10.1002/anie.200906750. b) Kaur, T., Wadhwa, P., Bagchi, S., Sharma, A. Chem. Commun. **2016**, *52*, 6958–6976. doi: 10.1039/C6CC01562J.

[2] Chen, J., Natte, K., Neumann, H., Wu, X. F. *Chem. Eur.* **2014**, *20*, 16107–16110. doi: 10.1002/chem.201405221.

[3] a) Goutham, K., Ashok Kumar, D., Suresh, S., Sridhar, B., Narender, R., Karunakar, G. V. *J. Org. Chem.* **2015**, *80*, 11162–11168. doi: 10.1021/acs.joc.5b01733. b) Xu, Y. *J. Med. Chem.* **2016**, *59*, 6553–6579. doi: 10.1021/acs.jmedchem.5b00342.

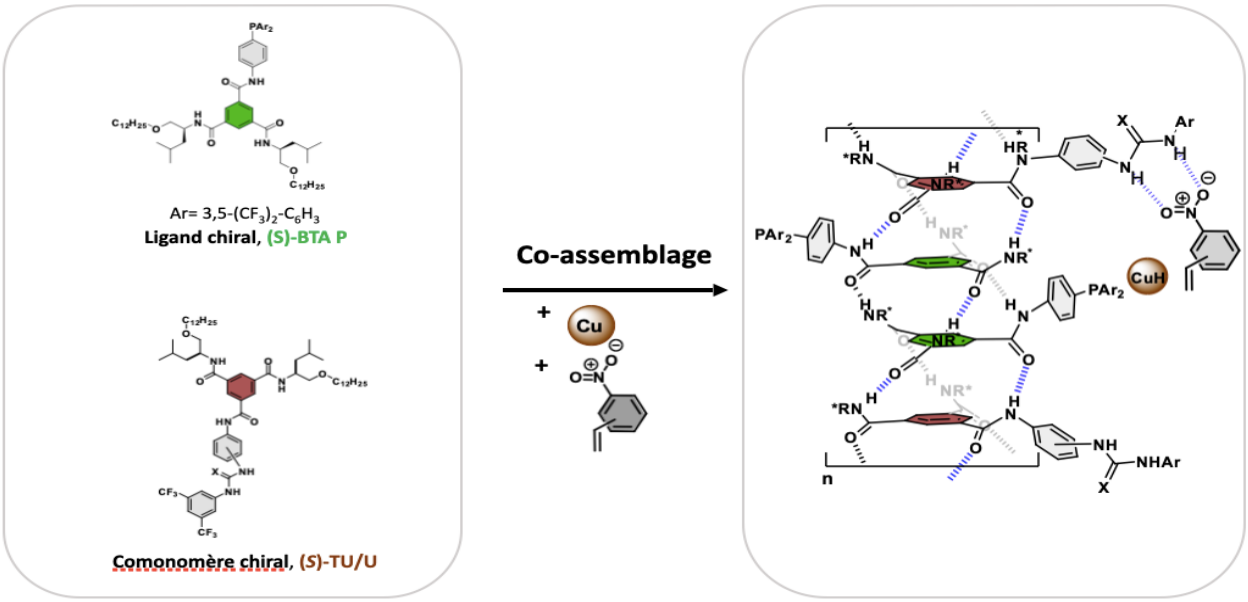
[4] Hammoud, S.; Anselmi, E.; Cherry, K.; Kizirian, J.-C.; Thibonnet, J. *Eur. J. Org. Chem.* **2018**, *45*, 6314–6327. doi: 10,1002/ejoc.201801167. b) Champciau, B.; Raynaud, C.; Viljoen, A.; Thibonnet, J.; Vincent, S. P.; Kremer, L.; Thiery, E. *Bioorg. Med. Chem.* **2021**, *43*, 116248. doi: 10.1016/j.bmc.2021.116248.

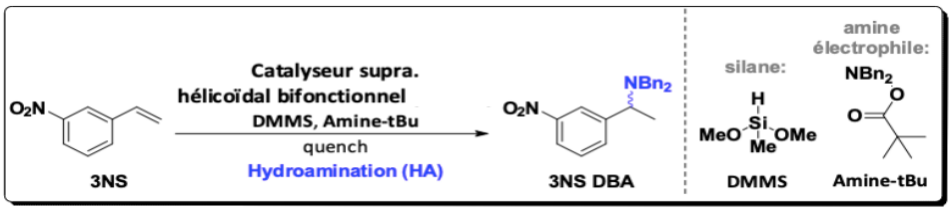
P B150

New Supramolecular Catalysts for Asymmetric Bifunctional Catalysis

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Chiral benzene-1,3,5- tricarboxamide (BTA) are able to co-assemble in an apolar solvent to form homochiral helices, the chirality of which can be efficiently transferred to styrene for its asymmetric hydroamination[1]. In this regard, functionalized substrates such as nitrostyrene can potentially be transformed in high activity and selectivity thanks to bifunctional catalysis[2]. Taking advantage of the modularity of BTA, a dual-catalyst can easily be made by mixing in situ two types of monomers : a BTA phosphine for the complexation of the active copper, and a BTA endowed with a urea or thiourea to link the nitrostyrene by H-bonding[3]. In virtue of the dynamic nature of BTA co-assemblies, a cooperative effect can be expected between the catalyst and the substrate, ensuring high activity and selectivity. Newly developped BTA catalysts have been implemented in copper-catalyzed transformations of nitrostyrenes.





[1] Aoun, P.; Hammoud, A.; Martínez-Aguirre, M. A.; Bouteiller, L.; Raynal, M. Asymmetric Hydroamination with Far Fewer Chiral Species than Copper Centers Achieved by Tuning the Structure of Supramolecular Helical Catalysts. Catal. Sci. Technol. 2022, 12 (3), 834–842

[2] Ma, J.; Cahard, D. Towards Perfect Catalytic Asymmetric Synthesis: Dual Activation of the Electrophile and the Nucleophile. Angew Chem Int Ed 2004, 43 (35), 4566–4583

[3] Doyle, A. G.; Jacobsen, E. N. Small-Molecule H-Bond Donors in Asymmetric Catalysis. Chem. Rev. 2007, 107 (12), 5713–5743

P B151

Photocaged amino acids for the site-selective functionalization of peptides

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Small peptides are attractive and underexploited biomolecules, that occupy an intermediate molecular space between that of traditional drug-like compounds and much larger 'biologics'. Because their sequence can be directly derived from proteins, they can closely reproduce specific side-chains arrangement and should thus incarnate the simplest protein mimetics.[1] However, outside of their proteic context, peptides are usually highly flexible and poorly stable in biological media. To overcome these limitations, intense research efforts have been devoted to the development of structurally constrained peptides, often easily prepared by standard solid-phase synthesis. Nevertheless, the introduction of additional functionalities (fluorescent probes, tags, etc.) on such structures remains challenging for synthetic reasons, due to the limited set of efficient orthogonal functional groups available. To overcome this limitation, the light-controlled post-functionalization appears as a promising strategy.

The aim of this research project is to synthesize new photocaged amino acid building blocks[2] (i.e. whose reactivity can be selectively modified under the effect of light irradiation) and incorporate them into cyclopeptides of biological interest. By adjusting the photophysical properties of the photocleavable protecting groups (PPGs), fine tuning of side-chain reactivity could be reached. This opens new perspectives for both the development of novel synthetic routes to biologically relevant peptide drugs showing increased stability and the activation of biological processes in living systems with a high degree of spatiotemporal control.

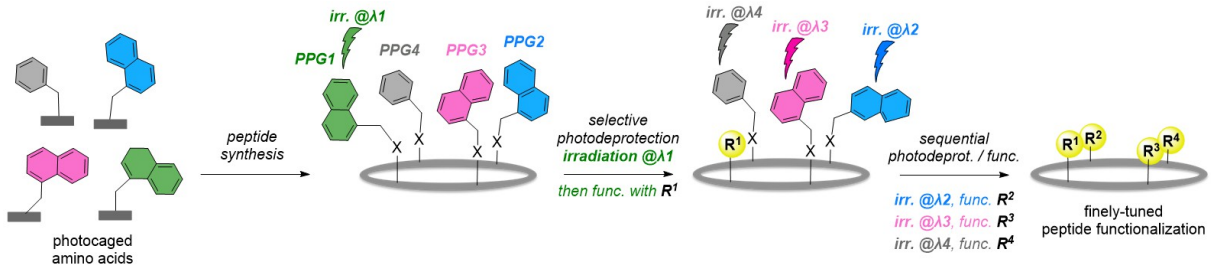


Figure 1. Schematic synthesis of relevant peptides controlled by light.

[1] Muttenthaler, M.; King, G. F.; Adams, D. J.; Alewood, P. F. Trends in Peptide Drug Discovery. *Nat. Rev. Drug Discov.* **2021**, *20* (4), 309–325. https://doi.org/10.1038/s41573-020-00135-8.

[2] Mangubat-Medina, A. E.; Ball, Z. T. Triggering Biological Processes: Methods and Applications of Photocaged Peptides and Proteins. *Chem. Soc. Rev.* **2021**, *50* (18), 10403–10421. https://doi.org/10.1039/D0CS01434F.

P B152

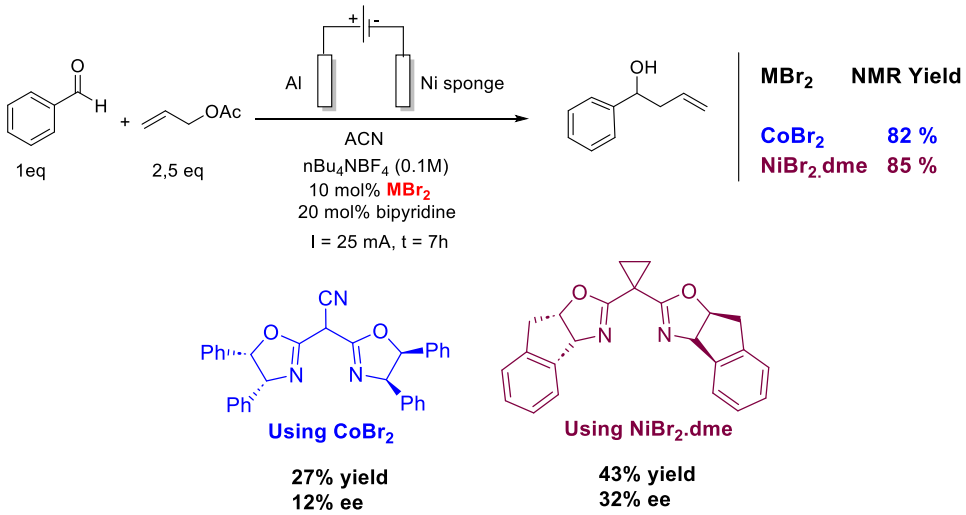
Ni- or Co-mediated electrocatalysis towards the enantioselective allylation of aldehydes

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The synthesis of enantioenriched synthons using asymmetric electrocatalytic processes is a fast-growing area of research, offering a sustainable alternative to conventional methods.[1] Unlike traditional catalytic approaches, which require the stoichiometric use of metallic co-reducers,[2] electrocatalytic reductive processes exploit the electrons generated electrochemically as reducing agents, thereby lowering the environmental impact of these transformations. Several teams have recently focused on the asymmetric allylation of carbonyl compounds. For example, Meng *et al.* have developed a protocol using manganese as a co-reducer for this reaction, catalyzed by a chiral cobalt complex, to generate the corresponding enantioenriched homoallylic alcohols.[3] Cozzi *et al.* have developed an approach based on photochemical activation, using a chiral nickel complex.[4] Sigman *et al*. have carried out an in-depth mechanistic study of an electrochemical allylation protocol catalyzed by cobalt complexes, albeit in the presence of an achiral ligand.[5] In this context, our project aims to develop an innovative method for the asymmetric electrocatalytic allylation of aldehydes in the presence chiral of nickel or cobalt complexes.



We first optimized the reaction under racemic conditions by varying experimental parameters such as metal sources, electrodes, solvents, electrolytes, and electrochemical conditions to get the target product with very good yields. The study of the enantioselective version is currently underway with interesting preliminary results using chiral bis(oxazolines).

[1] a) T. J. Delano, S. E. Reisman; *ACS Catal*., **2019**, *9*, 6751; b) L. Hu, J. L. Fosso, R. Guillot, M. Mellah, E. Schulz; *Chem. Eur. J.* **2024**, *30*, e202403432

[2] Z. Zhu, J. Xiao, M. Li, Z. Shi; *Angew. Int. Ed.* **2022**, *61*, e202201370

[3] L. Wang, L. Wang, M. Li, Q. Chong, F. Meng; *J. Am. Chem. Soc*. **2021**, *143*, 12755

[4] F. Calogero, S. Potenti, E. Bassan, A. Fermi, A. Gualandi, J. Monaldi, B. Dereli, B. Maity, L. Cavallo, P. Ceroni, P. G. Cozzi; *Angew. Chem. Int. Ed.* **2022**, *61*, e202114981

[5] T. Tang, E. Jones, T. Wild, A. Hazra, S. Minteer, M. Sigman; *J. Am. Chem. Soc.* **2022**, *144*, 20056

P B153

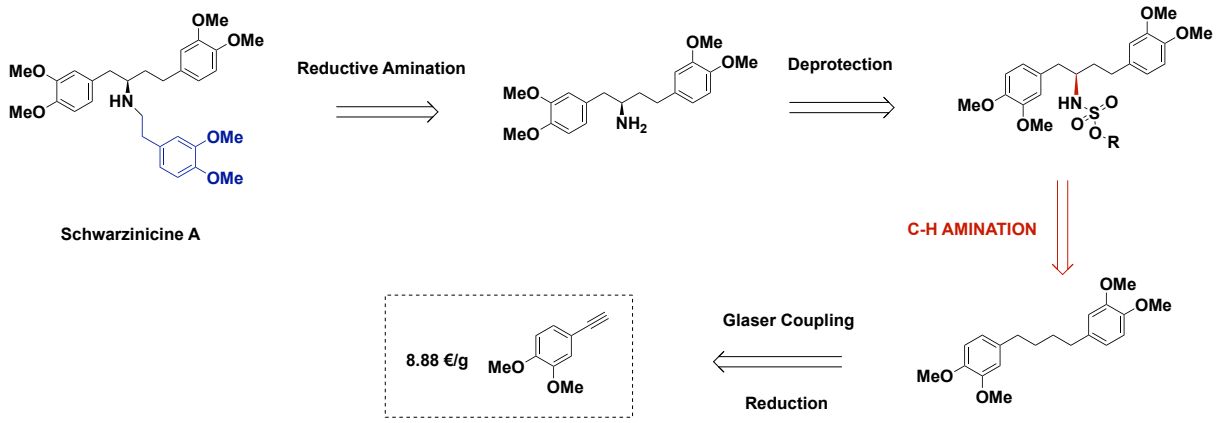
An Enantioselective Total Synthesis of Schwarzinicine A

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C–N Bonds are central motifs in a wide range of biologically active natural products. In particular, benzylic and homobenzylic amines occur frequently in these compounds. Traditional methods for C–N bond formation generally rely on pre-functionalized substrates such as ketones, alkenes, or halides. By contrast, recent advances in catalytic C(sp^3)–H functionalization have transformed retrosynthetic strategies by enabling the direct conversion of inert C–H bonds into amino groups in a step-economical manner.[1]

Our group has recently introduced a catalyst-controlled strategy for C(sp^3)–H nitrene insertion reactions that selectively target homobenzylic positions.[2] This method employs the chiral dirhodium catalyst Rh_2(*S*-tfpttl)$_4$ in combination with a phenol-derived sulfamate and a hypervalent iodine oxidant. The transformation has been demonstrated across a range of arylalkane substrates. Importantly, in the case of 1,4-diphenylbutane, the reaction proceeded with 97% enantiomeric excess, representing a rare example of catalytic, enantioselective intermolecular functionalization of a nonactivated C–H bond.

To showcase its synthetic utility, this methodology is being applied to a concise total synthesis of schwarzinicine A, a vasorelaxant natural product isolated from *Ficus schwarzii*. In this communication, we will discuss our approach that highlights the potential of catalytic C–H amination as a powerful tool in synthesis.



[1] (a) Roizen, J. L.; Harvey, M. E.; Du Bois, J. "Metal- Catalyzed Nitrogen-Atom Transfer Methods for the Oxidation of Aliphatic C–H Bonds." *Acc. Chem. Res.* **2012**, *45* (6), 911–922. (b) Buendia, J.; Grelier, G.; Dauban, P. "Dirhodium(II)-Catalyzed C(sp^3)–H Amination Using Iodine(III) Oxidants." *Adv. Organomet. Chem.* **2015**, *64*, 77–118. (c) Ju, M., Schomaker, J.M. "Nitrene Transfer Catalysts for Enantioselective C–N Bond Formation." *Nat. Rev. Chem.* **2021**, 5, 580–594. (d) Li, H.-H.; Chen, X.; Kramer, S. "Recent Developments for Intermolecular Enantioselective Amination of Non-Acidic C(sp^3)–H Bonds." *Chem. Sci.* **2023**, *14* (46), 13278–13289.

[2] (a) Brunard, E.; Boquet, V.; Bissonnier, T.; Saget, T.; Carrizo, E. D. S.; Sircoglou, M.; Dauban, P. "Catalyst- Controlled Strategies to Override the Bond Dissociation Energy-Driven Selectivity of Benzylic C(sp^3)–H Insertions." *Synlett* **2025**, *36* (06), 630–636. (b) Brunard, E.; Boquet, V.; Saget, T.; Sosa Carrizo, E. D.; Sircoglou, M.; Dauban, P. "Catalyst-Controlled Intermolecular Homobenzylic C(sp^3)–H Amination for the Synthesis of *β*-Arylethylamines." *J. Am. Chem. Soc.* **2024**, *146* (9), 5843– 5854.

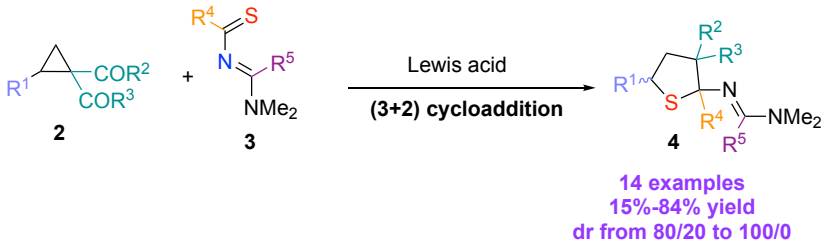
P B154

Straightforward access to thiolanes through (3+2) cycloaddition of donor-acceptor cyclopropanes with (*N*,*S*)-heterodienes

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Heterocycles are widely present in therapeutic and natural products, accounting for more than 85% of bioactive compounds.[1] Although nitrogen remains the most common heteroatom, other heteroatoms are gaining importance in modern drug design. In particular, sulfur is increasingly used thanks to its rich chemistry and valuable biophysical properties.[2] Thiophenes, phenothiazines and thiazoles are among the most common sulfur-containing or sulfur/nitrogen-containing heterocycles found in bioactive compounds. Nowadays, with the "escape from flatland" approach to improve clinical success, the synthesis of new 3D skeletons is becoming an emerging field of research, making the synthesis of saturated cyclic structures such as thiolanes attractive. However, the rapid and efficient synthesis of these functionalized compounds remains challenging and thus development of new synthetic routes is necessary.

Here, we report the synthesis of new polysubstituted thiolanes **4** bearing an amidine function through a (3+2) cycloaddition involving donor–acceptor cyclopropanes (DACs) **2** and (*N*,*S*)-heterodienes **3.** DACs **2** were synthesized through a rhodium(II)-catalyzed cyclopropanation of alkenes using diazo compounds while (*N*,*S*)-heterodienes **3** were obtained after condensation of a diacetal on a thioamide. Donor-acceptor cyclopropanes are known to be more reactive than classical cyclopropane and are activated, in our case, by a Lewis acid to act as 1,3-dipoles. [3] After optimization of the reaction conditions, the reaction scope was extended to various DACs and (*N*,*S*)-heterodienes to obtain thiolanes with good diastereoselectivity (ranging from 80/20 to 100/0). Post-transformation reactions were also carried out to extend the structural diversity that can be reached through this method.



[1] Heravi, M. M.; Zadsirjan, V. Prescribed Drugs Containing Nitrogen Heterocycles: An Overview. *RSC Adv.* **2020**, *10* (72), 44247–44311.

[2] a) Scott, K. A.; Njardarson, J. T. Analysis of US FDA-Approved Drugs Containing Sulfur Atoms. *Top. Curr. Chem. (Z)* **2018**, *376* (1), 5. b) Shamsudin, N. F.; Rullah, K. Synthetic Strategies and Therapeutic Applications of Sulfur-Containing Molecules. *Eur. J. Med. Chem.* **2025**, *298*, 118007. c) Benedetto Tiz, D.; Rosati, O.; Sancineto, L. Sulfur- and Phosphorus-Containing FDA Approved Drugs in the Last Five Years (2020–2024): A Journey among Small Molecules. *Phosphorus, Sulfur, and Silicon and the Related Elements* **2025**, 1–39.

[3] Schneider, T. F.; Kaschel, J.; Werz, D. B. A New Golden Age for Donor–Acceptor Cyclopropanes. *Angew. Chem. Int. Ed.* **2014**, *53* (22), 5504–5523.

P B155

Catalytic silylation of alkynyl C(sp)–H Bonds with *tert*-Butyl-Substituted Silyldiazenes

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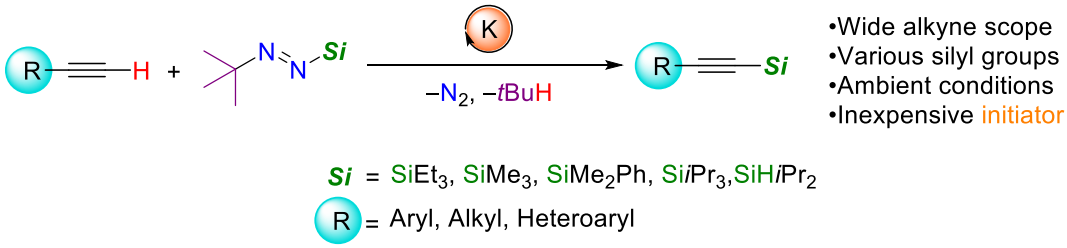
[2] *Collège de France, CNRS, Sorbonne Université, Laboratoire d'Activation Moléculaire, 11 place Marcelin Berthelot, Paris 75005, France*

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Silylacetylenes are invaluable synthons in molecular chemistry because of their stability and the peculiar reactivity brought by the silyl group bound to a sp-hybridized carbon atom.[1]

Among the various methods that have been reported to assemble alkynylsilanes, stoichiometric procedures relying on strong Brønsted bases (e.g., *n*BuLi or MeMgBr) and chlorosilanes remain the most common. However, recent developments have shown that such C(sp)–H metalation/silylation sequences can be transposed into a catalytic regime through so-called *pro-base* strategies.[2,3] Nonetheless, the stringent energetic constraints that accompany the reported pro-base silylation strategies usually translate into experimental limitations as well as a lack of generality.

In this communication, we will describe an alternative pro-base strategy towards the general silylation of C(sp)– H bonds that exploits the already-established[4,5,6] ability of *N*-*tert*-butyl-*N*'-silyldiazenes (*t*Bu–N=N–SiR_3) to liberate extremely strong base (e.g., *t*Bu–) under very mild conditions while behaving as potent silyl group donors towards carbanions. In particular, we demonstrate that a range of terminal alkynes can be silylated under ambient conditions, with high silyl group generality using KOH as a widely available and inexpensive catalytic promoter, and allow seamless one-pot integration with downstream transformations of alkynylsilane products.[7]



[1] G. Larson. Some aspects of the chemistry of alkynylsilanes. *Synthesis* **2018**, 50, 2433–2462.

[2] A. Bannykh, P. M. Pihko. Carboxylate-Catalyzed C-Silylation of Terminal Alkynes. *Org. Lett*. **2024**, 26, 1991-1995.

[3] T.-T. Feng, Y. Lin, B. Chen, D.-G. Zhou, R. Li. Alkali metal hydroxide-catalyzed mechanisms of C(sp)–H silylation of alkynes: a DFT investigation. *Org. Biomol. Chem.* **2024**, 22, 6352–6361.

[4] Neil, B.; Lucien, F.; Fensterbank, L.; Chauvier, C. Transition-Metal-Free Silylation of Unactivated $C(Sp^2)$–H Bonds with Tert-Butyl-Substituted Silyldiazenes. *ACS Catal*. **2021**, 11, 13085–13090.

[5] Neil, B.; Saadi, L.; Fensterbank, L.; Chauvier, C. Organopotassium-Catalyzed Silylation of Benzylic $C(Sp^3)$–H Bonds. *Angew. Chem. Int. Ed.* **2023**, 62, e202306115.

[6] X. Zhang, L. Fensterbank, C. Chauvier. Silylation of Allylic C (sp^3)–H Bonds Enabled by the Catalytic Generation of Allylpotassium Complexes. *ACS Catal*. **2023**, 13, 16207-16214.

[7] Y. Zeng, L. Fensterbank, C. Chauvier. Catalytic Silylation of Alkynyl C(Sp)–H Bonds with *Tert*-butyl-substituted Silyldiazenes. *ChemCatChem* **2025**, 17, e202500121.

P B156

Bioactives Endoperoxides from Plane Tree Bark: Extraction and Hemisynthesis

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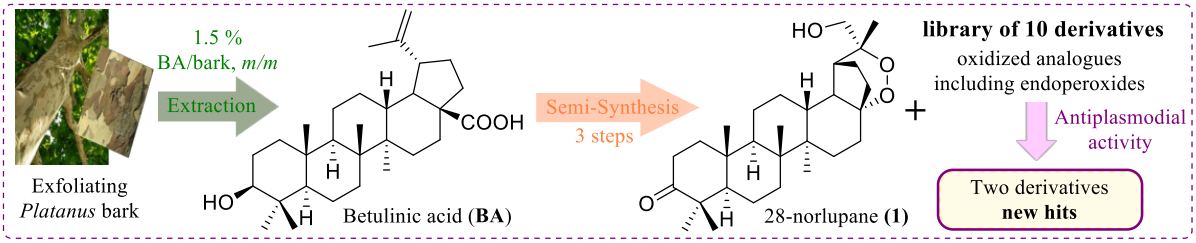
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Infectious diseases caused by protozoan parasites, remain a major health problem. Among these, malaria caused by *Plasmodium sp*. and especially by *P. falciparum* is of great concern with 263 million clinical cases and 597 000 deaths reported in 2023.[1] Despite the recent advances in vaccine therapy, there is still a need and interest in finding new active compounds to prevent or treat malaria infection.

Previous work in the laboratory, carried out on *Dipterocarpus costatus* Gaertn. *f*, led to the isolation of a new antimalarial hit compound: an endoperoxide 28-norlupane **(1)** which showed potent *in vitro* activity against *Plasmodium* sp.[2] Due to the originality of its structure, lupane core and endoperoxide function, it appears interesting to continue studying its antiplasmodial activities. However, the norlupane of the plant source is low, and the plant is also endangered and protected species of the rainforest of Thailand.

To get access to this natural endoperoxide **(1)** and to explore the chemical diversity in the series, we developed a semi-synthetic route from betulinic acid (BA). BA was extracted and purified from a readily available source, the exfoliating bark of common *Platanus acerifolia*.[3] A non-selective Co-mediated endoperoxidation[4] step was used to access to compound **(1)** together with a small library of various oxidized derivatives including endoperoxides. In collaboration with Pr. Sandrine Houzé and Dr Sandrine Cojean from the "Centre National de Référence du Paludisme" (CNRP, Hôpital Bichat, Paris), the biological screening of the library revealed submicromolar antiplasmodial activity for two new derivatives at concentrations lower than that obtained for **1**.



*Scheme 4 : Non-selective semi-synthesis of endoperoxide 28-norlupane (**1**) allowing an access to a library of 10 derivatives*

[1] World malaria report 2024: Addressing Inequity in the Global Malaria Response. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.

[2] Satiraphan, M.; Thai, Q. D.; Pamonsinlapatham, P.; Cuyamendous, C.; Prost, E.; Sittisombut, C.; Grellier, P.; Garbay, C.; Michel, S.; Cachet, X. 28-Norlupanes and Dammaranes from the Heartwood of Dipterocarpus Costatus Gaertn. f. (Dipterocarpaceae) and Their Cytotoxic and Antiplasmodial Activities. *Phytochemistry Letters* 2024, *63*, 31–36.

[3] PhD thesis of MA Zhonglian, Université Paris Cité, on-going

[4] Chen, H.-J.; Wu, Y. Expeditious Entry to the Chamigrane Endoperoxide Family of Natural Products. *Org. Lett.* 2015, *17* (3), 592–595.

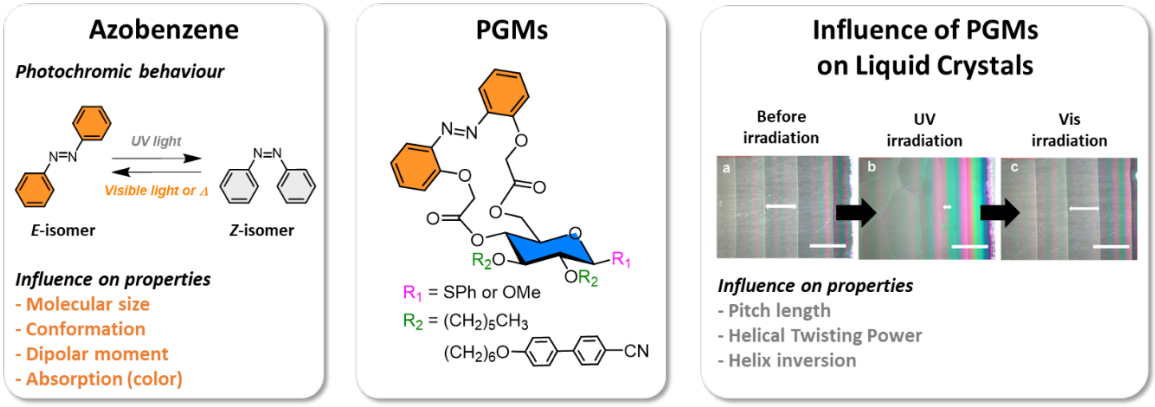
P B157

Photoswitchable GlycoMacrolactones as Chiral Dopants for Liquid Crystals

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Photochromic molecules and materials attract a considerable interest in different fields because they offer great opportunities for the reversible photomodulation of chemical, biological and pharmacological activities with potential applications in various domains like optical materials, photopharmacology and photocatalysis.[1]
Since a decade, XIE's group develop the synthesis and explore the photophysical properties and optical activities of Photoswitchable GlycoMacrocycles (PGM).[2,3,4] This new class of helical macrocycles has rapidly find remarkable photoswitchable features through molecular and chirality changes,[5] as multistimuli-responsive self-assembly,[6] as host for cations,[7] and as chiral dopant for liquid crystals.[8]

Combining in a same molecular architecture the advantages of a sugar-based macrocyclic compound (chirality) to a photoswitchable unit (azobenzene), under light irradiation we can modulate the intrinsic helicity of the macrocycle thanks to a chirality transfer from sugar to the azobenzene. This property is particularly appealing to develop chiral dopants for liquid crystals (LC). In this recent work, in order to evaluate the substituents on LC behavior, we developed 4 novel photoswitchable glycomacrolactones functionalized on the position-1, -2 and -3 of the sugar unit. An overview of their synthesis, photochemical and chiroptical properties, as well as their application as chiral dopants in liquid crystals will be presented.



[1] Feringa B. L.; *Molecular Switches*, Wiley-VCH verlag GmBbH **2001**.
[2] C. Lin, J. Jiao, S. Maisonneuve, J. Mallétroit, J. Xie ; *Chem. Commun.* **2020**, *56*, 3261 - 3264.
[3] J. Jiao, S. Maisonneuve, J. Xie ; *J. Org. Chem.* **2022**, *87*, 8534-8543.
[4] C. Ludwig, G. Li, P. Retailleau, S. Maisonneuve, J. Xie ; *Synthesis* **2025**, *57*, 2727-2732.
[5] G. Depras, J. Hain, S. O. Jaeschke ; *Chem. Eur. J.* **2017**, *23*, 10838 - 10847.
[6] C. Lin, S. Maisonneuve, R. Métivier, J. Xie ; *Chem. Eur. J.* **2017**, *23*, 14996 - 15001.
[7] P. Sokołowska, K. Dąbrowa, S. Jarosz ; *Org. Lett.* **2021**, *23*, 2687-2692.
[8] Y. Kim, N. N. Mafy, S. Maisonneuve, C. Lin, N. Tamaoki, J. Xie ; *ACS Appl. Mater. Interfaces* **2020**, *12*, 52146 - 52155.

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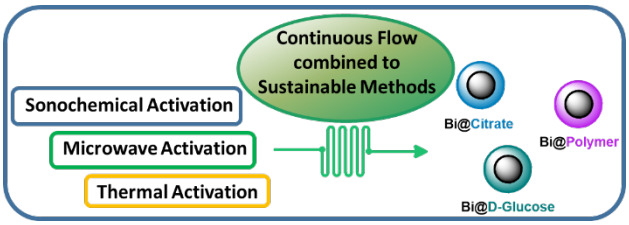
Continuous Flow combined with Greener Activation Methods Inorganic Compounds Applications

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Continuous flow chemistry is increasingly used in organic and inorganic synthesis.[1, 2] Indeed, it has many advantages by addressing a wide range of issues in terms of reproducibility, stability, safety and productivity, all of which are essential for numerous academic and industrial syntheses in organic and inorganic chemistry. In this context, our approach consisted in developing continuous flow devices coupled with different methods of thermal activation,[3] sonochemical[4] or microwave.[5] Indeed, the use of more efficient and greener synthesis pathways currently represents a major challenge. Several examples exist in the literature to access organic compounds following this methodology.[1] Obtaining inorganic compounds[2] is also possible and constitutes the objective of this study.



The interest in synthesizing inorganic compounds and more particularly metal nanoparticles is directly related to their applications since these nano-objects are used in catalysis, electronics as well as in the medical field, covering diagnosis and therapy.[6] Their use is often controversial and yet these nano-objets are very attractive due to their numerous properties (surface atoms, high surface energy, small sizes). Given their strong potential, several synthesis methods have been developed by combining continuous flow and various activation mechanisms with the aim of respecting as much as possible the green chemistry criteria defined by Anastas and Warner then adapted to nanochemistry. Each of the methods has been optimized in relation to the quantities of material, reaction time, productivity between the different devices, as well as the quality of the nano-objets obtained, so that they are pure, stable and homogeneous in size. These parameters are major criteria that we have sought to achieve on large scales to access a variety of applications.[6]

[1] Jaman, Z. ; Sobreira, T.J.P. ; Mufti, A. ; Ferreira, C.R. ; Cooks, R.G. ; Thompson, D.H. Rapid On-Demand Synthesis of Lomustine under Continuous Flow Conditions. *Org. Process Res. Dev.* **2019**, *23*, 334–341. [2] Gomez, C. ; Hallot, G. ; Port, M. Bismuth metallic nanoparticles in A.M. Grumezescu Inorganic frameworks as smart nanomedicines. Pharmaceutical *Nanotechnology Series*, Elsevier **2018**, 1-699. [3] Hallot, G. ; Chan, Y.S. ; Ménard, F. ; Port, M. ; Gomez, C. Continuous Flow Synthesis of Bismuth Nanoparticles: A Well-Controlled Nano-Object Size Thanks to Successful Scaling-Up. *ACS Sustainable Chem. Eng.* **2025**, 13, 1431-1439. [4] Gomez, C. ; Hallot, G. ; Pastor, A. ; Laurent, S. ; Brun, E. ; Sicard-Roselli, C. ; Port, M. Metallic Bismuth Nanoparticles: Towards a Robust, Productive and Ultrasound Assisted Synthesis from Batch to Flow-Continuous Chemistry. *Ultrason. Sonochem.* **2019**, *56*, 167-173. [5] Hallot, G. ; Cagan, V. ; Laurent, S. ; Gomez, C. ; Port, M. A Greener Chemistry Process Using Microwaves in Continuous Flow to Synthesize Metallic Bismuth Nanoparticles. *ACS Sustain. Chem. Eng.* **2021**, *9*, 9177-9187. [6] Gomez, C. ; Hallot, G. ; Laurent, S. ; Port, M. Medical Applications of Metallic Bismuth Nanoparticles. *Pharmaceutics* **2021**, *13*, 1793-1819.

P B159

Atroposelective Synthesis of Axially Chiral Compounds

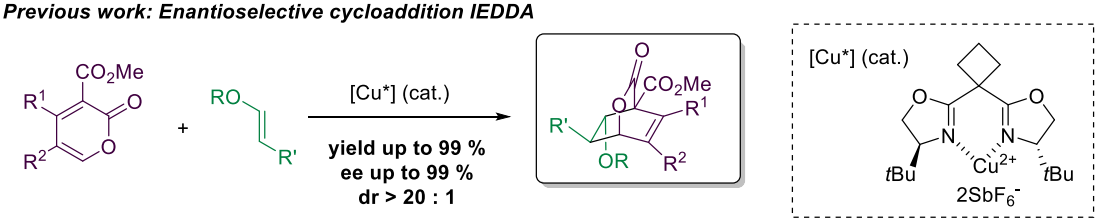
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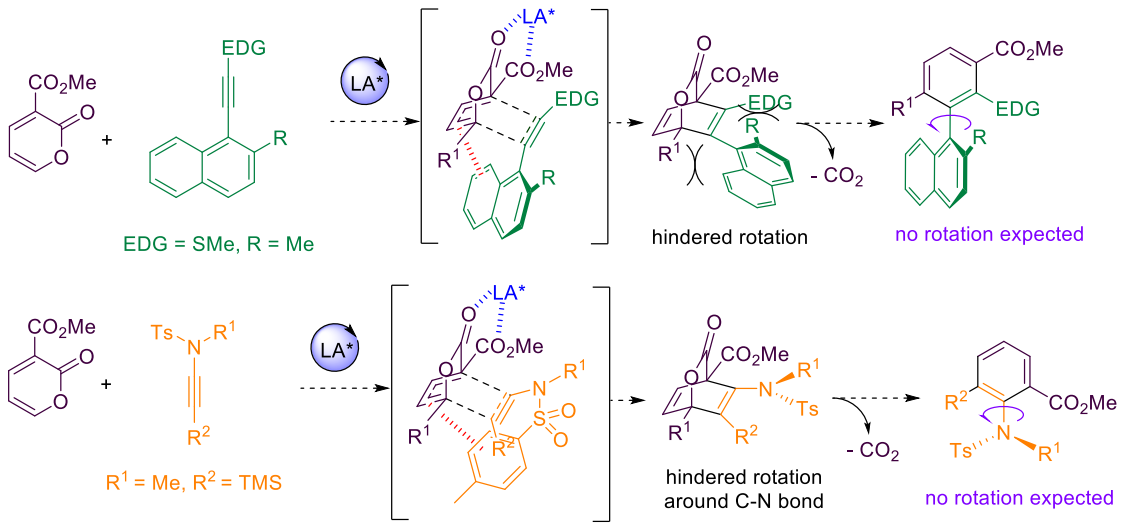
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Atropisomerism is a form of chirality arising from restricted rotation around a bond, exemplified by axially chiral biaryls, which are valuable in catalysis and bioactive molecules. Their stereocontrolled synthesis remains a major challenge[1]. Cycloadditions, particularly inverse-electron-demand [4+2] Diels–Alder reactions (IEDDA) involving 2-pyrones, are key for building complex structures. Our laboratory has developed a Cu-catalyzed enantioselective cycloaddition IEDDA involving 2-pyrones and acyclic enol ethers[2]. This project aims to exploit further these cycloadditions with electron-rich alkynes, followed by CO_2 extrusion, to transfer the central chirality generated under control during the cycloaddition into the axial chirality of biaryls and sulfonamides.

A) Previous work: Enantioselective cycloaddition IEDDA



B) This project: Cycloaddition IEDDA of 2-pyrone and enriched alkynes to obtain axially chiral structures



[1] Wang, Y.-B ; Tan, B. Construction of Axially Chiral Compounds via Asymmetric Organocatalysis. *Acc. Chem. Res.* **2018**, *51*, 534-547.

[2] Huang, G.; Guillot, R.; Kouklovsky, C.; Maryasin, B.; de la Torre, A. Diastereo- and Enantioselective Inverse-Electron-Demand Diels-Alder Cycloaddition between 2-Pyrones and Acylic Enol Ethers. *Angew. Chem. Int. Ed.* **2022**, *61*, e202208185.

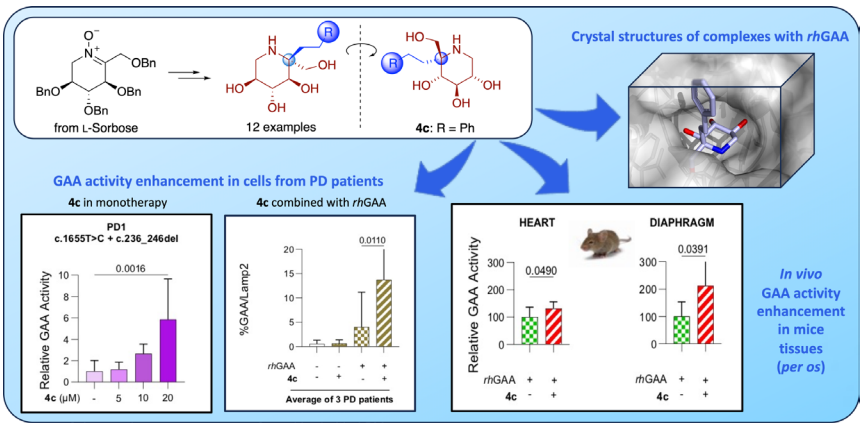
P B160

New Iminosugars as Selective Pharmacological Chaperones for the Treatment of Pompe Disease

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We have designed and synthesized a series of 5-*C*-alkyl-deoxynojirimycins through an efficient and scalable method. By investigating *in vitro* the capacity of these compounds to interact with human acid α-glucosidase (GAA), the genetically defective enzyme in patients suffering from Pompe disease, we identified a new family of pharmacological chaperones exhibiting outstanding selectivity for this enzyme. A rationale for their binding mode to GAA and mechanism of action was provided by crystallographic analysis of their complexes with recombinant GAA. 5-*C*-Phenethyl-DNJ (**4c**) was selected as a lead compound in this class to be evaluated *ex vivo* in cells from Pompe disease patients, and *in vivo* in GAA-KO mice.[1]



The significant increase of GAA activity in the presence of **4c** in various tissues, more particularly in the diaphragm, encourages further studies on this class of small molecules towards the development of clinical drugs. Their chaperone activity and excellent selectivity may offer potential benefits over the current treatments of Pompe disease.

[1] Vieira Da Cruz, A.; Perraudin, V.; Minopoli, N.; Iacono, R.; Roig-Zamboni, V.; Bossio, A.; Tangara, S.; Fayolle, M.; Kanazawa, A.; Philouze, C.; Tarallo, A.; Heming, J. J. A.; Artola, M.; Behr, J.-B., Overkleeft, H. S.; Moracci, M.; Sulzenbacher, G.; Parenti, G.; Py, S. *J. Med. Chem.* **2025**, https://doi.org/10.1021/acs.jmedchem.5c01349

P B161

Synthesis of organic radicals within rotaxanes

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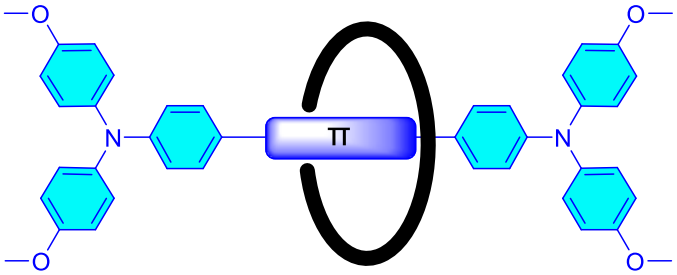
Research and development on new organic materials for innovative technologies have attracted significant interest in recent years. While closed-shell species have been extensively studied, their open-shell counterparts—radicals—remain relatively unexplored. Despite their well-known instability, radicals possess remarkable potential due to their unique properties, such as electron delocalization.

This project focuses on investigating the stability and properties of radicals within a specific molecular architecture: rotaxanes. To achieve this, novel rotaxanes have been designed and synthesized to generate and stabilize radicals through both electron delocalization and steric hindrance.

The molecular thread features two triarylamine groups that serve as both redox centers[1] and stoppers. These centers are connected by an acetylenic bridge, which enhances electronic delocalization and, consequently, radical stabilization. The macrocycle[2] was selected for its small size, which increases steric protection, and for the presence of a phenanthroline unit capable of chelating a copper atom.

The rotaxanes were assembled using the active metal template method, specifically through copper-catalyzed Glaser coupling[3] between two alkyne derivatives within the macrocycle. Two rotaxanes and two free dumbbells containing either diacetylenic or tetraacetylenic motifs were successfully synthesized and characterized by NMR spectroscopy.

Preliminary optical (absorption and emission) and electrochemical (cyclic voltammetry) studies have also been conducted.



[1] Lambert, C.; Nöll, G. The Class II/III Transition in Triarylamine Redox Systems. J. Am. Chem. Soc. 1999, 121 (37), 8434–8442.
[2] Franz, M.; Januszewski, J. A.; Wendinger, D.; Neiss, C.; Movsisyan, L. D.; Hampel, F.; Anderson, H. L.; Görling, A.; Tykwinski, R. R. Cumulene Rotaxanes: Stabilization and Study of [9]Cumulenes. Angew. Chem. Int. Ed. 2015, 54 (22), 6645–6649.
[3]Saito, S.; Takahashi, E.; Nakazono, K. Synthesis of [2]Rotaxanes by the Catalytic Reactions of a Macrocyclic Copper Complex. Org. Lett. 2006, 8 (22), 5133–5136.

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