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Short history of French-Polish Chemistry Meetings

Ie Assises began with the evening gala – Soiree d'hommage à Jean-Marie Lehn – on July 23, 2015 at the Embassy of the Republic of Poland in Paris, dedicated to Prof. Jean-Marie Lehn from the University of Strasbourg, Nobel laureate in chemistry in 1987, the member of the College de France. Another important event was a popular science lecture given by Prof. Jean-Marie Lehn "De la Matière à la Vie: Chimie? Chimie" in French, his native language. The audience had no doubts that Prof. Jean-Marie Lehn is a virtuoso of chemistry. July 24, 2015 was the day of the scientific conference Assises Franco-Polonaises de Chimie, where 15 lectures were given. At the end of the conference, young scientists, PhD students at the Faculty of Chemistry, Adam Mickiewicz University, presented the results of their research to Prof. Jean-Marie Lehn. The intimate atmosphere of the meeting in the stylish hall of the Polish Academy of Sciences in Paris made these young people most satisfied with the participation in the meeting, since they had the opportunity to talk to the best French researchers.

On March 14-15, 2018 at the Scientific Station of the Polish Academy of Sciences in Paris second scientific symposium took place – **IIe Assises Franco-Polonaises de Chimie**. The festive evening on March 14, 2018 at the Embassy of the Republic of Poland in Paris was dedicated to Prof. Jean-Pierre Sauvage, University of Strasbourg, Nobel laureate in the field of chemistry in 2016 together with Sir J. Fraser Stoddart and Professor Ben L. Feringa, member of French Académie des Sciences, co-inventor of molecular machines, who gave a popular science lecture entitled "Molecular machines in biology and in chemistry". In addition, on March 15, 2018, 17 lecturers presented their achievements in various fields: from supramolecular chemistry through catalysis, hybrid materials, graphene to applications in sensors and power engineering.

The **1st French-Polish Chemistry Congress was held in Paris in 2019** and gathered over **100 participants** from France, Poland, and beyond. The meeting featured an exceptional scientific program, including a lecture by the Nobel Prize Laureate in Chemistry, Prof. Jean-Marie Lehn, as well as contributions from Prof. Krzysztof Matyjaszewski, nominated for the Nobel Prize. Other distinguished speakers included Prof. Bruno Ameduri, Prof. Karol Grela, Prof. Mir Wais Hosseini, and Prof. Adam Proń. The Congress provided a forum for high-level discussions spanning diverse areas of contemporary chemistry.

The **2nd French-Polish Chemistry Congress took place in Montpellier in 2023** and attracted nearly **130 participants**. Its scientific program included plenary and invited lectures, oral communications, and poster presentations. Prominent speakers at this edition were Prof. Artur Ciesielski, Prof. Teofil Jesionowski, Prof. Karol Grela, Prof. Guillaume Maurin, Prof. Miłosz Pawlicki, and Prof. Sébastien Ulrich. As with the first edition, the Montpellier Congress fostered intensive scientific exchange and networking among established researchers, early-career scientists, and students.

WEDNESDAY 1ST JULY

SCIENTIFIC CENTRE OF THE POLISH ACADEMY OF SCIENCES IN PARIS

YOUNG SCIENTISTS SESSION

Chairmen: Dr. Adam Gorczyński & Dr. Maciej Zaranek

09:30 **REGISTRATION**

10:00 **M.Sc. Miłosz Piechocki**, University of Camerino, Camerino, Italy
EXPLORING LIGNIN-DERIVED ELECTROSPUN CARBON FIBERS FOR ORR/OER ELECTROCATALYSTS AND ZINC-AIR BATTERIES

10.10 **M.Sc. Niccolo Nova**, Aix-Marseille University, Marseille, France
MIMICKING LPMO'S ACTIVITY USING CU2+ SYNZYMES AND METALLOPEPTIDES FOR BIOMASS VALORIZATION

10.20 **M.Sc. Aleksandra Sikora**, Adam Mickiewicz University, Poznań, Poland
ADVANCED HYBRID MATERIALS FOR SUSTAINABLE ELECTROCHEMICAL ENERGY STORAGE

10.30 **M.Sc. Marcin Nowacki**, Adam Mickiewicz University, Poznań, Poland
TRANSITIONING TOWARD FIVE STATE ELECTROCHROMIC SYSTEM IN NAPHTHALENE DIIMIDE BASED MATERIALS

10.40 **M.Sc. Magdalena Stasiuk**, University of Gdańsk, Gdańsk, Poland
THE SEARCH FOR NEW ARYLSULFONAMIDE DERIVATIVES - A RELATIONSHIP BETWEEN THEIR CHEMICAL STRUCTURE AND BIOLOGICAL ACTIVITY

10.50 **M.Sc. Natalia Żukowska**, University of Gdańsk, Gdańsk, Poland
BIOLOGICAL ACTIVITY OF PHENANTHROLINE SULFONAMIDE AND ITS RH(III) AND IR(III) COORDINATION COMPOUNDS - STRUCTURE-ACTIVITY RELATIONSHIP ANALYSIS

11.00 **M.Sc. Sergiusz Napierała**, Adam Mickiewicz University, Poznań, Poland
METAL-DEPENDENT ELECTROCHROMISM AND ELECTROFLUOROCHROMISM IN TETRAPHENYLETHYLENE-BASED SALEN COMPLEXES

11.10 **M.Sc. Ernest Ewert**, Adam Mickiewicz University, Poznań, Poland
TEMPLATE SYNTHESIS OF NON-RIGID LANTHANUM(III) MACROCYCLE AND ITS INTERACTIONS WITH G-QUADRUPLEXES AND HUMAN SERUM ALBUMIN

11.20 **M.Sc. Klaudia Krysiak-Smułek**, Adam Mickiewicz University, Poznań, Poland
MONITORING OF LUMINESCENTLY LABELLED NANOPET AND NANOPMMA AMONGST HUMAN GUT MICROORGANISMS

11.30 **Karol Garbaczewski**, Adam Mickiewicz University, Poznań, Poland
AZAMACROCYCLES AS INNOVATIVE INITIATOR-CATALYST PLATFORMS IN ROP-NCA POLYMERIZATION

11.40 **M.Sc. Jakub Nowicki**, Adam Mickiewicz University, Poznań, Poland
STEREOCONTROLLED SYNTHESIS OF FLUORINATED A-HYDROXY- AND A-AMINOPHOSPHONATES

11.50 **Mateusz Bogusławski**, Adam Mickiewicz University, Poznań, Poland
APPLICATION OF PYRROLO-[3,4-C]-PYRROLE-1,4-DIONE DERIVATIVES IN ORGANIC ELECTRONICS

12.00 **Ewelina Gruszczyńska**, University of Warsaw, Warszawa, Poland
PHEROMONE SYNTHESIS UTILISING STEREORETENTIVE OLEFIN METATHESIS CATALYSTS

12.10 **M.Sc. Volodymyr Lyakh**, Wrocław University of Science and Technology, Wrocław, Poland
ENGINEERING COLLAGEN MIMETICS FROM THE INSIDE OUT: BEYOND PROLINE CONSTRAINTS, SUPRAMOLECULAR TRIPLE-HELIX ASSEMBLY, AND TISSUE ENGINEERING PROSPECTS

12.20 **Maria Stachowiak**, Adam Mickiewicz University, Poznań, Poland
PORPHYRIN-BASED COVALENT ORGANIC FRAMEWORKS (COFS) FOR ENERGY STORAGE: SYNTHESIS AND APPLICATIONS

12.30 **M.Sc. Bartosz Łagan**, Wrocław University of Science and Technology, Wrocław, Poland
LOVE, BUT LONGER: CONFORMATIONALLY LOCKED OXYTOCIN ANALOGUES

12.40 **M.Sc. Krzysztof Cwynar**, University of Silesia, Katowice, Poland
BETWEEN NANOFLOWERS AND CARBON NANOTUBES. A STORY ON REDUCING THE VISCOSITY OF IONANOFLUIDS

12.50 **M.Sc. Wojciech Dudziak**, Adam Mickiewicz University, Poznań, Poland
POLYMER DATA STORAGE – CAN SYNTHETIC, ABIOTIC POLYMERS COMPETE WITH DNA?

IBPP Institut Bibliothèque Polonaise de Paris

OPENING CEREMONY

18:30 **Prof. Krzysztof Matyjaszewski,** Carnegie Mellon University, Pittsburgh, USA
PRECISELY CONTROLLED MACROMOLECULAR ARCHITECTURE BY ATRP

CONFERENCE PROGRAMME

THURSDAY 2ND JULY

SCIENTIFIC CENTRE OF THE POLISH ACADEMY OF SCIENCES IN PARIS

Chairmen: Prof. Monika Wałęsa-Chorab & Prof. Marcin Hoffmann

9.30 **REGISTRATION**

10:00 – 17:30 **POSTER SESSION**

10:00 **Prof. Jean-François Nierengarten,** CNRS and University of Strasbourg, Strasbourg, France
NEW SYNTHETIC STRATEGIES FOR THE EFFICIENT SYNTHESIS OF PILLAR[5]ARENE-CONTAINING INTERLOCKED SYSTEMS

10.20 **Prof. Szymon Chorąży,** Jagiellonian University, Kraków, Poland
MULTIFUNCTIONAL SOLID LUMINOPHORES BASED ON METAL COMPLEXES FOR LUMINESCENT THERMO-HYGROMETRY

10.30 **Prof. Wojciech Chaładaj,** Institute of Organic Chemistry, Polish Academy of Sciences, Warszawa, Poland
REGIO- AND STEREOSELECTIVE FLUOROALKYLATION-FUNCTIONALYZATION OF ALKYNES

10.40 **of. Mihail Barboiu**, European Institute of Membranes, Montpellier, France
ARTIFICIAL WATER CHANNELS-TOWARD BIOMIMETIC MEMBRANES FOR DESALINATION

10.50 **Dr. Anna Kajetanowicz**, University of Warsaw, Warszawa, Poland
DESIGNING ALKENE GEOMETRY: STEREOSELECTIVE OLEFIN METATHESIS IN ACTION

11.00 **Dr. Bastien Chatelet**, Sorbonne University, Paris, France
BREAKING THE SYMMETRY IN CHIRAL SUPRAMOLECULAR RECEPTORS: FROM HEMICRYPTOPHANES TO CYCLODEXTRINS

11.10 **Prof. Katarzyna Matczyszyn**,Wrocław University of Technology, Wrocław, Poland
MULTIPHOTON-ACTIVE NANOPARTICLES FOR BIOPHOTONICS

11.20 **Prof. Krzysztof Kuciński**, Adam Mickiewicz University, Poznań, Poland
BEYOND CLASSICAL CATALYSIS: HFIP-ENABLED ACTIVATION STRATEGIES

11.30 **Dr. Sébastien Ulrich**, CNRS, Montpellier, France
DYNAMIC COVALENT SYNTHESIS: FROM CAGES TO POLYMERS

11.40 **Dr. Michèle Salmain**, Sorbonne University, Paris, France
LOCALIZATION AND SPECIATION OF A HIGHLY CYTOTOXIC ORGANOGOLD(III) COMPLEX IN A LUNG CANCER CELL MODEL

11.50 **Prof. Beata Dudziec**, Adam Mickiewicz University, Poznań, Poland
STRUCTURE–PROPERTY RELATIONSHIPS IN SILSESQUIOXANES: FROM MOLECULAR SCALE TO MACROSCOPIC PERFORMANCE

12.00 **Prof. Davy-Louis Versace**, University Paris-Est Créteil, Paris, France
PHOTOCHEMISTRY: TOWARDS THE SYNTHESIS OF NEW INNOVATIVE AND ANTIBACTERIAL BIOMATERIALS

12.10 **Prof. Agnieszka Wilczewska**, University of Bialystok, Białystok, Poland
RATIONAL DESIGN IN NANOMEDICINE: PHYSICOCHEMICAL AND MORPHOLOGICAL EVALUATION OF LIPID-BASED SMART DRUG DELIVERY SYSTEMS

12.20 **Prof. Michał Banaszak**, Adam Mickiewicz University, Poznań, Poland
VICE RECTOR OF ADAM MICKIEWICZ UNIVERSITY IN POZNAŃ

12.30 LUNCH BREAK

The parallel session will take place at IPBB

Chairmen: Prof. Joanna Gościańska & Prof. Krzysztof KucińskI

14.30 **Prof. Bruno Ameduri**, ICGM/CNRS, Montpellier, France
WHAT DO WE KNOW ABOUT PER- OR POLYFLUOROALKYL SUBSTANCES (PFAS)?

14.50 **Prof. Guillaume Vives**, Sorbonne University, Paris, France
SWITCHABLE MOLECULAR TWEEZERS AS A MULTIFUNCTIONAL PLATFORM

15.00 **Prof. Beata Zielińska**, West Pomeranian University of Technology in Szczecin, Szczecin, Poland
STRATEGIES FOR ENHANCING PHOTOCATALYTIC HYDROGEN EVOLUTION OVER GRAPHITIC CARBON NITRIDE-BASED MATERIALS

15.10 **Dr. Joanna Wątły**, University of Wrocław, Wrocław, Poland
PROTEASE-RESISTANT SALIVARY PEPTIDOMIMETICS ACTIVATED BY METAL IONS: A NEW STRATEGY AGAINST ORAL PATHOGENS

15.20 **Prof. Régis Gauvin**, Chemistry Research Institute of Paris, Paris Tech Chemistry, France
(ULTRA) HIGH FIELD NMR FOR STRUCTURAL STUDIES IN MOLECULES AND MATERIALS FOR CATALYSIS

15.30 **Prof. Elżbieta Pamuła**, AGH University, Kraków, Poland
ADVANCED PULMONARY DELIVERY PLATFORMS: ENGINEERING TARGETED THERAPY FOR RESPIRATORY DISEASES

15.40 **Prof. Paula Gawryszewska-Wilczyńska**, University of Wrocław, Wrocław, Poland
INTENTIONAL STRUCTURAL MODIFICATION AND THE UNIQUE PHOTOPHYSICAL PROPERTIES OF HOMO- AND HETERONUCLEAR LANTHANIDE CHELATES

15.50 **Dr. Emmanuel Flahaut**, CNRS/University of Tolouse, Tolouse, France
PHOTOCATALYTIC HYDROGEN PRODUCTION FROM WATER SPLITTING USING DWCNT:G-C3N4 NANOHYBRIDS

16.00 **Prof. Beata Kalska-Szostko**, University of Bialystok, Białystok, Poland
LOW DIMENSIONAL MAGNETIC STRUCTURES – CHARACTERIZATION AND PROPERTIES

16.10 COFFEE BREAK

Chairmen: Dr. Ingrid Suzana & Prof. Robert Wojcieszak

16.20 **Dr. Anne Vessières**, Sorbonne University, Paris, France
CYCLODEXTRIN-FORMULATED FERROCIFEN PENETRATES THE MOUSE BRAIN AND SIGNIFICANTLY IMPROVES SURVIVAL IN AN ORTHOTOPIC MODEL OF GLIOBLASTOMA

16.30 **Prof. Katarzyna Świrk-Da Costa**, Norwegian University of Science and Technology, Trondheim, Norway
STRUCTURAL RECONSTRUCTION OF NICKEL PHYLLOSILICATES IN KIT-6 MESOPOROUS SILICA DURING REDUCTION AND ITS IMPACT ON CATALYTIC ACTIVITY

16.40 **Prof. Renaud Nicolaÿ**, ESPCI Paris - PSL University, Paris, France
FROM PHASE SEPARATION TO NITRENE CHEMISTRY: SOME RECENT ADVANCES IN THE DESIGN OF DYNAMIC POLYMER NETWORKS

16.50 **Prof. Michał Bielejewski**, Institute of Molecular of the Physics Polish Academy of Sciences, Poznań, Poland
ADVANCED NMR METHODS IN ENERGY STORAGE MATERIALS STUDY

17.00 **Dr. Jamal Moussa**, Sorbonne University, Paris, France
PYRIDYLIDENE LIGANDS AND THEIR RELATED ORGANOMETALLIC COMPLEXES FOR NOVEL OPPORTUNITIES IN VARIOUS APPLICATIONS

17.10 **Dr. Dominika Czerwonka**, Institute of Bioorganic Chemistry Polish Academy of Science, Poznań, Poland
HIGH-THROUGHPUT DISCOVERY OF DIVERSE ALLOSTERIC AND COVALENT INHIBITORS OF PYCR1

17.20 **Dr. Veronica Montes Garcia**, Adam Mickiewicz University, Poznań, Poland
FROM WASTE TO INTERFACE: PRECURSOR PRETREATMENT GOVERNS SURFACE CHEMISTRY AND ELECTROCHEMICAL PERFORMANCE OF COFFEE-DERIVED ACTIVATED CARBONS IN ZINC-BASED ENERGY STORAGE

17.30 **Prof. Wojciech Smułek**, Poznan University of Technology, Poznań, Poland
ENVIRONMENTAL SAFETY OF THE PYRETHROIDS AND PYRETHRINS

IBPP Institut Bibliothèque Polonaise de Paris
The parallel session will take place at Scientific Centre of PAS

Chairmen: Dr. Nahir Vadra-Garcia & Prof. Filip Ciesielczyk

15.00 **Dr. Grzegorz Markiewicz**, Adam Mickiewicz University, Poznań, Poland
AMINO ACID-DERIVED AROMATIC SCAFFOLDS FOR CONTROLLING (A)SYMMETRY IN SUPRAMOLECULAR ASSEMBLIES

15.10 **Dr. Jan Holub**, University of Chemistry and Technology, Prague, Czech Republic
ELECTRO- AND PHOTOCATALYTIC AMMONIA OXIDATION WITH RUBDA-FUNCTIONALISED CARBON MATERIALS

15.20 **Dr. Anna Berlicka**, University of Wrocław, Poland
CARBAPORPHYRIN: REACTIVITY OF A CYCLOPENTADIENE MOIETY WITHIN A MACROCYCLIC FRAMEWORK

15.30 **Dr. Mateusz Kowalik**, University of Gdańsk, Poland
ORGANOMETALLIC RHODIUM(III) COMPLEX WITH PHENANTHROLINESULFONAMIDE IN THE FIGHT AGAINST LEUKEMIA CANCER CELLS

15.40 **Dr. Christophe Desmarets**, Sorbonne University, Paris, France
ENGINEERING FUNCTIONAL POLYMETALLIC M_2L_4 ASSEMBLIES

15.50 **Prof. Martin Jönsson- Niedziółka**, Institute of Physical Chemistry, Polish Academy of Sciences, Warszawa, Poland
PEPTIDES FOR ELECTROCHEMICAL BIOSENSORS – TOWARDS SELECTIVE DETECTION OF C-REACTIVE PROTEIN ISOFORMS

16.00 **Dr. Constance Lecourt**, Sorbonne University, Paris, France
SYNERGISTIC PHOTO-SWITCHABLE EFFECTS IN MULTIFUNCTIONAL HETERO-POLY-METALLIC COMPLEXES

16.10 COFFEE BREAK

Chairmen: Prof. Justyna Walkowiak-Kulikowska & Dr. Sreenivasachary Nampally

16.20 **Dr. Antonio Santoro**, University of Messina, Italy
STIMULI-RESPONSIVE SELF-ASSEMBLY OF METAL-BASED HELICAL ARCHITECTURES

16.30 **Dr. Iwona Misztalewska-Turkowicz**, University of Bialystok, Białystok, Poland
THE GRADIENT RAFT COPOLYMERISATION FOR CO2/N2 SWITCHABLE POLYMERS PREPARATION

16.40 **Dr. Fan Yang**, Chimie ParisTech, PSL University, Paris, France
MULTICATALYTIC ACCESS TO RENEWABLE POLY(SILYL ETHER)S WITH TUNABLE PROPERTIES

16.50 **Dr. Tadeusz Muzioł**, Nicolaus Copernicus University in Toruń, Poland
STRUCTURAL AND SPECTROSCOPIC STUDIES OF COMPLEXES WITH [CR(OX)3]3- UNITS

17.00 **Dr. Katarzyna Kaczmarek**, Univerity of Silesia, Katowice, Poland
EFFECT OF FUNCTIONALIZED CARBON NANOTUBES ON THE PHYSICOCHEMICAL PROPERTIES OF IONIC NANOFLUIDS BASED ON 1-ETHYL-3-METHYLIMIDAZOLIUM THIOCYANATE

17.10 **Prof. Jan Romański**, University of Warsaw, Poland
SQUARAMIDE-BASED ION-PAIR RECEPTORS: FROM SALT EXTRACTION TO TRANSMEMBRANE TRANSPORT

17.20 **Prof. Adam Duong**, University of Picardie, Amien, France
MISSING PUZZLE IN CRYSTAL ENGINEERING: INTEGRATING COMPLEMENTARY HYDROGEN-BONDING MOTIFS WITHIN A SINGLE MOLECULAR CORE

CONFERENCE PROGRAMME

THURSDAY 3RD JULY
AMPHITÉÂTRE MICHELET DE LA SORBON

Chairmen: Prof. Izabela Nowak & Prof. Till Bousquet

9.30 **REGISTRATION**

10.00 **Prof. Paweł J. Kulesza**, University of Warsaw, Warszawa, Poland
DEVELOPMENT OF CATALYTIC SYSTEMS TOWARD REDUCTIVE CONVERSION OF ELECTROCHEMICALLY INERT REACTANTS: CARBON DIOXIDE, NITROGEN AND NITRATES

10.20 **Prof. Teofil Jesionowski**, Poznan University of Technology, Poznań, Poland
BIO-BASED HYBRID MATERIALS FOR ENVIRONMENTAL AND MEDICAL APPLICATIONS

10.40 **Prof. Fabien Cognon**, University of Jyväskylä, Jyväskylä, Finland
DESIGNING NEW, UNCONVENTIONAL PROTEIN FOLDS

10.50 **Prof. Karol Grela**, University of Warsaw, Warszawa, Poland
OLEFIN METATHESIS, A NARRATIVE AND TWO OTHER STORIES: REACTIVE DISTILLATION AND MINIMIZING CATALYST LOADING

11.00 **Prof. Joanna Ortyl**, Cracow University of Technology, Kraków, Poland
DEVELOPMENT OF NOVEL ANTIBACTERIAL PHOTOCURABLE RESINS FOR 3D PRINTING VPP APPLICATIONS IN DENTAL MATERIALS

11.10 **Prof. Anna Maria Papini**, University of Florence, Florence, Italy
PEPTIDE CHEMISTRY FOR WELL-BEING: PROOFS OF CONCEPT IN DIAGNOSTICS, THERAPEUTICS, AND COSMECEUTICALS

11.20 **Prof. Artur Stefankiewicz**, Faculty of Chemistry/Center for Advanced Technologies, Adam Mickiewicz University, Poznań, Poland
TOWARD ADAPTIVE SYSTEMS: AMINO ACID-BASED SELF-ASSEMBLED NANOSTRUCTURES

11.30 **Dr. Ingrid Suzana**, Aix-Marseille University, Marseille, France
MULTIFUNCTIONALITY VIA METAL INTEGRATION: THE PROMISE OF HETERO-POLYMETALLIC ARCHITECTURES

11.40 **Prof. Joanna Pietrasik**, Łódź University of Technology, Łódź, Poland
POLYMER NETWORKS BASED ON OLIGO(ETHYLENE GLYCOL) METHYL ETHER METHACRYLATE

11.50 **Prof. Juliene Leclaire**, ENS Lyon, Lyon, France
SYNERGISTIC CO2-CAPTURE AND METAL RECYCLING: FROM DISRUPTIVE CONCEPT TO OPERATING PLANT

12.00 **Dr. Nahir Vadra-Garcia**, Adam Mickiewicz University, Poznań, Poland
MULTIFUNCTIONAL STIMULI-RESPONSIVE HYBRID MATERIALS BASED ON POLYOXOMETALATES

12.10 **Prof. Adrian Michail Stadler**, Institute of Supramolecular Science and Engineering, Strasbourg, France
SUCCESSIVE TRANSIMINATIONS: PH-TRIGGERED SWITCHES AND MULTISTEP PROCESSES

12.20 **Dr. Wojciech Drożdż**, Adam Mickiewicz University, Poznań, Poland
ORGANIC AND COORDINATION CAGES FOR AQUEOUS MOLECULAR RECOGNITION AND FUNCTIONAL APPLICATIONS

12.30 **Dr. Damian Syjczak**, NAWA, Warszawa, Poland
VICE DIRECTOR OF NAWA. THE INTERNATIONALIZATION OF POLISH SCIENCE IN THE CONTEXT OF POLISH-FRENCH RELATIONS

12.40 GROUP PHOTO

2.50 LUNCH BREAK

Chairmen: Prof. Mariusz Makowski & Prof. Piotr Pawluć

14.30 **Prof. Ewa Mijowska**, West Pomeranian University of Technology in Szczecin, Szczecin, Poland
DEFECT-DRIVEN ENGINEERING OF BOROPHENE-LIKE DERIVATIVES FOR ENHANCED ELECTROCATALYTIC WATER SPLITTING

14.50 **Dr. Artur Ciesielski,** Adam Mickiewicz University, Poznań, Poland , University of Strasbourg, France
2D COVALENT ORGANIC FRAMEWORKS AND THEIR HYBRIDS: BRIDGING SYNTHESIS AND APPLICATIONS

15.10 **Prof. Paweł Chmielarz**, Rzeszow University of Technology, Rzeszów, Poland
REVERSIBLE DEACTIVATION RADICAL POLYMERIZATION: OUTLOOK FOR SYNTHESIS OF FUNCTIONAL MATERIALS

15.20 **Dr. Yvan Six**, Laboratory of Organic Synthesis, Ecole University of Technology, Palaiseau, France
TITANIUM-MEDIATED CONSTRUCTION OF POLYSUBSTITUTED AROMATIC SYSTEMS FROM 1,3-DIYNES

15.30 **Prof. Agnieszka Jastrzębska**, Warsaw University of Technology, Warszawa, Poland
REFINING STABLE AND BIOCOMPATIBLE MXENE CANDIDATES FOR FUTURE BIOTECHNOLOGICAL APPLICATIONS

15.40 **Prof. Ahmed Legrouri**, Mohammed VI University of Technology (UM6P), Benguerir, Marocco
ENHANCING WATER PURIFICATION VIA LAYERED DOUBLE HYDROXIDES

15.50 **Prof. Paweł Kowalczyk**, University of Łódź, Poland
TOWARD TRANSPARENT ELECTRONICS: PECULIAR PHENOMENA IN 2D MATERIALS

16.00 **Prof. Sebastian Suárez**, Autonomous University of Madrid, Madrid, Spain
NITROXYL (HNO): REDOX CHEMISTRY, METAL-BASED DETECTION, AND ENDOGENOUS FORMATION

16.10 **Prof. Marzena Dzida**, University of Silesia, Katowice, Poland
HEAT TRANSFER MECHANISMS IN IONIC LIQUID WITH LONG MULTI-WALLED CARBON NANOTUBES

16.20 **Dr. Paweł Dydio**, University of Cambridge, Great Britain
DESIGNING REACTIVITY IN CATALYSIS: FROM MECHANISTIC INSIGHT TO MULTICATALYSIS

16.30 **Prof. Volodymyr Sashuk**, Institute of Physical Chemistry, Polish Academy of Sciences, Warszawa, Poland
WHEN MONOLAYERS BECOME CATALYSTS – AND ENABLE CONTROL OVER CATALYSIS

16.40 **Prof. Jędrzej Walkowiak**, Adam Mickiewicz University, Poznań, Poland
HYDROBORATION CATALYZED BY IONIC LIQUIDS AND SINGLE-ATOM CATALYSTS

16.50 **Prof. Iwona Rutkowska**, University of Warsaw, Poland
CATALYTIC AND COCATALYTIC PROPERTIES OF POLYNUCLEAR COBALT HAEXACYANOFERRATE NETWORKS TOWARD WATER OXIDATION IN ACID MEDIUM

17.00 **Prof. Marcin Drąg**, Center for Chemical Biology, Institute of Physical Chemistry, Polish Academy of Sciences, Warszawa, Poland
BREAKING NATURE'S LIMITS: THE ERA OF UNNATURAL AMINO ACIDS

THURSDAY 4TH JULY

IBPP INSTITUT BIBLIOTHÈQUE POLONAISE DE PARIS

Chairmen: Prof. Valerie Marvaud & Prof. Régis Gauvin

9.30 **REGISTRATION**

10.00 **Dr. Fabrice Pointillart**, CNRS-University of Rennes, Rennes, France
PRESSURE-MAGNETIC MODULATION AND MULTIFUNCTIONALITY IN SINGLE-MOLECULE MAGNETS

10.20 **Prof. Miłosz Pawlicki**, Jagiellonian University, Kraków, Poland
PI-DELOCALISATION IN 2D AND 3D CONJUGATED SKELETONS

10.40 **Prof. Rinaldo Poli**, CNRS - Coordination Chemistry Laboratory, Toulouse, France
TERMINATION STUDIES OF ACRYLATE RADICALS IN ATRP

10.50 **Prof. Justyna Walkowiak-Kulikowska**, Adam Mickiewicz University, Poznań, Poland
STRUCTURE-PROPERTY RELATIONSHIPS IN CARBOHYDRATE-FUNCTIONALIZED FLUORINATED STYRENE COPOLYMERS: FROM CUAAC SYNTHESIS TO INTERFACIAL BEHAVIOR

11.00 **Prof. Róża Szweda**, Adam Mickiewicz University, Poznań, Poland
ENCODING AND PROPAGATION OF STEREOCHEMICAL INFORMATION IN SEQUENCE-DEFINED OLIGOURETHANES

11.10 **Dr. Yvain Nicolet**, Institute of Structural Biology, Grenoble, France
STRUCTURE AND MECHANISM OF THE DAROBACTIN SYNTHASE DARE UNVEIL HOW THE ENZYME TAMES OXYGEN

11.20 **Prof. Izabela Zaborniak**, Rzeszow University of Technology, Rzeszów, Poland
CONTROLLED SYNTHESIS OF BRANCHED POLYMERIC EXCIPIENTS FOR MODIFIED DRUG RELEASE APPLICATIONS

11.30 **Prof. Artur Krężel**, University of Wrocław, Wrocław, Poland
CHEMICAL DETERMINANTS OF METAL COORDINATION AND STRUCTURAL DYNAMICS IN Zn(II) AND Cu(I)/Zn(II) METALLOTHIONEINS, KEY PROTEINS IN METAL HOMEOSTASIS

11.40 **Dr. Nicolas Illy**, Sorbonne University, Paris, France
HARNESSING THIOLACTONE CHEMISTRY FOR THE DESIGN OF FUNCTIONAL POLYMERS

11.50 **Prof. Jan Paczesny**, Institute of Physical Chemistry Polish Academy of Sciences, Warszawa, Poland
PHYSICOCHEMICAL ENGINEERING OF MATERIAL–VIRUS–BACTERIA INTERFACES FOR SELECTIVE BIOCONTROL

12.00 **Prof. Sławomir Potocki**, University of Wroclaw, Wrocław, Poland
COORDINATION CHEMISTRY IN ACTION: STRATEGIES FOR METALLOPROTEIN INHIBITION

12.10 **Dr. Cataldo Valentini**, Center for Advanced Technologies, Adam Mickiewicz University, Poznań, Poland
AMBIPOLAR DONOR-ACCEPTOR 2D COVALENT ORGANIC FRAMEWORKS AS CATHODE MATERIAL FOR ALUMINUM ENERGY STORAGE DEVICE

IBPP Institut Bibliothèque Polonaise de Paris

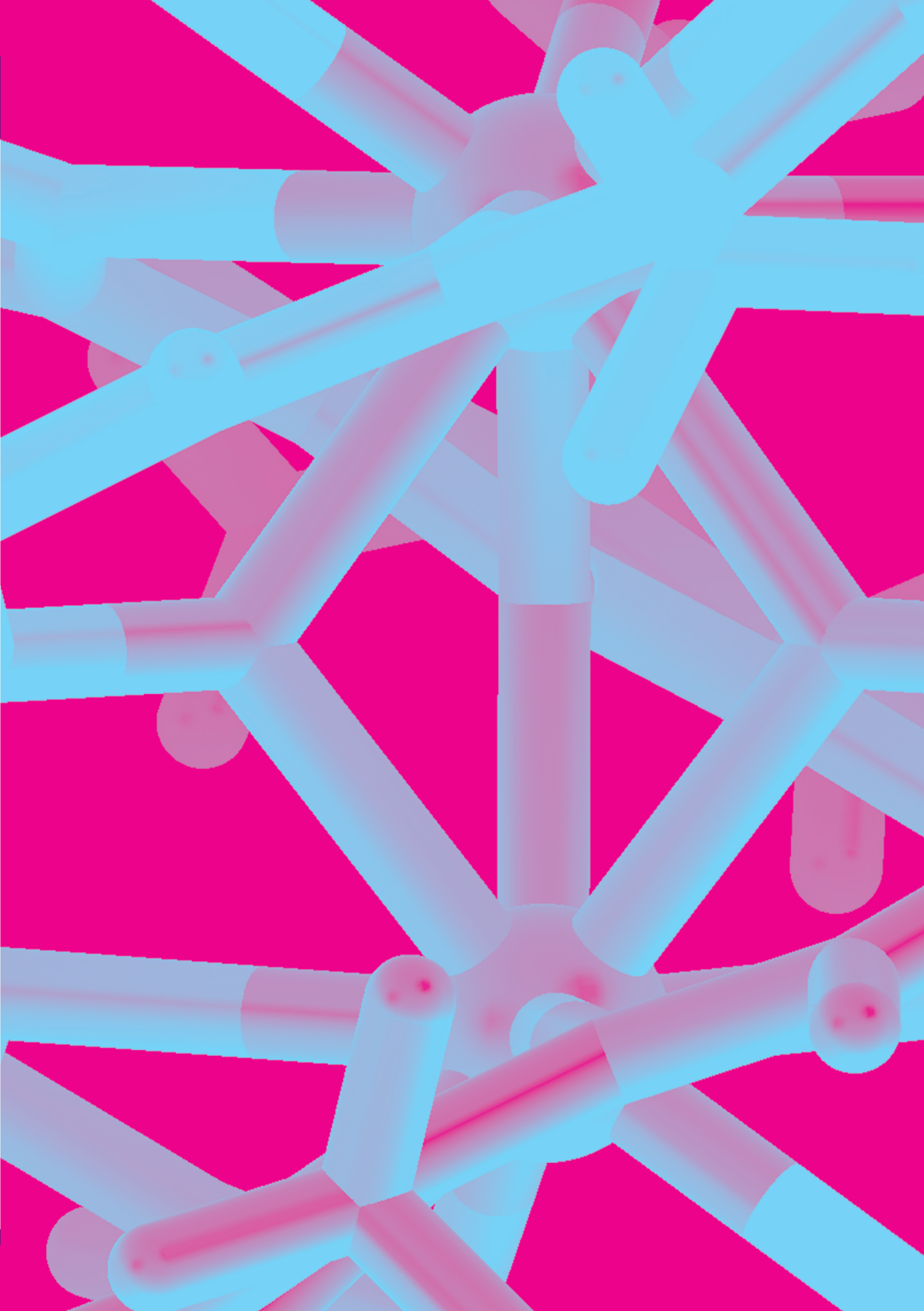
CLOSING CEREMONY

Chairmen: Prof. Maciej Forycki

12:30 **Prof. Jean-Marie Lehn**, Institute of Supramolecular Science and Engineering, University of Strasbourg, France
FROM SUPRAMOLECULAR TOWARDS ADAPTIVE CHEMISTRY: IF ORDER CAN BE, ORDER WILL BE!

Prof. Bogumiła Kaniewska, Adam Mickiewicz University, Poznań, Poland
RECTOR OF ADAM MICKIEWICZ UNIVERSITY IN POZNAN

Prof. Violetta Patroniak, Adam Mickiewicz University, Poznań, Poland
CHAIR OF 3RD FRENCH-POLISH CHEMISTRY CONGRESS



FROM SUPRAMOLECULAR TOWARDS ADAPTIVE CHEMISTRY: IF ORDER CAN BE, ORDER WILL BE!

Jean-Marie LEHN

ISIS, Université de Strasbourg, France

Supramolecular chemistry is intrinsically a dynamic chemistry in view of the lability of the non-covalent interactions connecting the molecular components of a supramolecular entity and its resulting ability to exchange components. Similarly, dynamic covalent chemistry concerns molecular entities containing covalent bonds that may form and break reversibly, so as to allow for a continuous modification in constitution by reorganization and exchange of building blocks. These features define a Constitutional Dynamic Chemistry (CDC) on both the molecular and supramolecular levels. Because of the intrinsic ability of the constituents to exchange and rearrange their components, they may in principle select them in response to physical stimuli or chemical effectors. They thus behave as adaptive chemical entities, leading to the development of an Adaptive Chemistry of both molecular or supramolecular nature.
Of special significance is the fact that the possibility of a constitutional dynamic system to achieve a state of higher organization (such as the transition from a Sol to a Gel) drives the amplification of those constituents that lead to that very state in a sort of autocatalysis of organization.

Dynamic and adaptive features introduce a paradigm shift in Soft Matter Chemistry, opening wide perspectives towards adaptive soft matter science and in a broader view towards higher levels of (self)organization and complexity .

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PRECISELY CONTROLLED MACROMOLECULAR ARCHITECTURE BY ATRP

Krzysztof Matyjaszewski

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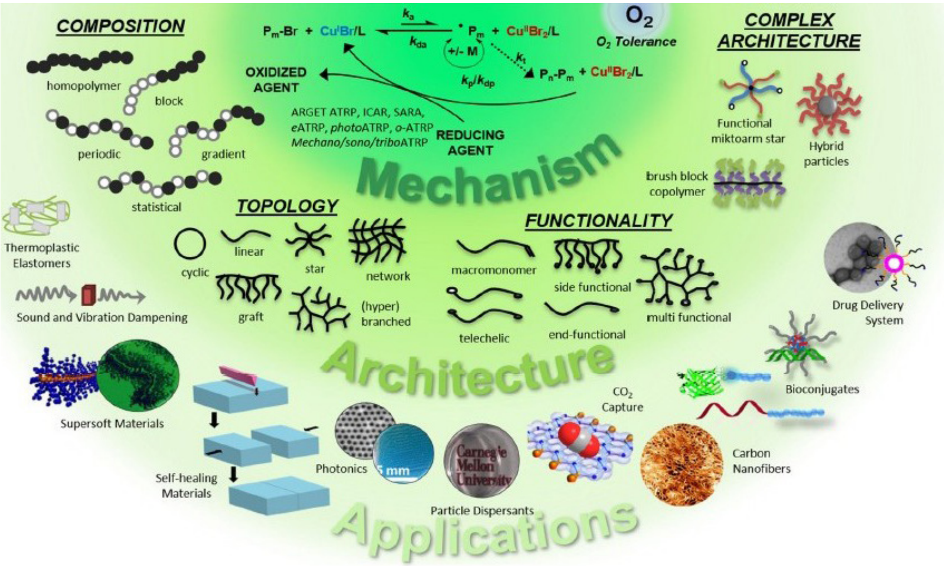
Various well-defined polymers with precisely controlled macromolecular architecture were prepared under environmentally benign conditions, with ppm of catalysts, in an aqueous environment, and in open-air with temporal control by light, electrical current, mechanical forces, or benign chemicals such as ascorbic acid. The dynamic exchange between active radicals and dormant species catalyzed by ppm amounts of copper catalyst in atom transfer radical polymerization (ATRP) or by degenerative transfer (RAFT) enabled access to uniform star, comb, bottlebrush, or cyclic polymers with controlled chain composition, such as block, gradient, or periodic structures. Macromolecular engineering provided access to designed bioconjugates by covalently linking synthetic polymers with proteins or nucleic acids (DNA and RNA) and attaching polymers to inorganic surfaces such as nanoparticles or flat wafers. Such well-defined polymers and hybrid materials outperform conventional commercial products; they can self-assemble, selfrepair, depolymerize back to monomers, and respond to external stimuli. They find applications in the areas of biomedicine, environment, and energy.



DEVELOPMENT OF CATALYTIC SYSTEMS TOWARD REDUCTIVE CONVERSION OF ELECTROCHEMICALLY INERT REACTANTS: CARBON DIOXIDE, NITROGEN AND NITRATES

Pawel J. Kulesza

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There has been growing interest in the electrochemical reduction of carbon dioxide, a potent greenhouse gas and a contributor to global climate change. In this respect formation of simple fuels and utility chemicals is of interest. Formation of ammonia is one of the most important chemical synthetic processes. Development of low-temperature synthetic (e.g., electrochemical) methodology is tempting both from the practical and fundamental reasons. Nitrogen (N2) molecule is not only electrochemically more inert (during reduction) than CO2, but also hydrogen evolution is truly a competitive and complicating process in aqueous media. Consequently, the low NH3 production rates during N2-reduction limit its widespread application. The nitrate (NO3-) anion reduction is considered as an alternative to N2 fixation due to its lower dissociation energy of the N=O bond, which promises much better reaction kinetics for electrochemical NH3 production..

Our recent studies demonstrate that coordinatively stabilized iron catalytic sites, e.g. FeP and Fe2P phases, act as efficient catalysts for reduction of not only CO2 but also NO3- or, even, N2. In this respect, the copper and iron-based metal organic frameworks (MOFs) are of importance as well. Another possibility to enhance the electroreduction processes is to consider Cu or Fe-intercalated metal oxides (e.g., WO3) as active matrices. The hydrous behavior of such oxide cocatalysts favors proton mobility and affects overall reactivity and selectivity. Of interest are also the structurally and functionally advanced complexes in which benzimidazole-scaffolded imine ligands are capable of binding more than one metal (e.g., Cu) ion as well as the systems with imine moiety allowing for effective formation of multidentate coordination pockets. Correlation of such parameters as structure, electrocatalytic activity and durability of operation will be addressed.

WHAT DO WE KNOW ABOUT PER- OR POLYFLUOROALKYL SUBSTANCES (PFAS)?

Bruno Améduri

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Per- or polyfluoroalkyl substances (PFASs)(1-2) are man-made compounds involved in compositions of many industrial processes and consumer products. They are categorized into two main families based on their molar mass: i) The low molar mass-products (<1000 Da) are toxic, mobile, bioaccumulative and cross the human membranes; ii) others of much higher molar masses, e.g., fluorinated macromolecules and especially fluoropolymers are safe, reliable, do not face such concerns, do not cross the membranes (hence, they are regarded as Polymers of Low Concern)(3) and are involved in many applications including medical products(4) and high value-added materials and devices.(5-6) Because the former family has led to a severe global contamination, recent regulating agencies in Europe (REACH) and USA (EPA) have aimed at restricting fluorochemicals. Last year, the consultation from affected organisms and industries have led to more than 5,600 answers and comments. This review supplies an update on the overall situation of PFAS(7), their limitations, regulations, end of life, degradations and possible alternatives.

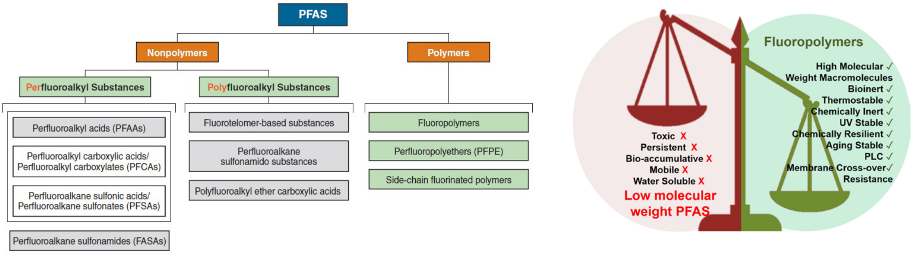

Figure 1: distinguishing PFAS families by their molar masses (MW, left); drawbacks of low MW PFAS in contrast to advantages of high MW ones (Fluoropolymers) (right)

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2D COVALENT ORGANIC FRAMEWORKS AND THEIR HYBRIDS: BRIDGING SYNTHESIS AND APPLICATIONS

Artur Ciesielski

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The Two-dimensional Covalent Organic Frameworks (2D COFs) are an emerging class of crystalline porous materials whose well-defined molecular architecture, high surface area, and chemical versatility make them compelling candidates for energy storage applications. Integrating COFs with functional materials, such as Metal-Organic Frameworks (MOFs) and Polyoxometalates (POMs) to form hybrids further expands their property space beyond what pristine frameworks offer.
This talk opens with an introduction to key energy storage systems and the materials challenges that currently limit their performance. It then covers the design and synthesis principles that govern 2D COFs and their hybrids, focusing on strategies to control crystallinity, tune porosity, and install functional groups that modulate electronic and electrochemical behavior. I will then show how these structural handles translate into performance gains in pseudosupercapacitors and both zinc and aluminum batteries, with emphasis on redox-active frameworks, charge storage mechanisms, and ion transport dynamics. The talk concludes by connecting fundamental design principles to the practical challenge of building sustainable energy technologies from next-generation porous materials.

BIO-BASED HYBRID MATERIALS FOR ENVIRONMENTAL AND MEDICAL APPLICATIONS

Teofil Jesionowski

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The lecture will focus on current trends in the fabrication and development of bio-based hybrid materials. Additionally practical utilities of those materials will be also emphasized. Methods of their design, production, characteristics as well as potential applications will be described. An extremely important element of research is the work devoted to neutralization of substances of organic origin. Materials of natural origin, obtained from biomass or other sources, are of great interest among scientists. One example of unique biocomponents is lignin. Hybrid materials produced with lignin and selected oxides can serve as advanced fillers, eco-friendly components of abrasives or biosensors as well as cement additives. Sea sponges or their derivatives (skeletons, including carbonized forms), due to their unique spatial structure and properties, are also the subject of numerous studies. Additionally, the potential for carbonization of marine sponge skeletons at extremely high temperatures (up to 3000°C) will be demonstrated. Recently, the use of deep eutectic solvents in the design of materials for tissue engineering has also become very important. Another direction in the development of hybrid materials is their use as carriers in the immobilization of enzymes, followed by the production of enzymatic biosensors. For this purpose, nanomagnetite, lignin, polydopamine, poly(caffeic acid), etc. are used as components, as well as suitable enzymes dedicated to environmental or medical applications. Furthermore, the production of membranes for use in biotechnological processes or the separation of microplastics from environmental systems will be indicated. Furthermore, directions for the development of COF structures with their potential for development will be indicated.

Acknowledgements

This work was supported by National Science Center Poland under the research grant no. 2025/57/B/ST8/01589. The author would like to thank all those who participate in the research in the area included in this paper.

DEFECT-DRIVEN ENGINEERING OF BOROPHENE-LIKE DERIVATIVES FOR ENHANCED ELECTROCATALYTIC WATER SPLITTING

Ewa Mijowska1,2, Jakub Brzeski3,4, Grzegorz Leniec1,2, Karolina Wenelska1,2, Klaudia Zielinkiewicz1,2

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2 Centre for Advanced Materials and Manufacturing Process Engineering (CAMMPE), West Pomeranian University of Technology, 70-310 Szczecin, Poland
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The search for efficient two-dimensional boron-based materials has intensified following the emergence of borophene as a unique non-van der Waals polymorph with remarkable electronic and catalytic properties. However, the synthesis of free-standing borophene remains a major challenge due to the complex crystal structure and strong covalent bonding present in β-rhombohedral boron (β-B). In this study, we present a defect-oriented top-down strategy for the preparation of boron-derived ultrathin nanostructures and their functional heterostructures designed for electrochemical water decomposition applications.
The proposed approach exploits the intrinsic structural instability associated with vacancies, partially occupied crystallographic sites, and self-interstitial defects naturally existing in β-B. These defects facilitate localized fragmentation and formation of nanoscale boron-rich sheets during physical and chemical treatment processes. Rather than generating ideal crystalline borophene phases, the obtained products are identified as defect-rich borophene-like architectures containing oxidized domains, disordered regions, and abundant active edge sites which can serve as active sites for both electrocatalytic hydrogen evolution reaction (HER) and oxygen evolution reaction (OER). To improve electrochemical functionality, the boron nanostructures were integrated with transition-metal-based compounds, forming heterostructures with enhanced interfacial charge transport and catalytic accessibility. Detailed physicochemical characterization revealed that defect density, heterointerface formation, and surface modifications strongly influence catalytic performance.

NEW SYNTHETIC STRATEGIES FOR THE EFFICIENT SYNTHESIS OF PILLAR[5]ARENE-CONTAINING INTERLOCKED SYSTEMS

Jean-François Nierengarten

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Interlocked molecular ensembles such as rotaxanes and catenanes are fascinating systems in which large amplitude molecular motions are possible. Chemists became rapidly interested in controlling the conformation of such molecules and the pioneering work of Sauvage and Stoddart in this area gave rise to the field of molecular machines.(1) The possible applications of such systems in various fields including biology, nanotechnology or catalysis have been a strong driving force to further improve the synthetic strategies allowing to efficiently produce mechanically interlocked molecules. Their preparation remains often challenging as pre-organization of separate molecular units into a well-defined supramolecular structure is mandatory. For example, the most classical approach to prepare rotaxanes is based on the grafting of bulky stoppers onto a linear building block associated to a macrocyclic moiety in an inclusion complex. This strategy is efficient as long as the reaction conditions are compatible with the formation of the supramolecular complex. This requirement is however often problematic, in particular when weak intermolecular interactions are used to assemble the two components. This is for example the case when pillar[5]arene is used as the macrocyclic component for the preparation of rotaxanes.[2] The direct preparation of rotaxanes from pillar[5]arene-based inclusion complexes is highly dependent on the nature of the reagents even when similar reactions are used for their synthesis and yields are often quite moderate. To solve this problem, we have developed the preparation of pillar[5]arene-containing [2]rotaxane building blocks allowing their efficient post-modification by a stopper exchange reaction.[3] The latest advances in this particular field will be presented.

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P-DELOCALISATION IN 2D AND 3D CONJUGATED SKELETONS

Miłosz Pawlicki

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The precisely planned strategy for formation of hybrid structures linking in one skeleton acene(s) or heteroacenes modulated by a presence of a specific defect predefined for binding small cation creates strictly designed systems.(1) It results in, depending on the complexity of the final molecule, the observation of local effects of conjugation efficiently influencing properties of each subunit. A specific construction opens a possibility for observation of the reactivity characteristic for isolated unsaturated units(6) in addition creating an opportunity for switching on the global diatropic currents(2-5) or stabilization of a biradical character.(7) All those effects will be presented and discussed focusing on the delocalization paths within precisely designed structural motifs introducing triangular defect(s) open for a post-synthetic modifications(8,9) or opening potential for a dynamic equilibrium and stabilization of open-shell character by showing the synthetic approach followed by the spectroscopic behaviour extended by XRD analysis and theoretical support.

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PRESSURE-MAGNETIC MODULATION AND MULTIFUNCTIONALITY IN SINGLE-MOLECULE MAGNETS

Boris Le Guennic,a Olivier Cador,a Michael R. Probert,b Dawid Pinkowicz,c B. Baguenard,d M. Atzori,e J. Crassous,a O. Gidron,f Fabrice Pointillarta

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e Univ. Grenoble Alpes, INSA Toulouse, Univ. Toulouse Paul Sabatier, EMFL, CNRS, Grenoble
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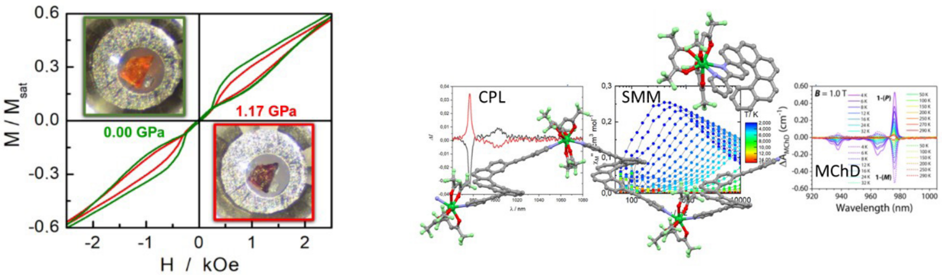
Single-molecule magnets (SMMs) have fascinated both chemists and physicists for the past three decades due to their potential applications in high-density data storage, quantum computing, and spintronics. An even greater challenge lies in the design of multifunctional SMMs, particularly those in which one property can be controllably switched. Such behavior could enable new applications in molecular switches and sensors, although it has only rarely been achieved.(1) The design of non-centrosymmetric molecular magnets is of paramount importance since the absence of an inversion centre leads to efficient coupling of electric fields to the molecular magnetic moment,(2) and to magnetochirality,(3) a non-reciprocal effect that can be harnessed by unpolarised light. Such molecular magnets may combine magnetism with other physical properties displayed independently or in synergy leading to an attractive and unusual example of multifunctional materials merging chiroptical, luminescence, and magnetic properties. In this context, a piezochromic isotopically enriched single-molecule magnet (SMM)(4) is first presented, followed by a series of enantiopure lanthanide SMMs displaying circularly polarized luminescence (CPL) and/or magneto-chiral dichroism (MChD).(5,6) The investigation of these compounds led to the tentative establishment of design guidelines for enhancing MChD signals in lanthanide-based systems, paving the way toward their application in unpolarized optical data-readout technologies.(7)



Magnetic bistability at ambient pressure and 1.17 GPa, highlighting the piezochromic effect (left), SMM, CPL and MChD behaviours observed in Ytterbium helicene complexes

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3RD FRENCH-POLISH CHEMISTRY CONGRESS

ARTIFICIAL WATER CHANNELS-TOWARD BIOMIMETIC MEMBRANES FOR DESALINATION

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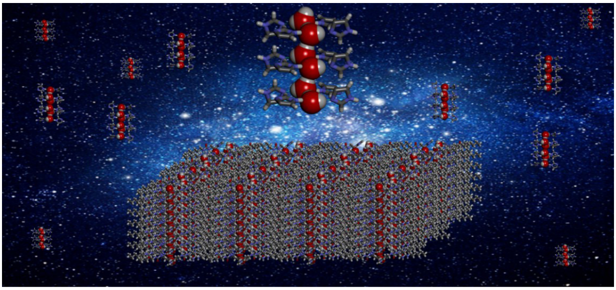
This lecture discusses the incipient development of the biomimetic artificial water channels systems. We include only systems that integrate synthetic elements in their water selective translocation unit. We review many of the natural systems involved in water and related proton transport processes. We describe how these systems can fit within our primary goal of maintaining natural function within bio-assisted artificial systems. In the last part, we present several inspiring breakthroughs from the last decade in the field of biomimetic artificial water channels. All these examples demonstrate how the novel interactive water--channels can parallel biomolecular systems. At the same time these simpler artificial water channels offer a means of understanding water structures useful for many biological scenarios. Moreover, they can be used for the preparation of highly selective membranes for desalination.



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CARBAPORPHYRIN: REACTIVITY OF A CYCLOPENTADIENE MOIETY WITHIN A MACROCYCLIC FRAMEWORK

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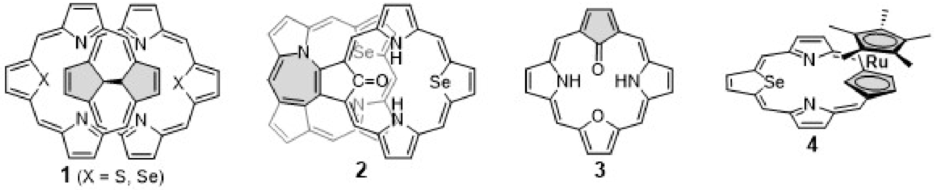
Carbaporphyrins – porphyrins modified in the coordination core by replacement of a nitrogen atom with a carbon atom – provide novel opportunities to control geometry, coordination, spectroscopic properties, and reactivity.[1] Embedding a cyclopentadiene unit in place of a pyrrole ring represents an efficient route to these frameworks. Recently, the rational synthesis of a series of 10,15-diaryl-21-carba-23-heteroporphyrins was reported.[2]

Herein, we demonstrate that the cyclopentadiene ring within the 21-carba-23-heteroporphyrins skeleton exhibits non-trivial reactivity (Figure 1), as shown by the formation of two types of porphyrin arrays (1,2).[2c,3] These arrays are distinguished by a parallel-displaced geometry (1) and an “open seashell” geometry (2) with a merging azepine-like motif. Oxygenation of 21-carba-23-oxaporphyrin afforded 21-oxo-21-carba-23-oxaporphyrin (3).[2b] Its structure reflects competition among three canonical forms associated with 20 π-electron antiaromaticity, 18 π-electron aromaticity, and local 4 π-electron antiaromaticity of the cyclopentadienyl cation, resulting in an overall nonaromatic character. Additionally, 21-carba-23-selenaporphyrin serves as an excellent πconjugated platform for coordination to the [RuCp*]+ moiety, yielding the 1,3metallocenoporphyrin hybrid (4).[4]

The presented examples demonstrate the role of novel structural motifs, such as cyclopentadiene, in creating porphyrinoids with unique architectures and distinct electronic and spectroscopic properties.



1 (X = S, Se)   2   3   4

Figure 1. Porphyrin arrays (1, 2), 21-oxo-21-carba-23-oxaporphyrin (3), and 1,3-metallocenoporphyrin (4).

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ADVANCED NMR METHODS IN ENERGY STORAGE MATERIALS STUDY

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Combining the selectivity of Nuclear Magnetic Resonance with its ability to study heteronuclear correlations and cross-polarization pathways between different nuclei allows investigation of the chemical composition of materials, as well as processes that can lead to structural and morphological changes induced by external and internal conditions. The influence of the nearest neighborhood and fluctuations in local magnetic fields allow us to study the relaxation phenomena that drive the molecular dynamics mechanism. The translational dynamics can be studied by applying magnetic field gradients to the studied materials, thereby introducing the spatial dependence of observed NMR signals. Recent developments in methodology and hardware make it possible to account for the influence of external electric fields acting on ionic species during NMR acquisition, introducing a new dimension of NMR spectroscopy called electrophoretic NMR (eNMR). All these aspects and advanced NMR methods provide a unique tool for studying solid-state materials, soft matter systems, liquids, and phenomena at their interfaces, delivering structural, dynamical, transitional, and intermolecular information on the systems and processes involved (1,2). Using advanced NMR methods, in-situ, ex-situ, post-mortem, and operando studies of individual and full-cell systems enable the tracing of electrochemical processes, intermolecular interactions, and structural changes in working energy-storing devices. The examples for high-resolution ssNMR for electrode studies, diffusion NMR for supramolecular and liquid electrolyte investigations, as well as the influence of the electric field on the ions' behavior, will be discussed.

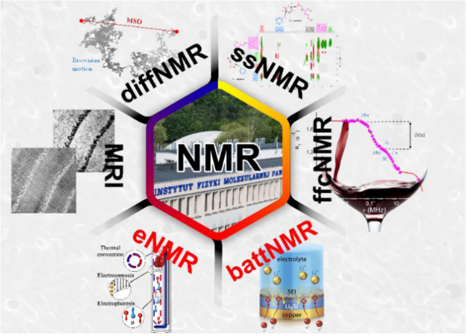

Figure 1: Core NMR facility at the Institute of Molecular Physics, Polish Academy of Sciences

Acknowledgements:
The financial support is provided by the National Science Centre, Poland (grant no. 2024/55/B/ST11/00250

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REGIO- AND STEREOSELECTIVE FLUOROALKYLATION-FUNCTIONALYZATION OF ALKYNES

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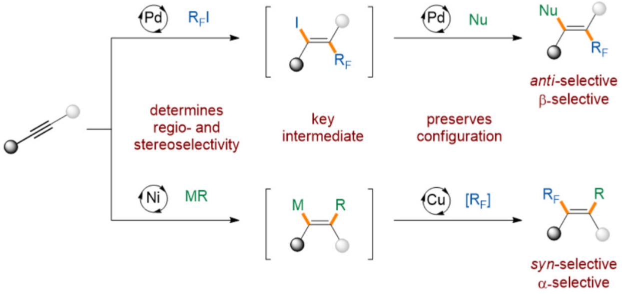
Due to small size and the highest electronegativity the incorporation of fluorine atom or fluorinated groups into the structure of organic molecules exerts a remarkable effect on their chemical, physical, and biological properties. It is reflected in the many varied applications of fluorinated organic compounds in medicinal chemistry, agrochemistry, material science and other branches of science.



We are focused on discovery, development and understanding of the straightforward catalytic methods for the synthesis of fluoroalkyl-substituted olefins, employing simple alkynes as readily available and inexpensive starting materials. Two strategies, featuring high levels of regio- and stereoselecvtivity will be presented. First is based on tandem Pd-catalyzed iodoperfluoroalkylation of acetylenes followed by cross--coupling.1 This modular approach enables highly anti-selective fluoroalkylation acompaigned by arylation, borylation and carbonylation. The second strategy relay on selective addition of organometallic species to alkynes followed by installation of fluoroorganic group.2 Typically, it features syn-selectivity and provide unique opportunity for installation of fluorinated function at ⊠-position.

Acknowledgements:
Financial support from the Polish National Science Centre (Grants 2016/21/B/ST5/03178, 2019/35/B/ST4/00599 and 2024/53/B/ST5/01407) is gratefully acknowledged.

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BREAKING THE SYMMETRY IN CHIRAL SUPRAMOLECULAR RECEPTORS: FROM HEMICRYPTOPHANES TO CYCLODEXTRINS

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Nature achieves exceptional enantioselectivity through proteins made exclusively from L-amino acids. Their precisely folded 3D structures create finely tuned cavities that enable highly regioselective and stereoselective reactions by accurately positioning reactive centers. In contrast, chemists generally rely on pairs of enantiomeric catalysts to access both enantiomeric products, with only a few examples of diastereomeric catalysts acting as pseudo-enantiomers.1 Moreover, unlike enzymes, most synthetic catalysts and receptors are highly symmetrical because they are easier to prepare. We will show how symmetry can be broken in hemicryptophanes2 and how we draw inspiration from Nature by modifying D-sugar-based ⊠-cyclodextrins3 (CDs) to generate regioisomers (1 and 2) with mirror-image-shaped cavities. These systems are expected to catalyze the formation of either enantiomer of product 4 from the same reactant 3, avoiding the need to synthesize enantiomeric catalysts. Only one enantiomer is accessible with CDs made of D-sugars and to access the other enantiomer, a L-sugar-made CD should be used. Although a recent synthesis of such a molecule was published by Stoddart,4 the synthesis of the ligand remains highly tedious (Figure 1).

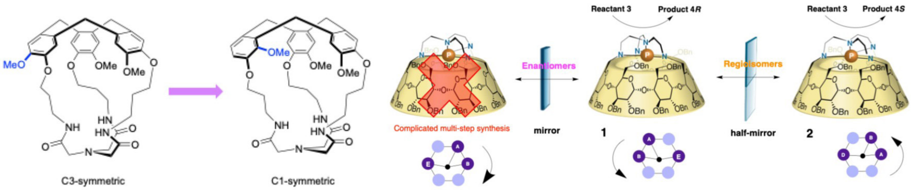

Figure 1. a) Hemicryptophane ligands with either C3 or C1 symmetry b) A D-sugar-based cyclodextrin scaffold is reshaped to give 2 regioisomers (1 and 2) displaying mirror patterns on their primary rims but the stereogenic centers on the cyclodextrin core remain the same. The 2 regioisomers are expected to give opposite enantioselectivity in organocatalysis and avoid a tedious synthesis of the cyclodextrin with the opposite enantioselectivity.

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REVERSIBLE DEACTIVATION RADICAL POLYMERIZATION: OUTLOOK FOR SYNTHESIS OF FUNCTIONAL MATERIALS

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The lecture focuses on the characterization and optimization of ATRP methods for synthesizing polymers with diverse structures and architectures. A crucial aspect was the development of new concepts controlled by external reducing agents, involving reduced catalyst loading via electrochemical methods (eATRP) [1] or polymerization without the need for a catalytic complex (metal-free ATRP) [2]. The research includes an original concept for the synthesis of homopolymers, star, graft, and brush copolymers. A breakthrough includes a significantly simplified procedure for synthesizing polymer brushes using microliter volumes of the reaction mixture. Additionally, modifications can be performed directly on the laboratory bench without the need for an anaerobic atmosphere. The novelty of this work lies not only in the use of water as an environmentally friendly solvent, but also in ATRP controlled by both external factors (blue light) and internal factors. The entire series of works serves as a guide, inspired by the principles of "green chemistry," for the synthesis of materials with desired properties [3]. With a view to simplifying the synthetic procedure and reducing its toxicity, the works propose methods that can successfully provide a sustainable alternative to current technological solutions used in the plastics industry and biomedicine, for example, as intelligent systems for the release of bioactive substances, implants in tissue engineering, and hydrophobic antimicrobial coatings.

Acknowledgments
All the authors acknowledge financial support from the National Centre for Science as part of the PRELUDIUM BIS 5 project (no. UMO-2023/50/O/ST5/00104).

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MULTIFUNCTIONAL SOLID LUMINOPHORES BASED ON METAL COMPLEXES FOR LUMINESCENT THERMO-HYGROMETRY

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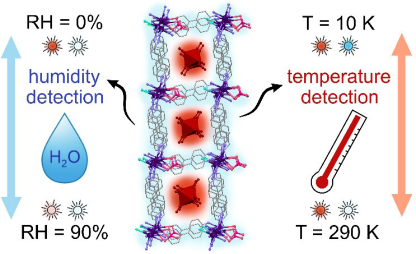
Metal complexes, either embedded in coordination polymers, molecules, clusters, or molecular hybrids, were found to exhibit a broad range of physical functionalities combined with the responsivity to external stimuli.[1–4] This opens their great potential in the application for the construction of sensors for chemical or physical stimuli, especially for the case of metal complexes revealing optical properties sensitive to the environment. Among them, photoluminescent (PL) metal complexes, including those based on transition metal ions, lanthanides, or even actinides, were considered particularly attractive as the PL features can give a simple yet efficient response to the changes of the specific external stimulus. In this context, other research groups and we focused attention on the design of stimuli-responsive solid luminophores showing PL sensitive to the variation of temperature and humidity, i.e., the construction of luminescent molecular thermometers and luminescent molecular hygrometers.[5–8] Besides the work towards the highly sensitive sensors of these two stimuli, the challenge also lies in merging these two sensing abilities within the bifunctional sensors of both temperature and relative humidity (RH). Here, we present the selected examples of the solid luminescent materials based on metal complexes that were found to be good optical sensors of temperature and/or humidity, revealing also other aspects of multifunctionality, enriching their potential application horizon. Among others, the strategy of embedding the NIR-emissive hexacyanidochromate(III) anions into the cationic Sr(II)-based MOF will be presented. It results in a proton-conductive MOF-type material exhibiting ratiometric and lifetime-based detection of RH and temperature (see figure below).[7] As an alternative, we will show ratiometric luminescent thermo-hygrometry, appearing along with metal-dependent second-harmonic generation (SHG) and humidity-variable magnetic relaxation in a Mn(II)-doped Zn(II) molecular halide material.[8]



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DESIGNING NEW, UNCONVENTIONAL PROTEIN FOLDS

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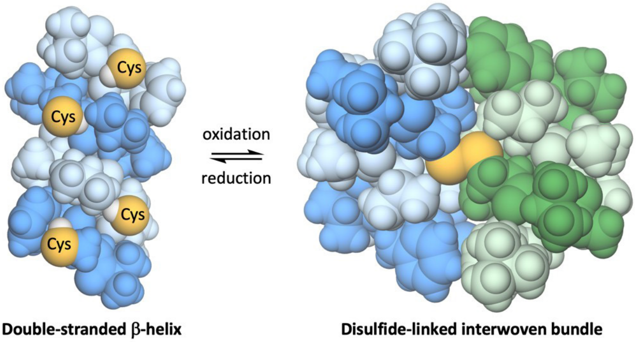
Recent advances in protein structure prediction, most notably with the development of AlphaFold, have revolutionized our ability to design de novo proteins. Yet, the vast majority of these proteins remain confined to canonical secondary structures, namely α-helices, β-sheets, and turns. This observation raises a fundamental question: is it possible to explore previously uncharted regions of conformational space and design proteins with entirely novel secondary and tertiary structures that have no natural precedent? Heterochiral amino acid sequences provide a promising route towards unconventional architectures because they can adopt conformations inaccessible to homochiral sequences. In addition, their enhanced resistance to proteolytic degradation makes them attractive as scaffolds for the development of novel therapeutics. Over the past few years, our group has begun investigating the self-assembly of octapeptides with strictly alternating sequences of L- and D-amino acids into double-stranded β-helices in chloroform. We recently identified the structural determinants governing the stability of these assemblies and demonstrated that double-stranded β-helices can be covalently connected through disulfide bonds to form tightly interwoven higher-order structures. [1] These results suggest that double-stranded β-helices can serve as a new structural motif for the design of larger protein architectures with noncanonical folds.



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HIGH-THROUGHPUT DISCOVERY OF DIVERSE ALLOSTERIC AND COVALENT INHIBITORS OF PYCR1

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Pyrroline-5-carboxylate reductase 1 (PYCR1) is a key enzyme of proline metabolism implicated in cancer progression and adaptation to metabolic stress.[1,2] Despite its therapeutic potential, only a limited number of PYCR1 inhibitors have been reported.[3,4,5]

To identify novel inhibitors, we performed high-throughput screening of more than 100,000 compounds from the European Chemical Biology Library together with a focused kinase inhibitor library. The screening campaign yielded 122 validated PYCR1 inhibitors spanning diverse chemical scaffolds.

Structural and kinetic analyses revealed that PYCR1 can be inhibited through multiple mechanisms, with ligand binding occurring predominantly at allosteric sites. Notably, we identified a previously unreported allosteric pocket that enables covalent targeting of Cys262. Analysis of active compounds further demonstrated that PYCR1 inhibition can be achieved by structurally diverse chemotypes rather than a single privileged scaffold.

These findings substantially expand the known chemical space and mechanisms of PYCR1 inhibition and provide new opportunities for the development of chemical probes and therapeutic agents targeting proline metabolism in cancer.

The project is supported by the National Science Centre (Poland) grant number 2021/43/B/NZ7/01611.

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ENGINEERING FUNCTIONAL POLYMETALLIC M_2L_4 ASSEMBLIES

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In the expanding field of supramolecular chemistry, metallocages, defined as self-assembled architectures formed through the coordination of metal ions with organic ligands around well-defined cavities, have attracted considerable attention because of their structural diversity and functional potential.[1] Among them, M_2L_4 metallocages represent a particularly versatile and highly tunable class of supramolecular assemblies, ranging from simple discrete capsules to sophisticated multifunctional architectures with promising applications in molecular recognition, catalysis, guest encapsulation, sensing, drug delivery, and responsive materials.[2]
In this context, early studies based on the semi-rigid benzimidazole ligand highlighted the crucial role of templating anions in directing the formation of Co(II) and Cu(II) based M_2L_4 supramolecular capsules.[3] To broaden the scope of molecular recognition beyond weakly coordinating anions, new rigid bis(ethynylpyridine)-based ligands were subsequently developed for the construction of Pd_2L_4 and Pt_2L_4 metallocages featuring endohedral functionalization.[4] These architectures enabled the encapsulation of organometallic guests, such as platinum(II) and gold(III) complexes, through synergistic electrostatic and host–guest interactions.
More recently, our research has focused on the engineering of multifunctional assemblies incorporating chiral environments, luminescent azo photoswitches, and lanthanide-containing dendritic fragments in order to introduce photoresponsive, chiroptical, magnetic, and cooperative recognition properties. This presentation will provide an overview of the synthetic strategies, structural characterization, of these new generations of assemblies.

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BREAKING NATURE'S LIMITS: THE ERA OF UNNATURAL AMINO ACIDS

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Unnatural amino acids are redefining the boundaries of biochemistry. By moving beyond nature's limited repertoire of twenty canonical building blocks, they introduce entirely new chemical functionalities—novel shapes, charges, and reactivities that dramatically expand the language of molecular recognition. What was once a constrained system is now an open chemical universe, offering unprecedented opportunities to interrogate and control biological processes with precision.

One arena where this expansion is particularly transformative is proteolysis. Proteases-enzymes responsible for protein cleavage-govern some of the most fundamental processes in biology, from protein quality control and apoptosis to blood coagulation and cellular signaling. Acting as both guardians and executioners, they maintain cellular homeostasis but can also drive disease when dysregulated, contributing to cancer, inflammation, infections, metabolic disorders, and neurodegeneration. Unsurprisingly, proteases represent a major class of drug targets, comprising roughly 5-10% of all pharmaceutical efforts.

Yet, despite their importance, proteases are notoriously difficult to study. Their substrate preferences often overlap, largely because they evolved to recognize sequences composed of the same set of natural amino acids. This biochemical redundancy masks subtle differences between enzyme families, making it exceptionally challenging to map proteolytic networks or to develop selective diagnostics and therapeutics. Even well-characterized systems, such as caspases, remain incompletely understood due to these limitations.

Unnatural amino acids provide a powerful solution. By introducing noncanonical residues into peptide substrates, we can expose hidden layers of protease specificity that are inaccessible with natural building blocks alone. These synthetic elements act as molecular probes, revealing unique recognition patterns and enabling the discrimination of closely related enzymes with remarkable precision.

ORGANIC AND COORDINATION CAGES FOR AQUEOUS MOLECULAR RECOGNITION AND FUNCTIONAL APPLICATIONS

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Supra- and molecular cages functioning in aqueous media constitute versatile platforms for molecular recognition, sensing, and stabilization processes relevant to environmental and biomimetic applications. Through careful control of architecture, dynamic behavior, and host–guest interactions, both organic and metalosupramolecular systems can be designed to selectively interact with chemically important targets. In this contribution, two complementary cage-based systems operating in water are presented. A fluorescent organic cage incorporating a triphenylamine chromophore together with acylhydrazone and disulfide dynamic covalent motifs was developed for the selective recognition of Cu2+ ions (1). The adaptive architecture produces a pronounced fluorescence "turn-off" response accompanied by a visible colorimetric change, enabling sensitive detection in aqueous media and successful application in real water samples. Expanding from sensing toward recognition-driven stabilization phenomena, a water-soluble lantern-type Pd2L4 coordination cage based on a ☒-diketonate Pd-TMEDA metalloligand was investigated as a supramolecular platform for interactions with profen-based pharmaceuticals (2). Despite its limited internal cavity, the system displays selective external host–guest recognition, leading to protection against UV-induced degradation and selective separation from structurally related compounds.

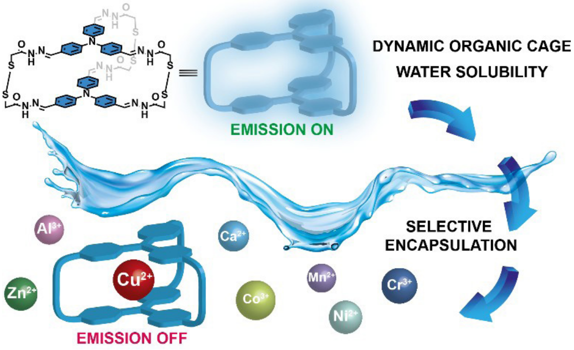

Figure 1. Dynamic cage as a fluorescent sensor for Cu2+ in aqueous solution.

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STRUCTURE–PROPERTY RELATIONSHIPS IN SILSESQUIOXANES: FROM MOLECULAR SCALE TO MACROSCOPIC PERFORMANCE

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Silsesquioxanes (SQ) are cage organosilicon compounds characterized by a well-defined Si–O–Si inorganic framework and a chemically tuneable organic corona. This unique combination makes them versatile molecular platforms for the design of hybrid materials with tailored structural and functional properties. Their architecture, ranging from irregular to highly ordered cages, strongly influences their stability, reactivity and physicochemical behaviour [1,2].

This lecture will present our recent studies on the synthesis and functionalization of silsesquioxanes especially in terms of the influence of reactive groups associated with the Si–O–Si framework on possible modification pathways. Such functionalized cage systems provide multiple reactive sites and can interact with polymer matrices, enabling the formation of grafted polymers, cross-linked networks and coordination polymers with distinctive properties.

Special attention will be given to the role of silsesquioxanes in coordination chemistry [3]. Terpyridine-derived SQ-based systems have been investigated as coordination platforms for ZnII, capable of forming well-defined supramolecular architectures [4]. They exhibit interesting photoactivity with high Stokes shifts ang quantum yields >60%. Furthermore, ZnII salphen-functionalized silsesquioxanes demonstrate the potential of these cages as tuneable scaffolds for photoactive metal complexes [5]. The incorporation of salphen ligands provides efficient absorption and emission properties and enables singlet oxygen generation under light irradiation, opening perspectives for photocatalytic applications, organic transformations and photodynamic therapy. These results focus functionalized silsesquioxanes as of high potential in platforms for hybrid, coordination and photoactive materials.

Acknowledgements:
National Science Centre, OPUS 21 project, UMO-2021/41/B/ST5/02028

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MISSING PUZZLE IN CRYSTAL ENGINEERING: INTEGRATING COMPLEMENTARY HYDROGEN-BONDING MOTIFS WITHIN A SINGLE MOLECULAR CORE

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Crystal engineering relies on the rational combination of complementary hydrogen-bonding synthons to achieve predictable supramolecular organization in the solid state. However, integrating multiple cyclic and competitive hydrogen-bonding "sticky sites" within a single molecular framework remains challenging and often leads to unexpected assembly pathways. Addressing this missing puzzle, we report a versatile molecular design that combines diaminotiazine (DAT) units with pyridine, polyether, and 2-pyridone functionalities within unified cores to explore how competing and cooperative interactions govern crystal packing. A series of structurally diverse positional isomers was synthesized through a straightforward and modular strategy. Their structures were confirmed by spectroscopic methods, and their solid-state organization was investigated by single-crystal X-ray diffraction. The DAT motif consistently promotes predictable and robust hydrogen-bonding patterns, whereas the introduction of additional functional groups modulates the aggregation landscape. In particular, polyether substituents induce interdigitated arrangements in selected systems, while 2-pyridone units deviate from classical homoleptic motifs and instead form unexpected heteroleptic interactions with DAT donors. These competing and complementary interactions give rise to a rich diversity of supramolecular architectures, including layers, tapes, ribbons, and chains. Overall, this work demonstrates how integrating multiple hydrogen-bonding motifs within a single molecular platform provides new opportunities to tune solid-state assembly and offers general design principles for the development of functional hydrogen-bonded materials.

DESIGNING REACTIVITY IN CATALYSIS: FROM MECHANISTIC INSIGHT TO MULTICATALYSIS

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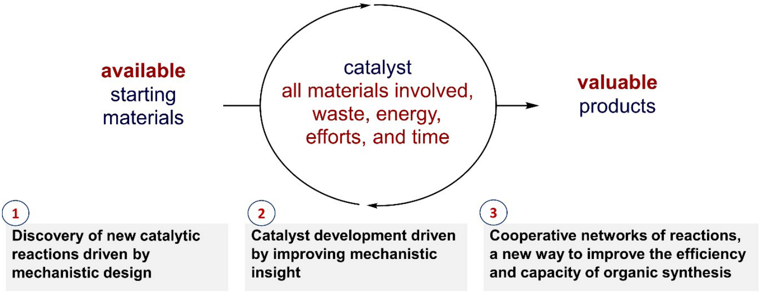
Catalysis lies at the heart of chemical innovation, enabling cleaner technologies, improving the material and energy efficiency of processes, and unlocking the potential of renewable feedstocks.[1] Central to these advances is the ability to design and control reactivity with precision.



In this contribution, I will present our group's research in catalytic chemistry, shaped by these challenges and opportunities. Our approach is founded on three interrelated strategies: (1) the development of new organic transformations through mechanistic design;[2,3] (2) catalyst development guided by detailed mechanistic understanding;[4,5] and (3) the creation of complex transformations through relay multicatalysis.[6–11] Each of these strategies will be illustrated through recent examples, highlighting not only synthetic utility but also conceptual advances in reactivity control and catalytic network design. I will also outline our ongoing efforts aimed at further expanding the reach of catalysis in chemical synthesis.

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HEAT TRANSFER MECHANISMS IN IONIC LIQUID WITH LONG MULTI-WALLED CARBON NANOTUBES

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Ionanofluids (INFs), composed of multi-walled carbon nanotubes (MWCNTs) dispersed in ionic liquids (ILs), exhibit enhanced thermal conductivity, non-flammability, and high physicochemical stability, making them promising candidates for efficient and safe heat-transfer media. In this work, we present structural and spectroscopic investigations, including cryo-transmission electron microscopy and Raman spectroscopy, supported by molecular dynamics simulations, to explain the remarkable 40% thermal conductivity enhancement observed in 1-butyl-1-methylpyrrolidinium bis(trifluoromethyl- sulfonyl)imide-based INFs containing long, crystalline, C-sp^2-rich MWCNTs (1). Our results reveal a subzipping phenomenon within the MWCNT networks dispersed in the IL, arising from interactions between adjacent nanotubes partially coalesced through IL nanolayers. This process involves intertube zipping accompanied by locally unzipped nanotube pairs and/or longitudinally unzipped nanotube structures. Such supramolecular rearrangements promote the formation of thermal bridges and interconnected three-dimensional conductive networks throughout the INF volume. Furthermore, molecular dynamics simulations demonstrated that CNT network formation, separated by IL ion layers, is thermodynamically favorable due to strong CNT wall–IL interactions. Raman spectroscopy analysis, particularly the integrated intensity ratios, additionally suggests the formation of new covalent bonds between damaged nanotube sites and, most likely, the IL cations. Overall, the molecular integrity of the MWCNTs, their supramolecular organization, and the nature of MWCNT–IL interactions collectively govern the exceptional thermal conductivity enhancement while maintaining favorable rheological properties.

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PHOTOCATALYTIC HYDROGEN PRODUCTION FROM WATER SPLITTING USING DWCNT:G-C3N4 NANOHYBRIDS

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Solar-powered hydrogen production from water is proposed as a viable method for sustainable energy production. The pursuit of efficient and sustainable photocatalysts has led to significant interest in graphitic carbon nitride (g-C_3N_4) owing to its suitable band gap (Eg) in the visible region and its electronic properties together with its ease of synthesis from low-cost precursors such as urea. Certain limitations of the high recombination rate of g-C_3N_4 paved the way for designing hybrid microstructures with carbon nanotubes to increase the separation efficiency of the photogenerated electrons and holes. In this study [1], we focused on the use of double-walled carbon nanotubes (DWCNTs) used at a constant weight ratio in the hybrids, while playing with the ratio between melamine and urea to obtain g-C3N4 with different properties. We propose a facile synthesis route to design g-C3N4:DWCNTs hybrids, involving separated syntheses before preparing the hybrids. The photocatalyst samples were characterized by X-ray diffraction (XRD [2]), scanning and transmission electron microscopy (SEM, TEM), specific surface area measurement (BET), X-ray Photoelectron Spectroscopy (XPS) and UV-Vis diffuse reflectance spectroscopy (UV-Vis DRS). The hydrogen production reached ca. 260 µmol/g in about 3 hours for the optimized composition. Our preliminary results suggest that the increased photoactivity originates from the enhanced charge-transfer effect due to the interface formed between g-C3N4 and CNT which decreases the recombination rate of photogenerated electron and holes.

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(ULTRA) HIGH FIELD NMR FOR STRUCTURAL STUDIES IN MOLECULES AND MATERIALS FOR CATALYSIS

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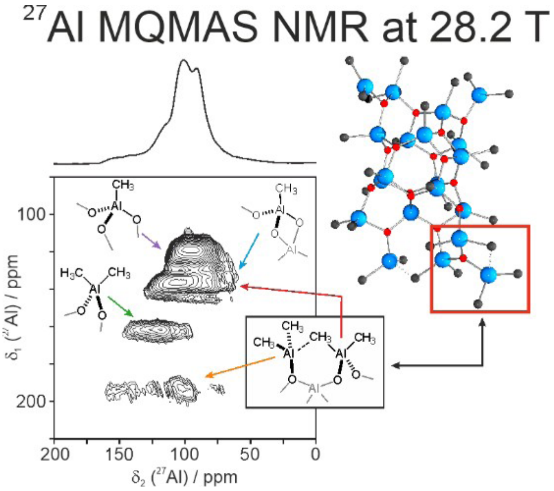
The development of efficient homogeneous and heterogeneous catalytic systems requires use of advanced and reliable characterization techniques that provide precise information for structural and mechanistic understanding. Combining advanced NMR methodology and high magnetic field (up to 1.2 GHz for 1H resonance) offers tremendous possibilities, most particularly in the case of quadrupolar nuclei.(1) In this presentation, we will describe how high-field solid state NMR can be harnessed to investigate challenging systems relevant to major catalytic applications such as alkene metathesis, alkene polymerization or alkane dehydrogenation, relying on quadrupolar nuclei such as 17O, 27Al or 71Ga.



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INTENTIONAL STRUCTURAL MODIFICATION AND THE UNIQUE PHOTOPHYSICAL PROPERTIES OF HOMO- AND HETERONUCLEAR LANTHANIDE CHELATES

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The lanthanide-lanthanide (Ln-Ln) ion and ligand-lanthanide (antenna effect) energy transfer is responsible for key luminescent phenomena utilized in functional materials. The aim of this work is to demonstrate how structural engineering modifies the photophysical properties of homo- and heteronuclear Ln compounds and to provide a theoretical explanation for unusual effects.

We have shown the enormous potential of N-phosphorylated carboxamides with heteroaromatic rings, multidentate ligands, to create efficient electromagnetic radiation converters of the [Na2LnL4(DMF)2][CF3SO3] (Ln3+= Eu, Tb, Dy) type with temperature-dependent emission and single-ion molecular magnet (SIM) behavior. We have analyzed how, by appropriate modification of the ligand heteroaromatic ring, we can tune the emission properties of luminescent thermometers based on the back energy transfer (BET) process of Ln®T1 and how the thermometric parameters may depend on the measurement conditions.

Through rational molecular design, we have also obtained systems with short Ln-Ln distances and discussed the influence of short carbonyl bridges in homo- and heterobinuclear Ln^{3+} coordination compounds with N-(diphenylphosphoryl)-pyrazine-2-carboxamide on the mechanism for controlling and tuning emission properties. The studies were carried out on two series of compounds in the form of single crystals: [Ln2L5(HL)]CF3SO3, [Tb2-xEuxL5(HL)]CF3SO3 and [Ln2L5(H2O)]NO3, [Tb2-xEuxL5(H2O)]NO3 (x = 0.1–0.7 mol%), where Ln^{3+} occupies two non-equivalent crystallographic sites in each series with CN = 8 and 9 and Ln-Ln distances of 3.8 Å. For the first time, new spectroscopic behaviors such as: the monoexponential emission decay time, which does not reflect the presence of two distinct Ln3+ sites; a prolongation of the donor (Tb3+) decay time with increasing acceptor (Eu3+) concentration; a negative value for the Tb→Eu energy transfer efficiency; Eu→Tb energy transfer have been explained on the basis of experimental data alongside theoretical investigation.

The conclusions drawn from our research are of a general nature and offer a completely new perspective on the influence of measurement conditions on the photophysical properties of compounds as well as on interionic energy transfer, which may give rise to unusual spectroscopic phenomena.

OLEFIN METATHESIS, A NARRATIVE AND TWO OTHER STORIES: REACTIVE DISTILLATION AND MINIMIZING CATALYST LOADING

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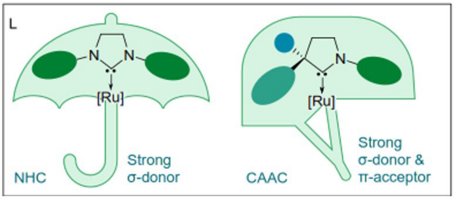
“Efficiency of a practically flawless kind may be reached naturally in the struggle for bread. But there is something beyond — a higher point, a subtle and unmistakable touch of love and pride beyond mere skill”
Joseph Conrad Korzeniowski, The Mirror of the Sea (1906)

Olefin metathesis, now reaching full maturity, enables the synthesis of a wide range of chemical architectures, from complex polyfunctional molecules typical of natural and bio-active products to simpler, yet highly valuable, fine chemicals and polymers derived from biomass or fossil resources. Among the various types of olefin metathesis, ethenolysis and self-metathesis reactions can be used to transform simple raw materials into more valuable products. However, given the low prices typical of commodity chemicals, achieving industrial viability requires in-depth optimization, particularly by minimizing catalyst loading. This lecture will present examples of ligands optimization that allow this, because such ligands can be compared to an engine powering the plane [2]. Additionally, using biomass-derived substrates, reactive distillation in olefin metathesis can produce valuable building blocks such as macro-cyclic lactones or ketones (musk) in high yield and at concentrations much higher than those typically used for similar transformations under classical conditions [3-5].



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ELECTRO- AND PHOTOCATALYTIC AMMONIA OXIDATION WITH RUBDA-FUNCTIONALISED CARBON MATERIALS

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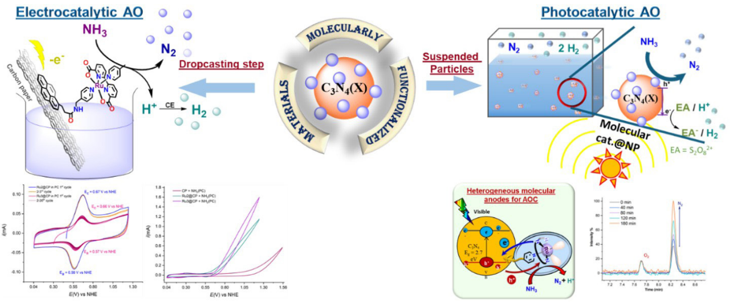
Transitioning from fossil fuels to sustainable alternatives will likely require diversification across multiple energy sources. In this effort, many consider molecular hydrogen as the leading candidate. However, green production via water oxidation requires high energy inputs, thereby limiting large-scale production and straining logistics infrastructure.[1] A solution to this presents an inexpensive, easily transportable hydrogen carrier with low hydrogen-release requirements, such as Ammonia, which has recently gained attention due to high hydrogen density, favourable thermodynamics for splitting, established global logistics, and improved safety relative to liquefied hydrogen.[1-3] Furthermore, electrocatalytic ammonia oxidation (AO) can, besides N2 and H+, produce other industrially relevant by-products. [2]
Here, we report ammonia oxidation using hybrid molecularly functionalized heterogeneous systems. We examined RuBda-functionalized carbon paper electrodes (Bda = 2,2′-bipyridine-6,6′-dicarboxylic acid[3]) and developed a new RuBda/C3N4 hybrid photocatalytic system in which carbon nitride acts as a photosensitizer and the ruthenium complex serves as the AO catalytic center, thus unlocking the path towards photocatalytic conversion of NH3 to N2 and H$^+$. These simple hybrid systems highlight new opportunities for sustainable energy conversion, potential wastewater treatment, and diversification of hydrogen-production pathways.



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HARNESSING THIOLACTONE CHEMISTRY FOR THE DESIGN OF FUNCTIONAL POLYMERS

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Although thiolactones (TLs), the sulfur analogues of cyclic esters, are less explored due to challenging ring-opening polymerization, they are gaining interest as versatile platforms for sulfur-containing polymers. Their nucleophilic ring opening with amines or alcohols generates thiols in situ, enabling subsequent thiol–ene or thiol–Michael reactions. This sequential reactivity supports one-pot cascade processes and modular control of polymer functionalization and architecture.[1,2]
In our work, TLs have been exploited in several synthetic strategies. TLs can be copolymerized with epoxides or cyclic carbonates to yield alternating poly(ester-thioether)s, incorporating degradable ester linkages, redox-active thioethers and various lateral substituents (Figure 1A).[3,4] Additionally, a versatile bio-based monomer was obtained via aqueous functionalization of itaconic acid with homocysteine thiolactone. This monomer was polymerized either via cascade polycondensation process to yield polyamides bearing carboxylic acid functionalities (Figure 1B), or through a radical polymerization route leading to functionalizable carboxylic acid-bearing (co)polymers with a carbon-chain backbone.[5] Different polymer structures bearing carboxylic acid groups were successfully prepared, exhibiting a range of properties such as metal-chelating ability, superabsorbent hydrogel behavior, and degradability.

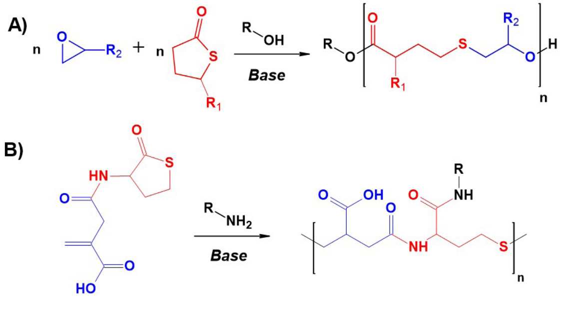

Figure 1. Synthesis of multi-functional macromolecules by anionic ring-opening copolymerization of epoxides and thiolactones (a) and by cascade step-growth polymerization (b).

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REFINING STABLE AND BIOCOMPATIBLE MXENE CANDIDATES FOR FUTURE BIOTECHNOLOGICAL APPLICATIONS

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Two-dimensional (2D) MXenes have emerged as highly promising materials for biotechnological and biomedical applications owing to their hydrophilicity, tunable surface chemistry, and stimuli-responsive behavior. Here, by using Ti3C2Tx and Nb2CTx MXenes as model systems, we demonstrate that the synthesis route critically governs surface oxidation layers, residual functional groups, and etching by-products, which collectively dictate physicochemical interactions with mammalian cells. By optimizing etching and delamination protocols, we identify processing pathways that significantly reduce cytotoxicity. MXenes synthesized via selected routes and delaminated with quaternary ammonium salts were well tolerated by normal human keratinocytes (HaCaT), showing no adverse effects even at concentrations up to 400 μg mL^{-1}. In contrast, NaF/HCl-etched MXenes delaminated using tetramethyl- or tetrabutylammonium hydroxide selectively induced apoptosis in melanoma cells, indicating synthesis-dependent, application-specific bioresponses (1). To address long-term stability, we introduce a tandem stabilization strategy that combines antioxidant protection with macromolecular surface functionalization. L-ascorbic acid was employed to suppress oxidative degradation, followed by modification with polyethylene glycol, poly-L-lysine, or polydopamine (2). Presented findings highlight the importance of integrating synthesis optimization with rational stabilization strategies to engineer MXenes that are both stable and biocompatible. This work establishes a robust framework for tailoring MXenes toward safe, application-specific use in future biotechnological and nanomedicine applications.

Acknowledgements:
MXene synthesis, samples characterization and biological studies were funded by the BIOTECHMED-1 project granted by Warsaw University of Technology under the program Excellence Initiative: Research University (ID-UB); 'OPUS' (UMO-2022/45/B/ST5/03652; UMO-2019/35/B/ST5/02538) projects and 'PRELUDIUM' (UMO-2019/33/N/ST5/02095; UMO-2023/49/N/ST11/03574) projects.

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PEPTIDES FOR ELECTROCHEMICAL BIOSENSORS – TOWARDS SELECTIVE DETECTION OF C-REACTIVE PROTEIN ISOFORMS

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C-reactive protein (CRP) is an important acute-phase protein and a commonly used biomarker of inflammation, and elevated levels have been linked to increased risk for cardiovascular disease. The production of CRP is mainly stimulated by pro-inflammatory cytokines, especially interleukin-6. Increased CRP levels are used in diagnostics to evaluate inflammatory processes and disease progression, but fast and inexpensive quantitative sensors for CRP remain unavailable.

We describe the development and testing of peptides specific to CRP. The peptides were identified using phage display technology, and their amino acid sequences were determined. The binding of the identified peptides was investigated using biochemical methods as well as Molecular Recognition Force Spectroscopy. The peptides with the highest affinity towards CRP were selected for further electrochemical applications [1].

Under normal conditions, CRP mainly exists as a pentamer (pCRP), but it can dissociate into monomeric units (mCRP) at sites of tissue damage, platelet activation, and local inflammation. Compared to pCRP, mCRP has a stronger pro-inflammatory and pro-thrombotic effect, and its presence is associated with disease progression. Measuring both forms could enhance diagnosis and prognosis, though detecting mCRP remains challenging because highly specific antibodies that recognise only the monomeric form are unavailable [2]. With this in mind, we have set out to investigate whether our identified peptides could discriminate between the mono- and pentameric forms of CPR in an electrochemical sensor.

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EFFECT OF FUNCTIONALIZED CARBON NANOTUBES ON THE PHYSICOCHEMICAL PROPERTIES OF IONIC NANOFLUIDS BASED ON 1-ETHYL-3-METHYLIMIDAZOLIUM THIOCYANATE

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Ionanofluids (INFs) represent a modern class of heat-transfer working fluids. For such applications, it is essential to obtain INFs characterized by the highest possible thermal conductivity while simultaneously maintaining the lowest possible viscosity. INFs containing oxidized carbon nanotubes, namely in-house 16h MWCNTs-COOH (length < 500 μm, diameter ≈ 50 nm, COOH 1.0 mmol·g-1, OH 0.4 mmol·g-1), exhibit lower viscosity compared to those containing in-house 16h MWCNTs (length 780 μm, diameter 60 – 80 nm) [1]. Therefore, in this study, we investigated the effect of adding functionalized carbon nanotubes (in-house 16h MWCNTs-COOH and Nanocyl NC7000 MWCNTs-COOH), as well as non-functionalized carbon nanotubes (in-house 16h MWCNTs), dispersed in 1-ethyl-3-methylimidazolium thiocyanate ([EMIm][SCN]) at different mass concentrations on the properties of INFs. In each system, the total nanotube concentration was maintained at 1.0 wt%.

A comparison of the effects of functionalized carbon nanotubes, revealed a more favorable influence of the in-house 16h MWCNTs-COOH on the physicochemical properties of INFs. The addition of in-house MWCNTs-COOH resulted in a significantly lower increase in INF viscosity compared to INFs containing Nanocyl NC7000 MWCNTs-COOH (length 1.5 μm, diameter 9.5 nm, COOH 4.0 mmol·g-1, OH 1.8 mmol·g-1). At the same time, their addition led to a greater increase in thermal conductivity relative to systems containing Nanocyl NC7000 MWCNTs-COOH, making them a more suitable component for INFs. The INFs containing 0.75 wt% in-house 16h MWCNTs and 0.25 wt% in-house 16h MWCNTs-COOH achieved thermal conductivity only 0.4% lower than that of the INF containing 1.0 wt% in-house 16h MWCNTs at 298.2 K, while simultaneously reducing viscosity by 31% at 298.15 K and shear rate 50 s-1.

Such a combination of properties is particularly desirable, as it enables efficient heat transfer at low flow resistance, making the investigated INFs potentially attractive candidates for working fluids.

Work was financially supported by NCN (Poland) Grant No.2021/41/B/ST5/00892.

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DESIGNING ALKENE GEOMETRY: STEREOSELECTIVE OLEFIN METATHESIS IN ACTION

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Olefin metathesis is a versatile method for the synthesis of compounds containing carbon–carbon double bonds, with widespread applications in both academic and industrial chemistry. Despite the significant advances in this field, the control of the geometry of the resulting double bonds remained a long-standing challenge, often leading to mixtures of E/Z geometric isomers.
This limitation was first addressed by Grubbs, who introduced stereoselective ruthenium complexes featuring a C–H-activated adamantyl group and a nitrate(V) ligand [1]. Later, molybdenum-based catalysts with bulky, geometry-directing ligands expanded the toolbox [2]. More recently, stereoretentive catalysts emerged, capable of preserving the double-bond configuration from the substrate [3].

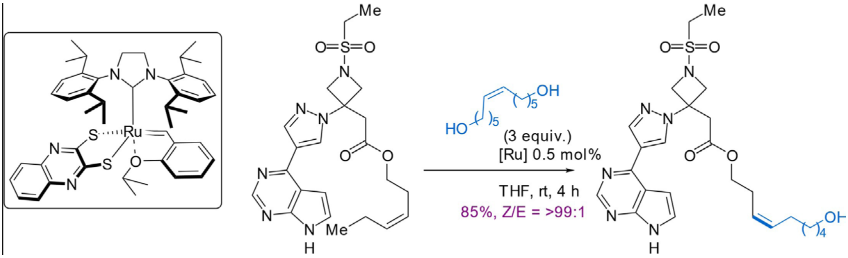

Figure 1. New stereoretentive catalyst and an example of its application in the synthesis of biologically active compound analogs

Despite their effectiveness, these catalysts are highly sensitive to oxygen and often costly due to complex ligand synthesis. Our work focuses on developing more robust and economical alternatives [4]. By incorporating a novel quinoxaline-based dithiolane ligand and optimizing the benzylidene substituent, we demonstrate enhanced stability and practical applicability in stereoselective olefin metathesis.

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LOW DIMENSIONAL MAGNETIC STRUCTURES – CHARACTERIZATION AND PROPERTIES

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Low-dimensional magnetic structures are an important class of nanomaterials exhibiting unique magnetic phenomena that are not observed in their bulk counterparts. The reduction of structured dimensionality to zero-dimensional (nanoparticles or quantum dots), one-dimensional (nanowires or nanotubes), and two--dimensional systems (ultrathin films or layered materials) significantly influences not only inter particles interaction but also intra particles phenomena as: spin interactions, magnetic anisotropy, domain formation, and magnetization dynamics. These effects arise from quantum confinement related to , finite-size effects, as well as the drastic increased contribution of surface and interface atoms in comparison to bulk one, leading to novel magnetic behaviors with considerable technological potential.

To understand all these phenomena the proper characterization of low-dimensional magnetic materials requires the application of few complementary methods including structural, chemical, and magnetic techniques. Structural properties are commonly investigated using X-ray diffraction (XRD), transmission electron microscopy (TEM), and scanning electron microscopy (SEM), which provide information on crystal structure, morphology, and particle size distribution. Surface chemistry and elemental composition can be analyzed by energy-dispersive X-ray spectroscopy (EDX). Magnetic properties can be evaluated by Mössbauer spectroscopy enabling the determination of key parameters such as magnetic phase composition, magnetic moment distribution, and superparamagnetic relaxation mechanisms.

Low-dimensional magnetic systems often exhibit specific size-dependent phenomena, including superparamagnetism, enhanced coercivity, exchange bias effects, and spin-dependent transport. These properties are particularly attractive for applications in high-density magnetic data storage, spintronic devices, magnetic sensors, and biomedical technologies such as targeted drug delivery and magnetic hyperthermia. Recent advances in synthesis and characterization methods give possibility of precise control over structural and magnetic parameters, allow to facilitate the design of materials with tailored functionalities. Consequently, understanding the relationship between dimensionality, microstructure, and magnetic behavior remains a key challenge in the development of next-generation functional magnetic nanomaterials.

TOWARD TRANSPARENT ELECTRONICS: PECULIAR PHENOMENA IN 2D MATERIALS

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This presentation focuses on pnictogen-based 2D materials, in particular α-antimonene and α-bismuthene, as well as on quasi-2D oxides such as Sb2O3 and MoO3. Interestingly, elemental pnictogen 2D materials host a variety of peculiar phenomena, including unpinned Dirac states [1], Dirac points enforced by nonsymmorphic symmetries [2], and signatures of topologically protected edge states [3]. More recently, we reported directional structural superlubricity and indications of Lévy-flight-like dynamics in the spontaneous diffusion of Bi nanostructures on graphite [4]. In turn, ultrathin oxides of Bi and Sb, together with related functional oxides such as MoO3, are particularly interesting because they combine low-dimensional structure with chemical functionality, optical response, and potentially useful electronic properties, making them relevant for transparent electronics. In this context, Sb2O3 triangular micro- and nanostructures have shown optical standingwave-like patterns, while Raman spectroscopy reveals pronounced resonance effects in both Sb2O3 and MoO3. These observations indicate that oxide-based 2D and quasi-2D systems may host rich optical and vibrational phenomena.

Acknowledgments.
This work was supported by National Science Centre, Poland, under project 2024/55/B/ST11/01717.

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ORGANOMETALLIC RHODIUM(III) COMPLEX WITH PHENANTHROLINESULFONAMIDE IN THE FIGHT AGAINST LEUKEMIA CANCER CELLS

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Among the many groups of non-platinum chemotherapeutic agents, half-sandwich organometallic complexes are attracting considerable interest in cancer research. Particularly promising are complexes of this type with Rh(III) ions and a negatively charged pentamethylcyclopentadienyl ligand. The biological activity of half-sandwich complexes can be modulated by selecting an appropriate chelating ligand [1]. Sulfonamides, which themselves exhibit cytotoxic activity against bacteria, fungi, and parasites, are also attracting considerable interest [2]. Recently, they have also been investigated for use in chemotherapy, which gives sulfonamides a 'second life'[3].

Our study demonstrates that the novel phenanthrolinesulfonamide ligand and its rhodium(III) complex exhibit potent and selective anticancer activity across multiple tumor cell lines, particularly in acute lymphoblastic leukemia (NALM-6). Compounds displayed submicromolar IC_{50} values and favorable selectivity toward non-malignant HEK-293 cells. In-depth biological research (including cell cycle arrest, apoptosis induction, evaluation of mitochondrial membrane potential, induction of DNA Double-Strand Break, and ROS generation) highlights its promise as a drug-like scaffold for further development.

Acknowledgments:
This work was supported by the Ministry of Science and Higher Education (statutory financing No. DS/531-T120-D846-26).

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CHEMICAL DETERMINANTS OF METAL COORDINATION AND STRUCTURAL DYNAMICS IN ZN(II) AND CU(I)/ZN(II) METALLOTHIONEINS, KEY PROTEINS IN METAL HOMEOSTASIS

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Metallothioneins (MTs) play a central role in cellular copper and zinc homeostasis by acting as dynamic metal reservoirs and exchangers that control the speciation and availability of these ions. They represent a distinctive class of cysteine-rich small proteins in which transition metal coordination governs structural organization and physicochemical properties at the molecular level [1]. Here, we present an integrated chemical perspective on the structure, dynamics, and reactivity of Zn(II) and Cu(I)/Zn(II) metallothioneins, focusing on the organization and transformation of metal–thiolate clusters. The combination of native mass spectrometry, ion mobility measurements, and molecular dynamics simulations enables high-resolution mapping of Zn(II) distribution in partially metalated Zn_{4}-$_{6}$MTs species and reveals the sequential, interdomain mechanisms of metal release involving cooperative interactions between α- and β-domains [2]. Despite similar $Zn(S–Cys)_4$ coordination motifs, distinct metal-binding affinities arise from subtle reorganization of Zn–S networks and differential solvent participation during metal exchange. Reaction of Zn_7MTs with Cu(II) induces extensive structural remodeling, involving disassembly of Zn_3S_9 and Zn_4S_{11} clusters and reassembly into thermodynamically favored $Cu(I)_xZn(II)_y$MTs species accompanied by disulfide bond formation and conformational compaction. Cu(I) ions preferentially occupy the β-domain, forming stable thiolate clusters that exhibit enhanced resistance to acidic conditions [3]. These transformations are associated with decreased conformational heterogeneity and increased mechanostability relative to Zn(II)-loaded forms. The results demonstrate that metallothionein properties are governed by a delicate balance between local coordination chemistry and long-range structural coupling [4,5]. This work provides a chemically grounded framework for understanding metallothioneins as dynamic coordination systems and establishes general strategies for characterizing metalloforms in complex cysteine-rich proteins.

This research was supported by the National Science Centre of Poland (NCN) under the Opus grants no. 2021/43/B/NZ1/02961 and 2018/31/B/NZ1/00567 (to A.K).

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BEYOND CLASSICAL CATALYSIS: HFIP-ENABLED ACTIVATION STRATEGIES

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Hexafluoroisopropanol (HFIP) has emerged as a unique reaction medium capable of profoundly altering reaction pathways through strong hydrogen-bond donation, stabilization of ionic intermediates, and modulation of electrophilic reactivity.1,21,1,3,3,3-hexafluoroisopropanol (HFIP In recent years, these properties have attracted increasing attention as an alternative to classical Lewis or Brønsted acid catalysis. In this contribution, several HFIP-enabled activation strategies developed in our group are presented (Figure 1). Initially, we demonstrated that HFIP enables catalyst-free functionalization of electron-rich secondary benzylic alcohols with thiols, allylsilanes, activated arenes, and indoles, providing efficient access to various trisubstituted methanes via stabilization of benzylic carbocations.3 Subsequently, we developed a Lewis acid-free methodology for the metalation of O-nucleophiles using allylsilanes, enabling efficient synthesis of silyl ethers, siloxanes, and borasiloxanes under mild conditions.4 Ongoing studies further demonstrate that HFIP-assisted activation can also be extended toward direct carbon–carbon bond-forming processes traditionally requiring Lewis acid catalysis. Together, these studies highlight the unique role of HFIP as a non-innocent solvent capable of replacing classical catalytic systems through non-covalent activation and stabilization effects.

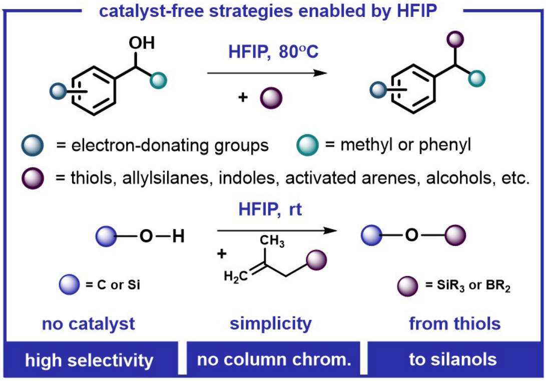

Figure 1. Catalyst-Free Construction of C–S and O–Si Bonds.

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SYNERGISTIC CO2-CAPTURE AND METAL RECYCLING: FROM DISRUPTIVE CONCEPT TO OPERATING PLANT

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Waste recycling and resource preservation are two key challenges related to planetary limits faced by humanity. They encompass organic and inorganic materials such as CO2 produced from hydrocarbon combustion as well as strategic metals contained in end-of life technological devices. Practically, the challenge relies in eco-efficiently turning waste to resource, with the lightest footprint and cost. Waste material is generally a complex molecular mixture whose conversion into resource requires mastering selective self-sorting in mild conditions. This presentation will show how academic investigations at the interface between organic, organometallic, supramolecular, analytical chemistry and electrochemistry, by exploring self-assembling processes within complex organic and organometallic dynamic molecular system [1-3], has revealed that organic species generated by CO2 capture can be valorized and act as a library of selective precipitating and chelating agents for metal cations found in lithium-ion batteries. This fundamental knowledge, and the underpinning disruptive concept, have led to the design of the first CO2-sourced metal separation process which is currently scaled up by our spin-off company MeCaWaRe SAS (65 employees) at the ton scale and is intended to be deployed at horizon 2028 in the first eCO2-efficient battery recycling plant [4-9].

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SYNERGISTIC PHOTO-SWITCHABLE EFFECTS IN MULTIFUNCTIONAL HETERO-POLY-METALLIC COMPLEXES

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One of today's key challenges is the fabrication of smaller nanodevices for technological applications in optics or electronics.[1] In line with this shrinking trend, molecular-based materials are increasingly being developed as platforms that implement different physical properties in a single phase. Beyond multifunctionality, the key challenge lies in achieving synergistic effects between the properties. Our group has addressed this challenge by designing hetero-poly-metallic species based on the rational assembly of lanthanide-based building blocks (CuLnCo or LnCo) made of Schiff base derivatives and a tripodal Kläui metalloligand (Co) to control structural modularity.[2] The resulting pre-organized units are subsequently connected through octacyanidometallate photoswitchable cores [M(CN)8]4– (MIV = Mo or W).[3] These photosensitive complexes are powerful subunits, capable of controlling magnetic interactions through a photomagnetic effect and emission quenching via an on-off antenna effect. Two distinct series of hetero-tetra-metallic ((CuLnCo)2-M, Fig.1) and hetero-tri-metallic ((LnCo)2-M) species have been studied, exhibiting photoswitchable single molecule magnet (SMM) or photoluminescence behavior, respectively.

Comparative characterization using X-ray diffraction, IR spectroscopy, magnetic and photophysical measurements of the molecular architectures, in both the ground and photo-induced metastable states, revealed controlled communication between distinct components.

These interplays highlight a promising strategy for creating multifunctional molecules with cooperative, tuneable behaviour.

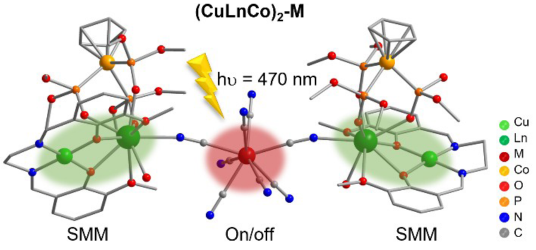

Fig.1: Crystallographic structure of (CuLnCo)$_2$-M) compound

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ENHANCING WATER PURIFICATION BY LAYERED DOUBLE HYDROXIDES

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Water security is a cornerstone of sustainable development, vital for both rural communities and urban centers. It directly supports critical sectors, including public health, education, and food production. Equitable access to safe water remains essential for building climate resilience and promoting regional peace. To address this need, our research group is investigating the potential of layered double hydroxides (LDHs) for advanced water purification [1].

Commonly known as anionic clays, LDHs consist of positively charged, brucite-like polymeric layers balanced by exchangeable interlayer anions and water molecules. Characterized by a unique layered structure, LDHs demonstrate excellent efficiency in eliminating a diverse array of contaminants, ranging from organic pollutants to inorganic anions, primarily through surface adsorption and ion-exchange processes [2]. However, scaling up this technology presents distinct hurdles, notably particle agglomeration, strict regulatory compliance, and the necessity of optimizing synthesis protocols to ensure uniform performance.

Our current research focuses on overcoming these limitations by improving the structural durability, reusability, and versatility of LDHs, ultimately tailoring them to meet complex, real-world water treatment challenges.

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AMINO ACID-DERIVED AROMATIC SCAFFOLDS FOR CONTROLLING (A)SYMMETRY IN SUPRAMOLECULAR ASSEMBLIES

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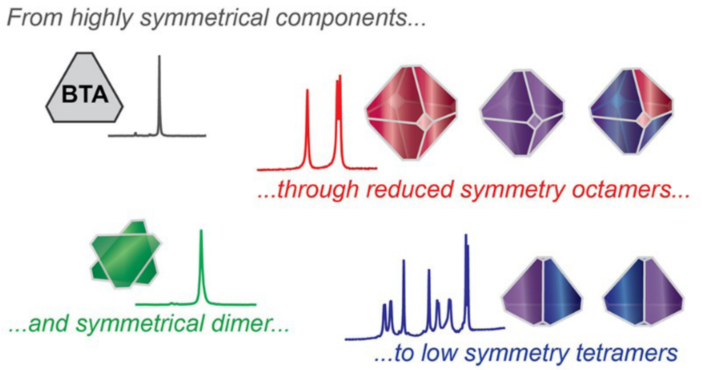
Non-covalent interactions are the foundation of all living organisms. Among these, hydrogen bonds play a central role in biology, with their complex arrays being responsible for protein folding and enzyme activity. One area where artificial systems still fall behind their biological archetypes is symmetry. In particular, enzymes possess inherently low symmetry, providing binding selectivity and functionality that remain unmatched by artificial systems.

This presentation will aim to explore the complex equilibria involved in the generation of multimembered non-covalent capsules and address the pending question: Is it possible to control the complexity of non-covalent interactions and steer the self-assembly outcome toward the selective formation of low-symmetry hosts? In addition to presenting recently published capsules,(1,2) the presentation will highlight future development prospects (3) and the direction of ongoing work.



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MULTIPHOTON-ACTIVE NANOPARTICLES FOR BIOPHOTONICS

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Designing light-active nanoparticles with finely tuned nonlinear optical responses creates new possibilities for precision biophotonics. Gold nanoparticles (AuNPs)1,2, carbon dots (CDs)3-5 and magnetic nanostructures are examined as complementary platforms for multiphoton bioimaging, photodynamic therapy, sensing, and theranostics. The main experimental strategies for characterising nonlinear behavior such as Z-scan, two-photon excited fluorescence, and hyper-Rayleigh scattering were exploited. AuNPs synthesis and exemplar applications in antimicrobial photodynamic inactivation, plasmon-enhanced catalysis, sensing, and nonlinear optical signal generation will be presented. Particular emphasis is placed on lyotropic liquid-crystalline (LLC) matrices, including DNA-based mesophases and myelin figures, as biomimetic hosts that support nanoparticle ordering, polarization-resolved studies, and photothermal control over local LLC structure. CDs are presented as a sustainable, carbon-based alternative whose multiphoton properties can be engineered via core structure and surface functionalisation, with growing impact in biomolecular environments and soft-matter imaging. Collectively, the link of nanoscale design to optical response and biological function, and future directions in deeper-tissue operation, hybrid architectures, and translational biophotonics will be presented.

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THE GRADIENT RAFT COPOLYMERISATION FOR CO2/N2 SWITCHABLE POLYMERS PREPARATION

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When we hear the word “polymers,” many people immediately think of one thing: large-scale plastics that surround us from every direction. However, today polymers also include a wide range of carefully designed smart materials developed for specialized applications. Among these, we can distinguish stimuli-responsive polymers, which exhibit sensitivity to specific external stimuli, such as temperature or pH.

A new class of materials sensitive to external stimuli is CO2/N2 switchable polymers. CO2-responsive polymers are advanced functional materials that undergo reversible changes in their physicochemical properties, such as solubility, surface charge, or macromolecular conformation, upon exposure to carbon dioxide.[1,2] This process can be reversed by purging the sample with an inert gas (e.g., nitrogen or argon), enabling repeated and controlled switching of the material’s properties.

The most important application areas of CO_2-responsive polymers include biomedicine, including applications in controlled drug delivery systems[1], and Pickering interfacial catalysis (PIC), where smart emulsifiers are used to enable controlled formation and destabilization of emulsions[3].

The presentation will introduce a strategy for the synthesis of copolymers that exhibit sensitivity to reversible CO_2/N_2 switching, together with the characterization of their response to the gaseous stimulus. Attempts to apply the obtained materials as emulsion stabilizers will also be discussed, highlighting their potential use in Pickering interfacial catalysis.

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FROM WASTE TO INTERFACE: PRECURSOR PRETREATMENT GOVERNS SURFACE CHEMISTRY AND ELECTROCHEMICAL PERFORMANCE OF COFFEE-DERIVED ACTIVATED CARBONS IN ZINC-BASED ENERGY STORAGE

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The development of sustainable and high-performance electrode materials is critical for next-generation zinc-based energy storage systems (Zn-ESSs), which offer advantages in safety, cost, and environmental impact compared to lithium-ion technologies [1-3]. Here, we present a scalable approach for converting coffee waste into high-performance activated carbon (AC) cathodes via $ZnCl_2$-assisted activation. The influence of precursor pre-treatment is systematically investigated by comparing raw coffee beans (RCB), used coffee beans (UCB), and washed used coffee (UCB_W). The optimized material derived from used coffee (UCB_AC) exhibits a hierarchical porous structure with a specific surface area of 884.85 m^2 g^{-1} and a pore volume of 0.713 cm^3 g^{-1}, enabling efficient ion transport and charge storage. In zinc-ion hybrid supercapacitors, UCB_AC delivers a high specific capacitance of 440 F g^{-1} at 0.1 A g^{-1}, excellent cycling stability (97% retention over 10,000 cycles), and high energy and power densities of 196.98 Wh kg^{-1} and 9030 W kg^{-1}, respectively. Notably, despite a lower surface area, UCB_AC outperforms commercial activated carbon, highlighting the importance of pore architecture over surface area alone. Furthermore, UCB_AC demonstrates competitive catalytic performance in zinc–air batteries, exceeding Pt/C in power density and durability. The results reveal that precursor pre-treatment plays a decisive role in tailoring porosity, conductivity, and electrochemical behavior. Importantly, additional washing does not improve performance, indicating that direct utilization of spent coffee is sufficient. This work demonstrates a sustainable and cost-effective strategy for transforming abundant coffee waste into multifunctional carbon materials, providing a viable pathway toward environmentally friendly and high-performance energy storage technologies.

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PYRIDYLIDENE LIGANDS AND THEIR RELATED ORGANOMETALLIC COMPLEXES FOR NOVEL OPPORTUNITIES IN VARIOUS APPLICATIONS

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Metal complexes of N-Heterocyclic carbenes (NHC) have found a plethora of applications in the last two decades following the seminal work of several groups. This contrasts with the underexplored pyridylidene category.1 Pyridylidenes exhibit a higher s-donor and p-acceptor character than imidazolylidenes, thus pyridylidenes are attractive ligands to promote organic transformations or light emission in the related transition metal complexes. Pyridylidenes remain scarcely investigated certainly due the absence of general methods for accessing pyridylidene-based metal complexes. Only few specific routes were reported to date. In this context our research investigations describe the development of several methods for the synthesis of organometallic compounds containing pyridylidene ligands with transition metals such as Ru(II), Os(II), Rh(III), Ir(III) and Pt(II).2-5 In particular, some of the complexes obtained exhibit strong phosphorescence in the solid state which makes them attractive candidates as doping materials in OLEDs to harvest the triplet excitons. Some of the non-metallated compounds exhibits TADF (Thermally Activated Delayed Fluorescence) which is of high interest in the third generation of OLED emitters. Moreover, our novel compounds also show interesting NLO,6 catalytic, biological and reactivity7 properties that are investigated in collaboration with several research groups. During this presentation, the development of new methodologies to obtain our novel materials as well as their photoluminescent properties will be presented.

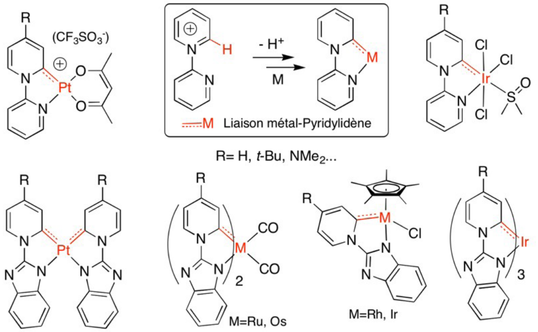

Figure: Archetypal structures of prepared compounds with pyridylidene ligands

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STRUCTURAL AND SPECTROSCOPIC STUDIES OF COMPLEXES WITH [CR(OX)3]3- UNITS

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Oxalato-based building blocks are interested structural units due to diversity of different topologies which can be obtained because of multiple oxalate coordination modes and chirality of [M(ox)3]n- moiety. The synthesis conditions enables reactions control and preparation of compounds revealing different properties. Oxalate complexes usually are reported as magnetic, porous, fluorescent and conductive materials [1]. We prepared [Cu2(bpy)4Cr(ox)3][Cu(bpy)2Cr(ox)3]·7H2O (1) and [Cu2(phen)4Cr(ox)3][Cu(phen)-2Cr(ox)3]·19.5H2O (2) and [Cu(phen)3]2[Cr(ox)3]·14.25H2O (3) complexes (bpy = 2,2'-bipyridine, phen = 1,10-phenanthroline). In (1) and (2) nitrate anion in [Cu2(bpy)4Cr(ox)3](NO3)·H2O [2] was substituted with dimer what significantly affected the created crystal network. Analysis of interactions between trimer and dimer units enclosed in the same crystal network revealed existence of different embraces between aryl rings (Fig. 1). The interactions landscape is completed by C-H...Oox and Oaq-H...Oox hydrogen bonds. XAS spectra recorded at PIRX beamline (National Synchrotron Radiation Centre SOLARIS, Kraków) showed that for Cr L2,3 edge the charge transfer transition should be taken into account. The ground state is composed in ca 80% of d3 and 20% of d4L (L = ligand p-hole). The magnetic study showed weak ferromagnetic and antiferromagnetic couplings between Cr(III) and Cu(II) connected via oxalate bridge.

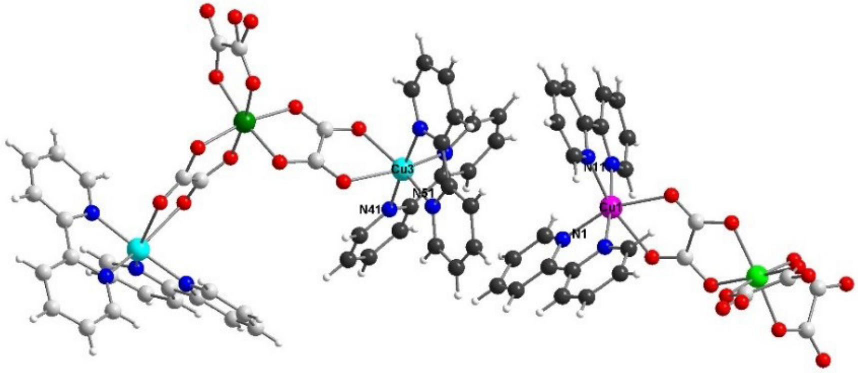

Fig. 1. Quadruple aryl embrace in [Cu2(bpy)4Cr(ox)3][Cu(bpy)2Cr(ox)3]·7H2O (1).

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FROM PHASE SEPARATION TO NITRENE CHEMISTRY: SOME RECENT ADVANCES IN THE DESIGN OF DYNAMIC POLYMER NETWORKS

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Vitrimers are chemically crosslinked networks that can rearrange their topology without decreasing their crosslinking density thanks to exchangeable links present in the network. As a result, vitrimers can be potentially reshaped and recycled at will, while displaying the superior properties of crosslinked polymers at service temperature. Very promising materials to create a circular economy of plastics and polymeric materials, vitrimers still display limitations that impact their transition towards industry, such as high viscosity even at elevated temperatures, due to the Arrhenian temperature dependence of the melt viscosity, or moderate creep resistance at working temperatures in the case of low Tg materials.

Although many strategies have been reported to address these issues, it remains challenging to overcome a key tradeoff between improving the processability or the mechanical performance of vitrimers. In this lecture, new strategies relying on phase separation and/or reactive processing will be presented to jointly improve the processability and the mechanical performance of vitrimers and dynamic polymer networks relying on dioxaborolane metathesis [1-4], or to recycle blends of polyolefins [5].

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STRUCTURE AND MECHANISM OF THE DAROBACTIN SYNTHASE DARE UNVEIL HOW THE ENZYME TAMES OXYGEN

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Ribosomally-synthesized and post-translationally modified peptides (RiPPs) constitute a rich and highly promising reservoir of natural products for drug discovery, often featuring chemically challenging transformations catalyzed with remarkable precision by specialized enzymes. Darobactin exemplifies this potential: its activity relies on an ether bond formed between an sp3 carbon of one tryptophan and an sp2 carbon of another, installed in a single step by an oxygen-sensitive metalloenzyme that harnesses molecular oxygen and radical chemistry.

By integrating structural, biochemical, spectroscopic, and computational approaches, we reveal how the enzyme DarE orchestrates a finely tuned interplay between the protein matrix, the iron-sulfur clusters, and the peptide substrate to regulate oxygen access and modulate redox potentials, thereby preventing O2-induced damage. The reaction, confined within a dedicated cavity, is tightly controlled to safely and selectively generate the ether crosslink. These insights provide the first mechanistic blueprint for this emerging class of antibiotics and open new avenues for rational engineering of RiPP pathways to create more selective and potent therapeutic agents.

DEVELOPMENT OF NOVEL ANTIBACTERIAL PHOTOCURABLE RESINS FOR 3D PRINTING VPP APPLICATIONS IN DENTAL MATERIALS

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Photopolymerization is a key technology for dental applications, aligning with green chemistry principles by offering fast, solvent-free reactions with low energy consumption. However, current formulations face significant limitations, including reliance on UV light, the use of petroleum-based products, and uncontrolled component leakage, which raise environmental and safety concerns. These issues are particularly critical in the biomedical field, where 3D printing via Vat Photopolymerization (VPP) is widely used for dental prosthetics and tissue engineering. Furthermore, bacterial proliferation on biomaterial surfaces leads to nosocomial infections, a problem exacerbated by the emergence of antibiotic-resistant strains.

The “DENTAL” project, conducted under the POLONIUM NAWA bilateral program, addresses these critical challenges by developing novel, bio-based, and non-toxic photocurable resins. This multi- and interdisciplinary project leverages strong synergy among the Cracow University of Technology, Université Paris-Est Créteil (UPEC), and Institut de Chimie et des Matériaux Paris-Est (ICMPE). The unique expertise of the Polish laboratory in photochemistry and the synthesis of dental restorative materials complements the French partner’s capabilities in advanced material design. Together, we are developing innovative photoinitiating systems (PIs) with inherent antibacterial properties for dental applications in 3D printing and Photodynamic Therapy (PDT).

Our strategy aims to produce high-added-value materials that can be engineered rapidly with significant economic and societal impacts. Beyond the scientific outcomes, this European collaboration strengthens the research and teaching capabilities of both institutions. By focusing on sustainable chemistry and integrating innovation into engineering education, this partnership not only advances the field of 3D-printed biomaterials but also fosters an attractive international environment for researchers and students alike.

PHYSICOCHEMICAL ENGINEERING OF MATERIAL–VIRUS–BACTERIA INTERFACES FOR SELECTIVE BIOCONTROL

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The growing need for safe, selective, and sustainable biocontrol strategies has spurred the development of functional materials for biocontrol applications. In particular, bacteriophages occupy a dual role: they are promising tools for antibacterial applications, but they can also be a serious threat to biotechnological processes based on bacterial cultures. This creates a need for approaches that can either protect phages or selectively inactivate them, depending on the application.

I will present our recent work on the physicochemical engineering of material–virus–bacteria interfaces. We investigate how surface chemistry, ligand composition, charge, hydrophobicity, redox activity, photoactivity, and nanostructure morphology determine the biological response of phages, bacteria, and mammalian cells.

A central theme of our research is selectivity. Rather than relying on broadly destructive disinfection methods, we aim to design materials and molecular systems that modulate biological activity.

These studies show that antimicrobial and antiviral performance can be rationally tuned by material composition and surface architecture. More broadly, they demonstrate how concepts from physical chemistry, colloid science, and materials chemistry can be used to understand and design complex biological interfaces. The resulting strategies may find applications in bioprocess protection, infection control, antimicrobial coatings, environmental safety, and the development of next-generation bioactive materials.

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ADVANCED PULMONARY DELIVERY PLATFORMS: ENGINEERING TARGETED THERAPY FOR RESPIRATORY DISEASES

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Drug delivery systems (DDS) in the form of dry powder for inhalation play an important role in the management and treatment of pulmonary diseases. They are engineered to provide accurate tissue targeting and controlled release of active pharmaceutical ingredients (APIs) to the defined place in the respiratory tract to minimise systemic exposure. Polysaccharides, lipids, and degradable polymers, e.g. polyanhydrides, are excellent candidates to produce such advanced DDS [1]. So far, we have developed inhalable stimuli-sensitive drug carriers that are intended to improve the efficacy of lung cancer therapy through guided accumulation directly at the tumour site and controlled drug release triggered by an alternating magnetic field, resulting in a local increase in temperature. Such DDS are in the form of solid lipid microparticles composed of fatty acids loaded with superparamagnetic iron oxide nanoparticles (SPIONs) and paclitaxel. Microparticles meet various criteria, including suitable aerodynamic properties, high drug loading efficiency, sufficient mobility in the magnetic field, melting temperature under hyperthermia conditions, and enhanced in vitro efficacy, as studied in contact with healthy and malignant lung epithelial cells [2,3]. Moreover, we have designed polyanhydride DDS of antibiotics and quorum sensing inhibitors (QSi) for the treatment of bacterial infections in patients with chronic obstructive pulmonary disease (COPD) exacerbations. Such DDS are microparticles made of poly(sebacic acid) derivatives loaded with antibiotics (gentamycin, tobramycin and azithromycin) and QSi (curcumin, linolenic acid) that have a synergistic effect [4]. Microparticles have a suitable size for inhalation (aerodynamic diameter in the range of 1-5 μm), degrade in a few days and release drug cargo, which is capable of killing pathogenic bacteria in planktonic form and preventing biofilm creation. The system is cytocompatible with lung epithelial cells and lung tissue, as shown by in vitro and ex vivo tests, respectively [5-6]. We are also working on pollen-like microparticles loaded with lipid nanoparticles as a carrier of ensifentrine for the treatment of COPD, which enable uniform deep-lung deposition and mucus penetration.

Acknowledgements:
This study was supported by the National Science Center (NCN) (2025/56/Q/ST5/00240)

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PEPTIDE CHEMISTRY FOR WELL-BEING: PROOFS OF CONCEPT IN DIAGNOSTICS, THERAPEUTICS, AND COSMECEUTICALS

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Bioorganic chemistry drives innovation in peptide science, enabling selective and sustainable solutions for diagnostics, therapeutics, and cosmeceuticals. Advances in chemoselective ligation and side-chain stapling have enabled the rational design of conformationally constrained peptides with enhanced stability and bioactivity (1). At PeptLab@UNIFI, peptide design, synthesis, and functional evaluation are integrated within a translational framework. Triazolyl-bridged peptides (1,2) and peptide–peptide nucleic acid chimeras (3) have been developed as multifunctional antiviral and antibacterial agents active against emerging pathogens and resistant strains (4). Sustainable synthetic strategies supporting GMP-compliant production and technology transfer have also been optimized to address the increasing demand for peptide manufacturing (5). In diagnostics, peptide probes enable epitope mapping and detection of disease-specific antibodies in autoimmune and infectious diseases (6). Peptides also contribute to cosmeceuticals (7), as demonstrated by the collagen-modulating peptide Definisse KP1, recently launched on the market by Relife (Menarini Group) (8). Overall, green chemistry (9), advanced molecular design, and interdisciplinary collaboration position peptide chemistry as a key driver of innovation for well-being.

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POLYMER NETWORKS BASED ON OLIGO(ETHYLENE GLYCOL) METHYL ETHER METHACRYLATE

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Polymer networks encompass one of the most versatile and functionally diverse classes of materials in modern materials science, with macroscopic performance directly governed by molecular architecture and crosslink topology. This work presents three complementary strategies for designing functional polymer gels intended for wound-dressing applications.

Photoresponsive hydrogels exhibiting distinct light-triggered behaviors — reversible proton cycling, photoisomerization, and irreversible photoactivation — were developed to enable dynamic control over local chemical environments. Networks incorporating spiropyran/merocyanine [1], azobenzene, and quinoline motifs were synthesized and characterized, demonstrating how molecular photochemistry can be translated into functional soft materials. The influence of network morphology on hydrogel architecture and antibacterial performance was systematically investigated as a function of polymerization mechanism [2,3]. Additionally, interpenetrating polymer networks (IPNs) were studied, with particular focus on how the polymerization pathway of the primary network directs the structural development of the secondary network.

All materials were synthesized using oligo(ethylene glycol) methyl ether methacrylate (OEGMA) as the base monomer via three radical polymerization techniques: free radical polymerization (FRP), atom transfer radical polymerization (ATRP), and reversible addition–fragmentation chain-transfer (RAFT) polymerization. Collectively, these studies establish clear structure–property–performance relationships, offering new design principles for stimuli-responsive hydrogels in biomedical applications.

Acknowledgement:
Financial support from the National Science Center, Poland (Grant UMO-2020/39/I/ST5/02108).

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TERMINATION STUDIES OF ACRYLATE RADICALS IN ATRP

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Catalyzed Radical Termination (CRT) complicates Atom Transfer Radical Polymerization (ATRP) (1) by causing undesired termination products and reducing control (2). It occurs when the organometallic complex, formed by addition of the growing radical chain end to the metal catalyst, interacts with a second active radical (see Fig. 1). This phenomenon is particularly detrimental for the controlled chain growths of acrylate polymers such as poly(methyl acrylate) (PMA), whereas it plays a negligible role in the ATRP of methacrylates and styrenics (3). To minimize the effect of CRT without disrupting the ATRP equilibrium, it is crucial to understand the CRT mechanism. The relative proportions of Combination (x) and Disproportionation (y) modes of termination in the spontaneous bimolecular radical termination (RT) and in CRT may be quite different. The most recent results on the termination of carbomethoxyethyl, as a PMA model radical, generated by various methods (4) will be presented here.

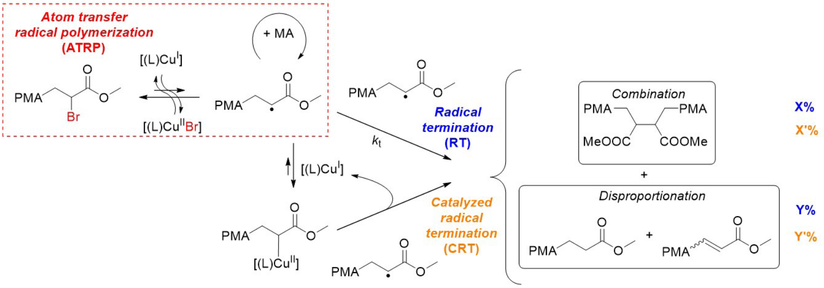

Figure 1. Termination pathways in the ATRP of methyl acrylate (MA).

Acknowledgment

We are grateful to the Agence National de la Recherche (grant ANR-23-CE06-0001-01) for support of this work.

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COORDINATION CHEMISTRY IN ACTION: STRATEGIES FOR METALLOPROTEIN INHIBITION

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Metalloproteinases are enzymes that hydrolyze peptide bonds and play important roles in both physiological and pathological processes. They occur in organisms ranging from bacteria, where they contribute to virulence, to humans, where their dysregulation is associated with diseases such as cancer and tissue remodeling disorders. Despite their functional and structural diversity, metalloproteinases share a conserved catalytic mechanism involving a metal ion, typically coordinated by three histidine residues, which stabilizes the active site and facilitates catalysis through precise positioning of water molecules and proton transfer steps [2].
Due to their central involvement in many disease pathways, metalloproteinases are considered attractive therapeutic targets. In particular, selective modulation of their activity remains a major challenge in drug design. Our research focuses on the rational design of peptide-based inhibitors capable of directly interacting with the catalytic zinc ion and modulating enzyme activity in a selective manner [4,5]. We investigate the formation, speciation, and thermodynamic stability of ternary complexes formed at the enzyme active site involving zinc and an inhibitor under physiologically relevant conditions [6]. Using a combination of potentiometric titrations, spectroscopic techniques, and computational methods, we aim to elucidate the structural and energetic factors governing inhibitor binding, selectivity, and overall affinity.

The financial support from the Polish National Science Centre (NCN, nr UMO-2023/50/E/ST5/00434) is gratefully acknowledged.

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SQUARAMIDE-BASED ION-PAIR RECEPTORS: FROM SALT EXTRACTION TO TRANSMEMBRANE TRANSPORT

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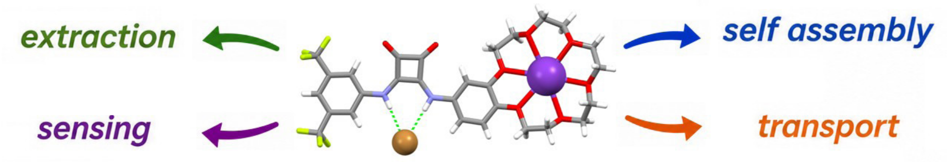
The simultaneous recognition of cations and anions by heteroditopic receptors offers unique opportunities for controlling molecular self-assembly and manipulating highly hydrated ionic species. In our research, we employ squaramide-based ion-pair receptors that combine strong anion-binding motifs with crown ether cation-binding domains. We have demonstrated that cooperative ion-pair recognition can be utilized for the selective extraction of inorganic salts, including sulfate and lithium salts, under both solid–liquid and liquid–liquid extraction conditions. Depending on the nature of the ionic guest, these receptors form supramolecular architectures with different stoichiometries, ranging from simple ion-pair complexes to higher-order sulfate-templated assemblies. We have shown that cation- and anion-induced aggregation processes can coexist and cooperate, giving rise to adaptive supramolecular structures with distinct binding and extraction properties. The versatility of this receptor platform has also enabled the development of fluorescent systems for zwitterion sensing and the selective recognition of amino acids. Furthermore, the incorporation of ion-pair recognition motifs into lipophilic transporters has led to the development of squaramide-based carriers capable of mediating the transmembrane transport of highly polar amino acids, including charged species such as glutamate and arginine. These results demonstrate how ion-pair recognition can be exploited as a general strategy for designing functional supramolecular systems for extraction, sensing, and transport applications.



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CATALYTIC AND COCATALYTIC PROPERTIES OF POLYNUCLEAR COBALT HAEXACYANOFERRATE NETWORKS TOWARD WATER OXIDATION IN ACID MEDIUM

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Electrochemical water splitting involves two heterogeneous multi-step half-reactions, which are referred to as the cathodic hydrogen evolution reaction (HER) and the anodic oxygen evolution reaction (OER). It should be noted that the OER under acidic conditions has the following two advantages compared to the process in neutral and alkaline solutions. The kinetics of the OER in acidic media could be much faster due to the higher proton transfer rate between anode and cathode. The proton exchange membrane (PEM) is an acidic solid polymer electrolyte membrane characterized by good proton conductivity, excellent electrochemical durability, and high mechanical strength. There has been growing interest in the development of active and stable catalytic systems that could efficiently operate under electrochemical and photoelectrochemical conditions.

Polynuclear iron(III) hexacyanoferrate(II), or Prussian blue, and its analogues possess unique open framework structures with the general chemical formula of $A_xM_y[Fe-(CN)_6]_z \cdot nH_2O$ (where A = alkali metal cation, M = transition metal cation). The possibility to accommodate different transition metal cations within the coordination framework renders them with appealing electrochemical, ion-exchange, sensing, or photomagnetic properties, which have been the subject of intense research for decades. Here we explore the water oxidation catalytic activity and stabilization effects exhibited by Prussian blue-type cobalt hexacyanoferrate modified electrodes both under conventional electrochemical (using Ru/RuOx substrate) and photoelectrochemical conditions (using WO_3 n-type semiconductor) in acid medium. In addition to co-catalytic effects, the enhanced catalytic activities of the as-synthesized electrodes should also be attributed to such features as high population of hydroxyl groups and high Broensted acidity (due to presence of Ru or W oxo sites) and related fast electron transfers coupled to unimpeded proton displacements. The possibility of metal-metal interactions between nanosized metals (Co and Ru or Co and W) cannot be excluded. It is reasonable to expect that the cyanometallate framework can facilitate formation of the active cobalt-oxo-species and enhance the intrinsic oxygen evolution reaction activity. The hexacyanoferrate stabilized CoIII species seem to be readily oxidized into catalytically active CoIV species, and the undesirable surface reconstruction process is largely minimized particularly under photoelectrochemical conditions. The strategies for designing active and stable polynuclear-cyanometalate-based catalytic systems for OER will be addressed.

LOCALIZATION AND SPECIATION OF A HIGHLY CYTOTOXIC ORGANOGOLD(III) COMPLEX IN A LUNG CANCER CELL MODEL

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Organogold(III) complexes have recently attracted growing interest for their anticancer activity, both in cell cultures and in vivo (1). This progress is largely due to advances in designing effective molecules by carefully selecting ligands that stabilize the inherently unstable +3 oxidation state of gold (2). A comprehensive study on the chemical reactivity in the gas phase, with amino acids and peptides, and in the cell, the anticancer activity and localization of a series of cationic biphenyl gold(III) complexes with various diphosphine ancillary ligands is presented (3). Despite some structural differences, all the complexes similarly featured high stability toward reduction or ligand exchange in cell-free conditions. The biphenyl Au(III) complex including the 1,2-diphenylphosphinoethane (dppe) ligand manifested the same high stability in a cellular setting, as attested by a combination of cryo-Synchrotron Radiation-X-Ray Fluorescence (cryo-SR-XRF) nano-imaging and cryo-Synchrotron Radiation-X-ray Absorption Spectroscopy (cryo-SR-XAS) measurements (Figure).

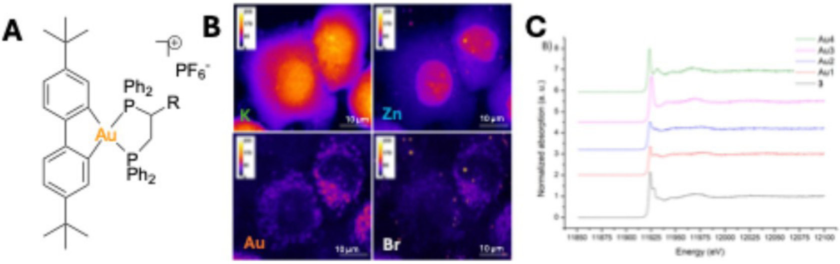

Figure. A) Chemical structure of gold(III) complex. B) cryo-SR-XRF elemental maps of K, Au, and Br in A549 cells treated with 1 µM of brominated gold(III) complex for 4 h recorded at a resolution of 50 nm pixel−1 (100 ms). Elemental contents are given in ng/mm2. C) Normalized reference XANES spectra of gold complex and 4 reference compounds dissolved in dioxane (5 mM). All spectra were recorded at 10 K in fluorescence mode at the Au LIII-edge.

Tandem cryo-SR-XRF elemental mapping and confocal fluorescence microscopy demonstrated the selective accumulation of the dppe complex in mitochondria. This represents the first study of the speciation and distribution of an organogold(III) complex in cancer cells.

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STIMULI-RESPONSIVE SELF-ASSEMBLY OF METAL-BASED HELICAL ARCHITECTURES

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The timeless elegance of helical geometry has captivated human imagination for centuries, finding expression in both art and architecture. More recently, this fascination has extended into the realm of chemistry, leading to the design of artificial chemical systems that intentionally intertwine chemical and topological properties.

In our work, we explore the design and formation of helicates—metal-coordinated helical architectures—through a dynamic, self-assembling process. While biological supramolecular structures rely mainly on organic non-covalent interactions like hydrogen bond donor-acceptor interactions and Van der Waals forces, helicate formation is driven by the coordination preferences of metal ions. In the developed system, we leverage the reversible nature of imine bond formation to self-assemble ligand strands from a library of organic building blocks. When exposed to a specific set of metal ions in solution (Cu(I), Zn(II), Cu(II)), the components spontaneously organize into metal-based helical architectures, by selecting the most suitable components from the library. The driving force of this process consists of the accommodation of the metal ions coordination sphere. Crucially, both the connectivity of the ligand components and the identity of the metal ions influence the system's responsiveness to external stimuli. We demonstrate that the introduction of an organic competitor to the reaction mixture can perturb the equilibrium, prompting a shift in the ligand strand composition. This adaptive reconfiguration leads to the formation of new helicate architectures through a self-organization process.

WHEN MONOLAYERS BECOME CATALYSTS – AND ENABLE CONTROL OVER CATALYSIS

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Molecular monolayers on nanoparticles provide a powerful supramolecular platform for controlling catalysis through confinement effects, yet achieving precise control over catalytic function remains a central challenge.(1) Here, I will show how catalytic nanoparticles can be obtained either by attaching external catalytic units(2-3) or by generating emergent catalytic sites through the self-assembly of functional ligands within the organic monolayer.(4) I will further demonstrate that incorporating molecular photoswitches into these systems enables remote modulation of catalytic properties through light-induced conformational changes in the ligand shell (Figure 1). Overall, this presentation aims to illustrate how molecular organization and motion at nanostructured interfaces can translate into tunable catalytic outcomes at the macroscopic level.

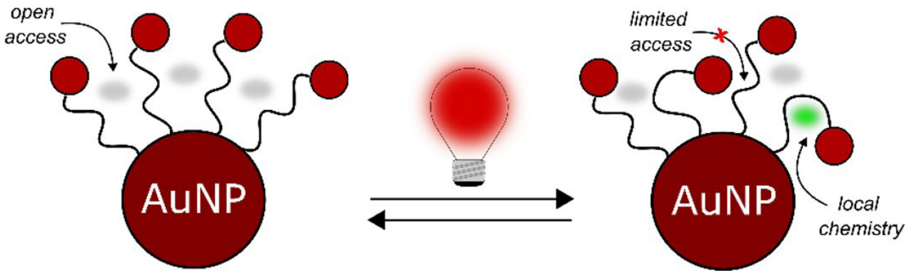

Figure 1. Schematic representation of the light-induced regulation of the local microenvironment and substrate accessibility by an organic monolayer on gold nanoparticles.

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TITANIUM-MEDIATED CONSTRUCTION OF POLYSUBSTITUTED AROMATIC SYSTEMS FROM 1,3-DIYNES

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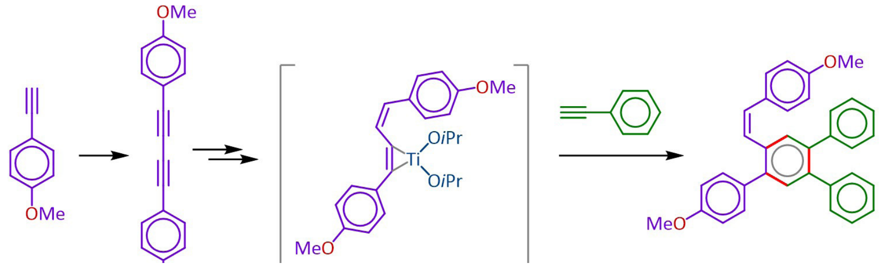
Some years ago, in the course of investigations focused on the use of the Ti(OiPr)4/nBuLi combination of reagents,(1) we developed a highly selective and efficient method for the synthesis of polysubstituted aromatic molecules. This transformation involves a controlled (2+2+2) cycloaddition process, operating from alkyne substrates.(2,3)

Based on literature reports concerning the reactivity of 1,3-diynes in the presence of similar reagent systems,(4,5) our latest work in the area has dealt with the exploration of the construction of larger molecular frameworks.(6) Preliminary results will be presented, highlighting some advantages and limitations of the method, as well as selectivity aspects, in particular with unsymmetrical 1,3-diyne substrates. An example of controlled synthesis of a polysubstituted (Z)-stilbene derivative is presented below.



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ENVIRONMENTAL SAFETY OF THE PYRETHROIDS AND PYRETHRINS

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The European Union's Green Deal and its "Farm to Fork" strategy mandate that 25% of agricultural land be managed under organic farming by 2030. This shift significantly increases the application of natural insecticides, such as pyrethrins, pyrethroids, and azadirachtin. Despite their natural origin, the chemical interactions between these compounds and soil microflora require rigorous evaluation. This study aimed to determine the physiological and biochemical impact of these substances on soil microorganisms using advanced analytical approaches.

The research focused on various microbial strains, including plant growth-promoting bacteria (PGPB). To achieve a comprehensive understanding of the insecticides' effects, a multi-faceted analytical protocol was implemented. Spectrophotometric methods were employed to quantify changes in intracellular enzyme activities and to monitor the metabolic kinetics of various carbon sources. Furthermore, chromatographic techniques were applied to verify the stability of the active ingredients in the experimental systems and to analyze the specific transformations of these compounds.

A key aspect of the study was the investigation of cell membrane integrity and composition. Gas chromatography was used to perform a detailed analysis of fatty acid methyl esters (FAMEs), allowing for the characterization of changes in the membrane lipid profiles. The results revealed that exposure to pyrethrins and azadirachtin induces significant membrane remodeling, evidenced by shifts in the ratio of saturated to unsaturated fatty acids and changes in membrane fluidity. These biochemical adaptations, often accompanied by altered cell surface hydrophobicity, indicate a robust stress response even at sub-lethal concentrations.

The experiments showed, that regardless of toxicity or lack thereof, the tested compounds affect bacterial cells and the microbiome on many levels. These findings emphasize the necessity of including detailed lipidomic and biochemical profiling in the environmental safety assessment of pesticides approved for organic farming.

SUCCESSIVE TRANSIMINATIONS: PH-TRIGGERED SWITCHES AND MULTISTEP PROCESSES

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After the formation of a first imine (Imine1), from an aldehyde and a first primary amine (Amine1), followed by the exchange of Imine1 with a second primary amine (Amine2), leading to a second imine (Imine2), it is possible, in the same pot, to reversibly switch between the second (Imine2) and the first (Imine1) imine. This can be done, where the difference of basicity and nucleophilicity between Amine1 and Amine2 is sufficient, as follows. Addition of acid (1 equiv. of trifluoroacetic acid, for example) to the mixture consisting of Imine2 and Amine1, produces the protonation of Amine2 and the formation of Imine1. Further, addition of base (e.g. 1 equiv. of triethylamine) leads to Imine2 and Amine1, together with the protonated base. This last step is represented in Figure 1a. We performed such pH-triggered switches[1] in solution, as well as under solvent-free conditions.

It is possible to combine multistep processes (like the passage, through transimination, from a first imine (Imine1), to a second one (Imine2), then to a third one (Imine3)) with pH-triggered switches (from Imine3 to Imine2, then to Imine3), as represented in Figure1b. We performed such exchanges under solvent-free conditions[1].

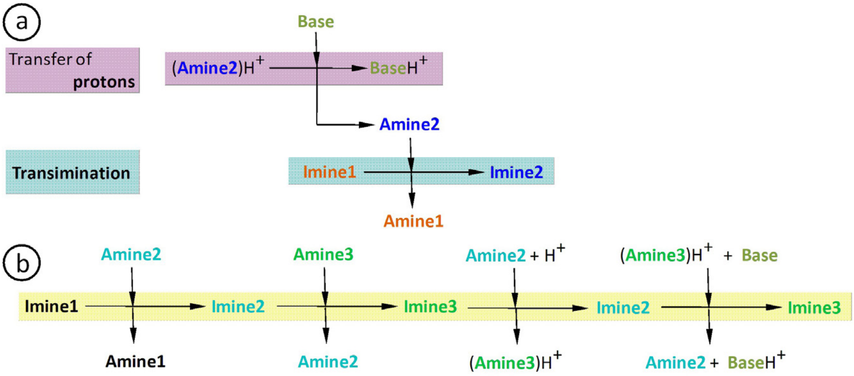

Figure 1. a) Representation of how the transfer of protons from the second protonated amine (Amine2)H+ to the base, is associated to a transimination where Imine1 leads to Imine2; b) Successive transiminations where a multistep process (from Imine1 to Imine3) is combined with a pH-triggered switch (from Imine3 to Imine2, then again to Imine3).

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TOWARD ADAPTIVE SYSTEMS: AMINO ACID-BASED SELF-ASSEMBLED NANOSTRUCTURES

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The self-assembly of molecular building blocks through non-covalent interactions offers a powerful strategy for creating functional materials. Moving beyond purely synthetic or natural systems, current research focuses on hybrid platforms that combine rational design with biologically inspired motifs. Amino acid-based components are particularly attractive, as they enable the formation of precisely organized nanostructures that exhibit adaptive behavior reminiscent of biological systems. Inspired by the dynamic and responsive nature of biopolymers, we explore how amino acid-derived building blocks can generate self-assembled nanostructures functioning as adaptive systems.1-4 Through reversible interactions and structural programmability, these architectures can respond to environmental stimuli and modulate their properties at the nanoscale. This presentation will highlight selected examples illustrating the design of adaptive amino acid-based nanostructures with potential applications in biotechnology, medicine, and advanced materials engineering (more information at www.arsgroup.amu.edu.pl).

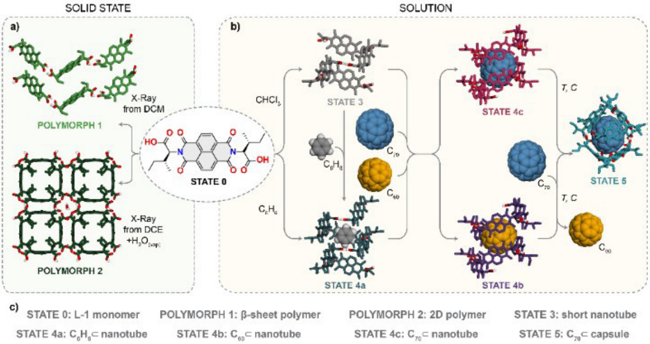

Figure 1. A structural reorganization of this artificial system into five distinct supramolecular states was accomplished, through modulation of solvent, temperature, concentration, and guest molecules.

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NITROXYL (HNO): REDOX CHEMISTRY, METAL-BASED DETECTION, AND ENDOGENOUS FORMATION

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Nitroxyl (HNO) has emerged as a chemically and biologically distinct member of the reactive nitrogen species family, exhibiting unique reactivity compared to nitric oxide (NO·) [1]. However, its transient nature and high reactivity have historically limited both its detection and mechanistic understanding.

To overcome the intrinsic difficulty of HNO detection, we have developed inorganic-based analytical strategies relying on transition metal complexes. In particular, electrochemical sensors based on cobalt porphyrins immobilized on conductive surfaces enable selective and time-resolved discrimination between HNO and NO· [2]. Complementary approaches, including metal-based trapping and indirect quantification via N_2O formation, provide consistent mechanistic insight into HNO generation.

Moreover, I present recent advances on the chemistry and formation pathways of HNO, with particular emphasis on the non-enzymatic interconversion between NO· and HNO mediated by biologically relevant reductants [3]. Kinetic and mechanistic studies demonstrate that reactions of NO· with thiols, hydrogen sulfide, and related nucleophiles efficiently generate HNO under physiologically relevant conditions, challenging long-standing thermodynamic assumptions.

Using these tools, we have demonstrated endogenous HNO formation in both plant and mammalian systems, including Arabidopsis thaliana and human platelets, revealing its role as a redox-active signaling molecule. Finally, controlled HNO generation in the gas phase using solid–gas reactions with biocompatible reductants highlights emerging applications in therapeutic delivery.

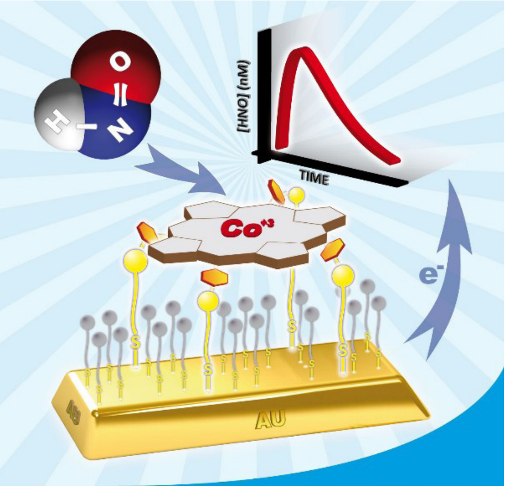

Figure - Cobalt porphyrin–based electrochemical detection of HNO at nanomolar levels connects its redox chemistry with endogenous formation and signaling roles in both plant and mammalian systems.

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MULTIFUNCTIONALITY VIA METAL INTEGRATION: THE PROMISE OF HETERO-POLYMETALLIC ARCHITECTURES

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Integrating multiple, responsive functions within a single molecule is one of the most compelling challenges in molecular materials chemistry. Hetero-polymetallic complexes offer a powerful route toward this goal, yet controlling structure-function relationships when several metal ions with distinct roles coexist in one framework is far from trivial. Here, we address this challenge through a modular "complexes-as-ligands" strategy that turns synthetic complexity into a predictive design principle. Pre-organised hetero-trimetallic CuLnCo units (Ln = lanthanide) act as robust magnetic building blocks, where each metal ion is assigned a defined structural and magnetic role. Their stepwise assembly with photoactive cyanidometallates affords a family of 18 hetero-tetrametallic architectures, enabling direct comparison between distinct regimes of multifunctionality. In nitroprusside-based FeNOCuLnCo assemblies, photo-isomerisation centred on the Fe2+ ion occurs without perturbing the intrinsic magnetic behaviour of the CuLnCo fragment, defining an additive regime.(1) In sharp contrast, octacyanidometallate-based M(CuLnCo)2 systems display a synergistic regime. Here, the reversible light-induced bond cleavage at the octacyanido core generates a triplet Mo4+ state that magnetically couples to the CuLnCo magnetic branches. In Mo(CuTbCo)2, this interaction produces a genuine photo-switchable single-molecule magnet, where light activation of the cyanido core directly modulates the relaxation dynamics of the Tb-based SMM.(2) By demonstrating that the cyanidometallate core programs whether functions coexist or cooperate, this work establishes a blueprint for the deliberate design of photo-switchable single-molecule magnets.

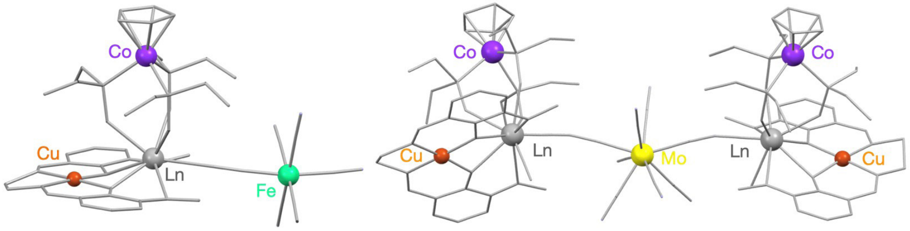

Figure 1. Crystallographic representation of FeCuLnCo and M(CuLnCo)2 complexes.

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ENCODING AND PROPAGATION OF STEREOCHEMICAL INFORMATION IN SEQUENCE-DEFINED OLIGOURETHANES

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The ability to encode, transfer, and interpret molecular information is a defining feature of biological macromolecules, where local stereochemical changes can profoundly influence structure and function. Replicating such information transfer in synthetic systems remains a major challenge. In this presentation, I will discuss how stereochemical information propagates in sequence-defined oligourethanes and how single stereochemical mutations influence conformational organization across different length scales. Using a combination of molecular dynamics simulations and spectroscopic methods, we demonstrate that stereochemical inversions alter backbone torsional preferences, reorganize intramolecular hydrogen-bonding networks, and reshape conformational free-energy landscapes (1). Finally, I will discuss how stereochemically encoded conformational ensembles can be translated into function through sequence-dependent self-assembly (2), ligand and metal-ion interaction patterns (3), and emerging catalytic behaviour. These processes illustrate that molecular information encoded at the level of stereochemical sequence can be transferred across length scales, from local conformational organization to supramolecular structure and molecular function. Together, these findings establish stereocontrol as a design parameter for programming self-assembly, molecular recognition, and catalytic activity in synthetic macromolecular systems.

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STRUCTURAL RECONSTRUCTION OF NICKEL PHYLLOSILICATES IN KIT-6 MESOPOROUS SILICA DURING REDUCTION AND ITS IMPACT ON CATALYTIC ACTIVITY

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Metal phyllosilicates have attracted considerable attention in catalysis due to their unique lamellar structure, which upon reduction can induce strong metal-support interactions (MSI) and the formation of highly dispersed metallic species [1]. In nickel phyllosilicates (Ni-PS), exposure to elevated temperatures under reducing atmosphere can lead to pronounced structural transformations, including dehydroxylation, partial collapse of the lamellar framework, and formation of metallic Ni nanoparticles. Despite their relevance, the direct impact of structural changes in Ni-PS on catalytic performance remains incompletely understood.

In this work, nickel phyllosilicates were synthesized within KIT-6-like mesoporous silica by a one-pot approach, enabling the in situ formation of Ni-PS through polycondensation between Ni2+(OH)2 and surface Si–OH groups [2]. The structural evolution during reduction was monitored by in situ XAS/XRD coupled with mass spectrometer under 4% H2/He at 750°C for 90 min. The results revealed the formation of thermally stable crystalline Ni3Si2O5(OH)4 phases together with time-dependent reconstruction associated with dehydroxylation. These structural features are particularly relevant for the chemical CO2 utilization through dry reforming for syngas production. Catalytic performance evaluated under methane-rich conditions (CH4/CO2/Ar=5.3/3.0/1.7, 700°C) showed improved stability for the one-pot catalyst compared with an impregnated reference catalyst. The enhanced stability was attributed to the co-existence of highly dispersed NiO nanoparticles and thermally resistant Ni-PS with ionic Ni species.

These findings demonstrate that the structural reconstruction of Ni phyllosilicate during reduction plays a key role in determining catalytic activity and stability.

Acknowledgements

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie Grant agreement No 892571. The BM31 at ESRF was funded by the Swiss National Science Foundation (206021_189629) and the Research Council of Norway (296087).

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DYNAMIC COVALENT SYNTHESIS: FROM CAGES TO POLYMERS

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Dynamic covalent synthesis is a bottom-up approach that enables the formation of complex architectures by thermodynamic selection.(1) Dynamic covalent synthesis uses the reversibility of dynamic covalent linkages to make the process self-correcting and adaptive. In collaboration with Prof. Artur R. Stefankiewicz, we initially discovered a case where two orthogonal dynamic covalent reactions operate simultaneously in one-pot to yield cage compounds.(2-3) In this presentation, I will show how we built upon this concept and extended it toward the formation of bioactive cages,(4-5) and macromolecular assemblies such as dynamic covalent networks(6) and hierarchical fluorescent supramolecular polymers displaying a selective self-replicating growth.(7)

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MULTIFUNCTIONAL STIMULI-RESPONSIVE HYBRID MATERIALS BASED ON POLYOXOMETALATES

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Polyoxometalates (POMs) are versatile molecular metal-oxide clusters with tunable redox, optical, and electronic properties, making them attractive building blocks for the development of multifunctional responsive materials. [1-2] In particular, ionic hybridization strategies provide an effective route for combining the physicochemical properties of inorganic POM clusters with functional organic components within supramolecular architectures.

In this work, a family of ionic hybrid materials based on different polyoxometalate structures, including Anderson, Wells–Dawson, Keggin, and octamolybdate systems, was developed and systematically evaluated. Special attention was devoted to understanding how the POM architecture, the central metal, and the nature of the organic cation influence the final responsive behavior of the materials. Through this comparative approach, structure–property relationships governing chromic, redox, and photophysical responses were established.

Different viologen derivatives bearing distinct substituents and alkyl-chain lengths were incorporated as electroactive and chromogenic units, leading to donor–acceptor hybrid systems with reversible thermochromic and electrochromic behavior together with selective vapor responses toward ammonia and primary amines. The influence of the POM structure and the viologen substitution pattern on the intensity, reversibility, and sensitivity of these responses was systematically investigated.

In addition, the incorporation of transition metals and lanthanide ions enabled further modulation of the photophysical properties, producing emission quenching and dual-emission behavior in selected systems. Particularly interesting luminescent behavior was observed for chromium-containing Anderson-type hybrids, which exhibit ruby-like emission sensitive to external stimuli. Importantly, these optical properties were preserved to a significant extent after ionic post-functionalization, demonstrating the possibility of introducing additional responsive functionalities while maintaining the intrinsic photophysical behavior of the POM platform.

Overall, the results demonstrate the high potential of ionic POM-based hybrids as chemically programmable multifunctional materials in which luminescent, chromic, redox, and sensing properties can be rationally tuned through molecular and supramolecular design.

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AMBIPOLAR DONOR-ACCEPTOR 2D COVALENT ORGANIC FRAMEWORKS AS CATHODE MATERIAL FOR ALUMINUM ENERGY STORAGE DEVICE

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Lithium-ion batteries (LIBs) have become the dominant power source across various industries due to their superior energy density. However, the rising cost and limited availability of lithium resources pose significant challenges to the further development of LIBs, driving the search for alternative materials and more sustainable energy storage solutions.(1) Recently, aluminum-based ESS (Al-ESS) have garnered significant attention as a sustainable alternative for next-generation of ESS.(2-3) This interest stems from aluminum's high abundance, the use of non-flammable electrolytes, the high safety, low toxicity and outstanding theoretical volumetric capacity.(3-4) Therefore, the development of cathodes material that are able to host the sterically hindered aluminum ions (i.e. AlCl2+, AlCl2+, AlCl4-, and Al2Cl7) is very coveted (Figure 1).(3,) Among emerging materials, covalent organic frameworks (COFs) possess numerous advantages, such as presence of redox-active functional groups, defined pores structure, and high-surface area. However, the limited electrical conductivity of COFs makes essential the use of additives (such as carbon nanotubes) to increase the ions mass transport and electrical conductivity. In this study, we focused on developing a 2D-COF formed by donor and acceptor building blocks with a strong charge transfer character, big pore size and high surface area, avoiding the use of carbon nanotubes. We employed as an electron donor tetrakis(4-aminophenyl)-1,4-phenylenediamine (TPA) and as an electron acceptor naphthalendiimide dialdehyde (NDI-DA) as the building blocks to synthesize functional COF TPA-NDI. The COF shows a Kagome topology with a high surface area (924 m2/g) and well-defined pores with 1.6 nm and 3.4 nm size. Consequently, the COF TPA-NDI electrode achieves an unprecedent reported specific capacity of 270 mAh/g at a current density of 0.2 A/g, achieving a maximum energy density of 447 Wh/kg and a power density of 7 kW/kg. The Al-ESS shows more than 99% capacity retention after 5000 cycles at a current density of 5 A/g.(5)

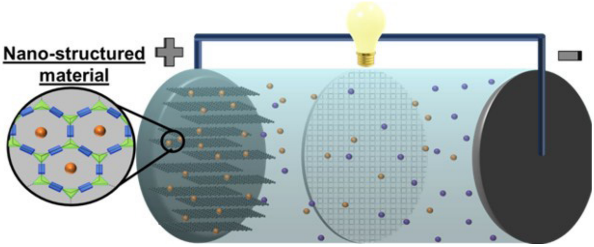

Figure 1. Scheme of an energy storage device

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PHOTOCHEMISTRY: TOWARDS THE SYNTHESIS OF NEW INNOVATIVE AND ANTIBACTERIAL BIOMATERIALS

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Nosocomial infections, contracted in hospitals and clinics, affect up to 750,000 people and cause more than 4,000 deaths each year in France. They also generate over €2 billion in annual healthcare costs. Many of these infections are caused by bacteria such as Escherichia coli, Staphylococcus aureus, or Pseudomonas aeruginosa. Repeated exposure to antibiotics has led these bacteria to develop resistance mechanisms, making infections harder to treat and highlighting the need for new therapies.

The synthesis of new antibacterial materials, among others, by photochemistry, from new monomers or photo-initiators from bio-resources, will be presented here while respecting the principles of green chemistry. The different strategies for obtaining these materials will be described in detail and concern:

- The synthesis of new photo-initiators (1, 2) from bio-resources and monitoring their reactivity by classical spectroscopic techniques such as transient absorption, electron paramagnetic resonance and infrared spectroscopy.
- The photochemical modification of polymeric substrates (3) using the "grafting-from" process under light irradiation.
- The synthesis of organic/inorganic (4) bio-based coatings (metallic or metallic oxides) under irradiation with bactericidal properties.
- The development of a new strategy to fight against bacteria: photodynamic inactivation of bacteria (5) using natural dyes that generate reactive oxygen species (ROS) under illumination.
- The development of new 3D printing and photoactive materials (5, 6) from bio-sourced photo-initiators.

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CYCLODEXTRIN-FORMULATED FERROCIFEN PENETRATES THE MOUSE BRAIN AND SIGNIFICANTLY IMPROVES SURVIVAL IN AN ORTHOTOPIC MODEL OF GLIOBLASTOMA

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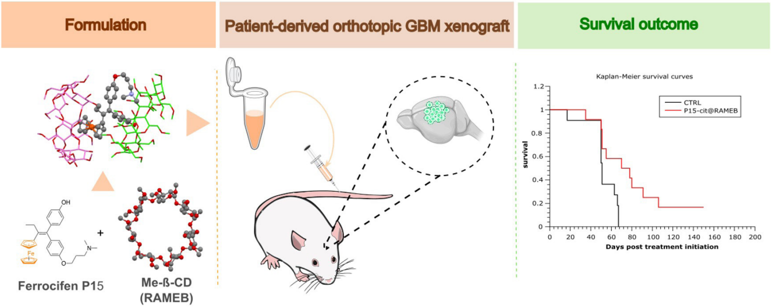
Glioblastoma (GBM) the most aggressive form of brain cancer, remains incurable despite heavy treatments including chemotherapy and radiotherapy. Therapeutic failures are in part related to the difficulty for active molecules to cross the blood brain barrier (BBB). Hence, the development of a suitable formulation is an essential step toward the in vivo translation of molecules having already demonstrated promising anticancer activity in vitro. In this talk, we will present the development of a formulation in randomly methylated b-cyclodextrin (RAMEB) of the lipophilic compound P15, a ferrocenyl analog of hydroxytamoxifen with broad antiproliferative activity on a panel of GBM cell lines [1]. We also found that inclusion of P15-cit, its citrate salt, is significantly more efficient. Actually, a solution of 5 mM of RAMEB is able to solubilize 1 mM of P15-cit but only 0.08 mM of P15. The inclusion complex P15-cit@RAMEB is characterized by a favorable stability constant in the order of 104 M-1 as determined from the phase solubility diagram. Extensive spectroscopic characterization showed that P15-cit@RAMEB exhibits a 2:1 host:guest ratio, with the ferrocenyl and one of the aromatic rings inserted in each cyclodextrin.



Pharmacokinetic analyses suggest a marked biodistribution of the complex in mice brain following iv administration (20 mg/kg). Importantly, we found a significantly improved survival of orthotopic GBM--bearing mice following iv administration of P15-cit@RAMEB at 20 mg/kg and complete rescue of 2 out of 12 mice. RNA sequencing analysis of treated mouse brains revealed that the treatment is associated with inhibition of pathways related to angiogenesis, metal ion homeostasis and calcium signaling.

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SWITCHABLE MOLECULAR TWEEZERS AS A MULTIFUNCTIONAL PLATFORM

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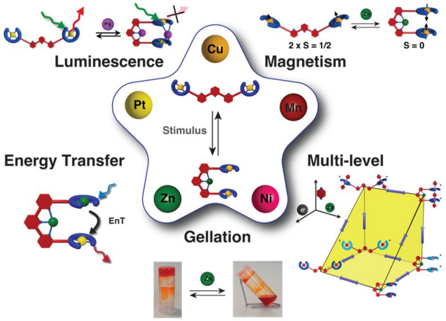
In recent years, artificial molecular machines have attracted considerable attention due to their ability to control motion at the molecular level. However, they are far from achieving the complexity of their natural counterparts and fully harnessing their mechanical motion to perform useful functions remains a challenge. We are interested in exploiting the dynamic interconversion between distinct states to modulate physical and chemical properties at the molecular scale.
We have developed a family of switchable molecular tweezers based on a terpyridine ligand functionalized with metal-salen complexes.[1] In their open state, the tweezers adopt a 'W'-shaped conformation, which can be reversibly switched by a coordination stimulus to a 'U'-shaped conformation that brings the two M-salen complexes into close proximity. This drastic change in distance resulted in the modulation of luminescence or magnetic properties by incorporating Pt(II) or Cu(II)-salen complexes respectively.[2] The modularity of our platform was further leveraged to integrate ion-triggered mechanical motion with the redox activity of Ni(II)-salen complexes, resulting in a remarkable six-level switch activated by three orthogonal stimuli.[3] More recently, we aimed to harness the structural reorganization of the tweezers to develop switchable organogels. A reversible sequential and time-controlled sol-gel transitions induced by the mechanical motion was achieved.[4]



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HYDROBORATION CATALYZED BY IONIC LIQUIDS AND SINGLE-ATOM CATALYSTS

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Transition Transition metal (TM) complexes still dominate as catalysts in hydroboration reactions. However, considering process sustainability, main-group element catalysts and organocatalysts have begun to play an increasingly important role over the last decade. Such systems often lead to different products compared to traditionally used TM catalysts, thereby opening new potential applications for organoboron compounds.(1-2)
Our research focuses on practical and highly selective methods for the synthesis of organoboron compounds via the hydroboration of olefins, alkynes, conjugated 1,3-diynes, carbonyl compounds, imines, and nitriles.(3–6) This communication will present new methods for the functionalization of these compounds using practical and straightforward catalytic systems based on ionic liquids and single-atom catalysts. We will demonstrate that the proper selection of readily available catalysts can significantly influence or even alter the regio- and stereoselectivity of the process.(3-6)

Acknowledgments:
Financial Support from the National Science Centre (Poland), no.UMO-2019/34/E/ST4/00068.

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STRUCTURE-PROPERTY RELATIONSHIPS IN CARBOHYDRATE-FUNCTIONALIZED FLUORINATED STYRENE COPOLYMERS: FROM CUAAC SYNTHESIS TO INTERFACIAL BEHAVIOR

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Fluorinated polymers are attractive materials owing to their unique thermal stability and surface properties.(1,2] Introducing polar functionalities into fluorinated polymer architectures offers opportunities to tailor their interfacial behavior while preserving the desirable characteristics of fluorinated backbones.

In this work, semi- and telechelic fluorinated styrene copolymers were synthesized via iodine transfer copolymerization (ITCo) of styrene and α-(trifluoromethyl)styrene.[3] Subsequent azidation and copper-catalyzed azide-alkyne cycloaddition (CuAAC)[4] with propargylated glucose and glucosamine derivatives afforded structurally defined carbohydrate-functionalized fluoropolymers.

The influence of polymer architecture, fluorine content, and carbohydrate functionality on material properties was investigated using spectroscopic, thermal, and surface analyses. Carbohydrate functionalization resulted in increased glass-transition temperatures while maintaining the high thermal stability characteristic of fluorinated polymers. Water contact angle measurements demonstrated that carbohydrate end groups modify surface wettability despite the presence of fluorinated segments.

In addition, selected conjugates were investigated at the air–water interface and transferred onto solid substrates for morphological characterization. The combined results demonstrate the utility of CuAAC-functionalized fluorinated copolymers as a versatile platform for exploring structure–property relationships in fluorinated polymer systems.

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PROTEASE-RESISTANT SALIVARY PEPTIDOMIMETICS ACTIVATED BY METAL IONS: A NEW STRATEGY AGAINST ORAL PATHOGENS

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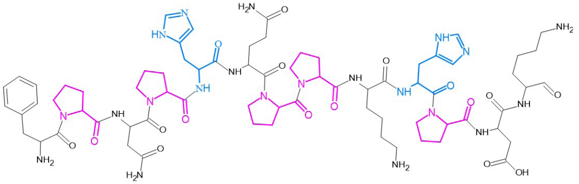
Salivary antimicrobial peptides and proteins, including MUC7, LL-37, histatins, and CCL28, are key components of oral innate immunity. However, their therapeutic application is limited by rapid proteolytic degradation.[1,2]

Herein, we present a strategy for designing protease-resistant salivary peptidomimetics with activity enhanced by metal-ion coordination. D-amino acid substitutions, retro and retro-inverso modifications (Fig. 1) improved enzymatic stability while preserving Cu(II) and Zn(II) binding abilities.



native sequence	FPNPHQPPKHPDK
2D-aa analogue	FPNPHQPPKhPDK
all D-aa analogue	fpnphqppkhpdk
retro analogue	KDPHKPPQHPNPF
retro-inverso analogue	kdphkppqhpnpf

Figure 1. Examples of peptidomimetics derived from MUC7 peptide fragment FPNPHQPPKHPDK.

Using MUC7-, LL-37- and histatin 5-derived fragments as model systems, we demonstrate that stereochemical modifications affect protonation equilibria, metal-binding modes, and complex stability, leading to enhanced antimicrobial and antifungal activity, broadened activity spectra, low cytotoxicity, and high resistance toward proteolysis. Particularly promising results were obtained for metal complexes of D-amino acid analogues active against S. mutans, S. sanguinis and Candida albicans.[3–5]

Overall, combining metal coordination with protease-resistant peptide engineering represents a promising strategy for developing new therapeutics against oral pathogens and biofilm-associated infections.

Acknowledgements

We thank the National Science Centre (grant UMO-2021/41/B/ST4/02654, J.W.) for financial support.

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RATIONAL DESIGN IN NANOMEDICINE: PHYSICOCHEMICAL AND MORPHOLOGICAL EVALUATION OF LIPID-BASED SMART DRUG DELIVERY SYSTEMS

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The rising global burden of cancer, with projections estimating 35 million new cases annually by 2050, necessitates a paradigm shift from conventional chemotherapy toward targeted therapies. Conventional anticancer drugs often lack selectivity, resulting in systemic toxicity and the development of multidrug resistance. This presentation highlights the critical importance of the rational design of Smart Drug Delivery Systems (SDDSs) to overcome these limitations.

The presentation outlines a five-step research cycle, beginning with the design and synthesis of thermoresponsive polymeric carriers via RAFT/MADIX polymerization and culminating in their comprehensive physicochemical evaluation. By incorporating specific moieties, such as cholesterol or glycerides, we aim to modulate drug-loading capacity and release profiles. A central aspect of this work is the physicochemical characterization of the obtained systems using a broad analytical arsenal: from structural and purity analyses (NMR, FT-IR) and molecular weight determination (SEC), to thermal stability assessment (TGA/DSC) and advanced morphological characterization (DLS, TEM).

Particular emphasis is placed on systematically investigating the relationships between the physicochemical properties of the carriers (including particle size, morphology (TEM/DLS), and surface charge (zeta potential)) and their biological performance, such as cytotoxicity and hemolytic activity. Due to the large number of interacting variables, establishing direct correlations remains challenging. Our research underscores that success in nanomedicine depends not only on synthesis itself, but also on deciphering the complex “Structure-Encapsulation-Activity” relationships. We emphasize that the conscious design of SDDSs must be an iterative process of evaluation and optimization to ensure the stability, specificity, and biological efficacy of these systems in complex biological environments.

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MULTICATALYTIC ACCESS TO RENEWABLE POLY(SILYL ETHER)S WITH TUNABLE PROPERTIES

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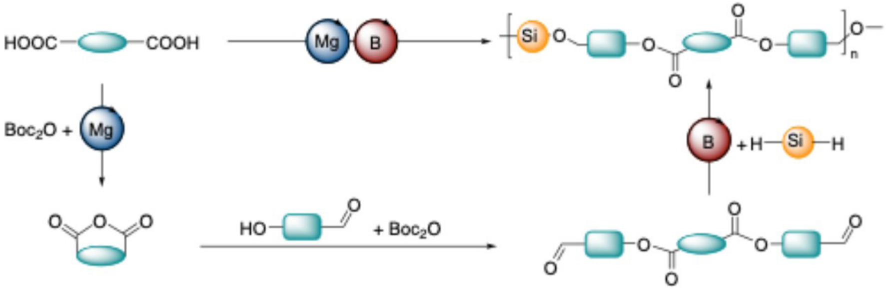

Figure 1. One-pot multicatalytic synthesis of poly(silyl ether)s from renewable feedstocks.

The global reliance on petroleum-based polymers presents urgent sustainability challenges. Addressing this issue, we present a novel one-pot multicatalytic strategy for synthesizing partially bio-based poly(silyl ether)s with tunable properties.

This method combines magnesium-catalyzed esterification of bio-based diacids and alcohols with borane-catalyzed hydrosilylation under mild conditions. This approach enables direct incorporation of ester functionalities into the polymer backbone, affording high-molecular-weight poly(silyl ether)s with tunable architectures and thermal profiles. The method demonstrates excellent catalyst compatibility and scalability, significantly reducing purification steps while broadening monomer scope.

Beyond thermal robustness, the resulting materials exhibit remarkable mechanical performance. Preliminary tensile tests revealed distinctive deformation behavior, with certain polymers achieving extraordinary extensibility (elongation at break >3800%) and high energy absorption, attributed to the synergistic interplay between flexible siloxane segments and dynamic silyl ether linkages.

Degradation studies confirm efficient chemical recycling, underscoring the potential of this one-pot process to deliver sustainable, high-performance polymers with customizable properties for advanced applications.

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CONTROLLED SYNTHESIS OF BRANCHED POLYMERIC EXCIPIENTS FOR MODIFIED DRUG RELEASE APPLICATIONS

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Modified-release oral dosage forms increasingly rely on advanced polymeric excipients that control the rate, timing, and site of drug release within the gastrointestinal tract [1, 2]. A key requirement for pharmaceutical excipients is the production of highly reproducible, structurally uniform materials, as even minor variations in polymer composition can affect drug absorption and bioavailability. Additionally, currently available pH-responsive pharmaceutical excipients are predominantly linear polymers, such as commercially available Eudragit® systems. In contrast, branched architectures could offer several advantages, including lower viscosity, higher functional-group density, and therefore improved packing efficiency of active pharmaceutical ingredients [3].

To address these issues, atom transfer radical polymerization (ATRP) was employed to synthesize well-defined star-like polymers with a sucrose core and (meth)acrylate copolymer arms containing both ionic and non-ionic monomer units, characterized by low dispersity and controlled topology.

The developed systems are pH-responsive materials for delayed and sustained drug delivery. Ionic functionalities, including acrylic acid and tertiary amine groups, govern polymer swelling, matrix interactions, and pH-triggered release behavior, whereas non-ionic components improve solubility, biocompatibility, and physicochemical stability. We assume that this type of polymer, with multiple chains, may reduce excipient content and tablet mass while improving patient comfort and lowering manufacturing costs. The synthesized polymers are systematically investigated with respect to their composition, ionic content, and pH-dependent release profiles of model active substances. Overall, this approach demonstrates the potential of precisely engineered branched polymeric excipients as next-generation materials for modified oral drug delivery systems.

Acknowledgments

All the authors acknowledge financial support from the National Centre for Research and Development as part of the LIDER XIV project (no. LIDER14/0058/2023).

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STRATEGIES FOR ENHANCING PHOTOCATALYTIC HYDROGEN EVOLUTION OVER GRAPHITIC CARBON NITRIDE-BASED MATERIALS

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Photocatalytic hydrogen production driven by solar energy is widely regarded as one of the most promising routes toward sustainable fuel generation. Among visible-light-responsive photocatalysts, graphitic carbon nitride (g-C3N4) has attracted considerable attention owing to its suitable band structure, chemical stability, and metal-free nature. However, its practical application remains limited by inefficient charge separation and the rapid recombination of photogenerated charge carriers.

This work presents selected strategies for enhancing the photocatalytic performance of g-C3N4-based materials toward hydrogen evolution under simulated solar irradiation. The investigated approaches include exfoliation, thermal treatment, and coupling with TiO2-based structures. Particular attention is given to the influence of these modifications on the physicochemical properties of the resulting materials, especially concerning light absorption, charge carrier dynamics, and interfacial charge transfer.

The obtained results demonstrate that rational structural and electronic engineering of g-C3N4-based photocatalysts can significantly improve hydrogen evolution performance by facilitating charge separation and suppressing electron-hole recombination. The findings provide valuable insight into the design of efficient photocatalytic systems for solar-driven hydrogen production.

APPLICATION OF PYRROLO-(3,4-C)-PYRROLE-1,4-DIONE DERIVATIVES IN ORGANIC ELECTRONICS

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Derivatives of pyrrolo[3,4-c]pyrrole-1,4-dione constitute an important class of organic compounds exhibiting a wide range of optical and electrochemical properties, which makes them attractive for applications in materials chemistry. Depending on the number and type of substituents, both symmetric and asymmetric derivatives can be obtained, with the latter offering particularly promising opportunities for fine-tuning electronic and optical properties.

In this work, an unsymmetrical pyrrolo[3,4-c]pyrrole-1,4-dione derivative was synthesized via the Suzuki–Miyaura coupling reaction [1]. Electrochemical characterization was performed using voltammetry, which revealed a two-step oxidation–reduction process. The obtained compound exhibits photosensitivity, as well as electrochromic and solvatochromic behavior.

These properties indicate potential applications of the studied system in optoelectronic devices and advanced functional materials. Electrochromic behavior makes such compounds suitable for use in dynamic military camouflage, smart windows, and sunglasses [2,3], while solvatochromism opens possibilities for the development of sensitive environmental sensors and other optoelectronic applications [4].

Acknowledgments
Funding from the NAWA PROM Programme 2025 is gratefully acknowledged.

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BETWEEN NANOFLOWERS AND CARBON NANOTUBES. A STORY ON REDUCING THE VISCOSITY OF IONANOFLUIDS

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Ionanofluids (INFs) are defined as a stable dispersion of nanoparticles in ionic liquids (ILs). The addition of ultra–long in–house 16h multiwalled carbon nanotubes (MWCNTs, 780 μm length, 60 – 80 nm diameter) to ILs results in a remarkable increase in thermal conductivity, marking their potential as novel heat transfer fluids (HTFs). Alas, it is hindered by an extreme increase in viscosity of INFs, by orders of magnitude, with the addition of in–house 16h MWCNTs, effectively rendering them unavailable for commercial application. Thus, it is imperative to seek a method to reduce the viscosity of INFs.

In this work, the reduction of viscosity of INFs is realized twofold. Nanoflowers WS_2 or Bi_2S_3 are applied along with in–house 16h MWCNTs in INFs to obtain reduced viscosity. The addition of 0.50 wt.% of WS_2 to 1-ethyl-3-methylimidazolium thiocyanate ([EMIm][SCN]) + 1.0 wt.% in–house 16h MWCNTs results in reduction of viscosity by 16%, at 298.15 K, 100 s^{-1}, while maintaining high increase in thermal conductivity of 29% at 298.2 K. On the other hand, functionalized MWCNT-COOH (length < 500 μm, diameter ≈ 50 nm, COOH 1.0 $mmol \cdot g^{-1}$, OH 0.4 $mmol \cdot g^{-1}$) and MWCNT-OH (length 780 μm, diameter 60 – 80 nm, OH 3.0 $mmol \cdot g^{-1}$) are dispersed in [EMIm][SCN] to form hybrid iononafluids (hINFs). [EMIm][SCN] + 1.5 wt.% MWCNT-COOH + 1.5 wt.% MWCNT-OH exhibits an increase in viscosity of only 86% (298.15 K, 100 s^{-1}), while maintaining a high thermal conductivity increase of 66% (298.2 K).

The viscosity of INFs can be effectively reduced by adding nanoflowers to INFs with in–house 16h MWCNTs or by functionalizing in–house 16h MWCNTs, paving the way for the potential commercialization of INFs.

This work was financially supported by the National Science Centre (Poland) Grant No.2021/41/B/ST5/00892.

POLYMER DATA STORAGE – CAN SYNTHETIC, ABIOTIC POLYMERS COMPETE WITH DNA?

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Polymer data storage solutions are of growing interest due to an ever-pressing global demand for recording larger and larger volumes of information [1]. At its simplest, the technology boils down to assigning binary values to individual monomeric units and then synthesizing a polymer with a strictly defined sequence, which corresponds to a string of code (= information) we intend to store. The data can then be read by sequencing the polymer, i.e. determining the exact order of monomeric units.

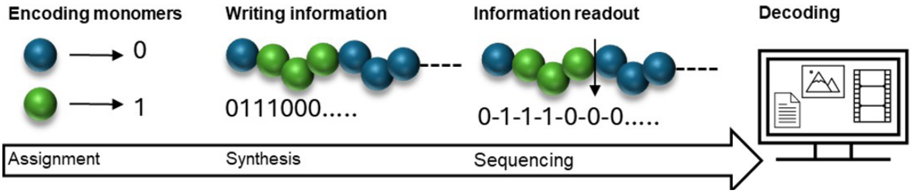

Fig.1 A simple representation of polymer data storage [5].

In contrast to DNA, abiotic, sequence-defined polymers lack an established and efficient synthesis and sequencing methodology, with the former being often constraint to short oligomers and latter essentially requiring the use of tandem mass spectrometry – an expensive, complicated and destructive analysis method [1,2,3,4]. However, data storage in abiotic polymers offers other benefits, including potentially higher information density, longer shelf-life and reduced cost – the last one being especially significant as cost is currently the limiting factor, preventing DNA data storage from being widely implemented [1,2,3,4].
Our team is currently working on new "digital" abiotic polymers with a simple, dedicated sequencing methodology. In regard to our research we would like to present an analysis comparing the performance of DNA and abiotic polymers for data storage, based on existing evidence. Parameters such as theoretical information density, synthesis and sequencing speed and cost are contrasted and can help form predictions as to the future development, implementation and weak points of polymer data storage technologies.

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TEMPLATE SYNTHESIS OF NON-RIGID LANTHANUM(III) MACROCYCLE AND ITS INTERACTIONS WITH GQUADRUPLEXES AND HUMAN SERUM ALBUMIN

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Cancer remains the second most common cause of death worldwide [1]. New compounds that could be applied in the therapy of this disease are still sought after. One of the approaches proposed in the literature is the selective stabilization of G-quadruplexes in particular genome regions of cancer cells.
The G-quadruplex (Fig. 1) is a non-canonical four-stranded secondary structure of nucleic acids formed by guanine-rich sequences. It consists of several guanine tetrads stacked one on another [3]. In turn, human serum albumin is commonly used as a model of transport protein [4].
The presentation will concern the synthesis and characterization of a macrocyclic coordination compound obtained from lanthanum nitrate, 2,6-pyridinedicarboxaldehyde and 1,2-ethylenediamine. The interaction studies of the complex with Pu22 (a fragment of the c-MYC oncogene promoter region) and hTERT (a fragment of the gene encoding the telomerase protein subunit) sequences, which form Gquadruplexes in the experimental conditions, will be presented as well. A model of double stranded DNA of no biological relevance was used as a control. The interaction studies involved also human serum albumin. The spectroscopic measurements are the first step of the potential drug's applicability evaluation.

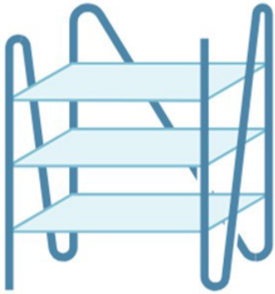

Figure 1. Schematic representation of a parallel-type G-quadruplex.

Acknowledgement
The research was financed by the National Science Centre of Poland, grant number: UMO-2022/44/C/ST4/00017 (E. W.-S.).

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AZAMACROCYCLES AS INNOVATIVE INITIATOR-CATALYST PLATFORMS IN ROP-NCA POLYMERIZATION

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Ring-opening polymerization of amino acid N-carboxyanhydrides (ROP-NCA) is a key method for synthesizing polypeptides (1), yet conventional initiator-catalyst (IniCat) systems often suffer from limited mass control and low initiation efficiency (2). In this work, a series of azamacrocyclic compounds were employed as novel Ini(Cat) platforms for ROP-NCA polymerization (Fig. 1). This methodology enables the synthesis of a new class of hybrid materials, specifically azamacrocycle-polypeptide conjugates. The developed systems yield polymers with narrow molar mass dispersity. Furthermore, the polymerization reactions can be successfully conducted under open-air conditions.

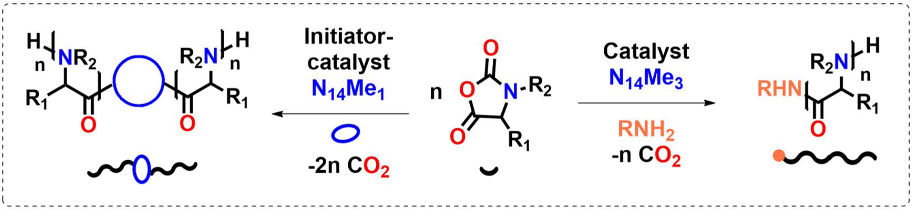

Figure 1. Scheme of ROP-NCA polymerization using the obtained Ini(Cat) systems: N14Me1 and N14Me3.

Acknowledgments
Funding from the NAWA PROM Programme 2025, the National Science Centre, Poland (SONATA BIS no. 2025/58/E/ST5/00124) and the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreements no. 210891528 is gratefully acknowledged.

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PHEROMONE SYNTHESIS UTILISING STEREORETENTIVE OLEFIN METATHESIS CATALYSTS

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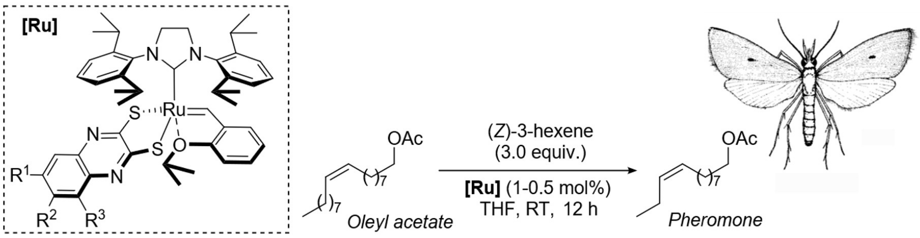
Agriculture, as a key sector of the global economy, requires continuous innovation and improvement. The widespread use of conventional insecticides adversely affects not only flora and fauna but also human health. Increasing environmental awareness has therefore stimulated the development of more sustainable and environmentally friendly crop protection strategies.

This work addresses the synthesis of the sex pheromone of Lobesia botrana (European grapevine moth), a major pest of grape crops. As pheromones are bioactive compounds, precise control over the geometry of the conjugated double bonds is crucial for their biological activity.

We have developed a novel synthetic pathway affording the target compound with excellent isomeric purity (>99%). The key step involves a cross-metathesis reaction employing new stereoretentive catalysts based on a quinoxaline-2,3-dithiolate ligand framework. The use of stereoretentive olefin metathesis enables efficient preservation of alkene geometry, providing a highly selective route to the desired pheromone.

Furthermore, this catalytic strategy was successfully extended to the synthesis of pheromones of other agriculturally important pests, including Scirpophaga incertulas (Yellow Rice Stemborer), as well as a precursor for pheromones of Helicoverpa zea (Corn earworm) and Spodoptera frugiperda (Fall armyworm). In these cases, excellent isomeric purity (>99%) was also achieved. Notably, oleic acid and its derivatives were used as substrates, highlighting the potential of this approach for more sustainable pheromone production.[1,2]



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MONITORING OF LUMINESCENTLY LABELLED NANOPET AND NANOPMMA AMONGST HUMAN GUT MICROORGANISMS

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Plastic objects break down into nanoplastics and can easily enter the human digestive system [1]. This raises questions about their impact on microorganisms naturally present in the human gut. Distinguishing nanoplastics from biological material is a challenge currently facing science. Plastic and biological material are organic substances, making them difficult to distinguish using traditional methods. In our research, we used upconversion nanoparticles (UCNPs) to label nanoplastics. These exhibit a phenomenon known as upconversion – they absorb radiation of lower energy and emit radiation of higher energy [2]. Biological materials do not exhibit this property, making them possible to distinguish from nanoplastics.

We have developed methods for the preparation of aqueous colloids of UCNP-labelled nanoPET (poly(ethylene terephthalate)) [3] and nanoPMMA (poly(methyl methacrylate)). Both methods involve dissolving plastic granules in a suitable solvent, mixing the resulting solution with an UCNP colloid, and then precipitating the labelled nanoplastic in water. The resulting nanoplastic colloids were purified using membrane dialysis. Infrared spectroscopy confirmed the effectiveness of the purification process, and dynamic light scattering analysis determined the size of nanoplastics (approx. 120 nm). Spectroscopic analysis and TEM imaging confirmed the presence of UCNPs in the nanoplastics.

Bacteria and fungi naturally inhabiting the human gut were exposed to nanoplastics and subsequently imaged using a fluorescence microscope. By utilising the ability of microorganisms to autofluoresce under UV light, and the ability of UCNPs in plastic to emit light under NIR radiation, we visualised the nanoplastics amongst human gut microorganisms. The studies demonstrated the tendency of nanoPET and nanoPMMA to adhere to the microorganism surface.

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ENGINEERING COLLAGEN MIMETICS FROM THE INSIDE OUT: BEYOND PROLINE CONSTRAINTS, SUPRAMOLECULAR TRIPLE-HELIX ASSEMBLY, AND TISSUE ENGINEERING PROSPECTS

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Native collagen-based materials are biomedically valuable, but source variability and limited molecular control have motivated chemically defined collagen-like peptides (CLPs). Their translational use still requires strategies that stabilize the triple helix physiologically. A model study of 2-azabicyclo[2.1.1]hexane-based proline analogues showed methano-bridging constrains pyrrolidine ring pucker and links it with prolyl amide trans/cis preferences, suggesting implications for collagen stability [1]. Here, Xaa-position proline was replaced with a chiral 2-azabicycloalkane residue (azBca). Related azBca derivatives were non-cytotoxic [2]. The peptide Ac-(Gly-Pro-Hyp)5-Gly-azBca-Hyp-(Gly-Pro-Hyp)3-Gly-NH2 was synthesized by Fmoc/tBu SPPS on Rink amide resin and compared with the proline reference. Linear strands and TREN-based trimers assessed architectural effects on helix formation [3].
Triple-helix assembly and unfolding were analysed by CD spectroscopy in PBS (10 mM, pH 7.4) after equilibration at 4 °C. Heating from 4 to 70 °C at 1 °C min^{-1} was monitored at 225 nm, and apparent melting temperatures (T□) were determined from extrema of dAbs/dT. azBca increased T□ from 41.9 °C for the proline reference to 63.9 °C, giving >22 °C stabilization. At 1.0 mg mL^{-1}, the CD minimum shifted toward 205–210 nm, suggesting supramolecular ordering; similar features have been linked to collagen fibrillogenesis, although CD alone does not prove fiber formation [4].
These findings highlight azBca-stabilized CLP triple helices as promising ECM-mimetic building blocks for future hydrogel-based tissue engineering.

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LOVE, BUT LONGER: CONFORMATIONALLY LOCKED OXYTOCIN ANALOGUES

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Oxytocin is a clinically established cyclic nonapeptide whose therapeutic utility is shaped by its short in vivo half-life, rapid enzymatic degradation, and conformational flexibility of the backbone [1]. Beyond obstetric applications, it has emerged as a central modulator of social cognition, anxiety, and emotional memory, opening therapeutic horizons in autism spectrum disorder, PTSD, and addiction. While the largest randomized trial of intranasal oxytocin in autism did not reach its primary endpoint, several factors likely contributed to the outcome. The peptide's intrinsic limitations restricted brain bioavailability, rapid degradation, and insufficient receptor selectivity remain key obstacles for any oxytocin-based therapy [2]. This reinforces the case for next-generation analogues with enhanced stability and selectivity over the related vasopressin receptors (V1a, V1b, V2).

Decades of effort have produced numerous oxytocin analogues, establishing a rich foundation but revealing a persistent trade-off between stability and selectivity. The Pro7-containing C-terminal tripeptide tail acts as a conformational gatekeeper modulating receptor interaction and enzymatic recognition; position 7 has been targeted with restricted residues that strongly influence activity [3]. Proline mimetics therefore offer a rational route to control backbone geometry while preserving the core pharmacophore.

Inspired by bicyclic proline analogues in collagen-mimetic peptides [4], we present an oxytocin analogue in which Pro7 is replaced by 2-azabicyclo[2.2.1]heptane-3-carboxylic acid (azBca), locking the backbone into a rigid conformation. The Fmoc-protected building block was synthesized, characterized, and incorporated into oxytocin by solid-phase peptide synthesis, affording the target azBca7-oxytocin. This establishes a platform for systematic SAR studies and the rational redesign of an old peptide drug into metabolically stable, receptor-selective therapeutics.

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METAL-DEPENDENT ELECTROCHROMISM AND ELECTROFLUOROCHROMISM IN TETRAPHENYLETHYLENE-BASED SALEN COMPLEXES

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Tetraphenylethylene (TPE)-based coordination compounds are attractive candidates for optoelectronic applications due to their aggregation-induced emission properties and tunable redox behavior [1–3]. In this presentation I will show a newly synthesized TPE-functionalized salen ligand and its Cu(II), Zn(II), and Ni(II) complexes. The complexes were obtained via template condensation reactions in the presence of appropriate metal salts, aldehyde, as well as ethylenediamine, and characterized using HR-ESI-MS, FT-IR, XPS, and single-crystal X-ray diffraction analysis. The crystal structure of the Cu(II) complex confirmed a square-planar coordination geometry typical for salen systems and Cu(II) ions.

Photophysical investigations demonstrate a strong influence of the coordinated metal ion on the emissive behavior of the complexes. The Cu(II) and Ni(II) complexes show efficient fluorescence quenching due to the presence of open-shell metal centers promoting non-radiative deactivation pathways. The Zn(II) complex additionally displays clear aggregation-induced enhanced emission (AIEE) behavior in THF/hexane mixtures, where the fluorescence quantum yield increased from 14% in pure THF to 51% in the aggregated state.

Electrochemical studies reveal metal-dependent redox processes. The Zn(II) and Ni(II) complexes undergo predominantly ligand-centered oxidation, while the Cu(II) derivative exhibits both ligand- and metal-centered redox activity. Spectroelectrochemical measurements confirmed distinct electrochromic responses accompanied by the formation of new absorption bands in the visible and near-infrared regions upon oxidation [4]. Notably, the Zn(II) complex demonstrates reversible electrofluorochromic behavior manifested by gradual fluorescence quenching under applied positive potentials. These findings highlight the potential of TPE-functionalized salen complexes as multifunctional electroactive materials with tunable optical and redox properties.

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MIMICKING LPMO'S ACTIVITY USING CU2+ SYNZYMES AND METALLOPEPTIDES FOR BIOMASS VALORIZATION

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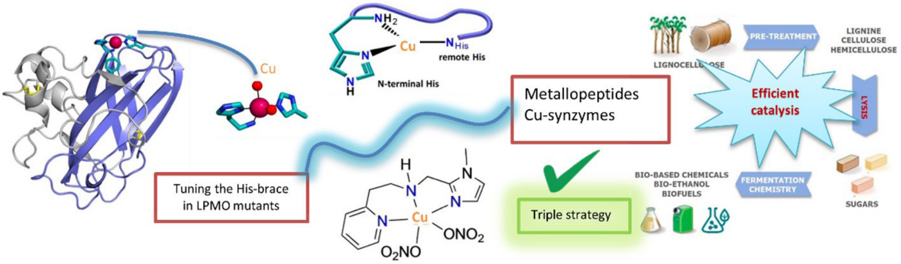
Biomass represents a sustainable alternative to petroleum-based resources, yet the efficient depolymerization of polysaccharides such as cellulose and chitin remains a major challenge (1). Lytic Polysaccharide Monooxygenases (LPMOs) address this limitation by catalyzing C–H bond hydroxylation at glycosidic linkages through a mononuclear copper active site coordinated by a histidine brace (3,4). However, the precise nature of the copper-oxygen catalytic intermediate is still under debate (2). Thus, we are investigating LPMOs mutants modified in their coordination sphere on the copper center, moving then the attention to smaller compounds aimed to have a mimicking activity, such as metallopeptides and Cu-complexes made with organic ligands (5). These two kinds of compounds can be also tuned to turn the effect of the second coordination sphere into the activity. In progress studies integrate synthetic chemistry, spectroscopic techniques, X ray crystallography, electrochemical methods and activity assays on simple and complex polysaccaride substrates. Moreover, a mechanistic investigation carried out by DFT method and synthetical intermediate trapping will potentially clarify the real nature of the catalytic pathway. Last but not the least, grafting of active synzymes on molecular supports with cellulose substrate affinity will allow to make new bionanomaterials coupled with luminescent probes, moving towards a more efficient biomass valorisation through eterogeneous catalysis.



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TRANSITIONING TOWARD FIVE STATE ELECTROCHROMIC SYSTEM IN NAPHTHALENE DIIMIDE BASED MATERIALS

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Naphthalene diimides (NDIs) represent a versatile class of conjugated, electron-deficient molecules characterized by high thermal stability and exceptional electron-transport properties [1]. While their utility in organic electronics and photovoltaics is well-established [2], their potential for precision-tuned optoelectronic applications, particularly in multi-state electrochromism continues to be a focal point of materials research [3].

In this work, we report the synthesis and characterization of three novel unsymmetrical NDI derivatives. By employing multi-step synthetic procedures, we systematically varied the aromatic N-substituents to investigate their influence on the molecules electrochemical and optical profiles. Our results demonstrate that the electronic nature of these substituents plays a critical role in modulating the HOMO-LUMO energy gap and the resulting charge-transfer characteristics.

Electrochemical and spectroelectrochemical investigations reveal that these derivatives exhibit highly tunable electrochromic behavior, with the number of accessible color states being directly dependent on the N-substituent. These transitions correspond to the reversible formation of radical anions (NDI•-), dianions (NDI2-), and oxidized species, featuring well-defined absorption bands that span the visible and near-infrared regions [4]. These findings highlight the effectiveness of unsymmetrical functionalization as a strategy for designing high-performance NDI-based materials, offering a path toward advanced electrochromic devices with precise, multi-state color control.

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STEREOCONTROLLED SYNTHESIS OF FLUORINATED A-HYDROXY- AND A-AMINOPHOSPHONATES

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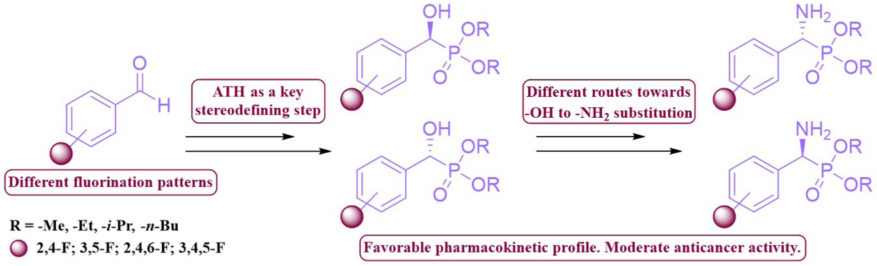
Fluorinated α-hydroxy- and α-aminophosphonates represent valuable phosphorus-containing analogues of
α-amino acids with increasing relevance in medicinal chemistry [1]. We describe the development of a stereocontrolled synthetic strategy enabling efficient access to fluorinated phenylglycine derivatives in high enantiomeric purity.
The sequence begins with a Pudovik reaction furnishing racemic α-hydroxyphosphonates, followed by oxidation to α-ketophosphonates (Scheme). Catalytic asymmetric transfer hydrogenation constitutes the key stereodefining transformation, affording enantioenriched α-hydroxyphosphonates in excellent enantiomeric excess [2, 3]. Subsequent functional group modification enabled conversion to the corresponding α-aminophosphonates, demonstrating the synthetic flexibility of the developed platform.
All compounds were comprehensively characterized by NMR spectroscopy (^{1}H, ^{13}C, ^{19}F, ^{31}P), and enantiomeric excess was determined by HPLC. In silico ADME analysis revealed favorable pharmacokinetic parameters, while preliminary anticancer activity studies indicated moderate activity. The presented approach provides a versatile platform for the stereoselective synthesis of biologically relevant fluorinated phosphonates.



Scheme. Synthetic approach to the title compounds.

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EXPLORING LIGNIN-DERIVED ELECTROSPUN CARBON FIBERS FOR ORR/OER ELECTROCATALYSTS AND ZINC-AIR BATTERIES

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Lignin is a highly promising renewable precursor, yet its conversion into useful fibrous materials remains challenging. One possible application is electrospun fibrous materials intended as carbon-based gas diffusion electrodes for ORR/OER catalyst architectures in zinc-air energy systems.
The present study examines how precursor purification, solvent choice, and spinning strategy affect process stability and fiber quality. A newly identified green solvent enabled highly efficient Kraft lignin fractionation, improved solution processability and reduced limitations related to solution conductivity that initially hindered electrospinning. In addition to dope optimization, the electrospinning process itself was refined. Nearly 100% lignin fibers were produced by co-axial electrospinning, which overcame needle clogging in highly concentrated lignin solutions and enabled stable fiber formation. Several co-axial configurations were tested, including a core-sheath approach designed to address and improve mechanical flexibility and stability of lignin-rich fibers, which exhibit intrinsic brittleness.
The study also highlights thermal treatment as a critical next step, since lignin-based fibers may undergo softening or structural changes during heating. Overall, the results establish a practical and adaptable pathway for lignin-based fiber processing while defining the key variables that must be refined before moving toward carbonization and catalytic functionalization.

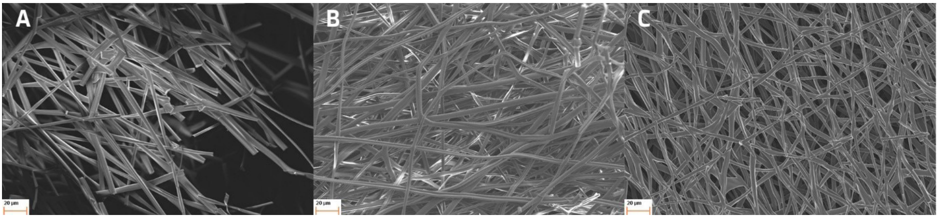

Figure 1. SEM images of lignin-rich fibers: (A) as electrospun, (B) thermally stabilized and (C) carbonized.

Acknowledgements
This project has received funding from the European Union’s EU Framework Programme for Research and Innovation Europe Horizon (Grant Agreement No 101120311)

ADVANCED HYBRID MATERIALS FOR SUSTAINABLE ELECTROCHEMICAL ENERGY STORAGE

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The growing demand for electricity, driven by rapid development in the industrial and technological sectors - including the increasingly widespread use of electronic devices, electric vehicles, and air conditioning systems [1] - is leading to an alarming rise in energy consumption. According to data from the International Energy Agency (IEA), global electricity consumption has increased by 3.5% over the past decade, reaching over 22,000 TWh in 2018, with production already exceeding 25,000 TWh [2]. Furthermore, an analysis of the reserves-to-production (R/P) ratio [3] indicates that the availability of fossil fuels is limited in time - at current consumption levels, global oil reserves will last only about 50 years. Therefore, it is crucial to develop systems capable of storing generated energy and releasing it when needed. Thanks to the synergy between the redox-active properties of Polyoxometalates (POM) and the conductive, porous nature of Covalent Organic Frameworks (COF), materials are created that serve as highly efficient cathode components in devices such as supercapacitors, which have become the most promising energy storage devices due to their unique properties (primarily safety, high power density, the ability to charge and discharge rapidly, and extended cycle life) [4]. The project involves the design, synthesis - using several different methods in order to ultimately select the most effective one, and analysis of hybrids under real conditions with regard to specific surface area and its correlation with electrochemical test results.

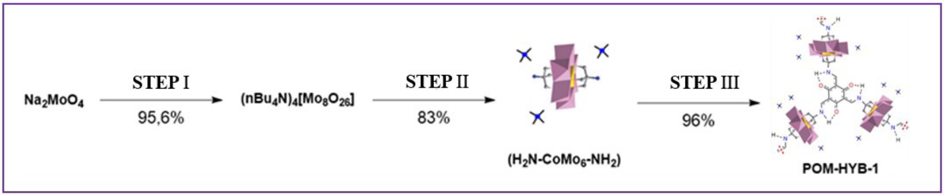

Figure 1: A simplified diagram of the synthetic methodology leading to the synthesis of the POM-HYB-1 hybrid (Preliminary results)

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PORPHYRIN-BASED COVALENT ORGANIC FRAMEWORKS (COFS) FOR ENERGY STORAGE: SYNTHESIS AND APPLICATIONS

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The growing demand for electronic devices and electric vehicles has increased interest in developing sustainable and cost-effective alternatives to lithium-ion batteries. Among them, aluminum-based energy storage systems (Al-ESSs) are promising due to the low cost, abundance, and safety of aluminum.[1-3] However, the low charge transport and noncompetitive cycling stability maked the development of tailored new materials crucial for the advancement of the field. In this constest, 2D covalent organic frameworks (2D-COFs) are a primising material for this application for high surface area, porosity and rich in redox-active groups.[4] In this work, we report the synthesis of novel 2D covalent organic frameworks (2D-COFs) based on metalloporphyrins and naphthalene diimide (NDI) units for Al-ESS applications. The COFs were prepared by combining tetrakis(4-aminophenyl)porphyrins (M-TAPP) containing different metal ions (Zn2+, Ni2+, Cu2+) with an NDI monomer. The ordered porous structure and tunable redox-active metal centers are expected to improve ion transport, conductivity, and cycling stability. The obtained materials were characterized by SEM, FT-IR, XPS, PXRD, and BET analysis, while their electrochemical properties were evaluated by cyclic voltammetry, galvanostatic charge-discharge, and impedance spectroscopy. The electrochemical performance strongly depended on the metal center: the metal-free porphyrin COF delivered a capacity of ~148 mAh g-1, whereas Zn incorporation increased the capacity up to ~280 mAh g-1. These results demonstrate the potential of metaloporphyrin-based 2D-COFs as cathode materials for Al-ESSs and highlight the key role of the metal center in tuning their energy-storage performance.

Figure 1. Schematic representation of the synthesis of the proposed COFs.

Acknowledgments
Funding from the NAWA PROM Programme 2025 is gratefully acknowledged

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THE SEARCH FOR NEW ARYLSULFONAMIDE DERIVATIVES - A RELATIONSHIP BETWEEN THEIR CHEMICAL STRUCTURE AND BIOLOGICAL ACTIVITY

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Sulfonamides, as synthetic pharmaceuticals, can be modified as needed, thereby influencing their interactions with biochemical targets and, consequently, altering biological activity [1].
The studies presented aim to determine the structure-activity relationships of aryl sulfonamide derivatives differing in the presence of various polycyclic aromatic hydrocarbons. The flat, relatively rigid structure of these compounds, combined with their hydrophobicity and extensive delocalized π-electron systems, indicates their potential for π-π interactions with DNA base pairs [2]. In addition to chemical synthesis, the obtained compounds were comprehensively characterized to assess their interactions with nucleic acids. Analyses were performed using spectroscopic methods and the switchSense technique, enabling assessment of both the nature and dynamics of the nucleic acid-binding process. The presented studies were supplemented with analysis of physicochemical properties and biological tests [3]. The results indicate that the sulfonamides studied might be promising biological ligands, capable of effective interaction with DNA.

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BIOLOGICAL ACTIVITY OF PHENANTHROLINE SULFONAMIDE AND ITS RH(III) AND IR(III) COORDINATION COMPOUNDS - STRUCTURE-ACTIVITY RELATIONSHIP ANALYSIS

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The aim of this study is to evaluate the biological activity of new coordination compounds of d-block metal ions containing a sulfonamide ligand. The growing interest in metal coordination compounds stems from the fact that complexation significantly alters the property profile of the ligands, thus, in many cases, leading to significant improvements in their biological activity and selectivity [1, 2].

The new sulfonamide ligand with a phenanthroline moiety was used to obtain two coordination compounds with Rh(III) and Ir(III) ions. Characterization of these compounds began with determining, among other things, the logP partition coefficient to assess the compound's lipophilicity [3]. The potential of these compounds as potential carbonic anhydrase inhibitors and their ability to interact with DNA were also examined, providing a basis for assessing their biological activity and their subsequent therapeutic use. Preliminary in vitro cytotoxicity studies (IC50) were also performed on a variety of cancer cells [4].

The obtained results confirm that complexation is an effective tool for modulating biological activity, opening up new perspectives for the design of compounds with increased efficacy.

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DESIGN, AI-SUPPORTED FLOW SYNTHESIS, AND APPLICATIONS OF MINIPROTEINS

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Miniproteins bridge the gap between peptides and proteins by combining a stable tertiary structure with the feasibility of chemical synthesis [1]. Their well-defined three-dimensional geometry makes them attractive scaffolds for developing molecules with advanced biological and catalytic functions [2]. Recent progress in computational protein design has greatly expanded the accessible structural space, enabling the creation of miniproteins with virtually any desired geometry.

In this contribution, an integrated three-stage workflow for miniprotein development will be presented. First, new miniproteins are designed de novo using the FastDesign algorithm within the Rosetta software suite. Conformational stability is enhanced by incorporating cyclic β-amino acids that enforce specific local conformations [3]. Miniproteins bearing defined internal cavities are also constructed for catalytic applications.

Second, designed miniproteins are produced using a fully automated flow solid-phase peptide synthesizer developed in our laboratory. Online UV monitoring enables real-time assessment of synthesis progress and automatic adjustment of key parameters. An AI model trained on experimental datasets determines optimal coupling times, allowing reliable synthesis of sequences up to 120 amino acid residues.

Third, miniproteins are evaluated for conformational stability, three-dimensional structure, and function. Applications include inhibitors of the PD-1/PD-L1 immune checkpoint interaction [4] and enzyme-like catalysts. Several cavity-bearing miniproteins act as enzyme mimics following Michaelis–Menten kinetics [5], demonstrating the versatility of the miniprotein scaffold as a platform for functional molecule development.

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VISIBLE-LIGHT DECARBOXYLATIVE FUNCTIONALIZATION OF FATTY ACIDS USING ALLYLIC ARYL SULFONES

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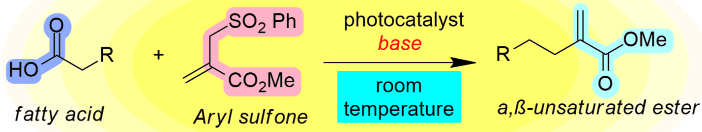
Carboxylic acids are abundant compounds that are widely used in organic chemistry due to their versatility, availability and structural diversity [1]. Among them, fatty acids are identified as long-chain carboxylic acids that can be used for the generation of alkyl radicals through photocatalytic decarboxylation pathways [2]. However, direct conversion of these non-activated manifolds into highly functionalized building blocks remains a key challenge in photocatalytic radical chemistry. Although decarboxylative methodologies are well established, the formation of selective C(sp3)-C bonds without prior activation of these free acids is considered challenging [3]. Therefore, the direct functionalization of non-activated carboxylic acids is a major approach to enhance sustainability, thus providing access to structurally diverse products.

In this work, we investigated the visible light decarboxylative coupling of fatty acids with aryl sulfones acting as radical acceptors. The reaction was performed under visible blue light irradiation at room temperature in the presence of a photocatalyst, (Ir[dF(CF_3)ppy]2(dtbpy))PF6, and a suitable base. Upon irradiation with two 40 W blue lamps, the photocatalyst is excited, promoting the decarboxylation process, leading to the formation of the desired product. Under the optimized conditions, α,β-unsaturated ester was obtained with an isolated yield up to 93%, enabling access to a broad range of structurally diverse products.



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LANTHANIDE-DOPED AND CO-DOPED ZNO FOR PHOTOCATALYTIC WATER TREATMENT APPLICATIONS

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Zinc Oxide (ZnO) has emerged as an alternative photocatalyst due to its numerous advantages, including low toxicity, relatively simple synthesis, and overall optic properties arising from its band-structure. Nonetheless, the wide band-gap energy (i.e., 3.37 eV) and rapid recombination of photogenerated charge carriers, inhibit the activation of ZnO under visible light irradiation and hinder its photocatalytic efficiency (1). Thus, doping with lanthanides has been adopted as an effective strategy to broaden the spectral response of ZnO and mitigate the recombination rate (2). Considering the above, this research aimed at investigating the effects of doping and co-coping ZnO with different lanthanide ions. A-ZnO (A=Sm, Ce, La, or Pr) and A-B-ZnO (A=La; B=Ce or Sm) were prepared by wet-chemical microwave assisted method, and the physicochemical properties and photocatalytic performance of the materials were thoroughly analyzed. The samples obtained under mild microwave conditions (T=80°C) exhibited high crystallinity and hourglass-like rod morphology, with average particle size ranging from 250-712 nm. The band-gap value of pure ZnO was found to be 3.13 eV, whereas doped-ZnO exhibited Eg values between 3.08-3.14 eV. XRF and SEM-EDS analyses confirmed the presence of the corresponding dopant ions, which were homogeneously and randomly distributed throughout the samples. The photocatalytic performance was evaluated in the degradation of Rhodamine B with H2O2, which acted both as an electron acceptor and as an additional source of hydroxyl radical. The obtained materials exhibited degradation efficiencies up to >95% in 3 h of irradiation. For some of the Ln dopants, the detrimental effect of the photo-activity was ascribed to the introduction of energy levels among the CB, which might act as recombination centers; meanwhile, the synergistic effect of co-doping was observed and attributed to the improved separation and transfer of charge-carriers.

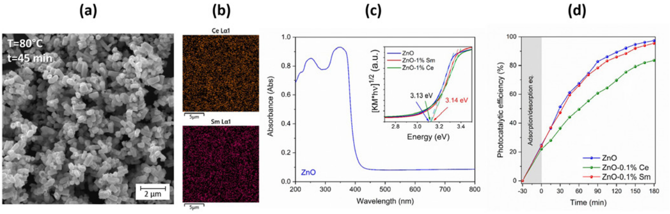

Fig. 1 (a) SEM micrograph of synthesized ZnO; (b) EDS mapping; (c) UV-Vis absorbance spectra and Tauc plot; (d) Photocatalytic efficiency achieved of representative samples.

Acknowledgments

This work was funded by the National Science Centre of Poland (2024/53/B/ST5/01357).

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MODIFIED ELECTROSPUN MATERIALS FOR ENVIRONMENTAL APPLICATIONS - NOVEL PROTOCOL FOR DESIGN OF THE FUNCTIONAL BIOCATALYTIC SYSTEMS

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Increasing contamination of aquatic environments with organic pollutants requires the development of efficient and sustainable treatment technologies. In response to the limitations of conventional adsorption and membrane-based processes, this study proposes a novel strategy integrating electrospinning, membrane modification, and enzyme immobilization to fabricate multifunctional biocatalytic systems for wastewater remediation [1-2].

Poly(methyl methacrylate) (PMMA)-based electrospun membranes were modified with hybrid Al2O3-cellulose and Al2O3-chitosan systems synthesized via a mechanochemical approach. Laccase from Trametes versicolor was immobilized onto the prepared membranes by adsorption. The physicochemical properties of the obtained materials were investigated using FTIR, XRD, SEM, BET, and TGA analyses. The catalytic performance of the biocatalytic systems was evaluated toward the removal of selected organic dyes from their model aqueous solutions.

The incorporation of Al2O3-biopolymer modifiers significantly affected membrane morphology, enzyme loading, and catalytic activity. Among the tested systems, the PMMA+Al2O3-chitosan/laccase membrane exhibited the highest enzyme immobilization yield and activity recovery. The modified systems demonstrated enhanced dye removal efficiency compared with pristine PMMA membranes, confirming the synergistic contribution of adsorption and enzymatic bioconversion.

The proposed biocatalytic membranes represent an effective and environmentally friendly platform for advanced dye-contaminated wastewater treatment. The combination of electrospun membrane technology with Al2O3-biopolymer modification and laccase immobilization, enables simultaneous adsorption and catalytic degradation of pollutants, offering significant potential for sustainable water purification applications and future development of multifunctional membrane-based systems.

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Acknowledgements

This work was supported by the National Science Centre, Poland (Research grant number 2021/43/B/ST8/01854).

FUNCTIONALIZATION OF ANDERSON-EVANS POLYOXOMETALATES WITH AROMATIC ALDEHYDES VIA SCHIFF BASE CONDENSATION FOR ENERGY STORAGE APPLICATIONS

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The escalating demand for electricity in sectors such as transportation, electronics, and cooling systems presents us with new challenges. In 2024, global consumption exceeded 30,000 TWh, an increase of as much as 4.3%. This is roughly double the average consumption of the previous decade (1). Studies on the reserves and consumption of crude oil and natural gas indicate that these resources will last us for about 35–50 years (2). Therefore, the great emphasis on discovering new forms of sustainable energy storage is important. Polyoxometalates (POMs) are anionic clusters of metal oxides whose reversible redox properties involving multiple electrons make them suitable for use as electrodes in supercapacitors (3,4). Working with the Anderson Evans type POM $MnMo_6$, functionalized in two steps: the cluster is first anchored using TRIS, leaving a free amino group, which then undergoes condensation with aromatic aldehydes to form Schiff base bonds, using imidazole at room temperature. Imidazole plays a key role in this synthetic pathway as an alternative to traditional methods for synthesizing hybrid materials, which rely on hydrothermal conditions, long reaction times, high heating temperatures, and the use of a catalyst (5). All these factors are eliminated when imidazole is used, thanks to the increased solubility resulting from hydrogen bonding and its mild acidity, which promotes the formation of imines while inhibiting reverse reactions.

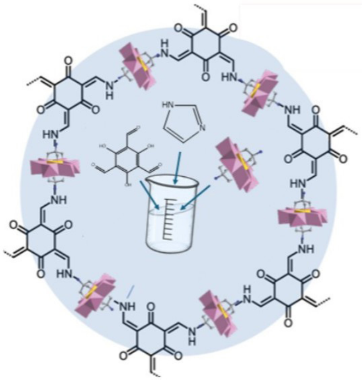

Fig.1: Schematic of the synthesis of POMs hybrid materials using imidazole at room temperature.

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MULTI-METAL STRATEGY FOR ENHANCED STABILITY OF UIO-TYPE METAL–ORGANIC FRAMEWORKS IN PHOTO-DRIVEN HYDROGEN EVOLUTION

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Green hydrogen is a clean energy carrier produced from renewable sources, e.g., from water via light-driven processes. However, catalysts applied in photosensitized systems often undergo structural changes, limiting their long-term use and recyclability. Developing materials that combine high catalytic activity with structural stability remains a challenge. Metal–organic frameworks (MOFs) have emerged as promising catalysts in this context due to their structural tunability and ability to incorporate catalytically active metal sites (1). In particular, zirconium-based UiO-type frameworks are of interest because of their exceptional water stability and versatile architectures.

This work examines a multi-metal strategy to improve the stability of UiO-type frameworks in photo-driven hydrogen evolution. Zirconium-based UiO-66, -67, and -69, differing in linker length and structure, were obtained and modified by incorporating cobalt and nickel. Structural and compositional characterization confirmed framework formation and successful metal introduction. Under photocatalytic conditions, pristine materials degraded and showed negligible hydrogen evolution. Incorporation of cobalt increased hydrogen production, but Co2+ species were reduced to metal particles, preventing recyclability. In contrast, samples containing both nickel and cobalt maintained their structure and were active over repeated cycles. These results show that a multi-metal approach suppresses degradation and improves the catalytic performance of MOFs.

A. E. would like to thank the National Science Centre, Poland, for financial support (MINIATURA 9, no. 2025/09/X/ST5/00238).

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INTERACTION OF LUMINARINE WITH DIFFERENT G-QUADRUPLEX TOPOLOGIES: UV MELTING AND CIRCULAR DICHROISM STUDIES

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G-quadruplexes (G4) are guanine-rich DNA or RNA structures that self-assemble into four-stranded conformations under physiological conditions, forming in proto-oncogene promoter regions and at telomere ends. They can either repress or enhance transcription, and their link to cancer makes them an important molecular target in anticancer therapies. However, G4 are characterized by a highly diverse topology, which affects their interaction with ligands. Therefore, there is a strong demand for ligands that can selectively recognize, bind and stabilize specific topology [1].
9-methoxyluminarine (9-MeLM) was identified as a ligand with such properties, exhibiting the strongest interactions with parallel G4 [2]. Moreover, 9-MeLM acts as a selective “turn-off” ligand, as its fluorescence is quenched upon binding to a G4 structure [3].
The aim of this study is to examine the interaction of the luminarine aglycone (LM) with G-quadruplexes of various topologies. Specifically, we investigate whether the absence of a methyl group at position 9 – resulting in the transition from the cationic to the zwitterionic form – affects the interaction of the fluorophore with different G4 sequences (Fig. 1). Four G4 models were examined: the c-MYC promoter sequence (parallel), the thrombin-binding aptamer TBA (antiparallel chair-type), and the human telomeric sequence 22HT folding differently in solutions containing K^+ (hybrid) or Na^+ (antiparallel basket-type) The interactions of LM with G4 were studied using UV-Vis spectroscopy and circular dichroism (CD) spectroscopy.

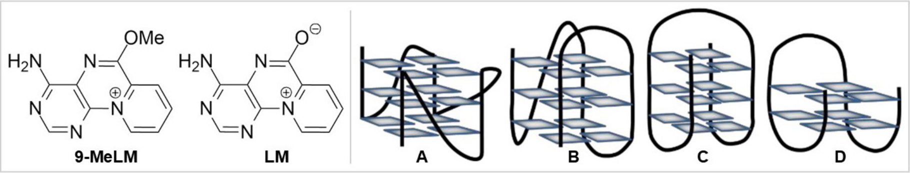

Figure 1. Structure of 9-methoxyluminarine (9-MeLM), structure of luminarine (LM), and different G4 topologies: parallel (A), hybrid (B), basket-type antiparallel (C), and chair-type antiparallel (D) [1].

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METALLOCARBONYL BROMOMALEIMIDE DERIVATIVES FOR THIOL BIOCONJUGATION AND DISULFIDE BRIDGING: SPECTROSCOPIC AND BIOLOGICAL PROPERTIES

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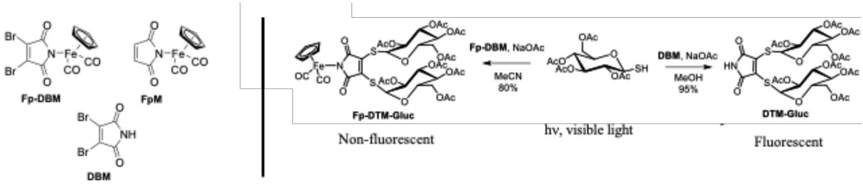
Biomolecules labelling is an important area of research to understand biological processes, to develop diagnostic tools and new approaches for the treatment of diseases. As Michael acceptors, maleimides are extensively used for conjugation of protein thiols. More recently, (Di)bromomaleimide, or (D)BM, were reported as useful reagents for the reversible modification of cysteine residues (1,2). By extension, mono- and dibromomaleimides allow for the rebridging of disulfide bonds in peptides and proteins through reduction followed by substitution and addition or double substitution, respectively. Interestingly, various functionalities can be attached to the N atom of the maleimide ring and the dithiomaleimide products display generally strong emission properties in the green region, providing assessment of thiol conjugation or disulfide rebridging.
Here, we present the reaction of Fp-DBM complexes (Fp= (η5-cyclopentadienyl) iron dicarbonyl) (3), and its organic analog DBM, with 1-thio-b-D-glucose tetraacetate and bovine insulin as well as the spectroscopic and biological properties of the conjugates.



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POLYOXOMETALATE-POLYPEPTIDE HYBRIDS AS PROTON-CONDUCTING MEMBRANES

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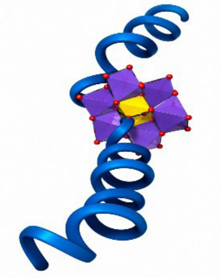
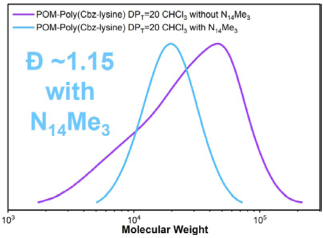
Covalent integration of polyoxometalates (POMs) into polymer electrolytes is an attractive strategy to combine the high proton activity of inorganic clusters with the processability of organic materials. Here we show that a catalytic de-pairing strategy enables controlled, open-air ring-opening polymerization of lysine-based N-carboxyanhydrides directly from an Anderson-type Mn-POM scaffold. Structurally defined POM-polypeptide hybrids(1,2) are obtained across a broad range of solvent polarities with targeted chain lengths and good control over molar mass distribution.(3) Deprotection yields free-standing proton-conducting membranes in which the POM units are covalently embedded within the polypeptide framework. Broadband dielectric spectroscopy reveals strongly decoupled proton transport, reaching up to eight orders of magnitude at the glass transition, together with persistent conductivity in the dry glassy state. Under humidified conditions, the membranes reach a proton conductivity of ca. 1.0 × 10-2 S cm-1 at 298 K and 98% relative humidity. These results establish on-cluster NCA polymerization as a viable route to covalent POM-polypeptide hybrids and identify them as a promising design principle for bio-inspired degradable proton-conducting materials of potential application as e.g. fuel-cells.





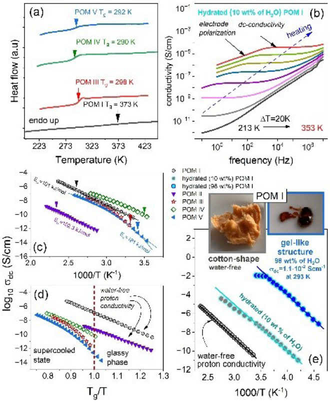


Figure 1. Schematic representation of electroactive POM-COF energy storage materials (red frame) and hybrid POM-polypeptide hybrids with proton conductive(1).

Acknowledgments

Work was funded in the frame of: The EU's Horizon 2020 research and innovation programme under the Marie Sklodowska Curie grant: 101105692 (PM) and the and SONATA BIS (2025/58/E/ST5/00124 – National Science Center, Poland) projects.

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CONTROLLED CO-DELIVERY OF NAPROXEN SODIUM AND CURCUMIN USING IRON-BASED MIL-101 CARRIERS

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Inflammatory diseases arise from intricate interactions among multiple molecular and cellular pathways, necessitating combination therapeutic strategies to achieve effective and sustained treatment outcomes. In this context, metal–organic frameworks (MOFs) have gained considerable attention as advanced drug delivery platforms due to their well-defined porosity, high loading capacity, and capability for controlled and stimuli-responsive release of therapeutic agents [1]. Herein, MIL-101(Fe) was systematically evaluated as a carrier for the co-delivery of naproxen sodium, a nonsteroidal anti-inflammatory drug, and curcumin, a bioactive polyphenol exhibiting complementary pharmacological activity.

MIL-101(Fe) materials were synthesized under different solvothermal conditions by varying the temperature and solvent volume, thereby enabling control over crystallinity, morphology, and pore architecture. The obtained materials were characterized by X-ray diffraction, nitrogen physisorption, scanning electron microscopy, thermogravimetric analysis, and FT-IR spectroscopy.

The applied synthesis parameters had a pronounced influence on the adsorption performance of the obtained materials. In particular, samples synthesized at 110 °C exhibited an optimal balance between micro- and mesoporosity, a high density of accessible adsorption sites, and favorable particle morphology. The most efficient MIL-101(Fe) demonstrated high co-adsorption capacities, reaching 470 mg/g for naproxen sodium and 167 mg/g for curcumin.

Release studies conducted under physiologically relevant pH conditions confirmed the sustained and controlled delivery of both therapeutic agents, with release profiles strongly dependent on the structural characteristics of the carriers. Biological evaluation using RAW264.7 macrophages revealed low cytotoxicity of the drug-loaded systems, with cell viability remaining above 90% at a concentration of 200 μg/mL. Furthermore, the materials significantly reduced key inflammatory markers, including cyclooxygenase activity and interleukin-6 (IL-6) production, highlighting their potential anti-inflammatory efficacy. Overall, these findings demonstrate that MIL-101(Fe) can be rationally engineered to act as a biocompatible platform for the co-delivery of synthetic and natural anti-inflammatory agents.

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CORE-SHELL NANOSTRUCTURES AS PLASMONIC PLATFORMS IN OPTICAL DETECTTION AND THEIR APPLICATIONS IN COSMETOLOGY

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Noble metal nanoparticles (Ag, Au), thanks to their unique properties, find applications in many fields, including electronics, medicine, and cosmetology. Their main feature is the presence of localized surface plasmon resonance, which arises from the excitation of electron cloud oscillations by an electromagnetic wave. This phenomenon has been used to construct plasmonic platforms that are successfully applied for the sensitive detection of biologically important chemical compounds.

In recent years, our research group has been conducting studies on core–shell nanostructures, a promising class of materials. These materials combine the unique physicochemical properties of both components. In particular, nanostructures based on a metallic core, such as gold nanoparticles coated with a silica layer, are of great interest due to the optical properties and the anti-inflammatory and antioxidant effects exhibited by Au NPs or Ag Nps, as well as the enhanced colloidal stability, chemical resistance, biocompatibility, and the possibility of easy surface functionalization provided by the silica coating, which is crucial in the context of cosmetics applications [1,2].

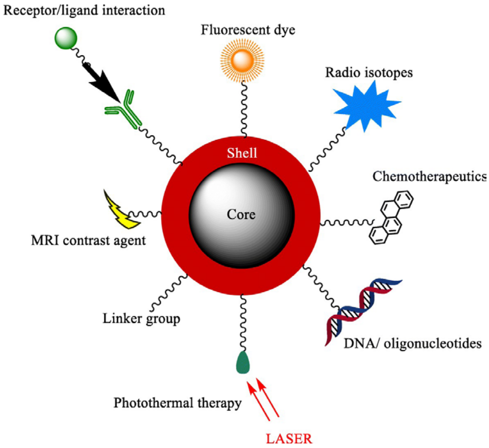

Fig. 1. Examples of possibilities for modifying core-shell nanostructures [1].

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ON DESIGNING MOLECULES WITH ARTIFICIAL INTELLIGENCE

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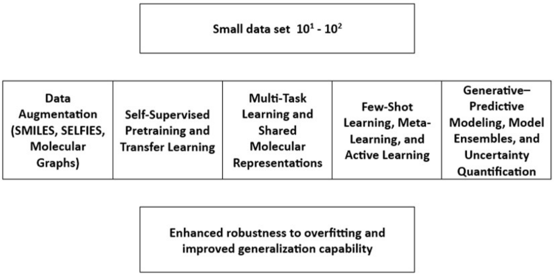
The discovery of new bioactive compounds requires the synergistic combination of computational design, targeted organic synthesis, and advanced analytical techniques. We present an interdisciplinary approach that integrates deep learning-based de novo molecule generation, rational synthesis of enzyme inhibitors, and mass spectrometry-based interaction studies.

A sequence-to-sequence LSTM neural network, trained on 121,000 compounds from the ZINC20 database and utilizing SELFIES representation, was employed to generate novel, chemically valid structures with predicted affinity toward selected protein domains (e.g., RORγ). Generated candidates were filtered by drug-likeness (QED, Lipinski rules) and synthetic accessibility (SYBA), followed by molecular docking validation, yielding compounds with binding energies as low as −10.0 kcal/mol.

Complementing this computational pipeline, novel dipeptide analogs of (E)-α-fluorovinylphosphonates were synthesized as reversible inhibitors of Cathepsin C. Key synthetic steps involved Horner–Wadsworth–Emmons olefination, providing compounds with promising inhibitory activity. In parallel, advanced mass spectrometric methods were developed for the screening and characterization of bioactive molecules. Post-column guanosine addition during HPLC-MS analysis enabled efficient screening of natural product extracts, while detailed studies on flavonoid–G-quadruplex DNA interactions revealed the critical role of the C4 carbonyl group in stable adduct formation.

This integrated workflow demonstrates how artificial intelligence, modern organic synthesis, and high-resolution mass spectrometry can be combined to accelerate the identification, design, and validation of new bioactive compounds with therapeutic potential.



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APPLICATION OF 3D METAL PINCER COMPLEXES IN THE SYNTHESIS OF ORGANOBORON COMPOUNDS

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Modern chemical synthesis places a strong emphasis on sustainability by minimizing the use and generation of hazardous substances. This is largely achieved through catalysts that activate new reaction pathways, enhancing process selectivity and enabling the use of less reactive substrates.1

A noteworthy example of recently well-studied homogeneous catalysts is pincer 3d metal complexes. These catalysts are known for their relatively simple synthesis, high stability, activity, and selectivity in reactions such as hydrogenation, hydroboration, hydrosilylation, and bond formation.2-4 A key feature is their tunable selectivity, which can be modified by altering reaction conditions or ligand structure.

In my communication, I will present the synthesis of organoboron compounds catalyzed by cheap pincer complexes. The presented methodology enables ligand-controlled synthesis regarding the principles of sustainable chemistry leading to a valuable group of compounds.5-7

Funding acknowledgment: National Science Centre Grant: UMO-2024/53/B/ST4/03116

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SAPONINS AS ECO-FRIENDLY ENHANCERS OF ANTIBIOTIC EFFECTIVENESS

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The extensive use of antibiotics in human healthcare and animal production results in continuous release of pharmaceutical residues into environmental compartments, where persistent low-level exposure may contribute to the development and dissemination of antimicrobial resistance (AMR). Beyond antibiotic stewardship and improved wastewater management, formulation-based strategies that enhance antibiotic performance may offer an additional opportunity to reduce overall antibiotic input into the environment. If auxiliary compounds are able to increase the apparent effectiveness of antibiotics, comparable antimicrobial outcomes may be achieved at lower doses.

Plant secondary metabolites constitute a diverse class of natural compounds, some of which have been associated with the modulation of antibacterial activity. Among these, saponins have attracted particular attention due to their unique physicochemical properties. Saponins are a structurally diverse group of naturally occurring glycosides characterized by an amphiphilic molecular architecture, consisting of a hydrophobic aglycone (sapogenin) linked to one or more hydrophilic sugar moieties. Depending on the structure of the aglycone, they are generally classified as either triterpenoid or steroidal. This distinctive combination of hydrophobic and hydrophilic domains confers surfactant-like properties in aqueous systems and promotes interactions with lipid-containing interfaces and biological membranes. Consequently, saponins may affect membrane permeability barriers relevant to antibiotic uptake, intracellular accumulation, and access to bacterial targets, highlighting their potential as adjuvants capable of enhancing antibiotic efficacy.

Our observations indicate that plant-derived saponins can enhance antibiotic activity in selected bacterial systems, likely through mechanisms involving membrane destabilization, increased permeability, and disruption of microbial surface structures such as biofilms. In certain cases, these effects appear to translate into improved antibacterial outcomes at reduced antibiotic concentrations, suggesting a possible route for lowering selective pressure associated with environmental antibiotic residues.

This research was funded by the National Science Center, Poland, grant number 2020/39/B/NZ9/03196.

FUNCTIONALIZED POLYSILOXANE COATINGS FOR ENHANCED PERFORMANCE AND DURABILITY OF PHOTOVOLTAIC PANELS

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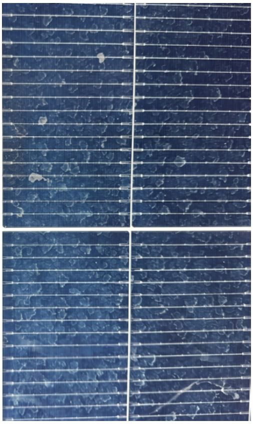
This study reports the synthesis, characterization, and application of a novel functionalized polysiloxane designed as a protective impregnating agent for photovoltaic (PV) panels. The formulation, developed at the Poznań Science and Technology Park and designated as Harsol Panel Protect, is a multicomponent system in which the active phase consists of an organofunctional polysiloxane bearing perfluoroalkyl and alkoxy functional groups. These functionalities enable durable adhesion to panel surfaces while imparting both hydrophobic and oleophobic properties.

Long-term laboratory investigations exceeding one year, supported by detailed molecular-level analyses, confirm the chemical stability, non-corrosive character, and operational safety of the formulation across photovoltaic panels from multiple manufacturers. The application of Harsol Panel Protect leads to improved surface cleanliness, enhanced operational efficiency, and increased durability of PV modules, while simultaneously simplifying maintenance procedures.

The poster presents the synthesis, physicochemical characterization, and performance evaluation of the Harsol Panel Protect formulation. The obtained results demonstrate that the developed functionalized polysiloxane system constitutes a safe, effective, and promising approach for improving the performance and extending the service lifetime of photovoltaic installations.



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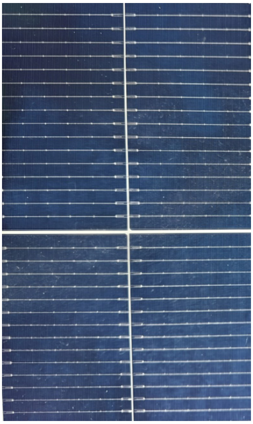

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INFLUENCE OF N- AND O-GLYCOSYLATION ON STRUCTURAL PRPOPERTIES AND BIOLOGICAL ACTIVITY OF A C-TERMINAL LL-37 FRAGMENT

Daria Grzywacza, Francesca Nutib, Krzysztof Żamojća, Sergey A. Samsonova, Marcelina Malinowskac, Małgorzata Paduszyńskad, Anna Maria Papinib, Joanna Makowskaa*

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Glycosylation represents a versatile strategy in peptide glycoengineering, enabling the modulation of the structural, physicochemical, and biological properties of antimicrobial peptides (AMPs)(1). In this study, we report the characterization of O- and N-glycosylated analogues of the C-terminal fragment of human cathelicidin LL-37 (Ac-DFLRNLVPRTES-COOH)(2). The metal-binding affinity of these glycopeptides and the unmodified peptide (hCAP) toward Cu^{2+} and Mn^{2+} ions was evaluated using steady-state fluorescence spectroscopy at three different pH values. All peptides formed non-permanent complexes ($K_a = 10^2–10^4\ M^{-1}$), with the native hCAP exhibiting the highest affinity toward the investigated metal ions. However, a slight yet noticeable increase in the affinity of the glycosylated derivatives toward metal ions was observed with increasing pH, which may indicate a subtle influence of the protonation environment on the coordination properties of the carbohydrate moieties. MD simulations revealed that glycosylation reduced conformational flexibility. Occasional sugar–metal contacts were observed, suggesting a transient involvement of carbohydrate residues in metal ion coordination. Cytotoxicity studies using the MTT assay confirmed the biocompatibility of all tested peptides. In this study, glycosylation serves primarily as a chemical model of post-translational modification, designed to investigate how the presence of a carbohydrate moiety influences peptide conformation and coordination behavior, rather than as a strategy for enhancing antimicrobial activity.

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SELECTED CONTRIBUTIONS TO THE DEVELOPMENT OF BIOACTIVE COORDINATION COMPOUNDS

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The design of effective therapeutic agents requires a multidisciplinary approach that integrates synthetic chemistry, physicochemical characterization, and biological evaluation. In recent years, coordination compounds have gained increasing attention as promising candidates for applications in medicinal chemistry, particularly in the context of drug resistance.

In this lecture, selected contributions from our research group will be presented, focusing on the development and investigation of bioactive organic molecules and metal-based systems. The studies discussed include sulfonamide derivatives, their transition-metal complexes, and imidazole-based systems that form cadmium(II) coordination compounds. These systems have been investigated using a combination of experimental and theoretical methods to elucidate their structural, spectroscopic, and thermodynamic properties.

Special emphasis will be placed on structure–property–bioactivity relationships, including detailed spectroscopic and crystallographic characterization of selected organic derivatives, including sulfonamides and their conformational preferences, supported by computational studies [1]. In parallel, the interactions of these compounds with biologically relevant targets, such as DNA and proteins, have been examined to identify key factors governing their biological activity [2]. The results demonstrate that both the ligand structure and the metal ion play a crucial role in determining activity, selectivity, and mechanism of action [3,4].

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EMULGELS STABILIZED BY NONIONIC SURFACTANTS: CHARACTERIZATION AND APPLICATION PERSPECTIVES

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Emulsions are widely used in the pharmaceutical and cosmetic industries due to their ability to deliver both hydrophilic and lipophilic active ingredients. However, their physical instability (e.g., flocculation, coalescence, and creaming) remains a major technological challenge. To address these limitations, emulgels, hybrid systems combining the properties of emulsions and gel, have attracted considerable interest [1,2]. Owing to the presence of hydrocolloids in the external phase, emulgels offer enhanced structural stability, favorable sensory properties, and controlled release of active compounds, making them attractive systems for skincare applications. Nonionic surfactants, traditionally used as co-surfactants, have recently emerged as primary emulsifiers due to their low toxicity, minimal skin irritation, and high biocompatibility.

The aim of this study was to evaluate the physicochemical stability and application potential of emulgels stabilized exclusively with nonionic surfactants [3].

Four formulations were developed using different primary emulsifiers: cetearyl alcohol, Tween 60, coco-glucoside, and PEG-1000. Their physicochemical properties were assessed through pH and density measurements, stability studies, and sensory evaluation.

The results confirmed that emulgels stabilized solely with nonionic surfactants are highly stable and promising systems for cosmetic applications. Among the tested formulations, the coco-glucoside-based emulgel exhibited the highest physical stability. All formulations showed appropriate pH values and favorable rheological properties. The formulation containing coco-glucoside appears particularly promising for the development of environmentally friendly, mild, and dermatologically safe skincare products.

This work was funded by the research subsidy No. 0912/SBAD/2608.

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CURRENT AND EMERGING TECHNOLOGIES FOR SUSTAINABLE HYDROGEN PRODUCTION

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Hydrogen is widely considered one of the key energy carriers for future low-carbon energy systems. Its use may significantly support the decarbonisation of industry, power generation and transport; therefore, the development of efficient and sustainable hydrogen production technologies is of growing importance. Currently, steam methane reforming remains the dominant industrial process owing to its high efficiency and relatively low cost. However, this technology is associated with substantial CO_2 emissions, which limits its compatibility with long-term climate targets (1). Water electrolysis, particularly when powered by renewable electricity, enables low-emission or nearly zero-emission hydrogen production, but its wider implementation is still constrained by high investment costs and electricity demand (1).

Among emerging technologies, methane pyrolysis has attracted increasing attention as a promising route for low-carbon hydrogen production. This process involves the non-oxidative decomposition of methane into hydrogen and solid carbon, avoiding direct CO_2 formation (2). Nevertheless, high reaction temperatures and catalyst deactivation remain major technological challenges. Catalytic methane pyrolysis may lower the required temperature and improve hydrogen selectivity. Catalysts based on nickel, iron, cobalt and noble metals have been widely investigated, with activity, stability and resistance to carbon deposition, sintering and poisoning being crucial performance factors (3). Further optimisation of catalyst composition, reactor design and carbon by-product management may contribute to the future industrial implementation of this technology.

Acknowledgements
This work was funded by the AGH Grant No. 16.16.210.476.

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ELECTROCHEMICAL REDUCTION OF SELECTED THREE-ELECTRON DEPOLARISERS IN THE MIXED AQUEOUS-ORGANIC SUPPORTING ELECTROLYTES SOLUTIONS ; “CAP - PAIR” EFFECT

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In systems with mixed solvents, interpreting kinetic and thermodynamic parameters from electrochemical measurements is complex. Alterations in the reaction environment can enhance or inhibit different stages of the electrode process simultaneously. Even during fundamental parameter analysis, dividing effects into purely thermodynamic or kinetic contributions often falls short. This is because the electrochemical response also reflects changes in the interfacial region’s structure [1].
This study examines the electroreduction of selected three-electron depolarisers, focusing on Bi(III) and In(III) ions, at a cyclically renewable liquid silver amalgam film electrode (R-AgLAFE) in chlorate(VII)-based supporting electrolytes with varying proportions of organic solvents. The effects of organic additives with catalytic or inhibitory properties, as described by the “cap–pair” concept, were also assessed [2]. The analysis is based on data from square-wave voltammetry (SWV), cyclic voltammetry (CV), DC polarography (DC), and electrochemical impedance spectroscopy (EIS).
Increasing the organic solvent content results in decreased kinetic parameters (ks, α) and increased peak separation (ΔE) [3]. This indicates reduced reversibility of the electrode process. Differential capacitance measurements show that these changes accompany interfacial reorganisation. In the presence of compounds that meet the “cap–pair” criterion, the reduction current changes significantly. These changes occur with only minor shifts in peak potential, suggesting a surface-controlled mechanism [4]. According to the literature, weak and transient interactions, such as dispersion forces, between the depolariser, organic molecules, and the electrode surface can significantly influence electron-transfer processes, even though they do not form stable complexes in solution.

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ENHANCING FOAMABILITY AND FOAM STABILITY OF SELECTED SURFACTANT SYSTEMS WITH STEARIC ACID

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Sodium cocoyl isethionate (SCI) is widely used in the cosmetic industry to produce syndet bars and other cleansing bars, including increasingly popular shampoo bars [1]. In these formulations, the application differs from that of conventional hair care products because the surfactant mixture must first dissolve in water before washing begins. This may hinder foam formation, while foam volume remains an important factor in consumers' subjective assessment of product effectiveness [2]. Stearic acid (SA) is used as a structuring additive in such formulations, improving product stability, hardness, and processing properties. Previous studies have shown that hydrophobic fatty acids can improve foam stability in surfactant systems by affecting liquid drainage and interfacial viscoelasticity [3].

This study aimed to evaluate the foaming properties and foam stability of SCI systems containing stearic acid. Measurements were performed using a multiple-light scattering method (Turbiscan Lab analyser). The method involves passing an 880 nm radiation beam through the sample and recording backscattering (BS) and transmittance (T) signals. SCI/SA mixtures were tested at different weight ratios, from 90/10 to 50/50, together with selected systems containing cocamidopropyl betaine (CAPB). Based on BS and T profiles, foamability, foam density, foam stability, liquid drainage, bubble coalescence, and foam half-life were determined.

Improved foamability was observed for all SCI/SA ratios except 50/50, as well as for the SCI+CAPB+SA system. The greatest improvement in foam stability was obtained for the 80 SCI/20 SA ratio. These results may support the development of syndet and solid shampoo formulations with improved application properties, promoting wider use of environmentally friendly cleansing products.

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REDOX-ACTIVE COVALENT ORGANIC FRAMEWORKS AS SUSTAINABLE CATHODES FOR RECHARGEABLE ALUMINUM BATTERIES

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The transition from fossil fuels toward renewable energy sources, together with the ever-growing worldwide energy demand, has intensified the search for efficient and sustainable electrochemical energy storage systems (ESS). Since their commercialization by Sony in 1991, lithium-ion batteries (LIBs) have dominated the portable-electronics market. However, the limited and geographically uneven distribution of lithium – recognized as a critical raw material by the EU in 2020 and 2024 – has driven the development of post-lithium chemistries based on Na^+, K^+, Mg^{2+}, Zn^{2+}, and Al^{3+}. [1]

Among these emerging technologies, rechargeable aluminum batteries (RABs) are particularly attractive. Aluminum is the most abundant metal in the Earth's crust, intrinsically safe, low-cost, and fully recyclable. Owing to its three-electron redox process, Al^{3+} offers an exceptional theoretical gravimetric capacity (2980 mAh g^{-1}) and the highest volumetric capacity (8046 mAh cm^{-3}) among all metal anodes. Nevertheless, the strong electrostatic interaction of trivalent Al^{3+} with host lattices results in sluggish ion diffusion and severely limits the choice of suitable cathode materials. [2]

In this context, the rational selection, design, and modification of redox-active covalent organic frameworks (COFs) provides a promising strategy toward high-performance aluminum batteries. Their pre-designed, tunable architectures, ordered porosity, and abundant redox-active sites enable fast charge transport and the accommodation of bulky chloroaluminate species. Being metal-free, COF-based electrodes combine low toxicity, sustainability, and easy processability with competitive electrochemical performance, as illustrated below. Expanding the family of redox-active COFs while systematically exploring their behavior in aluminum cells is essential to advance this field toward practical, environmentally friendly energy storage.

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SYNTHESIS OF ELECTROCHEMICALLY ACTIVE HYBRID MATERIALS UNDER MILD CONDITIONS USING READILY AVAILABLE TRANSITION METAL SALTS

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Covalent organic frameworks (COFs) are a class of crystalline, porous polymers characterized by a high degree of structural order and large specific surface area,which make them promising materials for applications including catalysis, molecular separation, and energy storage.[1] At the same time, intensive research has focused on polyoxometalates (POMs)—anionic transition metal oxide clusters characterized by favorable redox properties, high stability, and structural tunability.[2] Their incorporation into COF networks yields hybrid materials combining porosity and electrochemical activity, although current synthesis methods typically require high temperatures, long reaction times, and strongly acidic conditions.[3–5]
The aim of this work is to develop a mild and environmentally friendly method for the synthesis of POM–COF materials using readily available transition metal salts as mild Lewis acid catalysts. The synthesis is based on an imine condensation reaction between an amino-functionalized polyoxometalate and a trialdehyde organic precursor, carried out under room-temperature conditions. The use of transition metal ions (Fe^{3+}, Ni^{2+}, Zn^{2+}, Cu^{2+}, Co^{2+}) enables activation of carbonyl groups and promotes efficient formation of imine bonds without the need for harsh reaction conditions.[3]

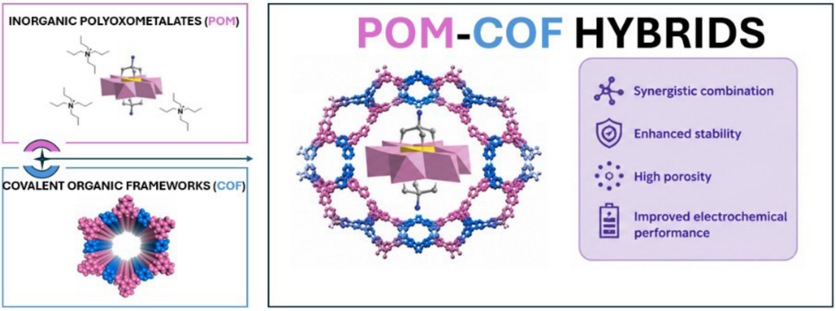

Figure 1. A schematic illustration of the benefits of the synergistic combination of POM and COF
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Funding from the NAWA PROM Programme 2025 and LIDER 0195/L-15/2024 is gratefully acknowledged

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ADSORPTION BEHAVIOR OF ETHYL 4-HYDROXYBENZOATE ON PHYSICALLY ACTIVATED INSECT-DERIVED CARBON MATERIALS

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The growing demand for sustainable and low-cost adsorbents has stimulated interest in carbon materials produced from unconventional biomass sources. Among emerging feedstocks, residues from the black soldier fly (Hermetia illucens) represent an abundant and underutilized by-product of insect farming. Converting this waste into functional carbon materials aligns with circular economy principles while offering potential applications in water purification.

In the present work, pupal casings of Hermetia illucens were transformed into activated carbons through direct physical activation using carbon dioxide under microwave irradiation. This approach enabled simultaneous carbonization and pore development without the use of chemical activating agents. The physicochemical properties of the resulting materials were evaluated by elemental composition analysis, Boehm titration for surface functional groups, and nitrogen adsorption–desorption isotherms for textural characterization.

The prepared carbons exhibited a predominantly basic surface chemistry and developed porous structures with specific surface areas reaching 230 m2/g. Their adsorption performance was assessed using ethyl 4-hydroxybenzoate as a model organic micropollutant. Batch adsorption experiments were conducted under varying operational parameters to determine equilibrium, kinetics, and regeneration potential.

Equilibrium data were best described by the Langmuir model, indicating monolayer adsorption on a homogeneous surface, with a maximum adsorption capacity of 150 mg/g. Kinetic analysis showed that the process followed a pseudo-second-order model, suggesting that adsorption was controlled primarily by surface interactions. Additionally, the most effective carbon material maintained high reusability, achieving approximately 80% desorption efficiency after four successive adsorption–desorption cycles.

Overall, the results demonstrate that activated carbons derived from Hermetia illucens pupal casings are promising adsorbents for the removal of organic contaminants from aqueous solutions. The combination of waste valorization, environmentally friendly activation, and satisfactory adsorption performance highlights their potential as sustainable materials for water treatment technologies.

SYNTHESIS AND CYTOTOXICITY OF PHOSPHONATE ANALOGUES OF FLUORINATED PHENYLGLYCINE AND PHENYLALANINE

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α-Aminophosphonates are an important subclass of organophosphorus compounds characterized by the presence of both an amino group and a phosphonate moiety attached to the same carbon atom in their core structure. They often act as antagonists of amino acids or as transition-state mimetics, enabling them to inhibit key enzymes involved in amino acid metabolism, peptide processing, or other biochemical pathways [1]. Their generally low mammalian toxicity, combined with potent bioactivity, has made α-aminophosphonates attractive in medicinal chemistry and pharmaceutical development.

We synthesized a range of structurally diverse α-aminophosphonates (Figure), many of which demonstrated high activity against the tested cancer cell lines and, at the same time, significant selectivity towards normal cells [2,3]. These results position the synthesized α-aminophosphonates as promising scaffolds for the development of novel anti-tumor agents.

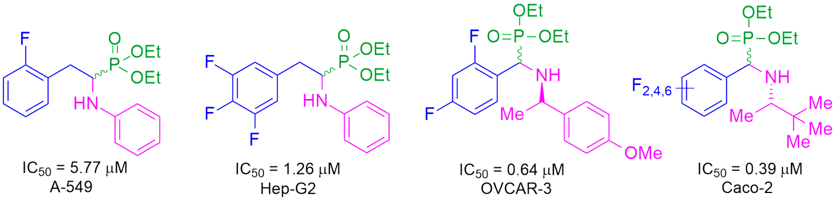

Figure 1. Examples of aminophosphonates obtained and their IC50 values for selected cancer cell lines.

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SELF-ASSEMBLED ARCHITECTURE OF LN(III) HEXAAZA MACROCYCLIC COMPLEXES

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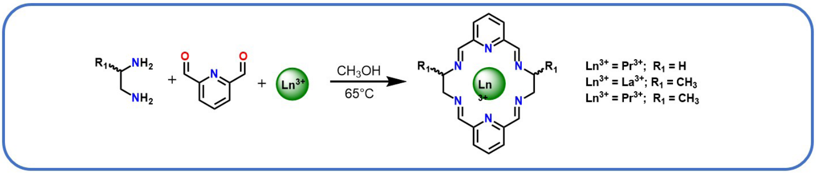
Lanthanide complexes have attracted considerable scientific interest due to their unique electronic, magnetic, and photophysical properties. The geometry and coordination behavior of lanthanide complexes, including their ability to adopt various coordination environments, make them highly versatile systems [1]. In this study, we report the synthesis and structural characterization of three hexaaza macrocyclic complexes containing La^{3+} and Pr^{3+} ions as templating metal centers. The complexes were obtained via template condensation reactions of 2,6-pyridinedicarboxaldehyde with either 1,2-ethylenediamine or racemic 1,2-propylenediamine Due to the nature of the central metal ion and the ligand, the diamagnetic La^{3+} complex [La(C20H22N6)(NO3)3] was selected for detailed NMR studies. In solution, the macrocyclic architecture of the complex was confirmed by 1H and 13C NMR spectroscopy. Detailed signal assignment was achieved using 2D NMR techniques (COSY, HSQC, and HMBC) [2]. The controlled synthesis of macrocycles with a predetermined ring size remains challenging due to the possible formation of numerous side products. To overcome this limitation, a template-directed synthetic strategy employing La^{3+} and Pr^{3+} ions was applied. As a result, three 18-membered hexaaza macrocyclic complexes were successfully obtained (Scheme 1).



Scheme 1. Synthesis of the Ln(III) complexes with 18-membered hexaazamacrocyclic ligands.

Acknowledgements
M. Lehmann acknowledges financial support from the NAWA PROM Programme.

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CRYSTALLOGRAPHIC FRAGMENT SCREENING REVEALS NEW STARTING POINTS FOR PYCR1 INHIBITOR DESIGN

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Human pyrroline-5-carboxylate reductase 1 (PYCR1) catalyzes the final step of proline biosynthesis and supports cancer-associated metabolic reprogramming through its roles in redox homeostasis, collagen production, and the proline–P5C cycle. Although PYCR1 is an emerging therapeutic target, structural and chemical efforts to inhibit PYCR1 remain limited and have largely focused on proline analogs.

In light of the above, we performed the first crystallographic fragment screening campaign against PYCR1 using a chemically diverse library of 96 fragments. Twelve PYCR1–ligand co-crystal structures were obtained, revealing fragments bound within the P5C and NADH binding regions of the active site. Several ligands displayed dual-site binding modes, spanning both pockets and providing new starting points for inhibitor design. The identified fragments highlight sulfonamide and sulfamate groups as promising carboxylate isosteres, while aromatic substituents uncovered a cryptic subpocket near the nicotinamide-binding site.

Moreover, the high-resolution structures highlight the remarkable adaptability of the PYCR1 active site, showing ligand-induced conformational changes and diverse fragment binding modes. Molecular dynamics simulations suggest that these states are accessible even in the ligand-free enzyme. These findings expand the current understanding of PYCR1 inhibition and provide new starting points for structure-guided inhibitor design.[1]

Acknowledgement
This research has been funded by the National Science Centre, Opus 2021/43/B/NZ7/01611.

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IN SEARCH OF NOVEL THERAPEUTICS TARGETING NEURODEGENERATIVE DISORDERS

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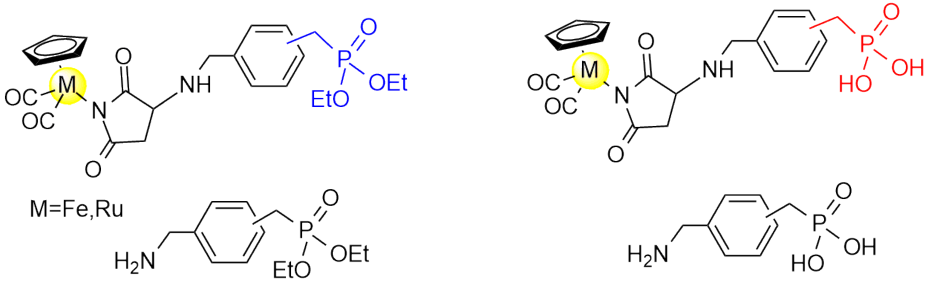
The development of dual-binding site cholinesterase (AChE/BuChE) inhibitors is a key strategy in Alzheimer's disease research (1). Our previous studies on organometallic complexes bearing aminophosphonate esters revealed that excessive steric bulk and lipophilicity limited their interactions within the enzymatic active site (2). To address this, we developed a novel series of iron and ruthenium complexes featuring aminophosphonic acid fragments (Fig. 1). This structural modification aims to reduce steric hindrance while significantly enhancing electrostatic interactions and hydrogen bonding networks with the catalytic triad (3). The target Fe and Ru complexes were successfully synthesized and confirmed by known spectroscopic methods. Finally, the obtained compounds were evaluated for their in vitro AChE/BuChE inhibitory activity and screened for cytotoxicity against selected human cell lines to determine their therapeutic potential and structure-activity relationships.



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FROM CO_2 UTILIZATION TO WASTEDERIVED ENERGY CARRIERS: CATALYTIC PATHWAYS TOWARD SUSTAINABLE FUEL PRODUCTION

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The development of alternative fuels is one of the key challenges of modern energy and environmental technologies. Limited fossil fuel resources, price instability and the need to reduce greenhouse gas emissions have intensified research into sustainable fuel-production pathways consistent with the principles of a circular economy. These include the production of hydrogen, synthetic natural gas, methanol, dimethyl ether and liquid synthetic fuels obtained from biomass, waste, natural gas or carbon dioxide.

Particular attention is currently being paid to Carbon Capture and Utilization (CCU), which enables to be converted into valuable chemicals and energy carriers [1]. Catalytic processes such as dry reforming of methane, methanation and hydrogenation to methanol or hydrocarbons are important examples of this approach [2]. They combine greenhouse gas valorisation with the possibility of storing renewable energy in chemical bonds. However, their practical implementation requires highly active, selective and stable catalysts resistant to carbon deposition, sintering and poisoning.

Another important direction is the production and use of waste-derived fuels, especially refuse-derived fuel (RDF) obtained from non-recyclable municipal solid waste [3]. RDF may reduce the amount of landfilled waste and partially replace conventional fossil fuels, particularly in cement kilns and power generation. Nevertheless, its application requires careful control of fuel composition, calorific value, chlorine content and emissions.

Catalysis plays a central role in the transition from conventional fuels to sustainable alternatives. The rational design of catalysts and integrated process concepts may significantly improve the efficiency, environmental performance and technological maturity of future fuel-production systems.

Acknowledgements

This work was funded by the AGH Grant No. 16.16.210.476.

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SILANOL-BASED SURFACE FUNCTIONALIZATION OF TI$_3$C$_2$T$_x$ MXENES TOWARD ENHANCED ENERGY STORAGE PERFORMANCE

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MXenes are promising electrode materials for electrochemical energy storage because of their high electrical conductivity, large surface area and tunable surface chemistry. Nevertheless, Ti3C2Tx-based supercapacitors suffer from flake restacking, structural instability and limited cycling durability (1). Here, Ti3C2Tx MXenes were covalently functionalized with 5,5'-bis(triisopropoxysilyl)-2,2'-bipyridine (BPS), a bifunctional silane designed to form Si-O-Ti linkages while introducing a compact bipyridine spacer. Functionalization was performed in m-xylene, ethanol and isopropanol to evaluate the role of solvent selection. XPS and FTIR confirmed BPS incorporation, while XRD, TEM and Raman analyses showed preservation of the layered MXene structure. Among the tested solvents, m-xylene promoted effective covalent grafting without excessive surface coverage, preserving charge transport and improving ion-accessible pathways. Ti3C2Tx-BPS (m-xylene) delivered 490 F g-1 at 10 mV s-1, 2.95 mS cm-1 ionic conductivity and improved H+ diffusion. In an asymmetric Ti3C2Tx-BPS//activated carbon device, it achieved 32.3 Wh kg-1, 12 300 W kg-1 and 88.36% capacitance retention after 15 000 cycles. These results demonstrate that solvent-optimized silanol functionalization is an effective strategy for robust MXene electrodes.

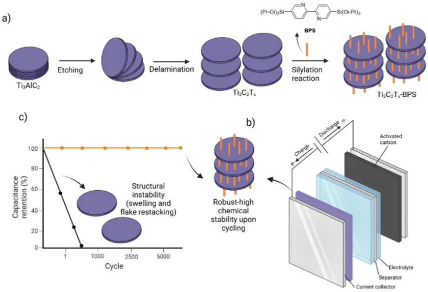

Figure 1. Schematic representation of Ti3C2Tx functionalization with BPS and the asymmetric supercapacitor configuration.

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APPLICATION OF HETEROSTRUCTURAL SYSTEMS BASED ON TITANIUM DIOXIDE AND RARE EARTH METALS IN PHOTOCATALYSIS

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Titanium dioxide-based heterostructures have attracted considerable attention as promising photocatalytic materials for environmental applications due to their high chemical stability, resistance to photocorrosion, and relatively low production cost. However, the practical application of TiO2 is still limited by its wide band gap energy and the rapid recombination of photogenerated electron-hole pairs, which significantly reduce photocatalytic efficiency. Therefore, current research is focused on the development of advanced heterostructural systems and the introduction of dopants capable of improving charge separation processes and extending light absorption properties.

In this study, TiO2-ZrO2 heterostructures doped with selected rare-earth ions (Ce, Sm) were synthesized using a sol-gel method assisted by solvothermal treatment.

XRD analysis confirmed the formation of anatase TiO2 and monoclinic ZrO2 phases in doped systems, while no crystalline phases of Ce or Sm were detected. Nitrogen sorption studies demonstrated that lanthanide doping significantly increased the BET surface area from 66 m2/g for the undoped TiO2-ZrO2 system to 80-97 m2/g and 77-99 m2/g for Ce- and Sm-doped materials, respectively. FT-IR spectra indicated the presence of Ti-O-Ln interactions and an increased intensity of hydroxyl groups, which may favor photocatalytic reactions. Optical studies showed that Ce doping reduced the band gap energy of the heterostructures, whereas Sm-doped systems exhibited relatively stable band gap values.

The photocatalytic activity of the synthesized materials was evaluated in the degradation of Rhodamine B. The results demonstrated that photocatalytic efficiency increased with irradiation time for all investigated samples. Among the analyzed materials, TiO2-ZrO2/Ce0.05% and TiO2-ZrO2/Sm0.05% exhibited the highest photocatalytic activity, achieving up to 99.2% degradation of Rhodamine B after 120 min of irradiation. The obtained results confirm that low-concentration lanthanide doping effectively enhances the physicochemical properties and photocatalytic performance of TiO2-ZrO2 heterostructures, making them promising materials for environmental remediation applications.

Acknowledgments
This work was funded by the National Science Centre of Poland (2024/53/B/ST5/01357).

LEVERAGING DYNAMINC BONDS FOR SELF-HEALING USES: FROM ACTUATING ENERGY SENSORS TO CONDUCTIVE SURFACES

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Elastomers have become ubiquitous in everyday life. Recently, they have come to play an important role in enabling wearable electronics. This is because their softness is ideal for contact with skin. Elastomers further readily absorb stresses/strains of human motion owing to their flexibility and stretchability. These attributes allow the elastomer to conform to biomechanical movement without unwanted stress to the wearer. Polydimethyl siloxane (PDMS) has become the gold standard for wearable elastomers in part because of the mechanical compliance with biomechanics and its inertness. However, once stretched beyond its breakpoint, the ruptured junctions of PDMS cannot be repaired. Therefore, it is of interest to develop elastomers that can reversibly form breaks and tears when they are formed. This would improve the overall longevity of the wearable and preserve its operation.

Integrating reversible bonds into the elastomer are ideal solutions to reforming unwanted rips and tears [1]. By virtual of their reversibility, dynamic bonds such as imines are ideal for developing self-healing elastomers [2]. Elastomers meeting the needs for wearables can be achieved by covalently cross-linking PDMS functionalized amines with their aldehyde counterparts [3]. Given the reversible bonds are formed in the solid-state with PDMS, their tracking cannot be done using conventional methods in solution. To overcome this challenge, two complementary colored and fluorescent dyes were developed as cross-linkers to form elastomeric PDMS via dynamic imine bonds. The dyes, when blended, result in a unique color that is visually detectable for tracking how the dynamic bonds are formed during the healing of scars. The dyes are equally fluorescent and their respective emission wavelengths can be used to provide further details about the solid-state healing of the dynamic bonds. It will be shown that both fluorescence and Raman microscopy can be used to track the bond formation and the dynamic bond exchange at the interface of elastomers toward understanding solid-state self-healing. This knowledge can be leveraged to make conductive elastomers that can be self-healed, opening opportunities for reparable wearable sensors [4] and electricity generation by human actuation [5].

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SYNTHESIS OF N,N,N-DONOR QUINOLINE SCHIFF BASES LIGANDS AND LANTHANUM COMPLEXES

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Schiff base and chelation chemistry based on quinoline derivatives has attracted increasing attention due to the structural diversity and wide range of applications of these compounds. Quinoline derivatives are important compounds with pharmacological properties and are widely used in medicinal chemistry (1). The structure of quinoline and its derivatives enables the synthesis of a variety of ligands in combination with amines. The study of metal complexes with Schiff base ligands is widespread because of their numerous advantages (2). These complexes are characterized by relatively simple synthesis procedures and excellent properties, making them attractive research materials (3). The aim of this work was the synthesis and characterization of N,N,N-donor chelating Schiff base ligands. The ligands were obtained via condensation of quinoline-2-carboxaldehyde (a) with 1,3-diaminopropane (b) or 1,3-diaminopropan-2-ol (c) (Fig.1). The condensation products were subsequently used for the preparation of lanthanum chelate complexes based on Schiff bases. Template reactions leading to the formation of complexes using the same substrates were also carried out. The obtained products were characterized using analytical and spectroscopic methods.

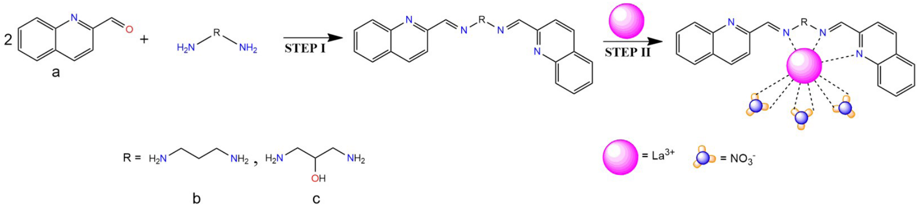

Figure 1: Synthesis scheme of complex compounds with lanthanide ions.

Acknowledgments
Funding from the NAWA PROM Programme 2025 is gratefully acknowledged

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POLYOXOMETALATES- COVALENT ORGANIC FRAMEWORKS (POM- COF) HYBRID SYNTHESIS WITH DOUBLE LAYER METHOD

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The rapid growth of industry and technology—including the increasing use of electronic devices, electric vehicles, and air conditioning systems—is driving a steady rise in electricity demand [1]. According to IEA [2] data, global electricity consumption in 2018 exceeded 22,000 TWh, while production reached over 25,000 TWh. At the same time, limited fossil fuel resources highlight the need to develop efficient energy storage systems that enable the accumulation and utilization of energy during periods of increased demand [3]. POM-COF hybrids are one of the promising candidates for constructing such storage systems. POM-COF hybrids were synthesized using a double-layer interfacial method in which the POM precursor was confined to one layer while the aldehyde-containing organic linker was introduced in a second layer. It is predicted that the separation of POM and COF into two non-mixing solvents would promote the formation of thin POM-COF hybrid membranes, similar to those obtained from COF double-layer synthesis [4]. The resulting hybrid materials may combine the reversible multielectron redox properties of POMs with the high porosity and stability of COFs [5].

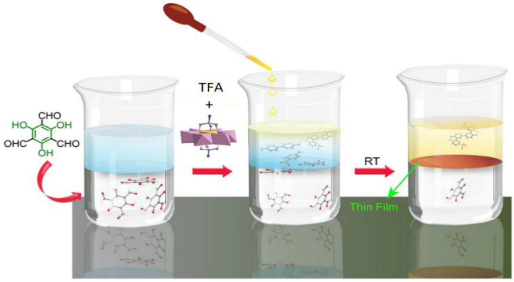

Figure 1. Simplified scheme of synthesis procedure [6]

Acknowledgments
Funding from the NAWA PROM Programme 2025 is gratefully acknowledged. Special thanks to project LIDER 0195/L-15/2024.

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SOLVOTHERMAL SYNTHESIS OF POM-COF HYBRIDS AS MATERIALS FOR ELECTROCHEMICAL ENERGY STORAGE

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The development of industry and technology requires an increase in global electricity consumption due to the growing use of electrical devices in everyday life, such as electric cars.[1]

For this reason, electricity is increasingly being generated from renewable sources and any surplus energy should be stored. Advanced hybrid materials based on polyoxometalates (POMs) and Covalent Organic Frameworks (COFs) are considered promising candidates for electrochemical energy storage applications due to their redox activity, porous structure, and tunable physicochemical properties.

One of the most extensively used method for producing POM–COF hybrid materials is solvothermal synthesis, but a better option is a specific variant of the solvothermal method is the flux method. The difference between them is that the flux method is more ecological (no need for toxic solvents), safer (no high pressure) and the products have higher crystallinity and efficiency.[2] The proces involves grinding the ingredients (polyoxometalate, aldehyde and benzoic acid as a modulator) in a mortar and transferring them to high-pressure reactor, next heated in 90 °C for 72 h.

The obtained products were isolated and subjected to preliminary physicochemical characterization, including XRD, IR, BET, and TGA analyses.

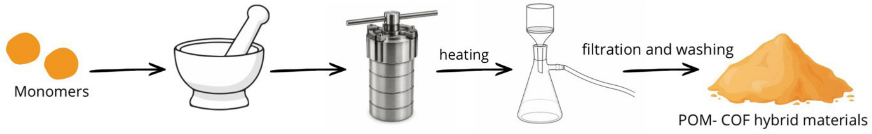

Figure 1. Scheme of the solvothermal synthesis of POM-COF hybrid materials.

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HOW TWO D-AMINO ACIDS RESHAPE METAL BINDING AND ANTIMICROBIAL FUNCTION IN A MUC7-DERIVED PEPTIDE

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Mucin 7, a protein found in saliva that contributes to non-immune defense mechanisms, is proteolytically cleaved within the oral fluid, producing fragments that exhibit antimicrobial activity [1]. To overcome proteolytic instability of antimicrobial peptides (AMPs), a Mucin 7-derived sequence was modified with two d-amino acids at the site most susceptible to proteolytic cleavage. This subtle modification alters peptide's metal coordination properties, thermodynamic stability, secondary structure and antimicrobial activity [2]. The coordination, structure and activity of the modified peptide with Cu(II) and Zn(II) were investigated using potentiometry, mass spectrometry, multiple spectroscopic techniques (UV-Vis, CD, EPR) and quantum-chemical calculations, complemented by antimicrobial and antibiofilm assays. The peptidomimetic exhibits enhanced resistance to enzymatic degradation and shifts Cu(II) binding from {2Nim} to {3Nim}, while retaining similar Zn(II) speciation.[3]

Importantly, metal binding combined with d-amino-acid-induced conformational flexibility converts the otherwise inactive peptide into a selective, metal-dependent antimicrobial agent targeting S. mutans and S. sanguinis, without cytotoxicity toward human cells.

The results show that minor changes in stereochemistry can serve as a powerful tool for tuning peptide properties, opening the door to the deliberate engineering of stable and biologically active peptidomimetics for therapeutic applications.

Acknowledgments
The work was supported by the National Science Centre (Grant UMO-2021/41/B/ST4/02654 to J.W.)

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CARBONATION-BASED HARDENING OF ELECTRIC ARC FURNACE SLAG BINDERS USING CO_2 AT LOW AND SUPERCRITICAL PRESSURES

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This study investigates the effect of CO_2 pressure conditions on the carbonation hardening of electric arc furnace (EAF) slag-based binders. Ten specimens containing 8 wt.% added water were prepared by static compaction and cured under accelerated carbonation curing (ACC) or supercritical carbonation curing (SCC).

The binders were characterised using compressive strength testing, thermogravimetric analysis (TGA), X-ray diffraction (XRD), scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDX), and mercury intrusion porosimetry (MIP). SCC specimens exhibited more homogeneous carbonation, lower porosity, and higher compressive strength than ACC specimens, indicating enhanced carbonation efficiency under supercritical CO_2 conditions.

The improved performance of SCC samples was associated with a denser microstructure resulting from a more uniform distribution of carbonation products. The results demonstrate that supercritical carbonation curing effectively enhances the engineering properties of EAF slag-based binders. Furthermore, the use of EAF slag supports industrial by-product valorisation and reduces landfill disposal [1,2], while carbonation enables long-term CO_2 storage through mineralisation, contributing to carbon sequestration and circular economy objectives [3]. Overall, SCC shows strong potential for producing durable and environmentally sustainable construction materials.

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EXPLORING THE POTENTIAL OF NTMP, EDTMP AND DTPMP AS FERTILIZER CHELATING AGENTS

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Due to the continuously growing global population and the rising demand for food, sustainable agriculture has become an increasingly important challenge. One of the key issues is ensuring an efficient supply of both micro- and macronutrients to plants while preventing these elements from becoming unavailable for plant uptake. To address this problem, chelating agents are widely used to enhance nutrient availability and stability in fertilizers [1].

Currently, polyaminocarboxylic chelators such as EDTA or DTPA are widely applied in agriculture due to their high complexation degrees of micronutrients. However, these compounds exhibit very low biodegradability, typically ranging from 0 to 20%, which raises significant environmental concerns [2, 3].

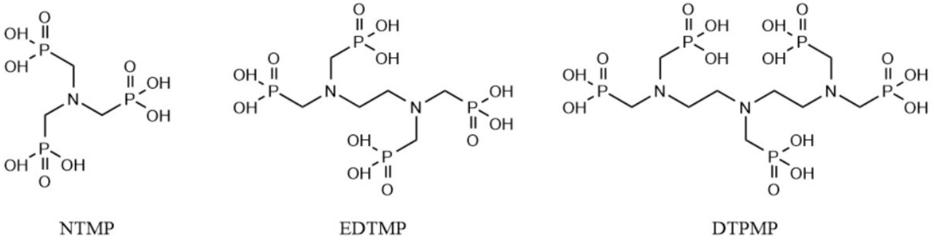

Figure 1. Structural formulas of the investigated organophosphorus chelators.

Therefore, the search for alternative fertilizer chelating agents with more favorable environmental properties has become highly important. This study investigates the potential of three organophosphorus compounds - NTMP, EDTMP and DTPMP - as fertilizer chelating agents. The research focuses on evaluating their complexation abilities toward selected metal ions relevant to plant nutrition and assessing their suitability for agricultural applications.

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SYNTHESIS OF SHORT PEPTIDES CONTAINING BICYCLIC PROLINE ANALOGUES AND RELATED FRAGMENTS OF CYCLIC SIDEROPHORES

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The modification of peptides through the introduction of unnatural amino acids is becoming an increasingly common strategy in peptide chemistry. These modifications are typically aimed at enhancing properties such as biological activity, solubility, and stability. Our research focuses on the replacement of proline with its bicyclic analogues in biologically active peptides. Some studies suggests that the incorporation of bicyclic systems can significantly enhance the conformational stability of peptides (1). An additional advantage of these derivatives lies in their potential for versatile structural modification (2). The use of more rigid bicyclic amino acids is expected to reduce the conformational flexibility of peptides, potentially resulting in a better fit within enzyme active sites, increased selectivity, and reduced toxicity.

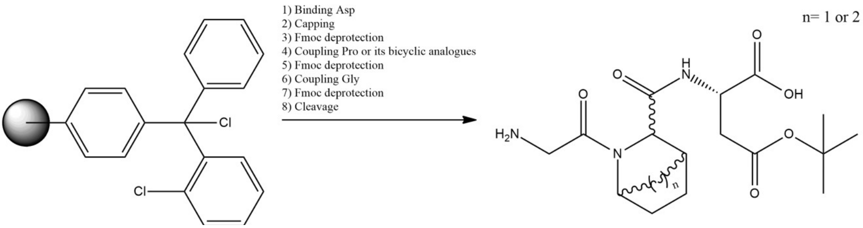

Figure 1 Example of obtained peptides with bicyclic proline analogues.

During the presentation, I will discuss the synthetic methods used for the preparation of bicyclic proline analogues, outline future synthetic plans, and present both the peptides obtained to date and those planned for future studies.

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This work was supported by project UMO-2022/47/I/ST4/02354

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TERMINOLOGY AND CLASSIFICATION OF PFAS:TOWARDS A SCIENTIFICALLY CONSISTENT FRAMEWORK

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Per- and polyfluoroalkyl substances (PFAS) comprise a structurally diverse group of fluorinated organic compounds that have attracted increasing attention across chemistry, materials science, environmental sciences, and related disciplines. Despite widespread use of the term PFAS, substantial differences exist among definitions proposed in the scientific literature and by various organizations. These differences often reflect distinct objectives and may lead to inconsistencies in the interpretation of terms such as fluorinated, polyfluorinated, perfluorinated, polyfluoroalkyl, and perfluoroalkyl.
An IUPAC Task Group has been established to examine PFAS terminology and classification from a scientific and nomenclature-oriented perspective. The project aims to develop a self-consistent framework based on chemical structure and established nomenclature principles, while remaining independent of regulatory, policy, hazard, or risk-assessment considerations. Particular attention is being given to the interpretation of prefixes such as per- and poly-, the relationship between fluorinated structural motifs and terminology, and the distinction between different classes of fluorinated organic compounds.
The work includes a critical review of existing definitions proposed in the scientific literature and by international organizations, together with an evaluation of their structural foundations and terminology implications. The emerging framework seeks to improve clarity and consistency in scientific communication by providing terminology that is chemically meaningful and compatible with established IUPAC nomenclature. This contribution presents the objectives, guiding principles, and current progress of the IUPAC project, and discusses key challenges associated with the development of a scientifically robust terminology and classification system for PFAS.

Keywords: classification, fluorinated compounds, IUPAC, nomenclature, PFAS, terminology

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DESIGN AND CHARACTERIZATION OF NAPHTHALENE DIIMIDE DERIVATIVES FOR ELECTROCHROMIC SYSTEMS

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Naphthalene diimides (NDIs) represent an important class of aromatic diimides characterized by strong electron-accepting properties arising from their electron-deficient aromatic core and high electrochemical stability. NDI derivatives undergo two reversible reduction processes, leading to the formation of radical anions and dianions. These redox transformations are accompanied by significant changes in the optical properties of the compounds, making NDI-based materials attractive candidates for electrochromic applications.[1–4]
The optical and electrochemical properties of NDI derivatives strongly depend on the nature and position of substituents attached to the aromatic core. Appropriate molecular design enables precise tuning of the HOMO and LUMO energy levels, which in turn allows modulation of electrochemical behavior, absorption characteristics, and fluorescence properties of these materials.
The presented research explores the potential of NDI derivatives as functional electrochromic materials through the investigation of their structural, optical, and electrochemical properties.

This research was financially supported by the National Science Centre, Poland, under the SONATA BIS project (No. 2019/34/E/ST5/00103).

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STRUCTURE–PROPERTY RELATIONSHIPS IN AZA-DIPYRROMETHENE AND DIPYRROMETHENE METAL COMPLEXES: TOWARDS SUPRAMOLECULAR PHOTOACTIVE SYSTEMS

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The rational design of photoactive coordination compounds requires a detailed understanding of the relationships between molecular structure, supramolecular organization, and photophysical behavior. Among emerging chromophoric systems, dipyrromethene (DPM) derivatives have attracted increasing attention due to their tunable electronic properties, strong visible-light absorption, and versatile coordination chemistry [1].

In this contribution, a series of brominated aza-dipyrromethene and dipyrromethene complexes incorporating Zn(II), Co(II), and Cu(II) ions are presented as model systems for investigating structure–property relationships in photoactive metal complexes. The coordination environment around the metal center significantly influences the electronic structure, fluorescence behavior, redox properties, and excited-state dynamics of the resulting compounds. Attention is devoted to the role of these structural factors in facilitating intersystem crossing and promoting the generation of singlet oxygen, a key reactive oxygen species in light-induced processes.

Furthermore, interactions of selected complexes with biologically relevant nucleic acid secondary structures, including G-quadruplex motifs, demonstrate the potential of these systems to function as multifunctional photoactive platforms. The obtained results provide insight into how coordination-driven molecular architecture governs both supramolecular recognition and photoinduced reactivity.

Overall, this work highlights aza-dipyrromethene and dipyrromethene metal complexes as a versatile family of compounds at the interface of coordination chemistry, supramolecular chemistry, and photochemistry, offering new perspectives for the development of advanced photoresponsive molecular systems [2].

This work was supported by the National Science Centre, Poland (grant no. 2022/44/C/ST4/00017).

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MEMBRANE-MEDIATED ACTION OF CANNABIDIOL: INSIGHTS FROM MONOLAYER AND BILAYER MODELS OF NEURONAL MEMBRANES

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Cannabidiol (CBD), the main non-psychotropic phytocannabinoid of Cannabis sativa, exhibits broad biological activity, but its molecular mechanism remains only partly understood. Besides direct interactions with receptors and ion channels, CBD may affect biological function by modifying the physicochemical properties of lipid membranes [1,2]. This mechanism is especially relevant for neuronal membranes, whose organization is strongly controlled by cholesterol, sphingomyelin and aminophospholipids. In this work, the interaction of CBD with model neuronal membranes was investigated using complementary monolayer and bilayer approaches. Binary Langmuir monolayers composed of CBD and individual neuronal lipids, namely cholesterol, POPC, POPE, POPS and sphingomyelin, were first studied to identify lipid-specific effects. Next, a multicomponent neuronal membrane model composed of Chol/POPC/POPE/POPS/SM at a molar ratio of 33/33/20/8/6 was analyzed using surface pressure–area isotherms, Brewster angle microscopy, Langmuir–Blodgett films, liposomes, DPH fluorescence anisotropy, dynamic light scattering, zeta-potential measurements and atomic force microscopy. CBD modified lipid packing, monolayer elasticity, morphology, bilayer fluidity and surface properties in a composition-dependent manner. The strongest effects were observed in cholesterol-containing systems, whereas POPC-rich films were the least affected. In the multicomponent neuronal model, CBD decreased monolayer condensation, increased bilayer fluidity, changed vesicle size and zeta potential, and reorganized nanoscale membrane topography. These results indicate that CBD acts not only as a ligand of membrane proteins but also as a membrane-active compound capable of remodeling neuronal lipid organization. Such membrane-mediated effects may contribute to the broad and context-dependent biological activity of CBD.

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BETWEEN PROMISE AND PRECAUTION: EVALUATING THE TOXICITY OF 'GREEN' POROUS LIQUIDS ACROSS BIOLOGICAL SYSTEMS

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Porous liquids have emerged as a promising class of advanced materials which combine permanent porosity with fluidity. They are often proposed as 'green' alternatives in separations and catalysis, although their biological safety remains underexplored. Here, we present a comprehensive evaluation of the toxicity of two representative porous liquid systems based on methyltriphenylphosphonium bromide ([P1Ph3][Br]) and trihexyltetradecylphosphonium bis(trifluoromethylsulfonyl)amide ([P66614][NTf2]) [1], combined with glycerol and ZIF-8, across a spectrum of biological models. Acute toxicity was assessed in microorganisms (Escherichia coli), aquatic organisms (Daphnia magna, Raphidocelis subcapitata, Artemia franciscana), plants (tomato and oat), and human dermal fibroblasts. While both materials exhibited low cytotoxicity towards human dermal fibroblasts (IC50>0.5 mM), notable toxicity emerged in aquatic organisms and bacteria, especially for aromatic [P1Ph3][Br]-based systems (EC50=1-10 mg dm-3). The studied multicomponent formulations disrupted microbial growth and inhibited seedling development even at low concentration, revealing unexpected phytotoxicity. These contrasting outcomes (lack of effect on human cells, hazardous to ecosystems) highlight the hidden complexity of structure-toxicity relationships in porous liquids. Our findings call for a shift from assumption to evidence in the development of so-called 'green' solvents, as functionality must go hand-in-hand with environmental foresight.

Acknowledgements
This study was financed by Ministry of Science and Higher Education (0912/SBAD/2606)

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NEW IODONIUM PHOTOINITATORS FOR CATIONIC VAT 3D-PRINTING

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3D-VAT printing is an excellent alternative to traditionally preparing polymer 3D objects, reducing costs, and increasing the resolution of the objects. However, the application of cationic 3D-VAT printing is still limited by a number of inconveniences such as the lack of suitable photoinitiators absorbing in the emission range of light sources used in printers (about 405 nm) (1].

Most of commonly used iodonium salts are diaryl derivatives proposed by Crivello in 70s. They absorb poorly above 300 nm and need photosensitizers or special light sources to initiate polymerization efficiently [2]. Therefore, the development of advanced iodonium salts that absorb in the longer wavelengths is essential. They must also efficiently generate super acid.

Our new innovative chromophore designs allow iodonium salts to be obtained in a selective manner which was previously impossible for the more sophisticated chromophores [3]. Moreover, a double bond was used in these chromophores and, among other, we obtained the first symmetric iodonium salts containing such moiety [4]. However, further extension of the double bond system allowed for a significant increase in the quantum efficiency of acid generation [5]. Such advances in the structure of iodonium salts (possible by our design) have produced compounds with excellent absorption properties reaching into the visible range. These new iodonium salts are able to photolyse efficiently even at 430 nm LED irradiation and can photoinitiate cationic polymerization process of such monomers as epoxides and vinyl ethers. It was possible to study the substituent effects due to the easily modifiable structure of the chromophore, what allowed for a better understanding of sophisticated iodonium salts properties. This design leads to a great improvement in photoinitiating properties so that our salts can be used in such advanced applications as cationic 3D-VAT printing.

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[4]. F. Petko, M. Galek, E. Hola, M. Topa-Skwarczyńska, W. Tomal, M. Jankowska, M. Pilch, R. Popielarz, B. Graff, F. Morlet-Savary, J. Lalevee, J. Ortyl, Chem. Mater. 2022, 34 (22) 10077–10092
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SPECIAL SPEAKERS

Paweł Kulesza
Pawel J. Kulesza is Professor of Chemistry at University of Warsaw (Poland), Fellow of the Electrochemical Society (USA), and Member of the Polish Academy of Sciences. His recent interests concern development and characterization of hierarchical and functionalized inorganic nanomaterials and interfaces of importance to electrocatalysis, electrosynthesis, photoelectrochemistry, mechanisms of charge propagation and induced electron transfer, analytical chemistry, as well electrochemical energy conversion and storage. For scientific achievements, he received in 2024 Volta Award and Medal from The Electrochemical Society. At University of Warsaw, he was Dean of Faculty of Chemistry and, presently, he acts as Chairman of Council for Chemical Sciences Discipline and Member of the University Senate. In Polish Academy of Sciences he is Member of Presidium and Chairman of Committee for Chemistry. On national level in Poland, he is Member of Council for Scientific Excellence. For 15 years (2010-2025), he served as Editor of Electrochimica Acta (Elsevier). He is a member of editorial boards of Journal of Solid State Electrochemistry, Electrocatalysis, Russian Journal of Electrochemistry (Springer) and Catalysts (MDPI). In The Electrochemical Society, in addition to activity in many committees and organization of symposia at meetings, he has served as Member of Board of Directors, Chair of Physical Analytical Electrochemistry Division and Chair of European Section. He is also a member of International Society of Electrochemistry, Polish Chemical Society, American Chemical Society, and Polish Catalysis Club.

PLENARY SPEAKERS

Bruno Ameduri
Besides Science, Bruno enjoys cycling, swimming and skiing and has some volunteered activities, dressed in clown to visit sick children and elders in the hospitals of Montpellier and in Japan.

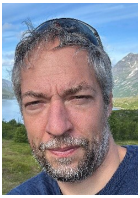
Artur Ciesielski
Outside the lab, Artur is an avid reader with a taste for epic fantasy and the kind of psychology books that make you question your life choices — Peterson and Saad are regulars on his shelf. He fuels his work (and alleged workaholism) with Chinese food, strong coffee, and the occasional travel to somewhere he's never been. Friends describe him as detail-oriented to a fault — he prefers "thorough." When not working on papers and proposals, he can be found chasing the next chapter of a 1000-page fantasy novel or planning a trip he may or may not have already color-coded in a spreadsheet.

Jean-François Nierengarten
Jean-François Nierengarten is currently Directeur de Recherche at the CNRS (DR1) and head of the Laboratoire de Chimie des Matériaux Moléculaires (University of Strasbourg and CNRS). When he's not doing chemistry, he manages a football team for AS Kilstett and plays in the super veteran league. He also enjoys spending time with his family and cooking a nice meal to share with friends.

Miłosz Pawlicki

Unfortunately, I do not have much free time that might be used otherwise than scientifically, nevertheless if something like that happens, I do enjoy music (listening and playing) of different kinds and origins. Besides that, my daughters and I like assembling Lego bricks. I personally focus on the Star Wars series keeping in mind Master Yoda's philosophy:

Do or do not. There is no try!



Fabrice Pointillart

I obtained my PhD in Physics and Materials Chemistry from Pierre and Marie Curie University in 2005, under the supervision of Prof. Cyrille Train and Prof. Michel Verdaguer. Following a postdoctoral fellowship at the University of Florence with Prof. Roberta Sessoli, I joined the University of Rennes in 2007 as a CNRS researcher. My current research focuses on multifunctional molecular lanthanides materials, exhibiting single-molecule magnet behavior, magneto-chiral dichroism, and circularly polarized luminescence. Outside of research, I have been practicing triathlon for over fifteen years. I also enjoy spending time with my wife, our two children, and friends, often sharing good food, including seafood and barbecues.

ORAL SPEAKERS

Mihail Barboiu

Mihail Barboiu graduated from University Politehnica of Bucharest and received his PhD in 1998 from the University of Montpellier. He is CNRS Research Director at the Institut Europeen des Membranes in Montpellier and Fellow of Royal Society of Chemistry. A major focus of his research is Dynamic Constitutional Chemistry toward Dynamic Interactive Systems: adaptive biomimetic membranes, dynamic delivery devices etc. Author of more than 400 scientific publications and 500 conferences and lectures, Dr Barboiu has received the 2024 Andre Collet Prize From French Chemical Society, European Investigator Award in Chemistry in 2004 and the RSC Surfaces and Interfaces Award in 2015 for the development of Artificial Water Channels.

Anna Berlicka

In my free time, I enjoy activities that allow me to relax and step away from my academic work. Gardening is my preferred way to unwind. I also enjoy reading crime novels and travel literature. Spending time traveling and exploring new places with my family is another activity I value highly.

Michał Bielejewski

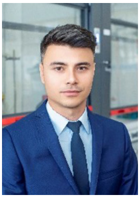
Michal Bielejewski is an Associate Professor at the Institute of Molecular Physics, Polish Academy of Sciences in Poznań (IMP PAS), specializing in molecular dynamics, intermolecular interactions, and charge transport phenomena within supramolecular ionic systems, soft matter, ionic liquids, and solid-state matter. Employs advanced nuclear magnetic resonance techniques (HR ssNMR, diffusion NMR, and FFC NMR Relaxometry). Notably introducing, for the first time in Poland, the electrophoretic NMR (eNMR) method. In his free time, he loves to read books, fish, and eat sushi.

Wojciech Chaładaj

My true passion lies in outdoor mountain activities – specifically climbing, canyoning, and ski touring. That's why the publication I am most proud of isn't in JACS or Angewandte, but in the American Alpine Journal (2010, pages 173–174). When I'm back in the flatlands, I try to find time for cooking, seeing friends, and, of course, chemistry.

Bastien Chatelet

Bastien Chatelet obtained his Phd in 2013 at École Normale Supérieure de Lyon under the supervision of Dr. Véronique Dufaud and Dr. Alexandre Martinez working on hemicryptophanes and organocatalysis in confined space. He, then carried out postdoctoral research at University of California, San Diego (UCSD) under the supervision of Prof. Guy Bertrand. He was appointed in 2016 assistant professor at Institut des sciences moléculaires (iSm2) in Marseille in the group of Prof. Alexandre Martinez. He developed catalysis and molecular recognition with hemicryptophanes He then moved to Sorbonne Université in Paris in 2024 in the group of Prof. Sollogoub developing organocatalysis with cyclodextrins. In his spare time, he enjoys cooking and practicing sport.



Paweł Chmielarz

Prof. Paweł Chmielarz is a Full Professor and Head of the Department of Physical Chemistry at Rzeszow University of Technology. He spent 3 research internships in the group of Prof. Krzysztof Matyjaszewski at Carnegie Mellon University (Pittsburgh, USA). Prof. Chmielarz scientific achievements include over 100 publications in international journals and patent applications in US Patent Office. He is a promoter of 9 doctoral dissertations, and 133 master's and bachelor's dissertations. Prof. Chmielarz has received numerous awards for his work, including the Kosciuszko Foundation Award (2016, New York), Minister of Science and Higher Education Award for outstanding young scientists (2018, Warsaw) and Bronze Cross of Merit awarded by the President of the Republic of Poland for his services in the development of science (2019, Warsaw). He is also a member of American Chemical Society, European Chemical Society, Kosciuszko Foundation, Polish National Agency for Academic Exchange, National Centre for Research and Development in Poland, National Science Centre in Poland, Research Council of Finland and Swiss National Science Foundation. He specializes in issues related to the synthesis of polymers using atom transfer radical polymerization methods. Chmielarz Research Group continues to improve low ppm ATRP methods and prepare materials with controlled topology and composition suited for many applications.

Fabien Cougnon

Fabien Cougnon obtained his PhD in 2011 from the University of Cambridge (UK), working under the guidance of Prof. Jeremy Sanders. After postdoctoral research with Prof. David Leigh (University of Edinburgh, UK) and Prof. Elizabeth Nolan (MIT, USA), he started his independent career in 2015 as a junior group leader at the University of Geneva (Switzerland). In September 2021, he moved to the University of Jyväskylä (Finland) where he is now an Associate Professor in Synthetic Nanochemistry. His research currently focusses on molecular nanotopology and dynamic covalent chemistry.

Dominika Czerwonka

Mum to a sweet little girl, two cats, and a German Shepherd. Outside the lab, she enjoys puzzles, reading, and binge-watching crime shows whenever time allows.

Christophe Desmarets
Christophe Desmarets obtained his Ph.D. in 2003 from the University of Nancy I under the direction of Pr. Y. Fort working on nickel-catalyzed polyarylamine synthesis for conductive materials. In 2004, he moved to Pr. John A. Gladysz's group (Erlangen–Nürnberg), as an Alexander von Humboldt fellow, studying triangular platinum complexes with carbon chain linkages. In 2006, he joined Pierre and Marie Curie University became Sorbonne University. He is associate professor in IPCM (Parisian Institut of Molecular Chemistry) and his major research focuses on the self-assembly of molecular functional chiral and luminescent coordination assemblies, especially metallocages for host–guest chemistry.

Wojciech Drożdż
My research interests focus on the broadly understood chemistry of organic and metal – organic cage systems, with particular emphasis on supramolecular chemistry and host–guest interactions. My work involves the design, synthesis, and investigation of complex molecular architectures and their properties. Outside research, I play volleyball and enjoy following sports such as snooker and golf. I am also interested in all kind of music and crime fiction literature.

Beata Dudziec
Beyond chemistry, I enjoy spending time with my dog, playing board games — with Terraforming Mars and Eclipse among my favourites — exploring international cuisine, and hiking in the mountains with a backpack. Curiosity, it seems, is useful not only in the laboratory, but also at the game table, on the trail, and .... in the kitchen?

Paweł Dydio A synthetic chemist focused on designing catalytic systems that enable new and efficient chemical transformations, particularly through mechanistic insights, multicatalysis, and reaction networks. Outside the lab, I enjoy traveling, exploring new ideas, and good food and drink.

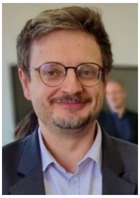
Emmanuel Flahaut
Dr E. Flahaut works as a CNRS Senior Researcher at the CIRIMAT (Inter-University Centre for Research and Engineering of Materials) working at the University Paul Sabatier in Toulouse, France. He was a post-doctoral research fellow at Oxford University in the group of Pr Malcolm Green where he worked mainly on the filling of CNT with 1D-crystals. His main research fields are the CCVD synthesis, functionalisation and filling of CNT (mostly DWCNTs), for various applications in the fields of materials (interconnections in nanoelectronics, composite materials, sensors) and bio-medicine. He is working on the human health issues related to CNT and graphene and related materials, including the synthesis and functionalisation as well as the study of their environmental impact. Author of 290 publications in int. peer-reviewed journals (H=58). He is expert for the French National Agency for Food, Environmental and Occupational Health & Safety since 2008 and currently member of its Scientific Council. Fellow of the European Academy or Sciences (EurASc, 2020) and of the European Academy of Sciences and Arts (2026).

Régis Gauvin
My main research interests are organometallic chemistry, mainly for applications in homogeneous and heterogeneous catalysis, and use of bioresources for small molecules and polymer synthesis.

Paula Gawryszewska
Prof. Paula Gawryszewska - obtained her PhD at the Faculty of Chemistry, University of Wroclaw and completed her postdoctoral fellowship in the group of Prof. J. P. Riehl at Michigan Technological University, USA, where she studied CPL generated in racemic systems. Her research focuses on multifunctional luminescent materials, energy transfer in Ln coordination compounds in the solid state, solutions and polymers. Recently, she has been developing fs and ns transient absorption techniques at the University of Wroclaw and is interested in enhancing Ln emission by plasmon coupling with Ag and Au NPs. She loves dancing, hiking in the mountains, especially in the Balkans, skiing and playing badminton. She loves watching ballet. Her favorite food is dumplings, and her favorite drink is tea.

Karol Grela
Karol Grela specializes in organic chemistry and catalytic olefin metathesis. His main scientific interest is the rational design of highly stable and selective ruthenium catalysts (especially those bearing NHC and CAAC ligands) for demanding metathesis reactions, including sustainable transformations of biomass and renewable feed-stocks. He is Professor at the University of Warsaw and heads the Laboratory of Organometallic Synthesis. For many years, he has been collaborating with Apeiron Synthesis S.A. and Polpharma S.A. Privately he likes small tropical inhabited (or uninhabited, even better!) islands where one can scuba dive in beautiful clear waters and afterwards write scientific papers, read, or simply think.

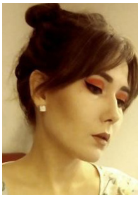
Jan Holub
Avid hiker and climber. In his spare time enjoys good sci-fi and fantasy books.



Nicolas Illy
Nicolas Illy is an Associate Professor of Polymer Chemistry at Sorbonne University (Paris, France). His research lies at the interface of materials chemistry and sustainable polymer science, with a focus on the design of functional polymeric materials. His work encompasses the development of novel polymerization methods, controlled polymerization processes, and macromolecular engineering strategies to tailor polymer structures and properties. His current research particularly targets multifunctional polyesters for applications in hydrogels and biomaterials. Outside academia, he enjoys swimming, hiking, and reading.

Agnieszka Jastrzębska
Agnieszka Maria Jastrzębska PhD, ScD, Eng. is a Professor at the Warsaw University of Technology (WUT). She is a nanotechnologist and leads an interdisciplinary research team at the Faculty of Mechatronics, Institute of Metrology and Biomedical Engineering. She has published numerous peer-reviewed articles in high-tier journals such as Advanced Materials, Advanced Functional Materials, to mention a few, and book chapters. Since 2021, among the World's TOP 2% Scientists according to Stanford University and Elsevier. For her research work and scientific activity she has received many awards and distinctions, such as Gold Cross of Merit (2025) from the President of the Republic of Poland, the Economic Award in the R&D category (2022), the Award of the Minister of Education and Science for implementation achievements (2021), and the Poland Now emblem (2023). Member of the scientific societies Materials Research Society (MRS USA, since 2019), American Chemical Society (ACS USA, since 2020), Scientific Committee of the NANONET Foundation (NANONET, since 2025).

Martin Jönsson-Niedziółka
Martin is a Swedish physicist who somehow ended up doing electrochemistry in Poland. When escaping from work, he enjoys rock climbing, hiking and bicycling. He also loves reading, photography and playing computer games.



Katarzyna Kaczmarek
Creative and artistic soul with a passion for drawing, linocut printmaking, cyanotype photography, playing the ukulele, and baking homemade cakes.

Anna Kajetanowicz
I'm passionate about keeping active, so fitness is a big part of my life. I also love reading, solving puzzles and crosswords, and discovering new places – especially when it comes to history and local cuisine, even though I'm a bit afraid of flying. Cooking isn't my strong suit, but luckily my husband is my personal chef at home! I'm a big animal lover, particularly cats, and I share my home with three adorable feline companions.

Beata Kalska-Szostko
Dr. hab. Beata Kalska-Szostko, prof UwB, graduated in Physics from the University of Warsaw (branch in Bialystok) (MSc) and in Materials Physics from Uppsala University (PhD). She completed her 3-year postdoc training at the Institute of Experimental Physics, Free University of Berlin. Since 2003, she has worked as a researcher at the Faculty of Biology and Chemistry University of Białystok (now Faculty of Chemistry) developing nanomaterials laboratory. She also participated intensively in designing and equipping the BioNanoTechno Center of the University of Bialystok. Scientifically she is focused on design, fabrication, and physicochemical characterization (including magnetic properties) of various nanomaterials. She worked with magnetic thin films, multilayers, nanowires, as well as other functional nanoparticles, carbon nanostructures, nanocomposites, and hybrid materials. Her scientific team also worked on various core-shell or multi-layered systems. She participated as the PI or scientific coordinator in a few research projects. She published over 135 articles in the fields of physics, chemistry, materials science, and nanotechnology (H index: 22).

Paweł Kowalczyk
Pawel J. Kowalczyk Polish physicist, University of Lodz professor, Head of Department of Solid State Physics. He is especially interested in the study of materials characterized by reduced dimensionality - mainly two-dimensional systems and their hybrids. He mainly focuses on nanoscale investigations of 2D materials using SPM and in microscale using ARPES/XPS. For last 10 years whenever he can he returns to investigation of bismuthine and antimonene his two favorite materials. Very recently he also engaged in development of green energy photovoltaics based on 2D materials. In private live he is interested what happens under the stone and what is behind the corner. He loves to travel and experience new things.

Mateusz Kowalik
M. Kowalik is employed at the Department of Bioinorganic Chemistry at the University of Gdańsk. In his research, he deals with the synthesis, physicochemical analysis, and determination of application properties, especially of metal complexes. Currently, he focuses his scientific interests on biologically active coordination compounds. In his free time, he is interested in movies, fantasy, and world cuisine.

Artur Krężel My research group focuses on the chemistry and biological roles of zinc ions in controlling a wide range of cellular processes, with particular emphasis on their storage, buffering, and redistribution mechanisms. We are also interested in uncovering the chemical interconnections between zinc and copper metabolism, especially how these metal ions influence each other at the molecular level. A significant part of our work is devoted to the development of advanced bioanalytical methods, including spectroscopic techniques (primarily fluorescence-based approaches) and mass spectrometry. Beyond research, I also enjoy traveling and exploring different cultures, as well as cooking, with a particular appreciation for Mediterranean cuisine.

Krzysztof Kuciński
Krzysztof Kuciński is an Associate Professor at the Faculty of Chemistry, Adam Mickiewicz University in Poznań, Poland. His research focuses on organosilicon chemistry, homogeneous catalysis, and catalyst-free activation strategies. He is especially interested in developing operationally simple synthetic methodologies. Outside the laboratory, he enjoys traveling, playing volleyball, and reading fantasy literature. He is also a multiple medalist in the Polish National Volleyball Championships for university employees.

Julien Leclaire
Outside his professional activities, Julien is a proud father of three who cultivates a strong appreciation for effort, creativity, and the natural world. He enjoys badminton, outdoor running, and fitness training, and is constantly driven by a curiosity to explore new places and experiences. His free time is devoted to gardening, travelling with the lowest possible environmental footprint, photographing remarkable landscapes, and renovating an old house nestled among vineyards. Deeply inspired by Nature's resilience and ingenuity, he also enjoys discovering authentic products from local growers and sharing them around the table with friends and family.

Constance Lecourt
Constance Lecourt is a CNRS researcher at IPCM (Paris), Sorbonne University, since 2024. She defended her PhD thesis in 2019, carried out at the LMI in Lyon under the supervision of Prof. Luneau and Dr. Desroches. She continued her research during a first postdoctoral period, in collaboration with Dr. Fillaud at LISE and Prof. Lescouëzec at IPCM in 2020. She then joined Dr. Sutter's team at LCC as an ATER (Toulouse), and finally Dr. Lescop's team at ISCR (Rennes) in 2021. Coordination chemistry is at the heart of her research activities, with a focus on the synthesis of multifunctional heteropolymetallic compounds for the study of their photophysical, magnetic and switchable properties.

Ahmed Legrouri
I am a dedicated academic, researcher, and leader with a profound passion for scientific innovation and global higher education development. Holding degrees from Morocco, France, and the United Kingdom, my career has been defined by a commitment to fostering academic excellence across Africa. Currently, I serve as a Senior Advisor for Research at UM6P, Morocco. I previously served as Professor, Provost, VPAA, and Dean in institutions in Morocco and Côte d'Ivoire. I have had the privilege of consulting for the United Nations and UNESCO on critical water management and educational initiatives. I supervised several doctoral theses and published numerous peer-reviewed documents. I speak Arabic, English, French, and German.

Grzegorz Markiewicz
Outside the lab, I am passionate about mountaineering, rock climbing, hiking, and delicious food. My ideal day combines sharp ridges and exposed walls in the Austrian Dolomites with Italian pasta and German wine afterward - a balance of challenge, adventure, and appreciation for life's simple pleasures.

Katarzyna Matczyszyn
Prof. Katarzyna Matczyszyn is physical chemists at PWr. She is also affiliated member of the WPI Chiral Meta Materials SKMC2 at the Hiroshima University, Japan. Prior to this she worked at CEA Saclay, ENS de Cachan and Paris-Sorbonne etc. Her major scientific interest falls into light-matter interactions, especially on biologically significant materials. She works with photoactive molecules, various types of nanoparticles, lyotropic liquid crystals such as myelin and DNA as well as in the field of nonlinear optics. She is particularly keen on novel approaches to photodynamic therapy. She got the title Wroclavian of the year 2024 in the science, the French-Polish prize of the French Chemical Society (SCF) 2023 as well as the Ministry of Science award in 2024.

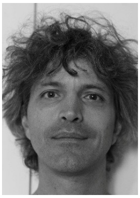
Iwona Misztalewska-Turkowicz
I am an Assistant Professor at the University of Białystok. After work, I relax by spending time in my garden. I have a small vegetable garden where, in addition to vegetables, I grow flowers. I also love to spend time with my children, especially in artistic activities, from drawing and painting to creating out-of-this-world creatures from toilet paper rolls. I love the Spanish language and, whenever I have the opportunity, I try to practice speaking it.

Verónica Montes-García
I am a materials chemist whose research focuses on the development of hybrid low-dimensional materials for sensing and energy storage. I obtained my PhD in Chemistry in 2017 from the University of Vigo (Spain). From 2018 to 2025, I was a postdoctoral researcher at the Institut de Science et d'Ingénierie Supramoléculaires (ISIS), Université de Strasbourg (France). Since October 2025, I have been working as a Postdoctoral Researcher at the Centre for Advanced Technologies (CAT), Adam Mickiewicz University in Poznań (Poland), in the group of Prof. Artur Ciesielski. In my free time, I enjoy hiking and running, I love exploring all types of cuisine, and I enjoy reading books on society, psychology, and contemporary cultural topics.

Jamal Moussa
Dr. Moussa obtained a PhD from Université Pierre et Marie Curie (UPMC), in Paris, France in 2007 working on the synthesis of luminescent transition metal complexes. He then moved to ETHZ for a two-year postdoctoral stay in the group of Antonio Togni working on the use of ferrocenyl based NHC ligands for asymmetric catalysis. He was then appointed an assistant professor position in 2009 at UPMC. In 2023 he defended the Habilitation to direct researches as associate professor at Sorbonne Université, Paris. He is currently leading his research in a reaserch group at Sorbonne Université involved in a strong CNRS-Kyushu University Japan with the group of Prof. C. Adachi in the frame of the IRP (International Research Project) LUX-ERIT with the aim to seek photonic applications such as OLEDs technology. Dr. Moussa has co-authored over 60 scientific publications and oral communications in addition to several invited lectures and visiting professor positions.

Tadeusz Muzioł
My scientific interests focuses on structural studies based on single crystal X-ray diffraction methods, supramolecular chemistry and XAS studies using synchrotron radiation. I like very much hiking and mountaineering and classical music.

Renaud Nicolaÿ
Travelling to new regions and countries.



Yvain Nicolet
Ever since I was a kid, I've been driven by curiosity about the tiny things around us — first insects and rocks, then microbes, and eventually proteins, their structures, and the mechanisms behind how they work. I'm also a big fan of comic books, classical literature, and music. To me, scientific research is very much about the same freedom and creativity that you find in art.

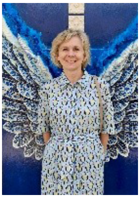
Joanna Ortyl
Joanna Ortyl is a Professor at the Cracow University of Technology, specializing in polymer photochemistry and the development of innovative photoinitiators for 3D printing, bioprinting, and 2D coating technologies. Her expertise also extends to non-invasive monitoring of photopolymerization kinetics for industrial applications. Her international career includes a long-term postdoctoral stay at Münster University of Applied Sciences (Germany) and several terms as a visiting professor at the University of Haute-Alsace (France) within Prof. Jacques Lalevée's group. She is also an alumna of the Top 500 Innovators program, having completed an MBA course at UC Berkeley. With over 15 years of research experience, Prof. Ortyl has managed more than 20 national and international R&D projects, collaborating closely with industrial partners. Combining science with entrepreneurship, she co-founded the startups Photo HiTech and Photo4Chem to commercialize her innovations. Her work bridges the gap between fundamental photochemistry and high-tech industrial materials, driving the development of sustainable and innovative chemical technologies.

Jan Paczesny
Jan Paczesny is an associate professor at the Institute of Physical Chemistry PAS, where he has led the Living Materials research group since 2022 and has served as Deputy Director for Scientific Affairs since 2023. He studied chemistry at Adam Mickiewicz University iPoznań, graduating in 2009 with the Maxima Cum Laude medal. During his studies, he completed a research internship at Lund University in Sweden in 2008. He received his PhD from the Institute of Physical Chemistry PAS in 2012, with distinction, and obtained his habilitation in 2022. From 2016 to 2018, he worked as a postdoctoral researcher in the group of Prof. Bartosz Grzybowski at the IBS Center for Soft and Living Matter in Ulsan, South Korea. He was also a fellow of the TOP500 Innovators program at UC Berkeley in 2013 and of the Matsumae International Foundation in Japan in 2023.

Elżbieta Pamuła
I am a full professor of biomaterials engineering, recently serving as Chair of the Biomedical Engineering Discipline Council at AGH University of Krakow, a President of the Polish Society for Biomaterials and a Council Member of the European Society for Biomaterials. I am mainly interested in the processing of polymers and lipids in drug delivery systems to the lungs, the design and manufacturing of multifunctional implantable and injectable bone substitutes, and surface modification of biomaterials. I have published more than 170 JCR listed papers and own 12 patents.

Anna Maria Papini

Anna Maria Papini is Full Professor of Bioorganic Chemistry at the University of Florence and in France, where she was awarded Chair of Excellence from the Agence Nationale de la Recherche (2009–2020). An expert in peptide and protein science, she obtained an international PhD under Prof. Luis Moroder supervision (Max Planck Institute for Biochemistry) and founded PeptLab in Florence and at CY Cergy Paris University. She leads major international projects in molecular diagnostics, sustainable peptide production, and technology transfer, and pioneered initiatives such as EspiKem, the University of Florence's first spin-off, and the start-up Toscana Biomarkers, bringing peptide-based diagnostics and the cosmeceutical Defenisse KP1 to market. She is delegate of the international affairs and Erasmus+ programme within the School of Sciences, and contributes to educational initiatives, including the EUniWell Champion, with the mission to train young scientists in peptide science. She coauthored over 420 publications and received prestigious awards, including the Leonidas Zervas Award (2008), Rita Levi Montalcini Prize (2019), Barry Cohen Prize (2024), and the Medal of the Polish Chemical Society (2025). She has been member of the Board of the European Peptide Society (2011-2020) and of the Council of the American Peptide Society (2019-2025).



Joanna Pietrasik

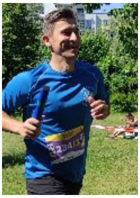
I have always found relaxation in a good thriller or crime novel, although recently I have started discovering fantasy literature as well. Besides that, I have always appreciated good food and music. To take a break from desk work, I have recently started learning sport shooting.

Rinaldo Poli

Rinaldo Poli's major hobby is Chemistry. Of all sorts, but mostly that involving transition metals (coordination, organometallic, metal-mediated organic synthesis, catalysis, metal-mediated polymerizations). However, he also enjoys listening to music, drinking good wines, and eating all sorts of food, especially if spicy, with a slight preference for the Asian cuisine (Indian, Chinese, Vietnamese, Thai, etc.).

Sławomir Potocki

I am a bioinorganic chemist interested in how metal ions shape protein structure and function, particularly in the context of pathogenic bacteria. I lead an NCN Sonata Bis project on unusual mycobacterial chaperonins, using a mix of coordination chemistry, biophysics, NMR spectroscopy, and protein engineering. I was trained in Poland and France and carried out a Marie Skłodowska-Curie postdoctoral fellowship at the University of Warwick. When I'm not in the lab, you'll most likely find me swimming, exploring new places, or spending time with dogs. I have a weakness for good traditional food, Wedel's Ptasie Mleczko, fast cars, and a well-timed power naps.

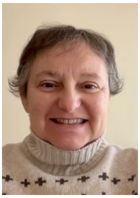


Jan Romański

Besides chemistry, I also enjoy cooking and, of course, eating. Fortunately, I can compensate for that through sports. My favorite activities are badminton, volleyball, and running, which help me stay active and burn off some of the calories from my culinary experiments.

Iwona Rutkowska

Iwona A. Rutkowska is a university professor at Faculty of Chemistry, University of Warsaw, Poland. Her current research focuses on materials chemistry and electrochemistry of nanostructured metal oxides, noble metal nanoparticles and functionalized carbons, organic and inorganic polymers with emphasis on electrocatalytic processes for energy conversion and storage as well as on mechanisms of charge propagation. Her recent activities has concentrated on oxidation of small organic fuels, oxygen reduction reaction, and carbon dioxide reduction at various experimental conditions. She is a member of The Electrochemical Society (ECS), International Society of Electrochemistry (ISE), Polish Chemical Society, American Chemical Society (ACS), and Polish Catalysis Club. In ECS she has served on many committees and co-organized numerous symposia. Presently, she is Secretary of Physical and Analytical Division and Secretary of European Section. She also acts as Secretary of Committee for Chemistry, Polish Academy of Sciences.



Michèle Salmain

After obtaining her PhD at the Ecole Nationale Supérieure de Chimie de Paris under the supervision of Professor G. Jaouen and a post-doc in the industry, Dr Salmain was recruited by the CNRS as associate researcher in 1992 and promoted to Director of Research in 2008. In 2014, she joined the Institut Parisien de Chimie Moléculaire at Université Pierre-et-Marie-Curie (UPMC) in Paris that became Sorbonne Université in 2018. She is the author of ca. 170 publications in peer-reviewed journals, 7 book chapters and one edited book.

Antonio Santoro

Antonio Santoro received his Ph.D. in chemical sciences at the University of Messina investigating photoinduced processes on organic species, he continued his academic path at Institut de Science et d'Ingénierie Supramoléculaires in Strasbourg where he focused his research on metal-based supramolecular chemistry. He is now senior researcher at University of Messina.

Volodymyr Sashuk

In my free time, I enjoy being outdoors and staying active, often exploring nature or traveling. I also love discovering different cuisines and am an avid tennis fan.

Yvan Six

Yvan Six obtained his PhD in 1997 and then worked as a post-doc with Prof. Willie Motherwell at University College London and with Prof. Samir Zard at the ICSN in Gif-sur-Yvette. He was hired by the CNRS in 2000. His research interests include organotitanium chemistry, cyclopropanes and cyclobutanes, endoperoxides and organic synthesis in general.Outside chemistry, he likes gardening, and playing electric guitar in an amateur rock band. He enjoys good food, whether French or Polish (krakowska, żurek, kotlety, bigos, szarlotka...). Together with his family, he is the happy owner of three guinea pigs.

Wojciech Smułek

I am interested in cycling tourism and regularly travel by bike to explore different regions and landscapes. The favorite travel destinations are the sea and oceans' coasts. I read a lot, mainly sci-fi and crime but also non-fiction, like historical books and literary reportage. I drink tea daily and prefer it to coffee.

Adrian-Mihail Stadler

I am currently a CNRS (the French National Centre for Scientific Research) researcher, in the field of supramolecular and coordination chemistry.

Artur Stefankiewicz

I received my PhD from the University of Strasbourg (France, 2009) under the supervision of Prof. Jean-Marie Lehn. In September 2009 I joined the group of Prof. Jeremy K. M. Sanders at the University of Cambridge as a Ministry of Defence research associate. In July 2013 I moved back to the Adam Mickiewicz University in Poznań to set up my independent research group. Currently, I am a full professor at the Faculty of Chemistry and Director of the Center for Advanced Technologies. I am happy husband and father of two kids: Wiktor and Hania. My hobbies include cooking, all kind of sports activities and spending time with my friends. I love spicy Asian food and Alsacian white wines.

Sebastian Suarez

I enjoy traveling and exploring new cultures, especially through local cuisine. I have a particular appreciation for Mediterranean, Latin American, and Polish food. Outside the lab, I like cooking, outdoor activities, and spending time with my family. I also enjoy communicating science and sharing the excitement of chemistry with broader audiences.

Ingrid Suzana

Ingrid Suzana is a fixed-term Assistant Professor at Centrale Méditerranée in Marseille, where she develops supramolecular porous materials. She earned her PhD at Sorbonne Université under the supervision of Dr. Valérie Marvaud, followed by postdoctoral research at University Paris-Saclay, gaining expertise in molecular magnetism and multifunctional materials. Her research journey has taken her across Europe and North America, including stays in Lisbon, Vancouver, and Berlin.

Róża Szweda

I enjoy spending time with my family and pursuing my passion for climbing, which I value for the combination of physical challenge, problem-solving, and perseverance it requires. Both in science and in the mountains, I am inspired by challenges that demand creativity, determination, and exploration of new perspectives. I also have a strong appreciation for music and art, which provide a source of inspiration, balance, and an opportunity to disconnect from everyday routines while exploring new forms of expression.

Katarzyna Świrk Da Costa

I am a great enthusiast of French cheese, especially comté 24 mois, brie truffé and chèvre. My favorite comfort dishes range from a perfectly cooked filet de bœuf and magret de canard to classic moules-frites, galettes and crêpes. Outside the table, I enjoy reading good books, playing table tennis, bowling, and new adventures with my little son.

Sébastien Ulrich
Sébastien Ulrich carried out his PhD with Prof. Jean-Marie Lehn (Université de Strasbourg, France), and post-docs with Prof. Harry L. Anderson (Oxford University, UK) and Prof. Eric T. Kool (Stanford University, CA, USA). He was recruited at the CNRS in 2012, and promoted Directeur de Recherche in 2023. He carries out his research at the IBMM in Montpellier in the field of supramolecular bioorganic chemistry, using dynamic covalent synthesis for accessing smart bioactive assemblies. He was awarded the CNRS Bronze Medal in 2017, the Forcheur prize in 2023, and the Jean-Marie Lehn prize of the Division of Organic Chemistry of the French Chemical Society in 2026.

Nahir Vadra García
Outside the laboratory, Nahir enjoys traveling and discovering new cultures and places around the world. She particularly enjoys exploring different cuisines and restaurants from different countries, as well as spending time with her family and friends.

Cataldo Valentini My research interests are diverse and include the design of heteroatom-doped Polycyclic Aromatic Hydrocarbons (PAH), the synthesis of Covalent Organic Frameworks (COFs), and the chemical functionalization of 2D materials. My work is particularly focused on applications in energy storage and sensing. My main hobbies include fishing, going to the gym, and playing football, which reflect my passion for staying active and enjoying the outdoors.

Davy-Louis Versace
Alongside my scientific work on the photochemical synthesis of bio-based antibacterial materials (120 accepted peer reviewed articles, 5 book chapters, 70 oral communications, 10 invited seminars and 10 invited conferences, > 3600 citations; h-index: 35), I am very active in sports. I practice kickboxing as an amateur and was the Île-de-France champion in 2016, and I also regularly play football. I also like travelling all around the world to discover new cultures, but my favorite dishes remain the Italian food.

Guillaume Vives
Guillaume Vives is associate professor at the Sorbonne University, Paris. He graduated from the Ecole Normale Supérieure of Lyon and obtained his Ph.D from the University Paul Sabatier, Toulouse, under the supervision of Gwenael Rapenne and Jean-Pierre Launay. He was then postdoctoral fellow at Rice University working with James M. Tour and in Bordeaux with Nathan McClenaghan. Since his appointment, G. Vives has been working in supramolecular chemistry on the development of rotaxanes and polyrotaxanes of cyclodextrins, as imaging agents and for the design of molecular motors. He is project leader for the development of molecular machines based on switchable molecular twezeers.

Jędrzej Walkowiak
I am a chemist at the AMU Center for Advanced Technologies, working on catalysis and the chemistry of organoboron and organosilicon compounds. I am fortunate to work with outstanding current and former students and co-workers, who continually remind me that science is a team effort. I am also a dog person and the proud owner of Cicero—the most handsome Irish Soft Coated Wheaten Terrier in Poznań (according to a completely unbiased scientific assessment).

Justyna Walkowiak-Kulikowska
Justyna Walkowiak-Kulikowska is an Associate Professor at Adam Mickiewicz University in Poznań, Poland. Her research interests include fluorinated polymers,

controlled radical polymerization, click chemistry, and the design of functional polymeric materials with tailored thermal, surface, and interfacial properties. When not in the laboratory, she enjoys sailing, reading, exploring nature, and spending time with her family.

Joanna Wątły
In the laboratory, I study His-, Pro-, and Cys-rich peptides, trying to understand why they 'get along' so well with metal ions. After work, I swap Cu(II) complexes for more stable sugar–sponge cake systems and decorate cakes with almost laboratory-like precision. I am fascinated by bioactive compounds – from those found in venoms and saliva to those hidden in the plant world, including both valued herbs and seemingly ordinary weeds. That is why many of my inspirations begin in the garden and end either in the laboratory or in the kitchen.

Agnieszka Wilczewska I am a Professor of Chemistry at the University of Bialystok. Outside my academic work, my main interests are sport, gardening, and painting. I enjoy playing and watching volleyball, especially men's matches. I am also passionate about swimming. I swim both short and long distances using different swimming styles. In my free time, I tend a flower garden, focusing on low-maintenance plants. Recently, I have also developed a passion for acrylic painting. I mainly paint flowers inspired by my garden and create illustrations for scientific publications, combining creativity with science.

Fan Yang
Fan Yang completed her PhD under Prof. C. M. Thomas in Chimie ParisTech PSL in 2025. She is now a postdoctoral researcher at Chimie ParisTech. Originally from China, she enjoys travelling and discovering local cuisine, especially spicy food.

Beata Zielińska
In my free time, I enjoy reading crime novels, especially those set in my hometown, Szczecin. I also like travelling, particularly together with my best travel buddy, Ewa Mijowska, and discovering different cultures through local cuisine. Among various international dishes, I especially enjoy Asian cuisine. I also enjoy spending time with my dog, Broki.

YOUNG ORAL SPEAKERS

Mateusz Bogusławski
I love Italian cuisine, especially pasta and pizza. In my free time I like listening music, going to the gym, reading books, playing board games and video games.

Krzysztof Cwynar
PhD student at the University of Silesia in Katowice, Poland. A fervent observer of contemporary politics, fascinated by Asian culture, especially Japanese culture.

Wojciech Dudziak
I enjoy bouldering and skiing. My biggest passion other than chemistry is music – I sing, play the guitar and teach myself music production.

Ernest Ewert
I am a second year doctoral candidate at the Faculty of Chemistry, Adam Mickiewicz University in Poznań. My scientific interests focus on the synthesis of macrocyclic complexes and studying their interactions with biomolecules. Apart from chemistry, I am interested in learning foreign languages, especially French. My other hobbies include reading, hiking and baking sweets. I love spending time with my friends and family, as well as enjoying nature on my own.

Karol Garbaczewski
Karol is a first-year Master's student at the Faculty of Chemistry, Adam Mickiewicz University in Poznań. He is actively involved in research at the Laboratory of Functional Nanostructure Synthesis. His work focuses on organic synthesis and supramolecular chemistry Recently, he received an ID-UB Study@Reasearch grant for the project "Conjugates of azamacrocyles and polypeptides as novel biomaterials". Outside the lab, he enjoys weightlifting and hiking.

Ewelina Gruszczyńska
Outside the laboratory, I enjoy slow and grounding activities such as baking, gardening, and painting. I am also a big fan of Asian and Italian cuisine and enjoy exploring new flavors, both at home and while traveling.

Klaudia Krysiak-Smułek
I enjoy capturing moments, people and places in photographs. I read books and watch sitcoms. My favourite author is Camilla Läckberg, and my favourite sitcom is "Friends". I love sitting on the swing in the garden with a cup of coffee and listening to the birds.

Volodymyr Lyakh
I am a PhD student in chemistry at Wrocław University of Science and Technology, working on collagen-like peptides for biomaterial and tissue-engineering applications. Outside the laboratory, I enjoy travelling, especially in nature, discovering new cultures, and meeting new people. I am also actively involved as an Erasmus Buddy, supporting international students. In my free time, I like reading adventure, science-fiction, and fantasy books, and I am learning 3D modelling and 3D printing.

Bartosz Łagan
I am a PhD student at the Wrocław University of Science and Technology, working on modified amino acids and their use in peptide drugs such as oxytocin. When I am not in the lab, I train calisthenics and cook. As for French cuisine, I am particularly fond of coquilles Saint-Jacques, moules, and a well-made sauce béarnaise.

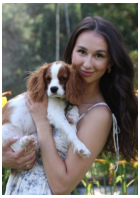
Sergiusz Napierała
Interested in basketball, music, concerts, and playing musical instruments. In my free time, I enjoy discovering, traveling, trying new food and learning recipes, and spending time with friends. My favorite foods are pizza and sushi. I am an open-minded and positive person who likes meeting new people and exploring new places. I love sports and fair competition at every level.

Niccolò Nova
Niccolò Nova obtained his MSc degree in Chemistry with top marks at the University of Parma (Italy), where he also earned his BSc degree in Chemistry. His research lies in the bioinorganic field, focusing on molecules with biological activity, or functionalizable supramolecular clusters. During his MSc, Niccolò spent a period of 6 months at the University of Michigan (USA), in the lab of Prof. Vincent L. Pecoraro, where he worked on functionalization of metallacrowns. He is now attending a PhD in the group of Dr. Jalila Simaan at University of Aix-Marseille (France), working on LPMO enzyme mimics for biomass valorization. He's the Vice-President of the Reseau Jeune section PACA of Société Chimique de France.

Marcin Nowacki
My research focuses on the molecular design of naphthalene diimides for electrochromic applications. Outside the laboratory I enjoy mountain trekking and visit cultural monuments. My favorite dishes include traditional Polish pierogi and spicy Thai cuisine. These diverse passions inspire my scientific work and personal growth.

Jakub Nowicki
Beyond research, I enjoy reading, football, and travelling whenever possible. I am deeply passionate about chemistry and appreciate the opportunity to share and discuss science with others.

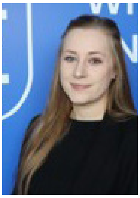
Miłosz Piechocki
I am a PhD researcher in materials science and electrochemistry, currently working on lignin-based electrospun fibers and non-PGM metals electrocatalysts for ORR/OER in zinc-air energy systems, fuel cell and electrolyzer applications. Besides my professional interests, I enjoy traveling and exploring new places, tasting local cuisine, admiring nature and discovering culture.



Aleksandra Sikora
Aleksandra is a first-year PhD student at the Faculty of Chemistry, Adam Mickiewicz University in Poznań. Since starting her studies in 2020, she has been actively involved in research at the Laboratory of Functional Nanostructure Synthesis. Her work focuses on functional materials and supramolecular chemistry. In 2025, she received a Ministry of Science and Higher Education scholarship for outstanding achievements. She also completed a research internship in Strasbourg under Professor Paolo Samorì. In her free time, she enjoys traveling and walking her dog.

Maria Stachowiak
I am a first-year Master's student in Chemical Analytics at the Faculty of Chemistry, Adam Mickiewicz University in Poznań. Since the first year of my studies, I have been actively involved in research activities at the Hybrid Materials Laboratory, where my work focuses on the synthesis and characterization of covalent organic frameworks (COFs). In addition, I lead a research project funded within the ID-UB programme. In my free time, I enjoy crocheting.

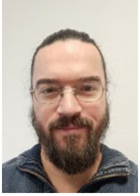
Magdalena Stasiuk
I am a second-year PhD candidate at the Doctoral School, Faculty of Chemistry, at the University of Gdańsk. My research is centered on investigating structure–activity relationships, the biochemical profiles of sulfonamide derivatives, and their interactions with biomolecules. I am particularly interested in understanding how structural modifications influence biological activity and molecular interactions. In my free time, I enjoy cooking, especially baking cakes, reading crime novels, and cycling.



Natalia Żukowska
Msc. Natalia Żukowska is a second-year PhD student at the Doctoral School at the Faculty of Chemistry, University of Gdańsk. She is completing her doctoral dissertation at the Department of Bioinorganic Chemistry. Her research interests include coordination chemistry, structural analysis and structure-activity relationships.In her free time, she plays games, reads fantasy books, and participates in live action role-playing games.

POSTERS

Łukasz Berlicki
Łukasz Berlicki is a Professor of Chemistry at the Department of Bioorganic Chemistry, Wrocław University of Science and Technology, Poland. His research focuses on the design and synthesis of peptides and miniproteins incorporating non-canonical amino acids, with applications in medicinal chemistry and biocatalysis. Outside the laboratory, he enjoys hiking in the mountains and is passionate about travel photography.

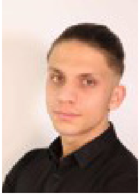


Till Bousquet
I enjoy spontaneous travel, sports, meeting new people, and cooking. A true food enthusiast, I have no single favorite dish. Living in northern France, I also enjoy local specialties such as carbonade flamande and regional beers.

Diana Cañas-Martínez
I am passionate about teaching and learning. I love losing the track of time over an interesting book. I enjoy hiking, looking forward to the reward of a nice waterfall or lake at the end of the track. I like traveling and experiencing new destinations. My favorite dishes are quite simple: I love ice cream and pasta.

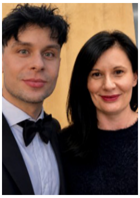
Filip Ciesielczyk
Professor Filip Ciesielczyk is a researcher at the Institute of Chemical Technology and Engineering, Faculty of Chemical Technology, Poznan University of Technology. His scientific interests focus on the synthesis and modification of oxide materials, inorganic/(bio)organic hybrids, as well their ap-

plication as (photo)catalyst, adsorbents, polymer fillers and electrospun materials additives. He is a co-author of more than 97 scientific publications indexed in the JCR database, a participant in numerous research projects, and a co-inventor of national patents. His hobbies are traveling, music, film, car modeling, running, and cycling.



Michał Drozda

Michał is a first-year Master's student in Cosmetic Chemistry at the Faculty of Chemistry, Adam Mickiewicz University in Poznań. Since joining the Laboratory of Functional Nanostructure Synthesis, he has been actively involved in research on the synthesis of POM-based hybrid organic-inorganic materials. His current work focuses on the functionalization of Anderson-Evans polyoxometalates under mild conditions for potential applications in electrochemical energy storage. In his free time, he enjoys cooking and fishing.

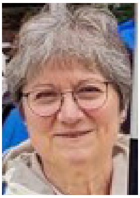


Aleksander Ejsmont

Joanna and Aleksander focus on advanced porous materials and their applications in environmental protection, catalysis, and biomedicine. Beyond science, they share small coffee breaks, lively conversations, and a sense of humour. Joanna enjoys long walks, while Aleksander occasionally appears on a squash court. They still debate whether garlic belongs in every dish and whether any plant can survive in their lab.

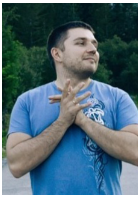
Zuzanna Filipiak

Zuzanna is a fourth-year chemistry student at Adam Mickiewicz University in Poznań. She is actively involved in research at the Department of Bioanalytical Chemistry. Her work focuses on the interactions of ligands with G-quadruplexes of various topologies. Recently, she received an ID-UB Study@Research grant to study photocrosslinking oligonucleotide probes for detecting cytosine modifications. Outside the lab, she enjoys hiking, swimming and knitting.



Nathalie Fischer-Durand

I like reading, hiking in the countryside, visiting old castles and admiring restored old houses in historic cities. I like Italian cuisine, especially the way they cook vegetables. I prefer to eat fish rather than meat, but I also like traditional French dishes.



Adam Gorczyński

Dr. Adam Gorczyński received his Ph.D. in 2017 from the Faculty of Chemistry, Adam Mickiewicz University in Poznań, Poland and is currently working towards his habilitation at the same institution. He completed a postdoctoral fellowship at the Matyjaszewski Polymer Group at Carnegie Mellon University, with a focus on RDRP techniques, mostly ATRP. His research centers on designing advanced multifunctional materials for applications in materials science, photonics, electrochemistry and catalysis, with the goal of discovering novel materials with unique properties.

Joanna Gościańska

Our team focuses on the synthesis of advanced porous materials (MOFs, mesoporous carbons, and silica) for environmental protection, catalysis, and biomedicine. Additionally, Joanna loves crime novels, cheesecake without raisins, and singing her way through stressful moments; Aleksandra brings a calming yoga mindset, a love for animals, and a spark to everything she does; Aleksander paints with acrylics, runs on Pad Thai, and is Björk-obsessed.

Beata Grobelna

Beata Grobelna is a chemist specializing in materials engineering and chemical nanotechnology. Head of the Department of Analytical Chemistry. Her research focuses on the development of inorganic and hybrid materials, including lanthanide- or biologically active compound-doped nanolayers. She also investigates noble metal nanoparticles or core-shell nanostructures, and their applications in spectroscopy, materials science, and cosmetology. She is also interested in exploring different countries and discovering new places. In her free time, she particularly enjoys mountain hiking, especially when it offers opportunities to admire scenic landscapes.

Marcin Hoffmann

My research interests focus on the application of computational methods of quantum chemistry in the investigation of the structure of molecules and the interactions between them, as well as modelling of enzymatic reactions along with designing novel drugs and chemical compounds of desirable activity with the use of computational models built for this purpose. Recently my attention shifts towards the chemical artificial intelligence.

Ewa Kaczorek

Professor Ewa Kaczorek is a researcher at Poznan University of Technology (PUT), specializing in environmental biotechnology and microbiology. Her research focuses on biodegradation of pollutants, microbial interactions with hydrocarbons, and sustainable environmental protection technologies. She has also explored the application of saponins in drug delivery systems and researched methods for removing antibiotics and pharmaceutical residues from the environment. She has authored numerous scientific publications and contributes to innovative biotechnological solutions for environmental remediation and pollution control. Outside academia, she enjoys traveling, discovering new places and local cuisines, and especially appreciates Mediterranean cuisine.

Mateusz Macioszek

In my day-to-day work, I bridge the gap between science and business. Aside from sports, my passion is commercializing innovative ideas and determining how best they meet real market needs. I travel a lot—for me, it's the best way to expand my horizons and seek global inspiration that can be successfully adapted to our local context. After hours, like many of us, I most appreciate great Italian cuisine and a glass of Malbec.

Joanna Makowska

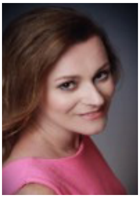
I specialize in bioinorganic and computational chemistry, focusing on the interactions of peptides with metal ions, drugs, and naturally occurring compounds. I am an expert in microcalorimetric techniques and the molecular dynamics of biomolecules. I really enjoy nature, forests, hiking in the mountains, and cycling. I also like reading crime novels.

Mariusz Makowski

Prof. Mariusz Makowski is the head of the Department of Bioinorganic Chemistry at the Faculty of Chemistry of the University of Gdańsk. Scientific interests: computational chemistry, nonlinear analysis, physics-based potentials, acid-base equilibria, hydrogen bond, d-block metal complexes with pyrazine and its derivatives, and recently sulfonamides. PI and investigator in several scientific projects. The author and co-author of more than 120 papers and book chapters. From 2004 to 2012, post-doc fellow and visiting scientist at Cornell University (USA) in the Prof. Harold A. Scheraga group. He plays basketball, bikes, swims, and hikes in his free time.

Katarzyna Materna
My research focuses on organic chemical technology, particularly on the properties and applications of amphiphilic compounds, including nonionic surfactants and surface-active ionic liquids. In my free time, I enjoy reading, travelling, and spending time outdoors.

Monika Motak
Prof. Monika Motak is a graduate of Chemistry at the Jagiellonian University in Krakow and currently serves as Dean of the Faculty of Energy and Fuels at AGH University of Krakow. Her scientific interests focus on chemistry, catalysis, energy technologies and environmental protection. In her work, she values cooperation, openness and the practical application of scientific knowledge. Outside academia, she enjoys travelling, discovering new cultures and good conversations. She is a great admirer of France – its language, cuisine, art and lifestyle. La France occupe une place particulière dans son cœur.



Agnieszka Nosal-Wiercińska
My research interests include the study of electrode mechanisms and adsorption phenomena occurring at the electrode/solution and solid/solution interphases. Currently, I hold the following positions, amongst others: coordinator of the Croatian CEEPUS Network "Colloids and nanomaterials in education and research", vice-chair of the Electroanalysis Group of the Committee on Analytical Chemistry of the Polish Academy of Sciences; chair of RiPOMN PAN/O Lublin; and treasurer of PTChem (2025–2028). On a personal note, my passions are dancing, travelling and volunteering in the broader sense of the word.

Izabela Nowak
I am a chemist and professor at Adam Mickiewicz University, Poznań, Poland, where I combine research, teaching, and industry collaboration. For many years, I have been especially interested in applied chemistry, including heterogeneous catalysis and... cosmetics (especially modern delivery systems for active substances). I enjoy working with companies because it helps scientific ideas move closer to real products and practical solutions. I have also been involved in organising meetings and seminars connecting science with the cosmetics industry. Outside my professional work, I collect old perfume bottles, radium artefacts, and fans from different places around the world, which nicely connects my love of chemistry, history, and beauty. I like to think of my work as a bridge between academic science, industry, and everyday life.

Dawid Pakulski
I am Dawid Pakulski, an adjunct at the Centre for Advanced Technologies of Adam Mickiewicz University in Poznań, Poland. I earned my PhD in 2019 within a cotutelle programme between AMU and the University of Strasbourg (ISIS), working on graphene-based materials. Since then, my research has centred on two-dimensional materials, covalent organic frameworks, and their applications in electrochemical energy storage. I currently lead several projects funded by the Polish National Science Centre, including a SONATA BIS grant (2026–2031), and have co-authored 30 publications and two patents. I especially value the long-standing scientific collaboration with my colleagues in France, which continues to shape much of my work. Outside the laboratory, I enjoy DIY projects, riding motorcycles, and travelling to explore new places.

Ahata Piatrutsik
Agata is a second-year undergraduate student at the Faculty of Chemistry, Adam Mickiewicz University in Poznań. Her research at the Laboratory of Functional Nanostructure Synthesis focuses on covalent organic frameworks (COFs), polyoxometalates (POMs), and electrochemically active porous materials for energy storage. She is a recipient of the Rector's scholarship for outstanding students. Outside academia, she enjoys roller skating, reading, travelling, and spending time with friends.

Robert Pietrzak
My research interests include studies in the fields of chemical engineering, coal chemistry and technology, coal-based materials, adsorption, and environmental protection. My primary research interests focus on the synthesis, modification, and characterization of carbon materials and polymer membranes, as well as their application in gas- and liquid-phase pollution removal processes. And beyond science and research… I like soccer (of course I prefer watching it), and travelling—but only with that one dream travel companion who loves seafood as much as I do; other than that, I collect owls—it's my hobby.

Donata Pluskota-Karwatka
My main research interests include interactions between biomolecules and endogenous electrophiles, mechanisms of DNA adduct and cross-link formation, and the synthesis of biologically active phosphonates.My fascinations include hiking, classical music, animals (especially cats), potted plants and relaxing in nature.

Izabela Pospieszna-Markiewicz
Chemistry has been an important part of my life for many years. My scientific interests focus on the coordination chemistry of lanthanide complexes. Apart from chemistry, I am an avid reader, especially of crime and detective novels. I also value spending time with my family and friends. In winter, I enjoy skiing, while in summer I like swimming in open water, not necessarily the warm ones.

Wiktoria Ragin-Oh
I completed my Master's degree in Chemistry at Adam Mickiewicz University in Poznań and I am currently a fourth-year PhD student in biological sciences. My research focuses on drug discovery, where I aim to combine structural approaches, especially protein crystallography, with my background in chemistry. Outside the lab, I am passionate about fashion, especially its history and cultural context.

Bogna Rudolf
Bogna Rudolf obtained her PhD in 1998 at the University of Lodz (Poland). After a few post-doc positions in France (ICSN Gif-sur-Yvette, ENSCP Paris) she obtained her habilitation in 2011 at the Faculty of Chemistry, University of Lodz. Her Team research interests encompass the synthesis of organometallic compounds and their application in biochemistry (anticancer drugs, antioxidants, metallocarbonyl labels, enzyme inhibitors, CO releasing molecules (CORMs)). She is passionate about art history and greatly enjoys traveling.

Bogdan Samojeden

Dr Bogdan Samojeden is a graduate of AGH University of Krakow, where he currently serves as Vice-Dean for Education at the Faculty of Energy and Fuels. His scientific interests focus on catalysis, energy technologies, fuel processing and environmental protection. His research interests focus on catalytic and adsorption processes, alternative fuels and energy-related environmental technologies. He is also involved in international academic cooperation, including activities related to the Erasmus+ Programme. Outside academia, he enjoys travelling, discovering new places, cultures and local flavours. He is a great admirer of Valencia, a city whose atmosphere, architecture and Mediterranean character hold a special place in his heart. He also appreciates good music, especially jazz, blues and classical music.

Abelardo Sánchez-Oliva

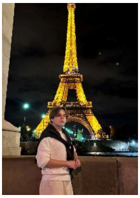
I am a chemist whose research focuses on the design of functional materials for energy storage, particularly electrodes and gel electrolytes for Zn-ion hybrid supercapacitors. I also have experience in emissive organic materials for optoelectronic applications, as well as in 2D materials and MXene-based supercapacitors. Beyond research, I enjoy learning new scientific approaches and working in international, multidisciplinary environments.

Katarzyna Siwińska-Ciesielczyk

D.Sc. Katarzyna Siwińska-Ciesielczyk, University Professor, is a researcher at the Institute of Chemical Technology and Engineering, Faculty of Chemical Technology, Poznan University of Technology. Her scientific interests focus on the synthesis and modification of inorganic oxide materials, particularly TiO_2-based systems exhibiting photocatalytic, electrochemical, and antibacterial properties. She is a co-author of more than 96 scientific publications indexed in the JCR database, a participant in numerous research projects, and a co-inventor of national and international patents. Her hobbies include music, travel, baking, reading, and cycling.

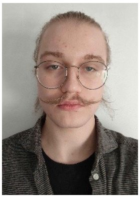
Will Skene

The Skene research group focuses on using sustainable practices for developing sustainable devices. The team is interested in establishing accurate structure-property relationships of conjugated organic materials to guide the rational design of functional materials. Knowledge acquired from such studies is used for tailoring the material's properties to meet the requirements for a given application. The group also evaluates the performance of materials in solution, thin films and devices.



Adam Stańczak

Adam is a first-year Master's student at Adam Mickiewicz University in Poznań. Since 2023 he has been participating in research at the Laboratory of Functional Nanostructure Synthesis. His Bachelor's thesis was based on complex compounds containing lanthanide ions, and his research is conducted under the supervision of AMU Prof. Izabela Pospieszna-Markiewicz. Since 2026, he has been actively participating in the HYDRA-POM project led by Dr. Marta Fik-Jaskółka. In his free time, he enjoys watching TV series and travelling.

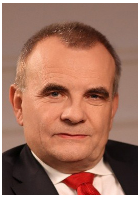


Marcel Stępniewski

Marcel Stępniewski- second year bachelor student at Collegium Chemicum Adam Mickiewicz University. Volunteer in the Laboratory of Functional Nanostructure Synthesis since this year. Loves cooking, music and relaxing in nature.

Karolina Sulanowska
Karolina is a second-year bachelor's degree student studying chemistry specializing in biological chemistry. Since this year she has involved in research in Laboratory of Functional Nanostructure Synthesis. She is working there on the synthesis of hybrid materials based on polyoxometalates. In her free time, she enjoys growing houseplants and travelling.

Klaudia Szarszoń
My scientific interests revolve around the molecular world of human saliva. I explore salivary peptides, peptidomimetics, metal-peptide interactions, antimicrobial mechanisms, and reactive oxygen species, with a particular fascination for how small structural changes can drive significant biological effects. Outside the lab, I am drawn to Eastern philosophy and yoga - the kind that makes you think as much as it makes you move. I also enjoy the occasional handstand and getting completely lost in a book.



Leszek Szojda
I am a Professor at the Department of Structural Engineering, Silesian University of Technology, where I specialize in structural engineering. My professional work focuses on the analysis of building structures located in mining areas, with particular emphasis on finite element method (FEM) modelling and structural assessment. In my free time, I enjoy travelling, practicing non-extreme sports both in summer and winter, and exploring topics related to aviation. I am always interested in discovering new places, cultures, and technologies. My favorite dishes include seafood and traditional home-cooked meals. I enjoy meeting people from different backgrounds, exchanging experiences, and learning about new perspectives and ideas.

Magdalena Tymoszewicz-Gaida
In my free time, I enjoy immersing myself in board games and video games, with a particular passion for RPGs. I also regularly take on escape room challenges with my friends - I have already completed over 100 of them. Another important passion of mine is travelling, especially to historical destinations, where I can experience and learn about different cultures. I am particularly fond of Italian cuisine, as most of my favourite dishes come from it, although I also greatly enjoy discovering and tasting local specialties when visiting new countries.

Radosław Tymoszewicz-Gaida
Outside the lab, I am an avid basketball player and water sports enthusiast, having successfully completed the Open Water Diver (OWD) certification. Traveling is another passion of mine; I particularly enjoy visiting historical cities to explore their rich culture and architecture. Beyond that, I have a keen interest in natural history, evolution, and the diversity of life sciences. In my free time, I also love exploring new culinary experiences from around the world, with a special fondness for Japanese cuisine.

Monika Wałęsa-Chorab
My scientific interests focus on the design, synthesis, and characterization of functional organic materials, including electroactive and electrochromic compounds for advanced optoelectronic applications. I have participated in numerous research projects and scientific collaborations in the field of organic and materials chemistry. In my free time, I enjoy traveling and reading books. Traveling gives me the opportunity to discover new cultures and places, explore natural landscapes, and appreciate the beauty of nature, while reading allows

me to. I also value spending time with family and friends and am always eager to discover new places and experiences.

Ewelina Wieczorek-Szweda
I am a researcher interested in the chemical aspects of photodynamic therapy, with a particular focus on the design, synthesis, and evaluation of novel photosensitizers for biomedical applications. I obtained my Ph.D. from the Medical University in Poznań and currently lead a SONATINA research project at Adam Mickiewicz University. Beyond my scientific work, I enjoy travelling and discovering new places, cultures, and cuisines. Travelling allows me to broaden my perspective and find inspiration both in my professional and personal life. I am also a happy mother of a young son, and spending time with my family is one of my greatest joys. In my free time, I appreciate outdoor activities, especially cycling.

Paweł Wydro
My name is Paweł Wydro and I work at the Faculty of Chemistry of the Jagiellonian University. I am a chemist and academic teacher, currently serving as Vice-Dean for Didactics at the Faculty of Chemistry UJ. I am also the Head of the Department of Physical Chemistry and Electrochemistry. In my professional life, I am interested in science, education and supporting students in their academic development. Outside work, my hobby is going to the gym, which helps me stay active, disciplined and full of energy. My favourite dish is steak, especially when it is well prepared and served simply. I value good food, regular physical activity and a healthy balance between work and private life.

Marcin Wysokowski
I earned a PhD in Chemical Sciences from Poznan University of Technology in 2016 and completed postdoctoral fellowships at MIT and TU Bergakademie Freiberg. My research focuses on the fusion of biomimetic technologies with sustainable materials design, particularly on harnessing the potential of deep eutectic solvents to enable novel, environmentally friendly pathways for the development of high-performance hybrid materials. Passionate about advancing the circular economy, I leverage renewable resources and cutting-edge solvent technologies to create innovative solutions that push the boundaries of green chemistry and materials science. Beyond my scientific pursuits, I am an avid angler and hunter, and a dedicated companion to my german shorthaired pointer.

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