

REIMS INSTITUTE OF MOLECULAR CHEMISTRY ICMR - Unité Mixte de Recherche CNRS 7312



Campus Moulin de la Housse – Faculté des Sciences



Campus Santé – Faculté de Pharmacie

OUR IDENTITY: MOLECULAR CHEMISTRY

The research work done at the Institute of Molecular Chemistry encompasses various basic aspects of molecular chemistry: synthetic methodology, reactivity and molecular engineering, green chemistry, advanced analytical methods, with many projects interfacing with

- fine chemistry, biomass valorization
- life sciences (biomolecules, pharmaceutical chemistry, cosmetics)
- environmental sciences (diagnosis, prevention, remediation),
- materials science (elaboration, structural and functional properties).

ORGANIZATION

The Institute is organized into 5 Research Groups

- Methodology for organic synthesis
- Biomolecules: synthesis and action mechanisms
- Coordination chemistry
- Isolation and structure of natural products
- Functional polymer and networks

ACADEMICS, STAFF AND STUDENTS

About 110 people are currently working in the Institute

- 42 academics
- 13 CNRS staff (6 senior researchers, 2 junior res., 5 engineers)
- 17 engineers, technical and administrative staffs
- 35 graduate students and post-doctorants

FIELDS OF EXPERTISE

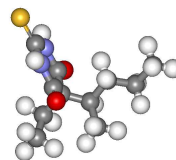
Organic synthesis – Catalysis – Coordination chemistry – Therapeutical chemistry – Natural substances – Separation methods – Organic structural analysis – Macromolecular chemistry – Encapsulation – Chemical valorization of biomass – Molecular modelling – Pharmaceutical Technology – Polymer materials - Environmental chemistry – Enzyme inhibition

Methodology for organic synthesis

5 Academics, 4 Researchers CNRS, 1 Research Engineer

Coordinator: Dr Jean Le Bras

- Catalysis
- Photochemistry
- Synthesis of organometallics (Pd, Ti, Zr...)
- Valorisation of biomass



keywords: Transition metals chemistry, chemistry of heteroelements (F, S, Si...), radical reactions, asymmetric synthesis, reaction mechanism studies, carbohydrate chemistry, glucides, detergents, bioactive molecules.

Biomolecules: synthesis and action mechanisms

13 Academics, 1 Researchers CNRS, 1 Research Engineer

Coordinator: Prof. Janos Sapi

- Anti-cancer candidates
- Aminoacids, peptides, peptidomimetics
- Nucleosides and nucleotides
- Heteroaromatics and/or terpene-type compounds
- Carbohydrate chemistry and agro-sources
- Molecular modelling



keywords: Enzymatic inhibition, G-quadruplex ligands, DNA photodamage, matrix metalloproteinase inhibitors, carbohydrates, glycosidase inhibitors, chemoenzymatic synthesis, valorisation of biomass.

Coordination chemistry

12 Academics, 2 Research Engineers

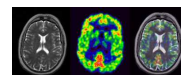
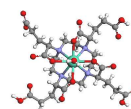
Coordinator: Prof. Emmanuel Guillon

- Health

Complexes for therapy and imaging (optical and magnetic) → Photo-Dynamic Therapy
Molecular and nanoparticulate probes for imaging (MRI and optical imaging)

- Environment

Ionic liquids, dendrimers and surfactants (biosourced)
Macroscopic and molecular approach of pollutant fate in the environment
(metals, emerging pollutants, pesticides)



keywords: transition metals; lanthanides; PDT; luminescence; MRI; characterization of complexes (structure, properties, stability); solid-solution interface; surface characterization; ionic liquids; dendrimers; valorisation of biomass.

Isolation and structure elucidation of natural products

6 Academics, 1 Researcher CNRS, 3 Engineers & technicians

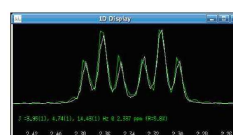
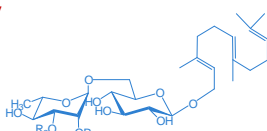
Coordinator: Dr Jean-Marc Nuzillard

- Isolation, purification of complex natural products (saponins, terpenes, carbohydrates, alkaloids, polyphenols)

Centrifugal partition chromatography

- Structure elucidation by NMR and MS

Advanced NMR methods



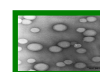
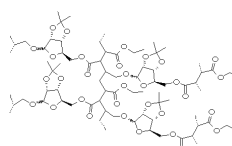
keywords: secondary metabolites, peptides and proteins from plants; pharmacologically active natural products; cosmetic active ingredients; structure elucidation by computer; micro-imaging by NMR; new extractive/separative methods.

Functional polymers and networks

6 Academics, 1 Researcher CNRS, 1 Research Engineer

Coordinator: Prof. Xavier Coqueret

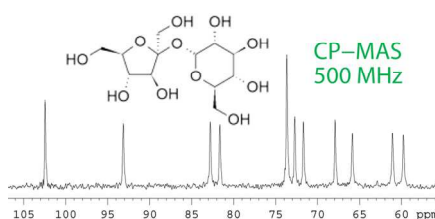
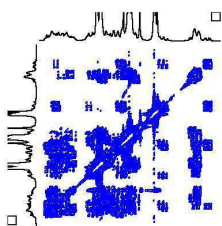
- Clean processes for polymer crosslinking
- Encapsulation (for cosmetics or therapeutic purposes)
- Radiation chemistry
- Bio-based monomers and polymers



keywords: Starch, «green monomers», oligo- and polysaccharides, lignin, grafting, polymerisation, biodegradation, clean processes, micro- nano- bio-encapsulation, vectorisation, gels, functional materials, composites.

MAIN SCIENTIFIC EQUIPMENTS

- NMR spectrometers at 250, 300, 500 and 600 MHz (Solution, HR-MAS, solid state, imaging)
- ESR spectrometer
- Mass spectrometers : MALDI-TOF, GCT, ESI-Q-TOF
- X-Ray Diffraction
- Atomic emission and absorption spectrophotometers (ICP-AES)
- Spectrofluorimeters
- Potentiometry, voltamperometry, polarography
- UV-visible, FTIR (MIR, NIR, ATR), Polarimeters
- Chromatographic methods CPC, HPLC, GC, FPLC, LC-MS, GC-MS, CES
- Pilot Extraction Plat-form (grinder, centrifugators, L/L, ASE, EPC, extractors, ...)
- Microanalysis (C, H, N, S)
- Malvern nanosizer (DLS, SLS)
- Peptide synthesizer, oligonucleotide synthesizer
- Radiation sources and processors (UV, electron beam)
- Mini-extruder, tensile testing machine
- Thermophysical analysis (DSC, DMA)
- Plat-form for molecular modelling (Romeo URCA)



PLAT-FORM FOR ANALYTICS AND CHEMICAL TRANSFORMATION - PLANET

The PLANET platform operated by our Institute supports the activity of academic and industrial research laboratories located on our campus and in the Champagne Ardenne region. PLANET covers a whole range of advanced structural characterization methods for molecular compounds as well quantitative chemical analysis. State-of-the-art equipments and expert scientists provide routine analysis as well as on-demand analytical service.

Contact : Dr. Dominique Harakat

dominique.harakat@univ-reims.fr

ICMR SUPPORTS ACADEMIC CURRICULA AND TRAINING AT URCA

Master of Science degrees Field : « Biology, Chemistry, Life Sciences »

Master « Chemistry, Natural Products, Drugs »

- Chemistry (Organic, Pharmaceutical, Inorganic, Polymer) (CHIMO)
- Natural Products: production and valorisation (PROVALI)
- Drugs : Product Quality and Regulatory Affairs (MQR)

Master « Engineering of Natural and Industrial Environments »

- Security, Quality, Hygiene, Environment (SQHE)
- Environmental Management of Wastes (MEDE)

Master « Production and valorisation of agro-sources/agromolecules »

- Speciality « Design Elaboration and Performances of Products derived from Agromolecules »
- Alimentary and non-food valorisation of agro-sources



OVERVIEW OF THE RESEARCH PROJECTS

Projects supported in the frame of State Region Projects Contract CPER 2007-2013

- PIAneT: Platform for analytics and Chemical Transformation
- FURASYNTH: Development of a set of synthesis methods hydroxymethyl furfural (HMF)
- XYLOCOS: New molecules based Xylose of Plant origin for anti-aging applications chemo-enzymatic synthesis and evaluation of the biological properties

Projects funded by the French national Research Agency

- RafiA: Elaboration of textile fibres by photopolymerization of biobased monomers
- CAPSHYDR: Fabrication, characterization and modelling of capsules under constraints hydrodynamic
- ANTIBIO-T: Development of new antibacterial agents that target the metalloenzyme GcpE
- xPC: Intensification of reactions and purifications by liquid centrifugal processes
- HFOrgCat: "5-hydroxyfuran-2 (5H) as a platform molecule developing new "one-pot" asymmetric reactions using organocatalysts"



Networks and thematic groups of CNRS

- Chemistry and Processes for Sustainable Development : *Solvolysis of lignins, monomers derived from itaconic acid, levulinic acid as a plat-form molecule, ...*
- National Chemiotheque



Federative Structures related to Health Research

- Federative Research Structure Cap Santé: *Interactions Cell Microenvironnement*
Cancer therapy, microenvironnement and tumor development: *natural and synthetic compounds for metalloproteinase inhibition, antiroliferative metabolites from biomass*
Treatment of infection, of inflammation and tissue reparation: *synthesis of MMP inhibitors, vegetal matrikines*
Dynamic and functional imaging: *tissue imaging using NMR*
- Federative Research Structure Condorcet
- Cancéropôle Grand-Est



Projects supported by Competitiveness Clusters



PARTNERSHIP WITH INDUSTRY

ADEME, AESN, AIRBUS DS, ARCELOR-MITTAL RESEARCH (Belgium), ARD, BASF, BAYER, CECODEL (Belgium), CEREP, GUERBET, GSK, INNOV'ORGA, KROMATON, LONZA (Switzerland), LVMH, MICHELIN, MINAKEM, PIERRE-FABRE, ROUSSELET, SANOFI, SAINT GOBAIN RECHERCHE, SCHNEIDER ELECTRIC, SERVIER, SOLIANCE, SYNGENTA, YANG-JI Chem. (Korea)

Since 2004, 20 patents (specialty chemicals, pharmaceutical chemistry, environment, materials)

CONTACTS

| | | | |
|-----------------|---------------------|----------------------------------|--------------------|
| Head : | Pr. Xavier Coqueret | xavier.coqueret@univ-reims.fr | (33) 3 26 91 33 38 |
| Deputy head : | Pr. Janos Sapi | janos.sapi@univ-reims.fr | (33) 3 26 91 80 22 |
| Administrator : | Christelle Anstett | christelle.anstett@univ-reims.fr | (33) 3 26 91 33 59 |

Address : ICMR – UMR CNRS 7312
Faculté des Sciences Exactes et Naturelles
Chemin des rouliers - BP 1039
51687 Reims Cedex (France)

