PÔLE CHIMIE BALARD
CHEMISTRY INSTITUTES RESEARCH TEAMS

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POLE chimie Balard

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Research in the Pôle chimie Balard

CNRS Research Federation – FR 3105

A new and sustainable chemistry, efficient in energy and atom-saving, at the service of mankind and the environment

Three priority areas:
- Energy and energy vectors,
- Sustainable exploitation of natural resources and chemical processes,
- Health and well-being of Man

Innovative interdisciplinary projects at the frontiers with biology/health sciences, physics and engineering sciences.

LabEx CheMISyst **CheMISyst horizontal programme** : building functional systems for the future by control of self-assembly and reactivity at interfaces.

527 permanent staff members (researchers, academic staff, engineers, technicians and administrative staff) and 380 doctoral students, post-doctoral researchers and visitors.

Competences of the four chemistry research Institutes to which is added that of a joint research unit CNRS - Saint-Gobain :
- Institut des Biomolécules Max Mousseron at the interface between chemistry/biology and health sciences
- Institut de Chimie Moléculaire et des Matériaux Charles Gerhardt at the interface between chemistry/materials sciences and physics
- Institut Européen des Membranes the interface between chemistry/materials sciences and process engineering
- Institut de Chimie Séparative de Marcoule at the interface between chemistry for the nuclear sector/physico-chemistry of processes and materials science
- Ceramic Synthesis and Functionalization Laboratory (LSFC)

Expertise in the areas of the elaboration, of control of texture, architecture and form of materials having specific properties, competence in modelling and physical chemistry with applications ranging from targeted novel molecules, biomaterials and energy materials to study of chemical reactivity.

Know-how for innovation and transfer to the industrial sector.

Advanced instrumentation assembled in an experimental Analysis and Characterisation Platform for a broad range of expertise and analyses (chemistry, materials sciences…).

Analysis and Characterisation Platform

Instrumentation and scientific expertise to support research and development activities:

- High performing equipment for high level research
- Organisation into competence centres under the responsibility of specialist scientists, and assisted by dedicated technical personnel
- Open to the public and private sectors

12 competence centres :

- X-ray diffraction, X-ray scattering, X-ray fluorescence
- Infrared and Raman spectrometries
- Nuclear magnetic resonance spectrometry
- Mössbauer spectrometry
- X-ray photoelectron spectrometry
- Textural analyses
- Thermal analyses
- Elemental analyses and polarimetry
- Mass spectrometry
- Nanoseparation and analysis
- Magnetic measurement, electron paramagnetic resonance spectroscopie
- Microscopies – transmission electron and scanning electron, high resolution transmission electron, atomic force

Advanced instrumentation for compositional, structural, textural, morphological and spectroscopic characterisation of solids, liquids & gases.

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Institut des Biomolécules Max Mousseron

IBMM UMR5247 CNRS-UM1-UM2-ENSCM

Biomolecules for Health and Environment

The Institut des Biomolecules Max Mousseron (IBMM - UM1, UM2, CNRS & ENSCM) is composed of more than 150 permanent researchers for a total of about 250 people including over 60 PhD students. About 150 papers are published each year, along with 10 patents applications. The research and innovative activities of concentrate on essential biomolecules, from design and synthesis to pharmacology and clinical studies. IBMM is definitely at the interface of Chemistry and Biology. The aim of IBMM is to study and understand the mechanisms of action of biomolecules to the treatment of human and animal pathologies (infectious, cardiovascular, degenerative pathologies, cancer, etc.). Applications include also cosmetology, agrofood industry, nano- and biomaterials, veterinary industry and friendly environment-agrochemicals.

Teams of IBMM develop research programmes with industry groups (Aeterna-Zentaris, Alnylam, Bayer, ChemGenes, Flamel Technologies, Idenix Pharmaceuticals, Laboratoires Pierre FABRE, E. Lilly, L'Oréal, Rhodia, Sanofi, Servier...) and host start up (COLCOM, S3F Chimie, NanoMedSyn).

Areas of Research

- Multi-step Synthesis of Bioactive Lipids and Antimalarial Compounds
- Analogues and Components of Nucleic Acids
- Amino Acids, Peptides and Proteins, Peptidomimetics, Glycopeptides
- Glycochemistry and Molecular Recognition
- Artificial Biopolymers, Macromolecular Prodrugs, Radiosynthesis
- Biomolecular Organizations, Origins of Life, Fluorinated Compounds
- Molecular Modelling and Bioinformatics
- Pharmacology of G-Protein Coupled Receptors (GPCR)
- Photobiology, oncopharmacology and pharmacotoxicology

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Institut de Chimie Moléculaire et des Matériaux de Montpellier

ICGM UMR 5253 CNRS-UM2-ENSCM-UM1

Institute for Molecular and Materials Chemistry

Institut Charles Gerhardt of Montpellier (ICGM) has been established January 1, 2007 as a center of excellence for advanced research and education in the field of molecular and materials chemistry. The Institute gathers 220 permanent staff and over 190 PhD students and post-docs. The ICGM research strategy is based on a multidisciplinary approach relying on molecular, supramolecular and macromolecular chemistries, sol-gel chemistry, materials science, solid state physics, quantum chemistry and modeling. It benefits from the constant advances in characterization and spectroscopy provided by its technical platform. Projects are focused on the preparation and integration of functional organic, inorganic and hybrid materials for environmentally-benign processes, energy generation and storage and healthcare.

Stimulating cooperation with leading academic groups through national (CNRS, ANR, ADEME,..) and international (UE, USA, NATO, Canada, Japan, ..) programmes and strong interaction with major industry groups (Total, Bayer, Nissan-Renault, St Gobain, Rhodia, Sanofi, Saft, Lafarge, EDF, Peugeot, Contralco, ..) give PhD students the opportunity to become familiar with other environments.

The activities of ICGM have already given rise to several innovative discoveries, concerning (bio)catalysts, selective extraction of pollutants, electrode and electrolyte materials for fuel cells and lithium batteries, targeted drug delivery and medical imaging, etc. (Start-up hosted: Specific Polymers, Sikémia, Atheor).

Institut de Chimie Séparative de Marcoule

ICSM UMR 5257 CEA-CNRS-UM2-ENSCM

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Methods of chemical separation of species using processes of "green chemistry" are central to the ability of producing not only nuclear energy with closed fuel cycle, but many other uses of finite natural resources

Nine research teams are active within ICSM, with strong accent on physical chemistry and nanoscience preparing the fourth generation of nuclear energy production and the challenges of strategic metal recycling.

ICSM gathers 7 university professors and assistant professors, 6 CNRS researchers and 13 CEA researchers with a permanent staff of 42. Three transverse teams are specialized in non-intrusive microscopies, small angle scattering for nanometric characterization of heterogeneities and statistical physical chemistry at meso-scale.

The five central directions of research are:

- Investigate mechanism and processes of ionic, molecular and colloidal chemistry
- Evaluate and Optimize extractions systems for Separation Processes
- Investigate the link between preparation of materials and the life-time during usage, which includes chemical and radiative stress
- Develop knowledge-based green chemistry, using waste as source of valuable chemicals, closing cycles and developing "stealth chemistry" such as sonochemistry, or chemistry using hot water used in cooling as degraded but chemically useful energy
- Develop methodologies associated to separation chemistry: modelisation of separation and transport at meso-scale, hard X-ray SAXS/WAXS scattering as well as environmental X-ray and scanning electron microscopies

Located at 100 km NE of Montpellier close to the ATALANTE facility for chemistry in radioactive environment, ICSM is a pluri-disciplinary institute devoted to fundamental research.

Institut Européen des Membranes

IEM UMR 5635 CNRS-ENSCM-UM2

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Membrane operations are already the dominant technology in water desalination, artificial organs and in some industrial processes (agro-food industry etc…)

They are going to be of growing importance in gas treatment, energy production, regenerative medicine and in various industrial processes (paper, petrochemistry, textile, chemistry and biotechnology).

IEM gathers 46 professors and research staff, 26 engineers and technicians and an average of 100 PhD students, post-docs and invited professors. It carries out multidisciplinary researches from molecular approaches for new membrane materials, operating membrane elaboration & scaling-up, achieving membrane characterization to design new concepts and membrane processes for production and energy transfer, water and effluent treatments, separation and gas treatments, biotechnologies, food & health.

The four areas we are putting a stress on are: Membranes and water treatment; Membranes for hydrogen & energy; Membranes and health; Membranes of the future.

Examples of on-going research fields are:

- Separation & gas treatments: separations, sequestration, packaging
- Selective systems at the solid/liquid interface: membrane interface optimization, molecular recognition; facilitated transport, enzymatic reactions, photo-catalytic membranes
- Ion conducting membranes: fuel cells, electrolysis, electro-separations
- Miniaturization of membrane systems: micro-reactors, micro-separators
- Hollow fibers as membranes
- Novel non-oxide membranes
- Dynamic adaptative combinatorial systems: hybrid bio-mimetic membranes, optical and electronic sensors

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TOTAL Chair

Total, one of the founding members of the Foundation Balard, is a long-term partner of the Pole chimie Balard. Total Chair on "Sustainable Chemistry and Energy", established September 25, 2012 for a term of four years, was the first Chair of the Foundation Balard. It supports research and training activities.

Among the training actions yearly supported by the Chair are, the organization of an "International School on Sustainable Chemistry and Energy (the first one dedicated to Materials, Processes and Modeling was held 21-24 January 2013) open to the students of Pole chimie Balard, the invitation of renown international scientists, to provide teaching and initiate or strengthen research collaboration and the funding of mobility scholarships for students at Master and Engineer level to help them complete an internship abroad as part of their professional project.

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Organisation des Nations Unies pour l'éducation, la science et la culture · Chaire UNESCO Science des Membranes Appliquée à l'Environnement (SIMEV)

UNESCO SIMEV Chair

SIMEV is a chair from the UNESCO which belongs to the International Hydrological Program (IHP). Its activities are focused on the Science of Membranes applied to the Environment". They develop through Education, Research/Development (R&D) and Demonstration/Innovation (D&I) programs. They aim at strengthening relations between the North and the South .

- Education: 14 thematic schools organized since 2004 in Europe, Africa and Asia: a few days each, with between 50 and 100 attendants. Also e-learning for master programs.
- R&D: as an example, through the creation with the support of the French Agency for Development (AFD) of a network of e-connected technical platforms between Burkina Fasso (2iE), Marocco (Rabat/Kenitra) and Montpellier (IEM UMR 5635); new candidates are at the door.
- D&I: in tight relation with industrial partners: for defluoration of water in Senegal (Pall company); for the design of a pilot plant fed by renewable energy (solar and wind) to provide potable water to a college in Marocco (Firmus, Beelectric and Comodos companies).

LabEx CheMISyst

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LabEx CheMISyst

The Labex CheMISyst aims at reinforcing the collaborations between teams belonging to the four Balard institutes (IBMM / ICGM / IEM / ICSM) with a common scientific ambition to invest on the long-term in the creation of a pool of expertise and skills recognised at the international academic level and valuable to industrial innovation.

Chemistry of molecular and interfacial systems is a cross-cutting theme, which deals with the organisation of molecular species that are interacting with one another, thus getting collective properties different from their owns individually. The objective is to achieve "systems" capable of selectively recognising, encapsulating, transporting or transforming ions and molecules in various media.
This includes interfacial chemistry, which deals with the study of the properties of ions and molecules confined at the surface of a solid or at the interface of two fluids.

Partnership and Valorization

Transforming discoveries into benefits for the whole society

PRESENTATION OF TOOLS AND ACTIONS OF PÔLE CHIMIE BALARD

- **Sustained R&D actions** with more than 140 industrial partners.
- **Labelling as Institut Carnot CED2**, « Chimie, Environnement, Développement Durable » : A major national research network dedicated to fostering enterprise innovation.
- **Chair of excellence ChemSuD**, « CHEMistry for SUstainable Development », ENSCM.
- **Chair unesco SIMEV** «Membrane sciences for Environment ».
- **Chair Total**, teaching and research.
- Advanced analytical equipement gathered in the **Analysis and Characterisation Platform (PAC)** open to the private companies, a **Biomolecule Synthesis Platform (SynBio3)** certified IBISA and a **Pilot plant unit**.
- **Start-up incubator «La Galera »** : 140 m² of laboratories and offices for young companies in Montpellier.
- **Technological Park Marcel Boiteux** in Marcoule linked to Separative chemistry Institute (ICSM) of Pôle chimie Balard.
- Ambitious prospects for development for 2015 :

1- Construction of the **Centre for Innovation and Technology Transfer Balard** whose mission is to host and accompany for 3-4 years, young start-ups inside the Pôle chimie Balard Campus.

2- **New R & D Balard Industrial Centre** to host private companies collaborating with Balard scientists who will benefit from the exceptional technological platforms and scientific environment of the Pôle chimie Balard.

3- Development of a **Hall of Technology Balard** for teaching and process development.

TECHNOLOGY TRANSFER

14 Companies created since 2002

- Arterial Remodelling Technology, Medincell, Specific Polymers, Solarcell, Genepep (Winner of 'Tremplin' contest Aventis 2011) Azasynth, S3F Chimie, Sikémia, Telosud, Ceremap, Colcom, Ecomap, Atheor, Technomembranes Développement

Clinical development and marketing

- **TyzekaTM®** (SebivoTM®) marketed in 2008 for B hepathisis treatment (collaboration with Idenix).
- **Macimorelin** (JMV1843, AEZS-130), the first growth hormone secretagogue, active per oral route (collaboration with ZENTARIS, end of phase III, marketed planned in 2013).
- **Valtorcitabine** (val-LdC) (collaboration with IDENIX), phase 2 clinical trials.
- **Anti-malarian drug** in phase II clinical trials (collaboration with Sanofi-Aventis).
- **Anti-obesity drug** in pre-clinical developement (collaboration with Zentaris).
- A peptidic agrochemical **ELIPEP** (sustainable development collaboration with DeSangosse and Agronutrition).

Patents

30 international patents/year filed by researchers from the Pôle chimie Balard in pharmacy, agrochemistry, cosmetics, materials, biotechnologies, processes : **a dynamic policy of intellectual protection**

Awards

Numerous national and international awards including 2 innovation trophies INPI, 4 national ADER awards, First Award ANVAR for young creator of enterprises.

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The research interests of CED2 teams are basically concerned with the mastered elaboration, the characterisation and the functional properties of molecules and materials for applications in energy and fuel production, "Green Chemistry", ressources saving, protection of environment and health.

- Energy with inorganic and polymer membranes for fuel cell applications, catalytic materials, materials for electrochemical energy storage, synthetic and biofuels, hydrogen.
- Protection of the environment with the implementation of a "green and sustainable Chemistry": process intensification, catalysis to prevent and cure pollutions, degradable biopolymers, chemicals and materials from renewable, inorganic and polymer functional membranes, separation with membrane processes.
- Research in health focuses on the development and characterization of bioactive compounds and polymers, dedicated bio-inspired molecular systems for imaging, vectorization and targeting; hybrid and biomimetic nanostructured materials for drug transport and controlled release.

Key features
Full staff : 162 - PhD / Post-doctorate : 117 / 25
Consolidate budget : 19 130k euros - Funds from collaborative research : 5 530k euros

Adressed industries
Refining and fuels - Energy - Chemical industries - Pharmaceutical industries - Transport industries - Building trade - Biotechs - Cosmetic industries - Agronomical companies

Research in collaboration
Europe: 16 Integrated Projects
Nationals: 55 projects with agencies (ANR, FUI...)
Industries: 97 research contracts - 68 partners (35 SMEs)

ChemSud Montpellier

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The CHEMistry for SUstainable Development – ChemSuD – Chair is localized at the National School of Chemistry in Montpellier. ChemSuD was created with the support of CNRS, Académie des Technologies and Région Languedoc Roussillon. This is a place for exchanges, meetings, formation and research in order to promote and develop of a new chemistry, in respect for a sustainable development.

ChemSuD activities are dedicated to formation, research and scientific mediation:

- Organization of seminars, lectures and conferences for students and researchers, not only in science and technology but also in human and social sciences, with an open mindedness on Europe area;
- Promotion of research and development for a chemistry answering to sustainable development stakes, in relation with chemical industry;
- Make large public aware of this new chemistry through lectures, debates and adapted publications.

These activities are oriented towards Green Chemistry and Biobased Polymers and Composites. Our projects aim at the identification of renewable resources, access ways and processes to synthesize biobased polymers and composites. ChemSuD is also a Foundation with Arkema, Basf, Colas, Firstsolar, Solvay and Tecsol.

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IBMM Institut des Biomolécules Max Mousseron

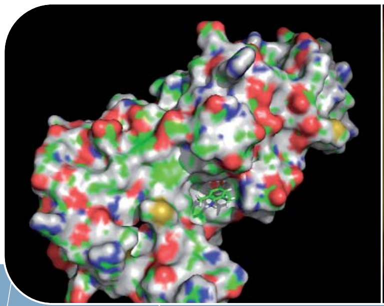
ICG Montpellier Institut Charles Gerhardt

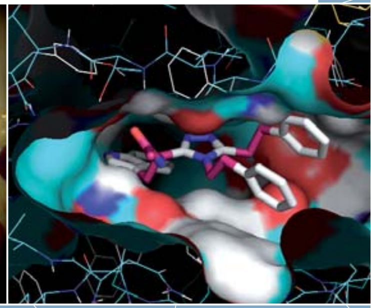
ICSM

iem Institut Européen des Membranes

Amino acids, peptides, solid phase synthesis

IBMM Institut des Biomolécules Max Mousseron





Team 17 permanent staff members
16 non permanent staff members

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Themes

- Design and synthesis of GPCR ligands and enzyme inhibitors
- Structured oligomers
- Methodology of synthesis on solid support, linkers, resins
- Cell penetrating compounds, vectors, MS-based quantification
- Hybrid materials, peptide-based polymers

Competences

- Medicinal chemistry, organic chemistry, peptide and pseudopeptide chemistry
- Drug design, docking, molecular modeling
- Parallel synthesis, combinatorial synthesis and heterocyclic chemistry

Specific equipment:

- Automated synthesis platform
- LCMS- Autopurification system

Partners

Sanofi - Pierre Fabre - VectHorus - Aeterna Zentaris - IEB - Genepep

Examples of projects

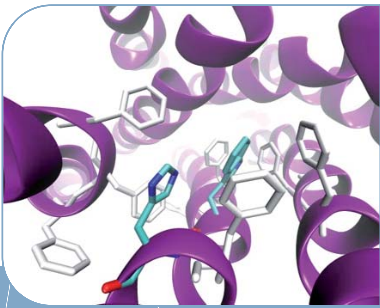
- Foldamers as protein-protein interaction inhibitors and intracellular penetration vectors
muriel.amblard@univ-montp1.fr (Labex CheMiSyst)
- Chemical tools for improving detection and quantification by mass spectrometry: crosslinkers, probes
gilles.subra@univ-montp1.fr
- Molecular systems for drug targeting and vectorization
vincent.lisowski@univ-montp1.fr
- Silica-peptide hybrid materials gilles.subra@univ-montp1.fr (Région LR, Labex CheMiSyst, Carnot CED2)
- Design and synthesis of high potent ligands of Ghrelin receptor for cachexia and obesity treatment
jean-alain.fehrentz@univ-montp1.fr (Aeterna Zentaris)
- Fragment based-approach to target serine proteases
ludovic.maillard@univ-montp1.fr (ANR fragspin)
- Enzyme inhibitors: metaloproteases and parasitic proteases
jean-françois.hernandez@univ-montp1.fr (Infectiopole)

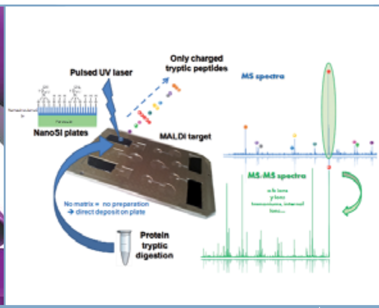
Selected publications/patents

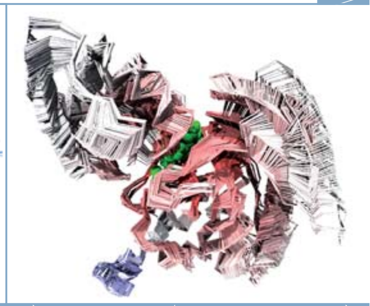
- **A straightforward approach for cellular-uptake quantification.** D. Paramelle, G. Subra, L.L. Vezenkov, M. Maynadier, C. André, C. Enjalbal, M. Calmès, M. Garcia, J. Martinez, M. Amblard. Angew. Chem. Int. Ed. Engl.**49**, 8240-8243 (2010)
- **Synthesis of Peptide Alcohols on the Basis of an O-N Acyl-Transfer Reaction.** J. Tailhades, M.A. Gidel, B. Grossi, J. Lécaillon, L. Brunel, G. Subra, J. Martinez, M. Amblard. Angew. Chem. Int. Ed. Engl.**49**, 117-120 (2010)
- **Ligands and signaling proteins govern the conformational landscape explored by a G protein-coupled receptor.** S. Mary, M. Damian, M. Louet, N. Floquet, J.A. Fehrentz, J. Marie, J. Martinez, J.L. Banères. Proc. Natl. Acad. Sci. U. S. A. 109, 8304-8309 (2012)
- **Bioorganic hybrid OMS by straightforward grafting of trialkoxysilyl peptides.** S. Jebors, C. Enjalbal, M. Amblard, A. Mehdi, G. Subra, J. Martinez. J Mater Chem B 2013 1: 2921-2925.
- **Helical Oligomers of Thiazole-Based -Amino Acids: Synthesis and Structural Studies.** L. Mathieu, B. Legrand, C. Deng, L. Vezenkov, E. Wenger, C. Didierjean, M. Amblard, M.C. Averlant-Petit, N. Masurier, V. Lisowski, J. Martinez, L.T. Maillard. Angew. Chem. Int. Ed. Engl.52, 6006-6010 (2013).

Analytical Sciences & Molecular modelling

IBMM Institut des Biomolécules Max Mousseron







Team 10 permanent staff members
3 non permanent staff members

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Themes

- Mass spectrometry
- Bioanalytical separation techniques
- Molecular modelling

Competences

- Development of innovative analytical tools for biomolecule analyses, peptide detection and sequencing in complex media
- Quantitative analyses (organics, drugs, biomolecules)
- Molecular dynamics, Coarse Grain modelling

Specific equipment:
Liquid Chromatography (HPLC-UV, nanoLC-UV), Capillary Electrophoresis (CE-UV, CE-LIF), Mass spectrometry (MS, MS/MS, LC/MS, LC/MS/MS)

Partners

GemacPharma (Bordeaux) - CNES (Toulouse) - Boiron (Ste Foy-les-Lyon) - Colcom, Horiba Médical, Genepep (Montpellier) - Lucasmeyercosmetics (Toulouse)

Examples of projects

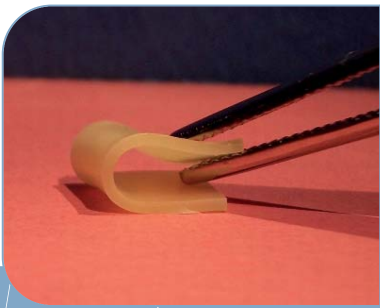
- Electrophoretic mapping of venoms used in pharmaceutical formulations: C. Perrin (caperrin@univ-montp1.fr), Boiron (Ste Foy-les-Lyon), R. Sabatier (EA 2415 Biostatistics, Montpellier)
- Characterization of complex (poly)peptides formulation by capillary electrophoresis using a proteomic approach: G. Coussot (gaelle.coussot@univ-montp1.fr) GemacPharma (Bordeaux), M. Geffard (ENSCPB, Bordeaux)
- Mass spectrometry analyses of synthetic peptides: C. Enjalbal (enjalbal@univ-montp2.fr), Genepep (Vendargues)
- Development of LDI-MS methodologies for biomolecule analyses: C. Enjalbal (enjalbal@univ-montp2.fr), MRT, J-O. Durand (ICGM, Montpellier) and R. Boukherroub / Y. Coffinier (IRI, Lille)
- Multi-scale dynamics of G-Proteins Coupled Receptors (GPCRs) and their partners: N. Floquet (nicolas.floquet@univ-montp1.fr), MRT and ANR, J-L. Banères / J-L. Fehrentz (IBMM, Montpellier) and David Perahia (ENS Cachan)

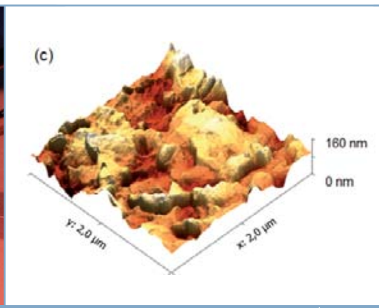
Selected publications/patents

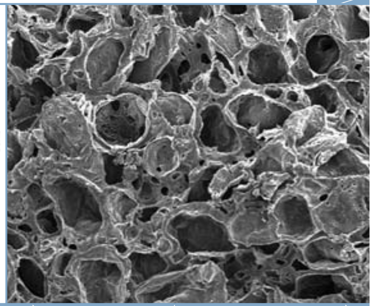
- **A Concerted Mechanism for Opening the GDP Binding Pocket and Release of the Nucleotide in Hetero-Trimeric G-Proteins.** M. LOUET, D. PERAHIA, J. MARTINEZ, N. FLOQUET, J. Mol. Biol., 411, 298-312 (2011).
- **Capillary electrophoresis for the assay of fixed-dose combination tablets of artesunate and amodiaquine.** N. C. AMIN, M.-D. BLANCHIN, M. AKE, J. MONTELS, H. FABRE, Malaria J., 11, 149 (2012)
- **Occurrence of C-terminal residue exclusion in peptide fragmentation by ESI and MALDI Tandem Mass Spectrometry.** M. DUPRE, S. CANTEL, J. MARTINEZ, C. ENJALBAL, J. Am. Soc. Mass Spectrom., 23, 330-346 (2012)
- **Laser Desorption Ionization Mass Spectrometry of protein digests on nanostructured silicon plates.** M. DUPRE, Y. COFFINIER, R. BOUKHERROUB, S. CANTEL, J. MARTINEZ, C. ENJALBAL", J. Proteomics, 75, 1973-1990 (2012)
- **Ligands and signaling proteins govern the conformational landscape explored by a G protein-coupled receptor.** S. MARY, M. DAMIAN, M. LOUET, N. FLOQUET, J.-A. FEHRENTZ, J. MARIE, J. MARTINEZ, J.-L. BANÈRES, PNAS, 109, 8304–8309 (2012)

Artificial Biopolymers

IBMM Institut des Biomolécules Max Mousseron







Team

14 permanent staff members
8 non permanent staff members

Team leader **Jean Coudane**
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Themes

Degradable polymeric biomaterials for Health and Environment
- Medical devices, implantable biomaterials
- Polymeric drug vectors

Competences

- Conception, syntheses and properties of new functional and degradable (co)polymers
- Chemical modification of aliphatic polyesters
- Biomedical applications: Tissue Engineering, vectorization, medical imaging (RX opacity, fluorescence, MRI), antibiotic surfaces…

Partners

Covidien - Sanofi - Biom'up - Aspide médical - Textile Hi-Tech

Examples of projects

- Ligament engineering: degradable elastomers and stem cells. benjamin.nottelet@univ-montp1.fr
- Anti-infectious meshes for genital prolapse. xavier.garric@univ-montp1.fr
- New amphiphilic copolymeric structures based on polyester-g-polysaccharide. helene.van-den-berghe@univ-montp1.fr
- New macromolecular architectures for therapeutic applications. vincent.darcos@univ-montp1.fr

Selected publications/patents

- **Cationic polyesters bearing pendent amino groups prepared by thiol-ene chemistry**
V. Darcos et al, Polym. Chem., 3, 362-8 (2012).
- **New magnetic-resonance-imaging-visible poly(epsilon-caprolactone)-based polyester for biomedical applications**
S. Blanquer et al Acta Biomater., 8, 1339-47 (2012).
- **Nanoaggregates of Biodegradable Amphiphilic Random Polycations for Delivering Water-Insoluble Drugs**
B. Nottelet, et al, Biomacromolecules, 13, 1544-53 (2012).
- **Anisotropic Self-Assembling Micelles Prepared by the Direct Dissolution of PLA/PEG Block Copolymers with a High PEG Fraction**
X.H. Wu et al, Langmuir 27, 13, 8000-8008 (2011).
- **Mild Methodology for the Versatile Chemical Modification of Polylactide Surfaces: Original Combination of Anionic and Click Chemistry for Biomedical Applications.** S.El Habnouni et al, Advanced Functional Materials, 21(17), 3321-3330 (2011).
- **Roles of hydrophobicity and charge density on the dynamics of polyelectrolyte complex formation and stability under modeled physicochemical blood conditions.** Leclercq L et al, J. of Bioactive and Compatible Polymers, 27, 2, 161-173 (2012).

Bioorganic Chemistry and Amphiphilic Systems

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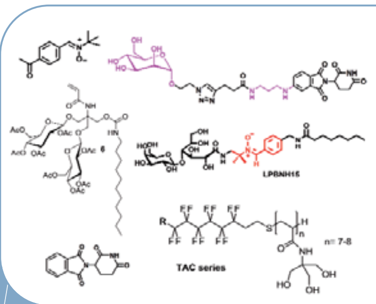

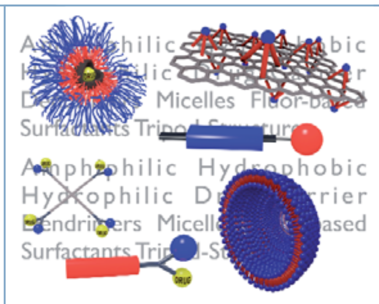

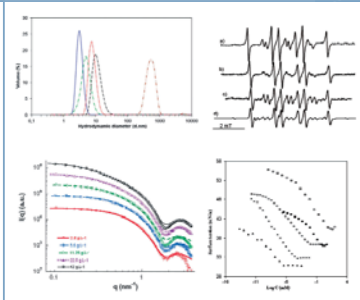

Team
6 permanent staff members
5 non permanent staff members

Team leader
Ange Polidori
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Themes

- Amphiphilic compounds for handling membrane proteins and nanoparticles,
- Drug delivery and pharmaceutical applications,
- Comprehensive studies of self-assembly properties.

Competences

- Organic and medicinal chemistry,
- Fluorine chemistry,
- Polymer synthesis,
- Self-assembly properties,
- Physical-chemistry analysis.

Specific equipment:

- EPR (Magnettech – MS300)
- Gel permeation chromatography (Waters & Wyatt): 2 lines for polymers (organic solvents) and nanoparticles (in water) studies
- Dynamic light scattering (Malvern)
- Tensiometer (Kruss – K100)
- Cyclic voltamperometry (Princeton)

Partners

Sanofi-Pasteur - Synprosis - Affymetrix

Examples of projects

- Fluorinated oligomers for ultrasound-mediated theranostics development (ANR nUCA, défi G3N) christine.pepin@univ-avignon.fr
- Innovative tools for direct solubilization of hydrophobic compounds (DGA funding), pierre.guillet@univ-avignon.fr
- Novel nitrone compounds as antioxidants and probes (region PACA/Synprosis), gregory.durand@univ-avignon.fr
- Immobilization of membrane proteins by non-ionic amphiphilic (ANR X-or), ange.polidori@univ-avignon.fr
- Comprehensive SAXS study of amphiphilic self-assemblies for membrane proteomics francoise.bonnete@univ-avignon.fr

Selected publications/patents

- **Non-Ionic Amphiphilic Homopolymers: Synthesis, Solution Properties and Biochemical Validation.** K. Shivaji et al. Langmuir 2012; 28: 4625-4639.
- **Synthesis and aqueous self-aggregation studies of novel persubstitued benzene based facial surfactants.** J. Dauvergne et al. New J. Chem., 2012; 1170-1179.
- **Synthesis of Tris-hydroxymethyl-Based Nitrone Derivatives with Highly Reactive Nitronyl Carbon.** F. Choteau et al. J. Org. Chem. 2012; 77: 938-948.
- **Propyl-Ended Hemifluorinated Surfactants: Synthesis and Self-Assembling Properties.** M. Abla, et al. J. Org. Chem. 2011; 76: 2084-2093.
- **Novel thalidomide derivatives as candidates for Multiple Sclerosis treatment.** C. Contino-pépin et al. Chem. Med. Chem. 2010; 5: 2057-2064.

Dynamics of complex biomolecular systems

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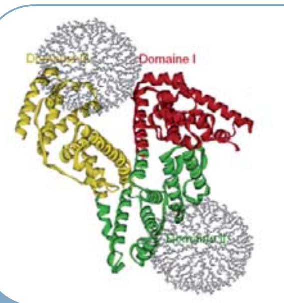

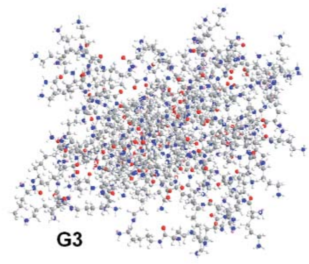

Team

12 permanent staff members
10 non permanent staff members

Team leader **Hervé Cottet**
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Themes

- Physico-chemical characterization of polymers, nanoparticles and proteins by capillary electrophoresis and by Taylor dispersion analysis.
- Systems chemistry of aminoacids and peptides (prebiotic chemistry)
- Polyelectrolyte complexes
- Dendrigraft poly-L-lysines
- Synthesis of organoperfluoroalkyl compounds

Competences

- Physical organic chemistry,
- Electrophoretic separation techniques, characterization of biopolymers, proteins and nanoparticles,
- Polymerization of amino acids N-carboxyanhydrides,
- Organic synthesis and process

Specific equipment: capillary electrophoresis (CE), CE-MS coupling.

Partners

Flamel Technologies - Rhodia - Debiopharm - Sanofi - Colcom - Analytics Consulting

Examples of projects

- Size and charge characterization of polymeric drug delivery systems by capillary electrophoresis and Taylor dispersion analysis (industrial) hcottet@univ-montp2.fr
- Study of polyelectrolyte interactions by capillary electrophoresis (IUF) hcottet@univ-montp2.fr
- Dendrimat: hybrid polypropylene/dendrigraft polylysine materials for ultra sensitive detection of bacterial contaminations and their elimination by filtration (ANR) rpascal@univ-montp2.fr
- Functionalization of dendrigraft poly-L-lysines (industrial) rpascal@univ-montp2.fr

Selected publications/patents

- **Size and Charge Characterization of Polymeric Drug Delivery Systems by Taylor Dispersion Analysis and Capillary Electrophoresis.** A. Ibrahim, R. Meyrueix, G. Pouliquen, Y. P. Chan, H. Cottet, Anal. Bioanal. Chem., 2013, 405, 16, 5369–5379.
- **Fast Characterization of Polyelectrolyte Complexes by the inline coupling of Capillary Electrophoresis to Taylor Dispersion Analysis.** L. Leclercq, H. Cottet, Anal. Chem., 2012, 84, 1740-1743.
- **Expeditious, Multi-Gram Scale Synthesis of Lysine DendriGraft (DGL) Polymers by Aqueous N-Carboxyanhydride Polycondensation.** H. Collet, et al. Chem. Eur. J., 2010, 16, 2309-2316.
- **Pathways for the formation and evolution of peptides in prebiotic environments.** G. Danger, R. Plasson, R. Pascal, Chem. Soc. Rev., 2012, 41, 5416–5429.
- **Procédé de détermination de la distribution en taille d'un mélange de particules par mise en œuvre de la dispersion de Taylor et système associé.** H. Cottet, L. Cipelletti, M. Martin, J.-P. Biron, FR 12 56050, PCT/EP2013/063432.

Glyco and nanovectors for therapeutic targeting

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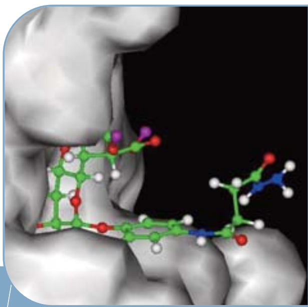

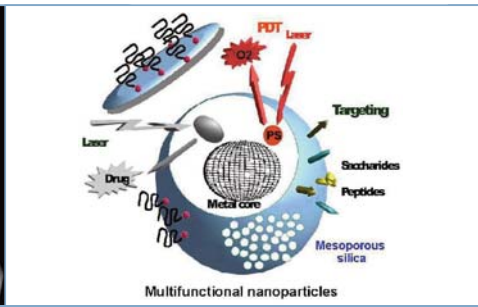

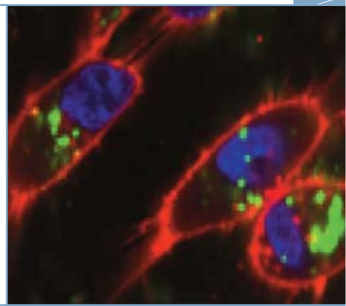

Team 9 permanent staff members
10 non permanent staff members

Team leader **Marcel Garcia**
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Themes

- Glycoconjugates for targeting of lysosomal diseases and cancers
- Multifunctional nanoparticles for imaging and cancer therapy
- Biological targets and personalized cancer therapies
- Primary tumor culture on chick chorioallantoic membrane
- Characterization of natural substances from medicinal and aromatic plants from Tropical and Mediterranean area

Competences

- Cell biology, experimental carcinogenesis
- Clinical studies
- Chick embryo model
- Organic synthesis and glycochemistry
- Natural substances and volatile compounds analysis (GC/MS and headspace analysis)

Partners

Eclosion SA, Phytobokaz, Aromatrope, SWM-INTL Dioptik, NanoMedSyn

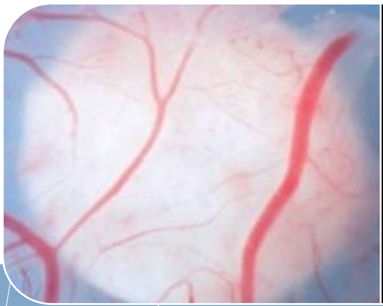
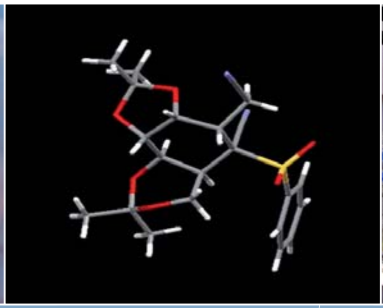
Examples of projects

- Saccharidic ligands for enzyme replacement therapy of lysosomal diseases (Région L-R, VML, AFM, Europe, ANR RPIB) alain.morere@univ-montp2.fr
- Glyconanoparticles for photodynamic therapy of cancers (ANR Blanc Intern. & P2N, PUF UCLA-UM2) magali.gary-bobo@inserm.fr
- Chemical and biological evaluation of extracts from endemic medicinal plants (Region L-R) chantal.menut@univ-montp2.fr
- Xenografting on chick embryo model (UM1) philippe.nirde@inserm.fr
- Clinical trials of prostate cancer therapies (ANR P2N) x.rebillard@languedoc-mutualite.fr
- Biological targets (RM6P, cathepsin D, estrogen receptor) for cancer therapy (ARC, ANR, Labex ChemiSyst, PIC-Curie, FRM) marcel.garcia@inserm.fr

Selected publications/patents

- **Two-Photon-Triggered Drug Delivery in Cancer Cells via Nanoimpellers.** Croissant J, Maynadier M, Gallud A, Peindy N'Dongo H, Nyalosaso JL, et al. Angew Chem Int Ed Engl. 2013, DOI: 10.1002/anie.201308647
- **Dipeptide mimic oligomer transporter mediates intracellular delivery of cathepsin D inhibitors: a potential target for cancer therapy.** M. Maynadier* L. Vezenkov,* M. Amblard, V. Martin, C. Gandreuil, et al. J. Control. Release, 2013, 171, 251-257.
- **Anionic porphyrin-grafted porous silicon nanoparticles for photodynamic therapy.** Secret E*, Maynadier M*, Gallud A, Gary-Bobo M, Chaix A, et al. Chem Commun (Camb) 2013, 49 (39); 4202-4204
- **Prostate-cancer mortality at 11 years of follow-up.** Schröder FH, Hugosson J, Roobol MJ, Tammela TL, Ciatto S, et al., New Engl. J. Med., 2012; 366, 981-90.
- **Mannose-Functionalized Mesoporous Silica Nanoparticles for Efficient Two-Photon Photodynamic Therapy of Solid Tumors.** Gary-Bobo M et al., Angew Chem Int Edit 2011; 50:11425-11429.

Glycochemistry and Molecular Recognition – Design, Synthesis, and Applications


Team
8 permanent staff members
12 non permanent staff members

Team leader **Pascal Dumy**
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Themes

- Synthesis of sugar analogues, glycoconjugates and oligosaccharides
- Engineering of multivalent and auto-assembled systems
- Click bioconjugation methodologies and dynamic combinatorial chemistry
- Metalloenzymes inhibitors
- Biomedical applications, cosmetics, and imaging

Competences

- Organic and enzymatic synthesis
- Methodologies in carbohydrate chemistry
- Design and synthesis of biomolecular systems

Specific equipment:
- LC/MS system
- Peptide synthesizer
- Non-conventional activation
- Microscopy
- Biological assays

Partners

L'Oréal - Serdex - Siena Biotech - Floptics - Sanofi - LifeSciences Corp

Examples of projects

- Synthesis of multivalent iminosugars
  alberto.marra@enscm.fr
- Synthesis of saccharides and multivalent glycosylated structures able to evaluate the role of the mannose-6-phosphate receptor in angiogenesis
  veronique.montero@univ-montp2.fr
- Design and synthesis of nanoplatforms targeting the carbonic anhydrase IX involved in cancer
  jean-yves.winum@univ-montp2.fr
- Multivalent recognition systems of oligonucleotides by dynamic combinatorial chemistry
  sebastien.ulrich@enscm.fr

Selected publications/patents

- M. W. Kellinger, S. Ulrich, J. Chong, E. T. Kool, D. Wang, **Dissecting Chemical Interactions governing RNA Polymerase II Transcriptional Fidelity**, J. Am. Chem. Soc., 2012, 134, 8231-8240.
- A. Dondoni, A. Marra, **Calixarene and Calixresorcarene Glycosides: Their Synthesis and Biological Applications**, Chem. Rev . 2010, 110, 4949–4977.
- N. Touisni, A. Maresca, P. Mc Donald, L. Yuanmei, A. Scozzafava, S. Dedhar, J-Y. Winum, C. T. Supuran, **Glycosyl coumarin carbonic anhydrase IX and XII inhibitors strongly attenuate the growth of primary breast tumors**, J. Med. Chem. 2011, 54, 8271-8277.
- V. Barragan-Montero, A. Awwad, S. Combemale, P. de Santa Barbara, B. Jover, J.-P. Molès, J.-L. Montero, **Synthesis of Mannose-6-Phosphate Analogues and their Utility as Angiogenesis Regulators**, ChemMedChem 2011, 6, 1771-1774.

Green chemistry & enabling technology

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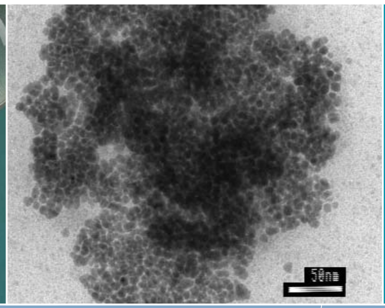

Team 4 permanent staff members
4 non permanent staff members

Team leader **Frédéric Lamaty**
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Themes

- Green Chemistry
- Solvent-free reactions
- Alternative solvents
- Catalysis
- Organocatalysis
- Flow Chemistry
- Applications to the synthesis of biomolecules and catalysts

Competences

- Organic synthesis
- Microwave chemistry
- Ultrasound activation
- Reactions in ball-mills
- Preparation of organometallic nanoparticles
- Supported synthesis and catalysis

Partners

Idenix - EADS - Sairem - Retsch

Examples of projects

- Solvent-free synthesis of amides and peptides
  Thomas-Xavier Métro: thomas-xavier.metro@univ-montp2.fr
  Frédéric Lamaty: frederic.lamaty@univ-montp2.fr
- Catalysis in Glycerol
  Evelina Colacino: evelina.colacino@univ-montp2.fr
  Frédéric Lamaty: frederic.lamaty@univ-montp2.fr
- Metal-catalyzed Amidation
  Xavier Bantreil: xavier.bantreil@univ-montp2.fr
  Frédéric Lamaty: frederic.lamaty@univ-montp2.fr
- Organic chemistry in PEG and PEG-IL
  Frédéric Lamaty: frederic.lamaty@univ-montp2.fr
  Evelina Colacino: evelina.colacino@univ-montp2.fr
  Xavier Bantreil: xavier.bantreil@univ-montp2.fr
- Catalysis in aqueous micellar medium
  Evelina Colacino: evelina.colacino@univ-montp2.fr
  Frédéric Lamaty: frederic.lamaty@univ-montp2.fr

Selected publications/patents

- Martinez, Jean; Lamaty, Frederic; Declerck, Valerie. **Method for solvent-free peptide synthesis, especially dipeptides, by coupling of urethane-protected amino acid N-carboxyanhydrides with amino acid esters.** FR 2913978 WO 2008125418.
- **Ring-Closing Metathesis in Aqueous Micellar Medium.** Laville, L.; Charnay, C.; Lamaty, F.; Martinez, J.; Colacino, E. Chem. Eur. J. 2012, 18, 760-764.
- **Preparation of Chiral Amino Esters by Asymmetric Phase-transfer catalyzed Alkylations of Schiff bases in a Ball Mill.** Nun, P.; Pérez, V.; Calmès, M.; Martinez, J.; Lamaty, F. Chem. Eur. J. 2012, 18, 3773-3779.
- **Alternative Energy Input for Transfer Hydrogenation using NHC-iridium Based Catalysts in Glycerol as Hydrogen Donor and Solvent.** Azua, A.; Mata, A. J.; Peris, E.; Lamaty, F.; Martinez, J.; Colacino, E. Organometallics 2012, 31, 3911-3919.
- **Comprehensive Study on Olefin Metathesis in PEG as an Alternative Solvent under Microwave Irradiation.** Bantreil, X.; Sidi-Ykhlef, M.; Aringhieri, L.; Colacino, E.; Martinez, J.; Lamaty, F. J. Catal. 2012, 294, 113-118.

Modified oligonucleotides

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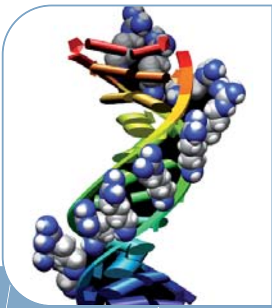

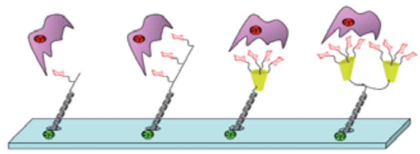

Team

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5 non permanent staff members

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Themes

Studies of Nucleic Acids-Biomolecules Interactions for Knowledge of Pathogens

- DNA Biosensors
- RNA Methodology
- Bio-Inspired Functional Systems

Competences

- Automated DNA Synthesizers
- HPLC chromatography
- MALDI-TOF Mass spectrometry
- Thermoregulated UV

Partners

Elicityl (France) - Noxxon (Germany) - EFS (France)
ChemGenes (USA)

Examples of projects

- "Synthetic methods for capped RNA to study capping enzymes of emerging viruses"
  françoise.debart@univ-montp2.fr – 7th PCRD (Europe)
- "Diagnostic of Viruses for transfusion based on ultrasensitive polythiolated probes: towards a generic platform for viral screening"
  françois.morvan@univ-montp2.fr - EFS
- "Proof of concept study for new Multivalent Glycomimetics active against Pseudomonas aeruginosa adhesion and biofilm formation"
  jean-jacques.vasseur@univ-montp2.fr – ANR
- "Design of a New Programmable and Dynamic Alternative Genetic System" msmietana@univ-montp2.fr
  ANR, Région Languedoc-Roussillon
- "SARS RNA Synthesis and Processing Activities"
  françoise.debart@univ-montp2.fr - ANR

Selected publications/patents

- **Development of innovative and versatile polythiol probes for use on ELOSA or electrochemical biosensors: application in hepatitis C virus genotyping.** Lereau, M. et al. Analytical Chemistry, 2013 DOI: 10.1021/ac401941x
- **Quantitative analysis (Kd and IC50) of glycoconjugates interactions with a bacterial lectin on a carbohydrate microarray with DNA Direct Immobilization (DDI).** Goudot, A. et al. Biosensors & Bioelectronics, 2013, 40, 153–160.
- **Synthesis of 5' Cap-0 and Cap-1 RNAs using solid-phase chemistry coupled with enzymatic methylation by human (guanine-N7)-methyl transferase.** Thillier Y, et al. RNA, a Publication of the RNA Society, 2012, 18, 856-868.
- **Dynamic and Programmable DNA-Templated Boronic Ester Formation.** Martin, A et al. Angew. Chem. Int. Ed., 2011, 50, 4193-4196.
- **DNA vs. Mirror-image DNA: A universal Approach to Tune the Absolute Configuration in DNA-based Asymmetric Catalysis.** Wang, J et al. Angew. Chem. Int. Ed., 2013 DOI: 10.1002/anie.201306232

Molecular Pharmacology

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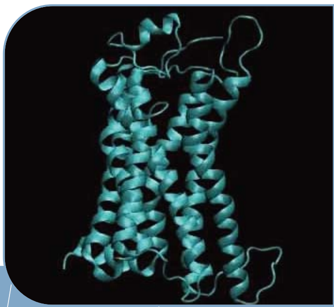

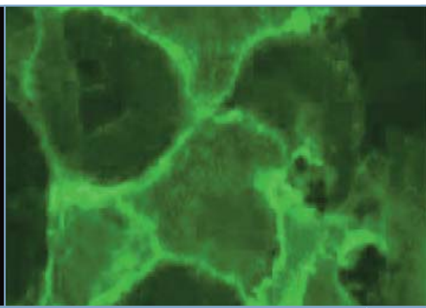

Team

7 permanent staff members
2 non permanent staff members

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Themes

- Mechanisms of G protein-coupled receptor signaling

Competences

- Cell biology (transient expression, stable cell lines),
- Protein expression and purification (E. coli),
- Biophysics (fluorescence, HTRF, BRET),
- Signaling techniques (ligand binding, second messenger dosage),
- Membrane protein biochemistry (détergent and surfactant manipulation)

Partners

CisBio Bioassays

Examples of projects

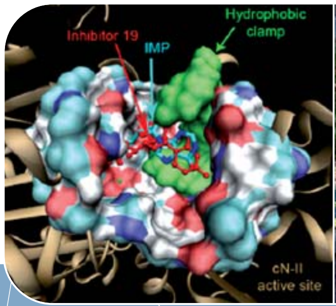
- Ghrelin mediated signaling, ANR funding
  jacky.marie@univ-montp1.fr
- GPCR dynamics, ANR funding
  jean-louis.baneres@univ-montp1.fr

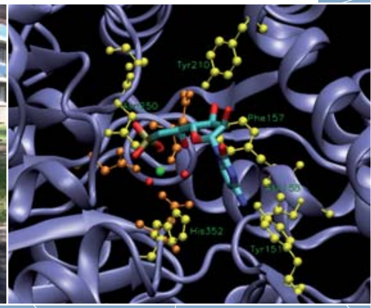
Selected publications/patents

- **Distinct roles of metabotropic glutamate receptor dimerization in agonist activation and G-protein coupling** (2012) *Proc Natl Acad Sci USA* **109**, *16342-7.* El Moustaine, D., Granier, S., Doumazane, E., Scholler, P., Rahmeh, R., Bron, P., Mouillac, B., Banères, J.-L., Rondard, P., & Pin J.-P.
- **Ligands and signaling proteins govern the conformational landscape explored by a G protein-coupled receptor** (2012) *Proc Natl Acad Sci USA* **109***, 8304-9.* Mary S, Damian M, Louet M, Floquet N, Fehrentz JA, Marie J, Martinez J, & Banères JL.
- **Structural insights into biased G protein-coupled receptor signaling revealed by fluorescence spectroscopy** (2012) *Proc Natl Acad Sci USA* **109***, 6733-8.* Rahmeh R, Damian M, Cottet M, Orcel H, Mendre C, Durroux T, Sharma KS, Durand G, Pucci B, Trinquet E, Zwier JM, Deupi X, Bron P, Banères JL, Mouillac B, & Granier S.
- **High constitutive activity is an intrinsic feature of ghrelin receptor protein: a study with a functional monomeric GHS-R1a receptor reconstituted in lipid discs** (2012) *J Biol Chem* **287***, 3630-41.* Damian M, Marie J, Leyris JP, Fehrentz JA, Verdié P, Martinez J, Banères JL, & Mary S.
- **Structure of a GPCR ligand in its receptor-bound state: leukotriene B4 adopts a highly constrained conformation when associated to human BLT2** (2010) *J Am Chem Soc* **132***, 9049-57 Catoire LJ, Damian M, Giusti F, Martin A, van Heijenoort C, Popot JL, Guittet E, & Banères JL.*

Nucleosides and phosphorylated effectors

IBMM Institut des Biomolécules Max Mousseron





Team

8 permanent staff members
7 non permanent staff members

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Themes

Scientific topics
- Search of new targets for the treatment of cancers and infectious diseases
- Design, synthesis and study of therapeutic agents with original mode of action
- Development of original strategies aiming to increase drug efficiency through site-specific activation or site-directed drug delivery

Background
- Nucleic acid chemistry: carbohydrates, heterocycles and phosphorylated derivatives
- Prodrugs
- Analytical methodologies

Competences

- HPLC-UPLC/LC/MS/MS
- Analysis and quantification of drugs and metabolites in biological media
- Soluble polymer-supported synthesis
- Synthesis of polyphosphorylated derivatives

Partners

Oxeltis - Sanofi-Aventis - Horiba-ABX - Provence Technologies - Idenix Pharmaceuticals

Examples of projects

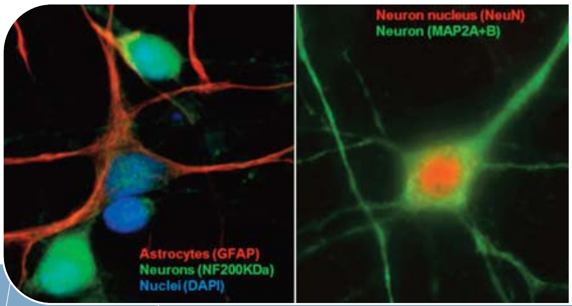
- InnoMaD, « Innovation Malaria Diagnostic », supported by the French state via the Single Inter-Ministry Fund (FUI)
- Virazal, « Treatment of flavivirus », supported by the French state via the Single Inter-Ministry Fund (FUI)
- NucleoTarg, « 5'-Nucleotidase cN-II: A novel target for chemotherapy? », National Cancer Institute (INCa)
- « Nucleic acids biosynthesis regulation: design and study of metabolic effectors », supported by the Region Languedoc-Roussillon, "Chercheurs d'avenir"
- cN-II Focus, « A key enzyme in nucleic acid biosynthesis: The 5'-cytosolic nucleotidase (cN-II) as new drug target", French National Research Agency (ANR)
- « Supported synthesis of nucleoside phosphoantigens for a potential use in immunotherapy", Medical Research Foundation (FRM)

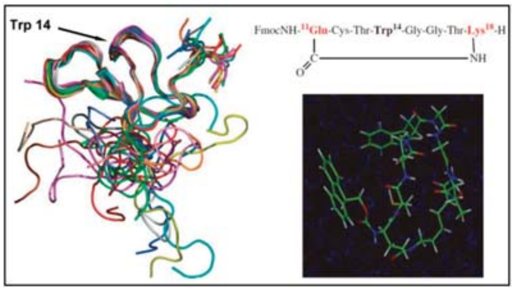
Selected publications/patents

- **Related to telbivudine, an anti-HBV drug, marketed by Novartis under the trade names Sebivo (Europe) and Tyzeka (United States).** EP2315776 (A1), Published: 02/08/12:«Beta-L-2'-Deoxy-Nucleosides for the Treatment of Hepatitis B». Gosselin, Imbach, Bryant. CNRS, Université Montpellier 2, Idenix Pharmaceuticals Inc.
- **Related to prodrug approaches.** NZ577999 (A), Published: 02/24/12: «Compounds and Pharmaceutical Compositions for the Treatment of Viral Infections». WO 2007US26408 20071228. Sommadossi, Gosselin, Pierra, Périgaud, Peyrottes. CNRS, Université Montpellier 2, Idenix Pharmaceuticals Inc.
- **Related to the collaboration with Sanofi.** Disulfide prodrugs of albitiazolium (T3/SAR97276): synthesis and biological activities". Journal of Medicinal Chemistry 2012, 55, 4619-4628.
- **Related to the patent WO 2009/115694.** Synthesis of 2', 3'-Dideoxynucleoside Phosphoesters Using H-Phosphonate Chemistry on Soluble Polymer Support. Journal of Organic Chemistry 2011, 76, 997-1000.
- **Related to the cN-II project.** Structural Insights into the Inhibition of Cytosolic 5'-Nucleotidase II (cN-II) by Ribonucleoside 5'-Monophosphate Analogues. PLoS Computational Biology 2011, 7, e1002295. An Alternative Pathway to Ribonucleoside β-Hydroxyphosphonate Analogues and Related Prodrugs. Organic Letters 2013, 15, 4778-4781.

Oxidative Stress, NeuroProtection and Plasticity

IBMM Institut des Biomolécules Max Mousseron





Team 8 permanent staff members
3 non permanent staff members

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Themes

From molecules to treatments: Allowing the collaboration of people with various areas of expertise - from chemistry to clinic, via physiology and biochemistry - our team is dedicated to translational studies.

- Experimental models of neurodevelopmental and neurodegenerative diseases: Focus on oxidative stress, synaptic transmission, plasticity alterations and their behavioral consequences.
- Synthesis and characterization of molecules targeting synaptic transmission (calcium channels, lipid neuromodulators, glutamate receptors and/or transporters).

Competences

- Chemistry
- Biochemistry, molecular biology
- Immunohistochemistry, immunocytochemistry.
- Cell biology: cell cultures including primary neuronal cell cultures.
- Calcium imaging
- Electrophysiology: patch-clamp, extracellular recordings, multi- electrode array recordings;
- Physiology: in vivo explorations including brain microsurgery; intracerebral microdialysis
- Medicine, in particular pediatrics

Specific equipment:

- Electrophysiology platform: classical extracellular and patch-clamp recording systems, double patch system, multi-array-electrode matrix.
- Calcium imaging system
- Analytical CLHP (assays for amino acids, monoamine, free radicals, glutathione,…)

Partners

University of Barcelona, Oran, Marseille 2, CRN2N, INSERM, ISM2, Amylgen (Montpellier)

Examples of projects

- AdHoc: Project coordinator: François Féron., Financial support: ANR

Selected publications/patents

- **Engraftment of human nasal olfactory stem cells restores neuroplasticity in mice with hippocampal lesions.** Nivet E., Vignes M., Girard S. D., Pierrisnard C., Baril N., Devèze A., Magnan J., Lanté F., Khrestchatisky M., Féron F. & Roman F. S. (2011) J. Clin. Invest., 121, 2808-2820.
- **Early, time-dependent disturbances of hippocampal synaptic transmission and plasticity after in utero immune challenge.** Escobar M., Crouzin N., Cavalier M., Quentin J., Roussel J., Lanté F., Batista-Novais A.R., Cohen-Solal C., De Jesus Ferreira M.-C., Guiramand J., Barbanel G., Vignes M. (2011) Biol. Psychiatry, 70, 992–999.
- **Alpha-tocopherol and alpha-tocopheryl-phosphate interact with the cannabinoid system in the rodent hippocampus.** Crouzin N., de Jesus Ferreira M.-C., Cohen-Solal C., M'Kadmi C., Bernad N., Martinez J., Barbanel G., Vignes M. & Guiramand J. (2011). Free Radic. Biol. Med., 51, 1643–1655.
- **Synthesis and characterization of a cyclooctapeptide analogue of ω-agatoxin IVB enhancing the activity of CaV2.1 calcium channels activity in cultured hippocampal neurons.** Pringos E., Crouzin N., Cavalier M., Guiramand J., Cohen-Solal C.,Martinez J., Vignes M. H. & Rolland V. (2012). Neurochem. Int., 61, 632-639.
- **Reversal of age-related oxidative stress prevents hippocampal synaptic plasticity deficits by protecting D-serine-dependent NMDA receptor activation.**Haxaire C., Turpin F. R., Potier B., Kervern M., Sinet P. M., Barbanel G., Mothet J.-P., Dutar P. & Billard J.-M. (2012) Aging Cell, 11, 336-344.

Stereoselective synthesis and unnatural amino acid analogues

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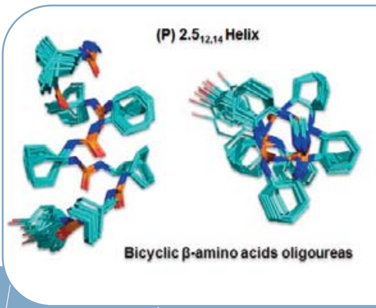

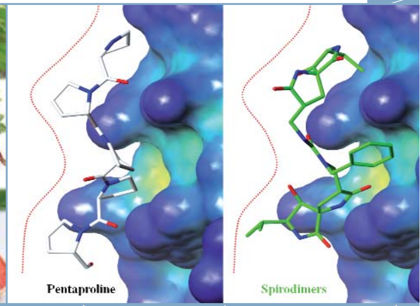

Team

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Themes

- Methodologies in asymmetric synthesis
- Chiral auxiliaries
- Unnatural amino acids
- Bioactive peptides
- Peptidomimetics and oligomers

Competences

- Asymmetric synthesis (solution and solid phase)
- Peptide synthesis (solution and solid phase)
- Organocatalysis

Partners

Medincell (Montpellier)
Nyseos (Montpellier)

Examples of projects

- Aromatic potential in wine. Contract Nyseos florine.cavelier@um2.fr
- Neurotensine and derivatives for pain treatment. PhD grant CIFRE, Contract Medincell. florine.cavelier@um2.fr
- Biopolymers of biological interest: N-carboxyanhydride and polymerisation of silylated amino acids. PhD grant florine.cavelier@um2.fr
- Cyclic β-amino acids and foldamers. monique.calmes@um2.fr
- Oxaproline and polyoxaprolines. ANR Oxaprol, Labex CheMISyst. isabelle.parrot@um2.fr
- Diaminopimelic acid (DAP) analogues as inhibitors of cell wall biosynthesis for antibacterial agents patrick.meffre@unimes.fr
- PPII project: inhibition in the Src kinases family. INCA isabelle.parrot@um2.fr
- Synthesis of 1,2-aminoalcohols. salom-roig@um2.fr

Selected publications/patents

- WO 2010 112697 **Nicotianamine-derived metallophore and processes for producing same.** C. DREYFUS, P. ARNOUX, D. PIGNOL, M. LARROUY, J. MARTINEZ, F. CAVELIER.
- **A new route to "all-cis" 2-methyl-6-substituted piperidin-3-ols alkaloids from syn-(2R,1'S)-2-(1-dibenzylaminomethyl)epoxide: rapid total synthesis of (+)-deoxocassine.** P-Y. GEANT, J. MARTINEZ, X. J. SALOM-ROIG Eur. J. Org. Chem., 36, 62-65, (2012).
- **(S)Robust Helix Formation in a New Family of Constraint b-Bicyclic Amino Acid Oligoureas** B. LEGRAND, C. ANDRÉ, E. WENGER, C. DIDIERJEAN, M-C. AVERLANT-PETIT, J. MARTINEZ, M. CALMES, M. AMBLARD. Angew. Chem. Int. Ed.,2012 51, 11267-11270.
- **Concise Pathway to New Multifunctionalized Constrained Pentacin Derivatives by Means of Two Stereospecific Tandem Reactions**, T. COURSINDEL, J. MARTINEZ & I. PARROT, Eur. J. Org. Chem., 4519-4522 (2011).
- **Chemoenzymatic routes to enantiomerically pure 2-azatyrosine and 2-, 3- and 4-pyridylalanine derivatives**, A. MOUSSA, P. MEFFRE, J. MARTINEZ & V. ROLLAND Amino Acids, 42, 1339–1348 (2012).

Supramolecular Machines and ARchitectures Team

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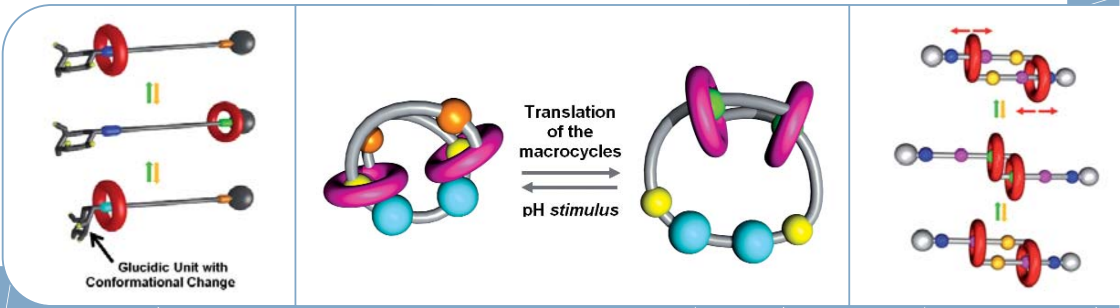

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Themes

- **Synthesis of new molecular machines for biological applications**
  - Synthesis of pH-sensitive glycorotaxane molecular machines: toward the modulation of the affinity of a glucidic ligand for lectins
  - Synthesis of peptidorotaxane and lasso molecular machine: switching on or off the activity of a peptide
  - Synthesis of lasso compounds able to tighten or loosen their cavity: toward new carriers able to release their guest upon specific stimulus.
  - Synthesis of peptide-containing lasso molecular switches
- **Synthesis of new molecular machines (rotaxanes, molecular muscles and lasso compounds) for materials**
  Partners: Dr Sophie Monge-Darcos - IAM - ICGM - University Montpellier 2.

Competences

- Organic synthesis
- Supramolecular chemistry
- Molecular machinery
- Templated synthesis
- Synthesis and characterization of interlocked and interwoven components

Examples of projects

Grants awarded by the LABEX CHEMISYST 2012-2015.
Title of the project: « Preparation of Molecular Muscle Building-Blocks for the Synthesis of Polymers having Controlled co-Conformations ».

Selected publications/patents

- **Tightening or Loosening a pH-sensitive double-Lasso Molecular Machine Readily Synthesized from an Ends-Activated [c2] Daisy Chain.** Camille Romuald, Ana Arda-Freire, Caroline Clavel, Jesus Jimenez-Barbero and Frédéric Coutrot. Chem. Sci. 2012, 3, 1851-1857.
- **Very Contracted to Extended co-Conformations with or without Oscillations in Two-and Three-Station [c2] Daisy Chains**
  Camille Romuald, Eric Busseron and Frédéric Coutrot. J. Org. Chem. 2010, 75, 6516-6531.
- **Bistable or Oscillating State Depending on Station and Temperature in Three-Station Glycorotaxane Molecular Machines**
  Eric Busseron, Camille Romuald and Frédéric Coutrot. Chem. Eur. J. 2010, 16, 10062-10073.
- **Controlling the Chair Conformation of a Mannopyranose in a Large-Amplitude [2] Rotaxane Molecular Machine**
  Frédéric Coutrot, Eric Busseron. Chem. Eur. J. 2009, 15, 21, 5186-5190.
- **A New pH Switchable Dimannosyl [c2] Daisy Chain Molecular Machine**
  Frédéric Coutrot, Camille Romuald, Eric Busseron. Org. Lett. 2008, 10, 17, 3741-3744.

Synthesis of bioactive lipids

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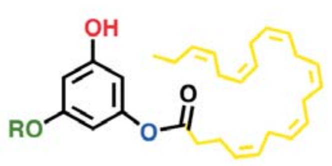

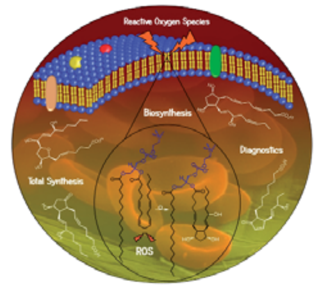

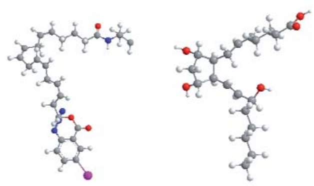

Team

12 permanent staff members
5 non permanent staff members

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Themes

Total synthesis of oxygenated cyclic and non cyclic metabolites of n-3 and n-6 PolyUnsaturated Fatty Acids (PUFAs)

- Iso, Phyto-, and Neuroprostanes
- Iso- and Neurofuranes
- Endocannabinoïds and dihydroxylated-DHA
- Alkylated-lipo-polyphenols

Competences

- Multi-step synthesis
- HPLC and GC
- LC-MS and GC-MS/MS
- Liquid-liquid Chromatography (CPC 50 ml and 5 l)
- Supercritic fluid extractor (2 l)
- NMR 500 MHz and 300 MHz

Partners

Syngenta (UK) - ATC Pharma (B) - ITERG (F) - Caudalie (F) - Bausch et Lomb (F) - Servier (F)

Examples of projects

- Total synthesis of Iso, Phyto-, Neuroprostanes: Not only Biomarkers of OS »
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  INRA-Alim-H, BQR UM I, Vanderbilt USA, FRM
- Total synthesis of Iso- and Neurofuranes: New Biomarkers of OS»
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  camille.oger@univ-montp1.fr
  thierry.durand@univ-montp1.fr
  FRM
- Total synthesis of endocannabinoïd probes and dihydroxylated metabolites of DHA
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- Total synthesis of lipophenols and anti-COS activities
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  joseph.vercauteren@univ-montp1.fr
  Caudalie

Selected publications/patents

- **Total synthesis of photoactivatable or fluorescent anandamide probes: novel bioactive compounds with angiogenic activity.** Balas, L.; Durand, T. Saha, S.; Johnson, I.; Mukhopadhyay, S. J. Med. Chem. 2009, **52**, 1005-10017.
- **The handy use of Brown's catalyst for a skipped diyne deuteration: application to the synthesis of a d_4-labelled-F_{4t}-neuroprostane**. Oger C., Bultel-Poncé V., Guy A., Balas L., Rossi J-C., Durand T., Galano J-M. Chem. Eur. J. 2010, **16**, 13976-13980.
- **F_2-Dihomo-isoprostanes as Potential early biomarkers of Lipid oxidative Damage in Rett syndrome.** C. De Felice, C. Signorini, T. Durand, C. Oger, A. Guy, V. Bultel-Poncé, J-M. Galano, L. Ciccoli, S. Leoncini, M. D'Esposito, S. Filosa, A Pecorelli, G. Valacchi, J. Hayek. J Lipids Res 2011, **52**, 2287-2297.
- J. Vercauteren, **Compositions de dérivés polyphénoliques et leurs applications comme bactéricide et fongicide,** n° PCT/IB2011/052571, 2011.
- **Are Alkyne Reductions Chemo-, Regio, and Stereoselective Enough to Provide pure (Z)-in Polyfunctionalized Bioactive Molecules.** C. Oger, L. Balas, T. Durand, J-M. Galano. Chem. Rev. 2013, **113**, 1313-1350.

Advanced Materials for Catalysis and Healthcare (MACS)

ICG Montpellier



Team 46 permanent staff members
41 non permanent staff members

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Themes

- Catalyses for sustainable development (vasile.hulea@enscm.fr)
- Elaboration of advanced functional materials (corine.gerardin@enscm.fr)
- Nanostructured materials for healthcare (jean-marie.devoisselle@univ-montp1.fr)

Competences

- Conception and synthesis of self-assembled nanostructured materials.
- Heterogeneous catalysis for refining, petrochemistry, fine chemistry, and pollution control.
- Modelisation and caracterisation of porous media and reactivity.
- Chemical valorisation of renewable resources.
- Functional systems for healthcare and diagnostics.

Specific equipment:

- CSTR and flow catalysis test systems
- Reactors for hydrothermal syntheses
- Spectroscopy-coupled adsorption systems
- Spray-dring and supercritical drying
- Dissolution tests for pharmacokinetics

Partners

Total - Rhodia - IFP Energies Nouvelles - Sanofi - Timac - Medesis

Examples of projects

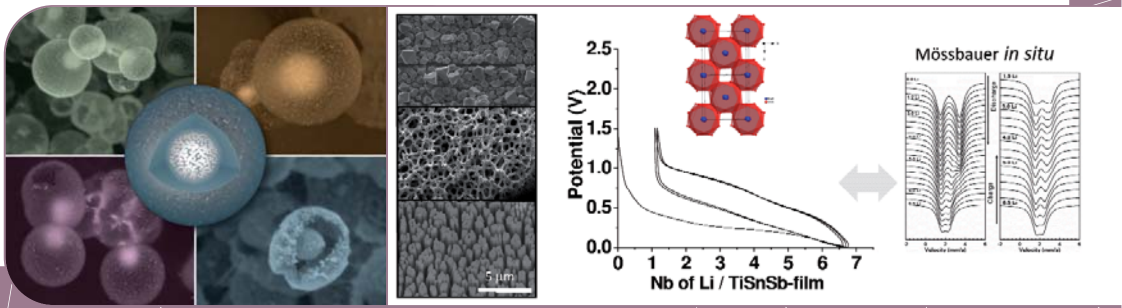
- Materials with hierarchical porosity for the valorisation of oil resources (corine.gerardin@enscm.fr)
- Control of water (anne.galarneau@enscm.fr) and gas (gerard.delahay@enscm.fr) pollution
- Fractionation and chemical valorisation of lignin (quignard@enscm.fr)
- Composite materials for enzyme immobilization (emmanuel.belamie@enscm.fr)
- Porous silicon for photodynamic therapy (frederique.cunin@enscm.fr) and pH-sensitives copolymers for immunotherapy (aaubert@univ-montp1.fr).

Selected publications/patents

- **Zeolites Y crystals with trimodal porosity as ideal hydrocracking catalysts.** Angew. Chemie Int. Ed. 49 (2010) 10074.
- **Profiling the active site of a cuproenzyme through its far-infrared fingerprint.** Angew. Chemie Int. Ed. 50 (2011) 8062.
- **Development of tripartite polyion micelles for efficient peptide delivery into dendritic cells without altering their plasticity.** J. Controlled Release 154 (2011) 156.
- **A regioselective biocatalyst foe alkane activation under mild conditions.** Angew. Chemie Int. Ed. 50 (2011) 2075.
- **Hybrid polyion complex micelles formed from double hydrophobic block copolymers and multivalent metal ions: sixe control and nanostructure.** Langmuir 28 (2012) 3773.
- **Structural regime identification in ionotropic alginate gels: influence of the cation nature and alginate structure.** Biomacromolecules 13 (2012) 215.
- **In situ synthesis of Cu-BTC (HKUST-1) in macro-/mesoporous silica monoliths for continuous flow catalysis.** ChemComm 48 (2012) 4749.

Aggregates, Interfaces and Materials for Energy (AIME)

ICG Montpellier



Team 30 permanent staff members
35 non permanent staff members

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Themes

- Ion and electron transfer, materials for energy storage
- Nanostructuring, materials for energy conversion
- Interface properties: mechanisms and interactions

Competences

- Fuel cell, supercapacitor, battery and sensor materials – from materials to integration in devices
- Non-conventional synthesis routes to hierarchical materials with tailored architecture
- Chemistry of interfaces, surface reactivity, molecular probe and thermochemical methods
- Complementary theoretical and experimental approaches applied to energy storage and conversion

Specific equipment:

- Fuel cells, electrolysers and battery materials experimental platform
- Mössbauer spectroscopy platform
- Thermodynamic properties and calorimetry platform

Partners

European Commission - ANR - RS2E - Eurogia- EADS - Saft - Total - Saint Gobain - Umicore - Süd-Chemie - IFP - Johnson Matthey Fuel Cells - EDF - PSA - Onet - Coatex - Sita - SNECMA

Examples of projects

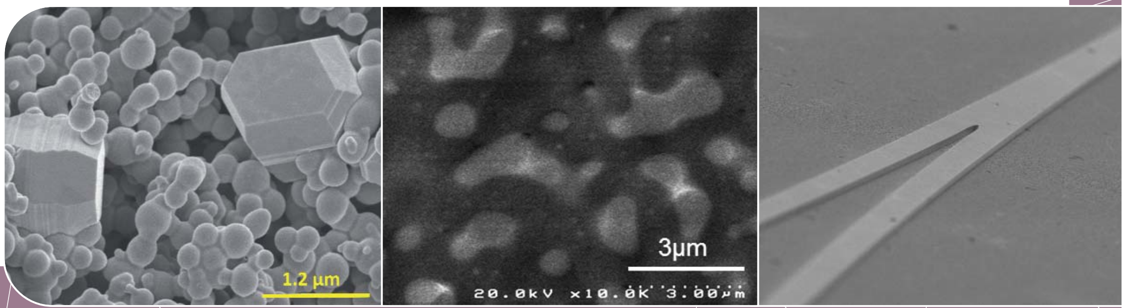
- New catalyst structures and membrane concepts for fuel cells (JTI Fuel Cells, FP7) deborah.jones@univ-montp2.fr jacques.roziere@univ-montp2.fr
- New electrode materials for Li-ion & Na-ion cells (ANR Blanc, Alistore ERI) laure.monconduit@univ-montp2.fr lorenzo.stievano@univ-montp2.fr
- Innovative materials for proton ceramic fuel cells (JTI Fuel Cells) gilles.taillades@univ-montp2.fr
- Supercapacitors: mechanisms and devices (ANR) frederic.favier@univ-montp2.fr
- Interface and colloidal mechanisms in synthesis and application of nanomaterials (ANR) jerzy.zajac@univ-montp2.fr, benedicte.prelot@univ-montp2.fr
- Spectroscopy studies of energy materials (ANR, FP7 IAESA-Nanotech). jean-claude.jumas@univ-montp2.fr pierre-emmanuel.lippens@univ-montp2.fr

Selected publications/patents

- **New topotactic synthetic route to mesoporous silicon carbide.** P.-C.Gao, Y. Lei, A. Cardozo-Pérez, K. Rajoua, D. Zitoun and F. Favier, J. Mater. Chem. 21, 15798-15805, (2011).
- **Optimized synthesis of Fe/N/C cathode catalysts for PEM fuel cells: a matter of iron-ligand coordination strength.** J. Tuan, A. Morozan, M. T. Sougrati, M. Lefèvre, R. Chenitz, J. P. Dodelet, D. J. Jones, F. Jaouen, Angew. Chem. Int. Ed. (2013) **52**, 6867-6870
- **Effect of nanoscale pore space confinement on cadmium adsorption from aqueous solution onto ordered mesoporous silica.** A combined adsorption and flow calorimetry study. B. Prélot, S. Lantenois, C. Chorro, M C. Charbonnel, J. Zajac and J.-M. Douillard, J. Phys. Chem. C, 115, 19686-19695, (2011).
- **Beyond intercalation-based Li-ion batteries, State of the art and challenges of electrode materials reacting through conversion reactions.** J. Cabana, L. Monconduit, D. Larcher and M. R. Palacin, Adv. Mater., 22, E170-E192, (2010).
- **A 3.90V iron-based fluorosulphate material for lithium-ion batteries crystallizing in the triplite structure.** P. Barpanda, M. Ati, B. C. Melot, G. Rousse, J.-N. Chotard, M.-L. Doublet, M. T. Sougrati, S A. Corr, J.-C. Jumas and J.-M. Tarascon, Nature Mater., 10, 772-779 (2011).

Chalcogenide materials and Glasses (ChV)

ICG Montpellier



Team 11 permanent staff members
5 non permanent staff members

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Themes

- Glasses and Solid State Ionics
- Chalcogenides and Data Storage
- Chalcogenides and IR Integrated Optics
- Chalcogenide glasses and Thermoelectricity
- Nanostructured Chalcogenides

Competences

- Synthesis of chalcogenide materials (bulk glasses, thin films, nano-structured chalcogenides) by melt-quenching or twin roller quenching, RF-sputtering, thermal co-evaporation, sol-gel, structuration with : ionic liquids,polymers…
- Specific characterizations: ion transport, advanced solid state NMR, near field microscopy, large scale facilities experiments (X-Ray, Neutrons)

Specific equipment:

- Furnaces with controlled atmosphere; glove-boxes; twin-roller quenching apparatus; thermal co-evaporation set-up; RF-sputtering set-up, mechanical alloying.
- Solartron and conductivity cells; UV-vis-NIR spectrophotometer
- Ion beam etching

Partners

ESA - Thales Alenia Space - Sanofi - IFPEN - ILL

Examples of projects

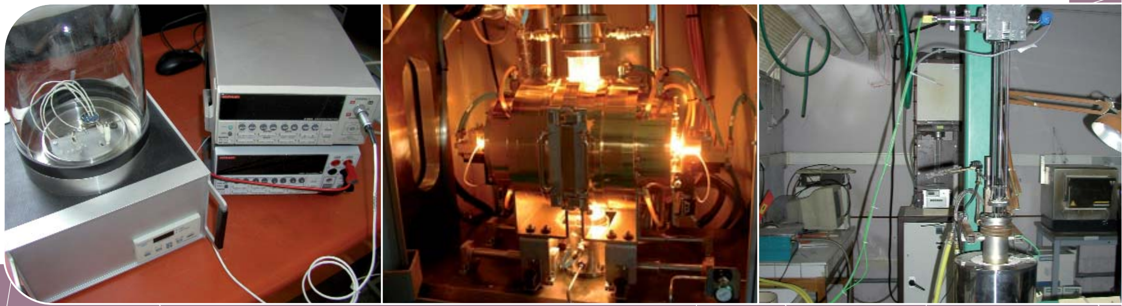
- New functionalities of tellurium based amorphous materials (“TEAM” ANR Project) annie.pradel@univ-montp2.fr
- Structuring Nanochalcogenides using Ionic Liquids (“Nanochalco” ANR Project) laurence.courtheoux@univ-montp2.fr
- Integrated Optics for the Darwin Mission (Industrial Contract supported by the European Space Agency, Thales Alenia Space) caroline.vigreux@univ-montp2.fr
- Chalcogenide glasses/glass-ceramics as thermoelectric materials for room temperature applications (“VTG” ANR Project) andrea.piarristeguy@univ-montp2.fr

Selected publications/patents

- Annie Pradel, Bérangère Raguenet, Grégory Tricot, Gilles Silly and Michel Ribes - **Revisiting the 'mixed glass former effect' in ultra-fast quenched borophosphate glasses by advanced 1D/2D solid state NMR.**, Journal of Materials Chemistry, 21, 2011, 17693.
- AAndrea Piarristeguy, Michel Ramonda, Nathalie Frolet, Michel Ribes and Annie Pradel. **High resolution electrical characterisation of Ag-conducting heterogeneous chalcogenide glasses**,Solid State Ionics, 181, **2010**, 1205-1208
- Milos Krbal, Alexander V. Kolobov, P. Fons, Julien Haines, Annie Pradel, Michel Ribes, Andrea Piarristeguy, Claire Levelut, Rozenn Le Parc, V. Agafonov, M. Hanfland and J. Tominaga - **Pressure-induced structural transitions in phase-change materials based on Ge-free Sb-Te alloys,** Physical Review B, 83, 2011, 024105.
- Caroline Vigreux, Eléonore Barthélémy, Lionel Bastard, Jean-Emmanuel Broquin, Marc Barillot, Stéphane Ménard, Gilles Parent and Annie Pradel. **Realization of single-mode telluride rib waveguides for mid-infrared applications between 10 µm and 20 µm,** Optics Letters, 36, 2011, 2922-2924.
- G. Leyral, M. Ribes, L. Courthéoux, D. Uzio, A. Pradel - **Synthesis and Structuring of Ni-MoS2 by using an ionic liquid,** European Journal of Inorganic Chemistry, 31, 2012, 4967-4971.

Chemistry and Crystallochemistry of Materials (C2M)

ICG Montpellier



Team

21 permanent staff members
14 non permanent staff members

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Themes

- Investigations of ferroelectric/piezoelectric properties as a function of Temperature, Pressure and Electric Fields. Multiferroïc properties
- Fundamental studies of non stoichiometric oxides for the understanding of ionic mobility
- Phase stability and thermoelectric properties.

Competences

- Synthesis of single crystals, ceramics and thin films (oxides and intermetallics)
- Structural analysis at different scale and under different conditions of pressure and temperature using large scale facilities (neutron and synchrotron radiation)
- Study of materials properties (thermoelectric, electromechanical, electric charge mobility)
- Experimental determination and modeling of phase diagram
- Modeling and simulation.

Partners

Saint Gobain - Total - Renault - PSA - Acome - Atmel - EADS - CEA - Onera - Ademe.

Examples of projects

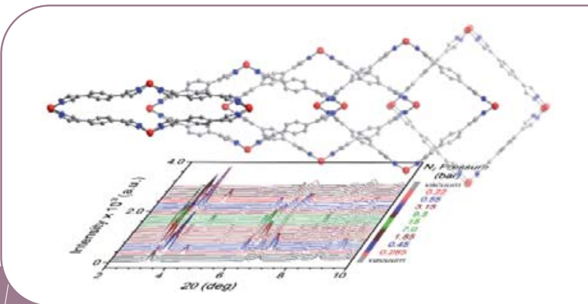
- Materials for energy conversion and sustainable development based on Titanium Half Heusler alloys. Financement industriel (EADS). jean-claude.tedenac@univ-montp2.fr
- NOCHIQRUS: Nouvelle formulation chimique du Quartz pour des Résonateurs Ultra Stables. Financement public (ANR) olivier.cambon@univ-montp2.fr
- Valorisation des déchets amiante neutralisation des dangers inhérents aux déchets d'amiantes et perspectives de valorisation. Financement public (ADEME) Julien.haines@univ-montp2.fr
- Ionic mobility in doped cerium oxide. Financement industriel (Saint Gobain). werner.paulus@univ-montp2.fr
- High dielectric constant in Ferroelectric materials. Financement industriel (EDF). philippe.papet@univ-montp2.fr

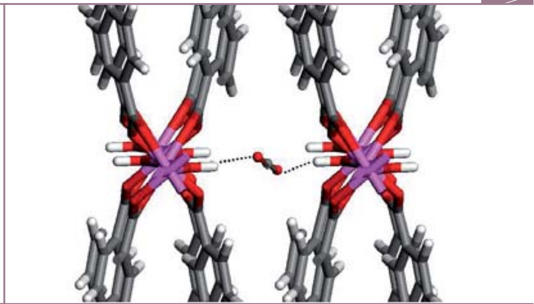
Selected publications/patents

- M M. Koza, M R. Johnson, R. Viennois, L. Girard, Hannu Mutka and Didier Ravot **Breakdown of phonon glass paradigm in La- and Ce-filled Fe4Sb12 skutterudites**, Nature Materials, 7, 2008, 805.
- J. Rouquette, J. Haines, Ali Al-Zein, P. Papet, Françoise Damay, J. Bourgeois, T. Hammouda, F. Doré, A. Maignan, M. Hervieu and C. Martin - **Pressure-Induced Structural Transition in LuFe2O4, Towards a New Charge Ordered State**, Physical Review Letters, 105(23) , 2010, 237203.
- A. Lignie, P. Armand and P. Papet - **Growth of piezoelectric water free GeO2 and SiO2-substituted GeO2 single-crystals**, Inorganic Chemistry, 2011, 7.
- O. Cambon, G. Bhalérao, D. Bourgogne, J. Haines, P. Hermet, D A. Keen and M G. Tucker - **Vibrational origin of the thermal stability in the high-perfomance piezoelectric material GaAsO4**, Journal of the American Chemical Society, (133) , 2011, 8048-8056.
- M. Ikbel Houchati, M. Ceretti, C. Ritter and W. Paulus - **From T to T'-La_2CuO_4 via oxygen vacancy ordered $La_2CuO_{3.5}$**, Chemistry of Materials, 2012

Dynamics & Adsorption in Porous Materials (DAMP)

ICG Montpellier





Team 8 permanent staff members
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Themes

- Adsorption & Dynamics of guest molecules (gas, vapour & drug) confined in nanoporous media (zeolites, clays, hybrid silica & MOFs)
- Dynamical response of porous solids upon diverse stimuli.

Competences

- Molecular simulations approach (Monte Carlo, Molecular Dynamics & quantum calculations) intertwined with experimental tools (Dielectric Relaxation Spectroscopy, X-ray and Neutron diffractions, Mercury porosimetry).

Examples of projects

- **European Project**
  FP7-EU European Research Council Starting Independent Research Grant BioMOFs « Bio-applications of Metal-Organic-Frameworks ».

  IFP7 Large-scale integrating project ENERGY E=M4C2 "Energy efficient MOF-based Mixed Matrix Membranes for CO2 capture"

- **International bilateral program**
  France-China Hubert Curien Cai Yuanpei with Beijing University of Chemical Technology, Beijing “Design of Novel MOFs for gas capture & separation (CO_2, H_2, CH_4, CO, H_2S)”.

  IFrance -Brasil CAPES COFECUB with Federal University of Rio de Janeiro "Design of Hybrid Nanoporous Materials for adsorption and catalysis multipurposes"

- **National Action**
  ANR Programme Matériaux Fonctionnels et Procédés innovants VIRMIL “Nanoparticles of MOFs for the treatment of HIV infections and opportunistic bacterial infections”.

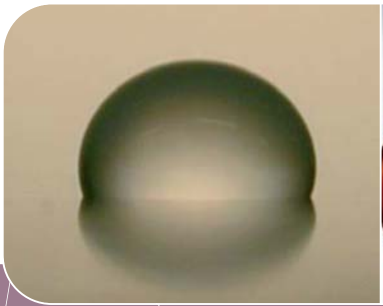
  ANR Programme Blanc MODS “MOFs as nanoDampeners or nanoSprings: an exploration of the thermodynamic & mechanical properties of Metal Organic Frameworks”.

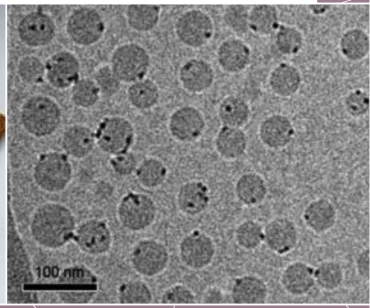
Selected publications/patents

- **Self- and transport diffusion of CO_2 in the MOF-type MIL-47(V) material explored by combining Quasi-Elastic Neutron Scattering Experiments and Molecular Dynamics Simulations**, F. Salles, H. Jobic, T. Devic, P. L. Llewellyn, C. Serre, G. Férey & G. Maurin, ACS Nano 4, 1, 143, 2010.
- **Why hybrid porous solids capture greenhouse gases?**, G. Férey, C. Serre, T. Devic, G. Maurin, H. Jobic, P.L. Llewellyn, G. De Weireld, A. Vimont, M. Daturi & J. S. Chang, Chem. Soc. Rev. 40, 550, 2011.
- **Large breathing of the MOF MIL-47(V^{IV}) under mechanical pressure: A joint experimental-modelling exploration**, P.G. Yot, Q. Ma, J. Haines, Q. Yang, A. Ghoufi, T. Devic, C. Serre, V. Dmitriev, G. Férey, C. Zhong & G. Maurin, Chem. Sci. 3, 1100, 2012.
- **Metal organic frameworks in biomedicine**, P. Horcajada, R. Gref, T. Baati, P.K. Allan, G. Maurin, P. Couvreur, G. Férey, R. Morris & C. Serre, Chem. Rev. 112, 1232, 2012.
- **Structure and Dynamics of the functionalized MOF type UiO-66(Zr): NMR and Dielectric relaxation spectroscopies coupled with DFT calculations**, S. Devautour-Vinot, G. Maurin, C. Serre, P. Horcajada, D. Paula Da Cunha, V. Guillerm, E. De Souza Costa, F. Taulelle, C. Martineau, Chem. Mater., 24, 2168, 2012.

Engineering and Macromolecular Architectures (IAM)

ICG Montpellier





Team

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44 non permanent staff members

Team leader

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IAM located in
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Themes

- Controlled polymerisations
- Polymers bearing hetero-atoms
- Polymers, unconventional media and clean processes
- Polymers from renewable resources

Competences

- Synthesis of monomers and modification of polymers
- Design of functional polymers
- Polymerisations under high pressure or in dispersed media
- Modification of biomass
- Photoreactors

Specific equipment:

- Supercritical carbon dioxide autoclaves
- High pressure autoclaves for polymerisation of gaseous monomers and feeding systems
- Dynamic mechanical analysers (solid, melt and solution)
- Size exclusion chromatographies with multi-detections
- Photopolymerisations processes
- UV/FTIR monitoring

Partners

Arkema - Sofiproteol - Bostik - Hutchinson - Dupont - Nexans - Honeywell - Peugeot-Citroen - PSA

Examples of projects

- MADE, European Seventh Framework Programme
  Jean-Jacques Robin, jean-jacques.robin@univ-montp2.fr
- GreenCoat, ANR project
  Sylvain Caillol, sylvain.caillol@enscm.fr
- COPOTERM, ANR project
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- FINATHER, FUI project
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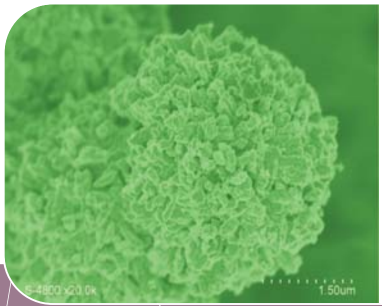
- MEMFOS, ANR Project, CEA,
  Ghislain David, ghislain.david@enscm.fr
- PREMHYS, ANR project involving Arkema, Clariant and CEA
  Bruno Ameduri, bruno.ameduri@enscm.fr
- Piezoelectric Polymers (PiezoTech-ARKEMA)
  Bruno Ameduri, bruno.ameduri@enscm.fr

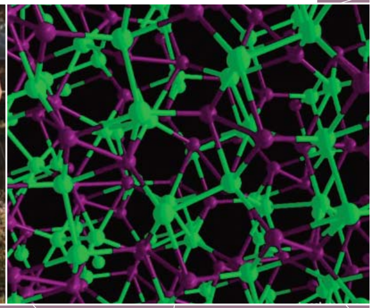
Selected publications/patents

- **Synthesis and evaluation of triazole-linked poly(epsilon-caprolactone)-graft-poly(2-methyl-2-oxazoline) copolymers as potential drug carriers**, Chemical Communications, 2012, 48, 2879.
- **Synthesis of double hydrophilic block copolymers and induced assembly with oligochitosan for the preparation of polyion complex micelles**, Soft Matter, 2011, 7(12), 5836.
- **Synthesis of Biobased Polyols by Thiol-Ene Coupling from Vegetable Oils,** Macromolecules, 2011, 44(8), 2489.
- **Polymeric materials as anion-exchange membranes for alkaline fuel cells,** Progress in Polymer Science, 2012, 36(11), 1521.
- **Process for preparing vinylidene chloride polymer latex,** Solvay, CNRS, UM2, 2012, WO 2012065901.

Modeling and Development of Multifunctional Materials (MESO)

ICG Montpellier





Team 4 permanent staff members
4 non permanent staff members

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Themes

- Ab initio modeling of materials for energy applications
- Innovative synthesis routes for high performance multifunctional materials
- Thermodynamics and modeling of phase equilibria and complex phases for intermetallic materials

Competences

- Numerical simulations (ab initio + parametrized)
- Computer codes : VASP, AbInit, QuantumEspresso, Boltztrap
- Stability of complex phases (Calphad techniques)
- Various synthesis methods: soft chemistry, mechanical alloying and Self-propagating High temperature Synthesis (SHS)

Specific equipment:

- Linux Infiniband computer cluster (440 CPUs)
- SHS reactor
- Ball mills, glove boxes, furnaces (1400°C), hot-pressing device
- DSC, Optical microscopes

Partners

Total, Hutchinson, ANR, EADS, Astrium, Renault, Acome, CEA/LITEN, HOTBLOCK ONBOARD

Examples of projects

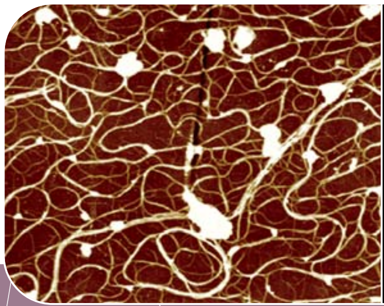
- ANR Project « PHIMS » (P-type HIgh Manganese Silicides by design for high performance and sustainable thermoelectric materials) pjund@um2.fr - 215 280 € (2012-2015)
- “Improving the thermoelectric properties of materials via first principles simulations”, pjund@um2.fr - Industrial thesis financed by Total/Hutchinson - 180 000 € (2011-2014)
- “New ZnSb based thermoelectric materials: synthesis, characterization and shaping”, rmayral@um2.fr - follow up industrial thesis financed by Total/Hutchinson - 180 000 € (2013-2016)
- “Systèmes de panneaux interactifs thermoélectriques, SYSPACTE”. tedenac@um2.fr - 145 000€ (2011-2014)

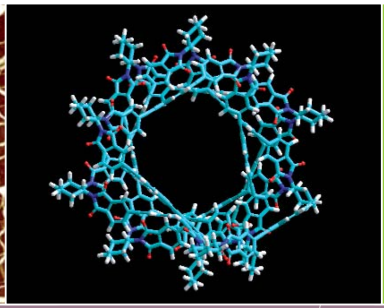
Selected publications/patents

- Patrick Hermet, Kinga Niedziolka and Philippe Jund, **A first-principles investigation of the thermodynamic and mechanica properties of Ni-Ti-Sn Heusler and half-Heusler materials,** RSC Adv., DOI:10.1039/C3RA43990A, (2013)
- Philippe Jund, Romain Viennois, Xiaoma Tao, Kinga Niedziolka and Jean-Claude Tedenac, **Physical properties of thermoelectric zinc antimonide using first-principles calculations,** Physical Review B, 85(22), (2012), 224105
- Florence Rouessac, Rose-Marie Ayral, **Combustion synthesis: a new approach for preparation of thermoelectric zinc antimonide compounds,** Journal of Alloys and Compounds 530, (2012), 56–62
- Catherine Colinet and Jean-Claude Tedenac, **Structural stability of the D8m- Ti5Sn2Si compound,** Calphad, 35(4) , 2011, 643-647
- Xiaoma Tao, Philippe Jund, Catherine Colinet and Jean-Claude Tedenac, **First-principles study of the structural, electronic and elastic properties of W5Si3,** Intermetallics, 18(4), (2010), 688-693

Molecular Architectures and Nanostructured Materials (AM2N)

ICG Montpellier





Team 26 permanent staff members
30 non permanent staff members

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Themes

- Nanostructured organosilicas
- π-Conjugated Nanoarchitectures
- Natural products synthesis
- Transition metal (Cu, Fe, Au, Pd) homogeneous and supported catalysis
- Phosphorus heterocycles

Competences

- Organic chemistry,
- Medicinal chemistry - drug design
- Heteroatom (P, Si, F) chemistry
- Supramolecular chemistry
- Sol/gel chemistry
- Organometallic chemistry

Partners

Idenix - Bayer CropScience - Atheor - Nosopharm - Beta Innov - Servier - Syngenta

Examples of projects

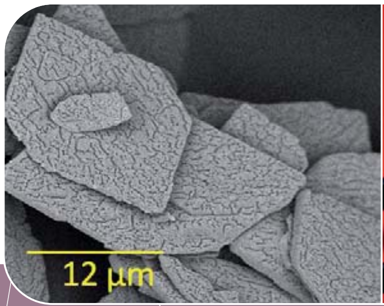
- Synthesis of Phosphorus Bioactive Molecules; BAYER CropScience / IDENIX: jean-luc.pirat@enscm.fr
- Nanoparticles of molecularly imprinted hybrid silica as pH-sensitive prodrugs delivery system: ANR JCJC; carole.carcel@enscm.fr
- Elaboration of transistors based on functionalized and insulated molecular wires and applications in chemical sensors: ANR Blanche; francoise.spirau@enscm.fr
- Ecologic and Economic Metal-catalyzed Syntheses of Phosphorus Molecules: Applications to iron-catalyzed additions to unsaturated systems: ANR - CP2D; marc.taillefer@enscm.fr
- Characterization and Properties of conjugated copper enolates ANR Blanche; jean-marc.campagne@enscm.fr
- Photochemical hydrolysis-polycondensation of chromophores: applications to photolithography: ATHEOR; olivier.dautel@enscm.fr

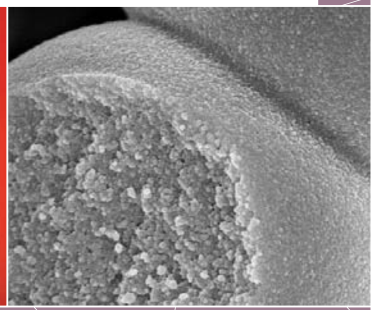
Selected publications/patents

- Ludovic Clarion, Carine Jacquard, Odile Sainte-Catherine, Séverine Loiseau, Damien Filippini, M H. Hirlemann, Jean-Noël Volle, David Virieux, Marc Lecouvey, Jean-Luc Pirat and Norbert Bakalara - Oxaphosphinanes, **New Therapeutic Perspectives for Glioblastoma, Journal of Medicinal Chemistry,** , 2012, 2196-2211.
- Anis Tlili, Ning Xia, Florian Monnier and Marc Taillefer - **A Very Simple Copper-Catalyzed Synthesis of Phenols Employing Hydroxide Salts,** Angewandte Chemie International Edition, 48(46) , 2009, 8725-8728.
- Nathalie Cheminet, Thibaut Jarrosson, Jean-Pierre Lère-Porte, Françoise Serein-Spirau, Luiz Cury, Joël Moreau J. E., Lydie Viau and André Vioux - **One pot synthesis of fluorescent p-conjugated materials, immobilization of phenylene-ethynylene polyelectrolytes in silica confined ionogels,** Journal of Materials Chemistry, 21, 2011, 13588.
- Laurent Fertier, Christophe Théron, Carole Carcel, Philippe Trens and Michel Wong Chi Man - **pH-Responsive Bridged Silsesquioxane,** Chemistry of Materials, 23, 2011, 2100-2106.
- Olivier Debleds, Eric Gayon, Emilie Ostaszuk, Emmanuel Vrancken and Jean-Marc Campagne - **A Versatile Iron-Catalyzed Protocol for the One-Pot Synthesis of Isoxazoles or Isoxazolines from the Same Propargylic Alcohols,** Chemistry - A European Journal, 16(40) , 2010, 12207-12213.

Molecular Chemistry and Structuration of Solids (CMOS)

ICG Montpellier





Team

30 permanent staff members
17 non permanent staff members

Team leader

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Themes

- Hybrid Materials
- Surfaces and Interfaces
- Functional Nano-objects
- π-Conjugated Systems

Competences

- Molecular, macromolecular and coordination chemistry
- Sol-gel, surface modification, nanoparticles synthesis
- Organosilicon and organophosphorus coupling agents, ionic-liquids
- Magnetism, electrochemistry, solid-state NMR

Specific equipment:

- Thermal analysis (TGA-DTA, DSC)
- Characterization of porous materials and nanoparticles (BET, DLS, multi-reflection FTIR-ATR, contact angle)
- Other: spectrofluorimeter, spin-coater, dip-coater, micro-wave reactor.

Partners

Chryso - PSA - Onet Technologies - CTI Salindres - Medesis Pharma - Rhodia - CEA

Examples of projects

- Design of hybrid materials using self-assembly
  ahmad.mehdi@univ-montp2.fr
- Sol-gel and ionic liquids: ionogels; iono-silicas
  andre.vioux@univ-montp2.fr
- Mixed oxide catalysts by non-hydrolytic sol-gel
  hubert.mutin@univ-montp2.fr
- Mesoporous nanoparticles for photodynamic therapy
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- Multifonctional nanoparticles and nano-materials based on coordination polymers
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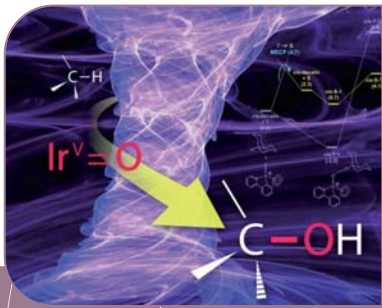
- π-conjugated materials and porphyrins for opto-electronic applications
  sebastien.clement02@univ-montp2.fr

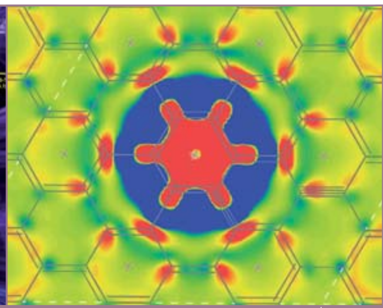
Selected publications/patents

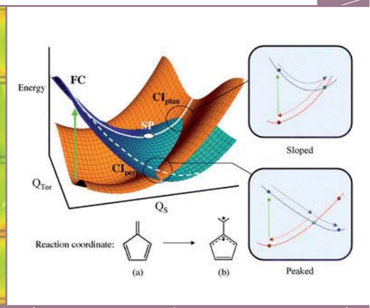
- **From molecular chemistry to hybrid nanomaterials. Design and functionalization.** Mehdi, A.; Reye, C.; Corriu, R., Chem. Soc. Rev. 2011, 40, 563-574.
- **Ionogels, ionic liquid based hybrid materials.** Le Bideau, J.; Viau, L.; Vioux, A., Chem. Soc. Rev. 2011, 40, 907-925.
- **Synthesis of stable free base secochlorins and their corresponding metal complexes from meso-tetraarylporphyrin derivatives.** Lo M. et al., Chem. Commun. 2012, 48, 3460-3462.
- **Surface modification of calcium carbonate with phosphonic acids.** El Malti W. et al., J. Mater. Chem. 2012;22, 1212-1218.
- **Non-hydrolytic sol-gel routes to heterogeneous catalysts.** Debecker, D. P.; Mutin, P. H., Chem. Soc. Rev. 2012, 41, 3624-3650.
- **Mannose-Functionalized Mesoporous Silica Nanoparticles for Efficient Two-Photon Photodynamic Therapy of Solid Tumors.** Gary-Bobo, M. et al. Angew. Chem., Int. Ed., 2011, 50, 11425-11429.
- **Water-Dispersible Sugar-Coated Iron Oxide Nanoparticles. An Evaluation of their Relaxometric and Magnetic Hyperthermia Properties,** Lartigue, L. et al. J. Am. Chem. Soc., 2011, 133, 10459-10472.

Theoretical Chemistry, Methodologies and Modeling (CTMM)

ICG Montpellier







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Themes

- Dynamics of Molecular Systems and Spectroscopy
- Mechanisms of reactions and catalysis
- Solid State Electronics

Competences

- Molecular ab-initio and DFT calculations
- Periodic DFT calculations
- Modeling of chemical reactivity, properties and structures
- Development of theoretical methods

Partners

Sanofi - Firmenich -
Energy Storage French Network (RS2E)

Examples of projects

- ANR ETPHOTOCY:
  Dynamic and photochemistry of organic molecules
  gatti@univ-montp2.fr

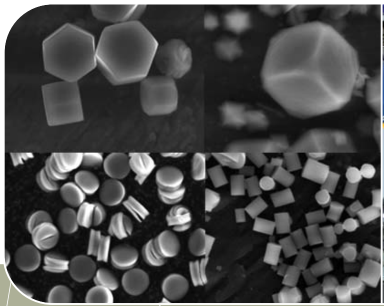
- ANR ALIBABA:
  Understanding and design of new Li-ion electrodes
  doublet@univ-montp2.fr

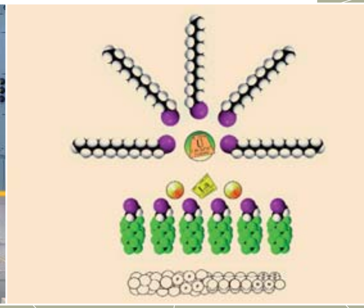
- ANR ENOLFUN:
  Pd-catalyzed C-H functionalization of organic molecules
  clot@univ-montp2.fr

Selected publications/patents

- Joaquim Jornet Somoza, Benjamin Lasorne, Michael A. Robb, Hans-Dieter Meyer, David Lauvergnat and Fabien Gatti **A generalised 17-state vibronic-coupling Hamiltonian model for ethylene**, J. Chem. Phys., 137, 2012, 084304
- Prabeer Barpanda, Mohammed Ati, Brent C. Melot, G. Rousse, Jean-Noël Chotard, Marie-Liesse Doublet, Moulay Tahar Sougrati, S A. Corr, Jean-Claude Jumas and Jean-Marie Tarascon **A 3.90V iron-based fluorosulphate material for lithium-ion batteries crystallizing in the triplite structure**, Nature Materials, 10, 2011, 772-779
- Andreas Berkefeld, Warren E. Piers, Masood Parvez, Ludovic Castro, Laurent Maron and Odile Eisenstein Carbon Monoxide **Activation via O-Bound CO Using Decamethylscandocinium-Hydridoborate Ion Pairs**, J. Am. Chem. Soc., 134, 2012, 10843-10851
- Paolo Larini, Christos E. Kefalidis, Rodolphe Jazzar, Alice Renaudat, Eric Clot and Olivier Baudoin **On the Mechanism of the Palladium-Catalyzed β-Arylation of Ester Enolates**, Chem. Eur. J., 18, 2012, 1932-1944
- Claude Leforestier, Michel Herman, Kevin Didriche, Clément Lauzin, T. Foldes and D. Golebiowski **High resolution overtone spectroscopy of the acetylene van der Waals dimer, $(^{12}C_2H_2)_2$**, Phys. Chem. Chem. Phys., 13, 2011, 14010

Chemistry and Physical Chemistry of Actinides





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5 non permanent staff members

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Themes

- Heavy Metal Molecular Chemistry
  - f-Element organometallics
  - Photophysics of heterobimetallic compounds
- Liquid-liquid Extraction
- Weak interactions in supramolecular assemblies
  - Organo-fluorinated surfactants
- Metallo-hybrid molecular assemblies
- Controlled Molecular matter
  - Micrometric morphology control
  - Nanoparticles
- Nuclear Toxicology

Competences

- Synthesis and characterization:
  - Hybrid organic-inorganic materials
  - Organic synthesis
  - Organometallic compounds
- Photochemistry, electrochemistry

Specific equipment: IR, Raman, UV-visible, NMR (liquid and solid), X-ray diffraction (single crystal and powder), photoreactor, electrochemical equipment, inert gloveboxes, Uranium and Thorium handling, Transuranic gloveboxes (CEA-Atalante Facility).

Partners

ICG - CEA/DSV - CEA/DRT - University of Grenoble - University of Strasbourg - College de France - University of Edinburg - Institute of TransUranic elements (ITU) - University of Cyprus - Veolia –SARP Industrie.

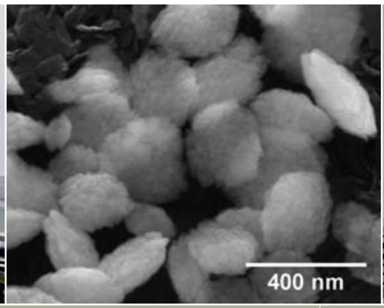
Examples of projects

- Synthesis, characterization and reactivity of molecular polymetallic compounds for photochemistry and charge transfers.
- Synthesis and intermolecular reactivity of Np and Pu coordination compounds.
- Fluorinated vs Hydrogenated supramolecular assemblies: importance of weak interactions in metal containing aggregates stability.
- Uranyl Biomineralization in Bones with a multiscale approach
- Actinides oxides nanoparticles (collaboration with ITU)
- Recycling of valuable elements of car batteries (collaboration with Veolia –SARPIndustrie)
- Eurac-NMR: Trans-national Access to Unique European Actinide and Radiological NMR Facilities

Selected publications/patents

- **From Coordination Polymers to Doped Rare-Earth Oxides.**
  T. Demars et al., European Journal of Inorganic Chemistry, 24, pp 875-3884, 2012.
- **Non-aqueous Synthesis of Isotropic and Anisotropic Actinide Oxide Nanocrystals.**
  D. Hudry et al., Chemistry - A European Journal, 18(27), 2012, pp 8283–8287.
- **Bone as Target Organ for Metals.**
  The Case of f-Elements: C. Vidaud, D. Bourgeois and D. Meyer, Chem. Res. Toxic. 25(6), 2012 pp 1161-1175.

Environmental electron microscopy group

Team 4 permanent staff members
2 non permanent staff members

Team leader **Renaud Podor**
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Themes

Development of in situ analytical methods by electron microscopy.

Competences

- Environmental scanning electron microscopy
- Transmission electron microscopy
- Nuclear magnetic resonance

Specific equipment:

- Scanning electron microscope FEI QUANTA 200 ESEM FEG
- Transmission electron microscope JEOL 200CX
- Spectrometer RMN BRUKER 400MHz

These equipments are part of the analysis facility of the Pôle chimie Balard.

Partners

Laboratory of Catalysis and Solid State Chemistry (UMR 8181) / "Glass and NMR methodology" group.

Examples of projects

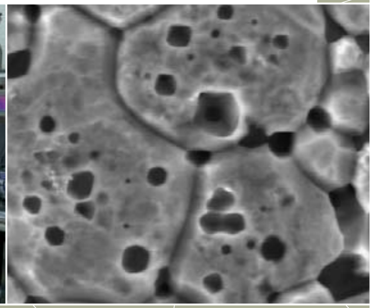
- Experimental study of ceramic sintering mechanisms at the sub micrometer scale.
- Development of a SEM in situ reactor for the direct observation of ceramic dissolution.
- High temperature reactivity of glasses and melts (Collaboration with CEA Marcoule).
- Development of glassy self-healing materials (Collaboration with UCCS-UMR8181 – Lille).
- Oriented growth of carbon nanotubes (Collaboration with L2C – UMR5221).

Selected publications/patents

- D. Coillot, F. Mear, R. Podor, L. Montagne. **Autonomic Self-Repairing Glassy Materials.** Advanced Functional Materials (2010) 20 4371-4374.
- N. Clavier, R. Podor, N. Dacheux. **Crystal chemistry of the monazite structure**. Journal of the European Ceramic Society (2011) 31[6] 941-976.
- N. Clavier, R. Podor, L. Delière, J. Ravaux and N. Dacheux. **Combining in situ HT-ESEM observations and dilatometry: an original and fast way to the sintering map of ThO2**. Materials Chemistry and Physics (2013) 137(3), 742-749.
- R. Podor, N. Clavier, J. Ravaux, L. Claparède, N. Dacheux, D. Bernache-Assollant. **Dynamic aspects of ceramic sintering**. HT-ESEM in situ sintering of CeO2 at T=1400°C. Journal of the European Ceramic Society (2012) 32 353-362.
- R. Podor, D. Pailhon, HP Brau, J Ravaux . **Porte-échantillon à thermocouple intégré**. Demande de brevet déposée le 21 juillet 2011 (n°11 56612).

Evolving interfaces in materials





Team

4 permanent staff members
5 non permanent staff members

Team leader

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Themes

Materials chemistry: solid-solid and solid-liquid interfaces

- Sintering of nuclear ceramics: nuclear fuels, specific conditioning matrices:
  - Development of transversal approach including synthesis, sintering capability and properties in use
  - Development of *in situ* experiments (dilatometry, ESEM)
- Nuclear fuel dissolution and alteration:
  - Kinetics: effect of structural and microstructural parameters
  - Thermodynamics: description of saturation processes
  - Optimization of the chemical durability
  - *In situ* and *in operando* studies of evolving solid/liquid interfaces

Front-end of nuclear fuel cycle

- Solubility of uranium-based minerals (phosphates, vanadates, silicates)

Competences

Materials Science, Actinide Science, Radiochemistry, Sintering, Dissolution and leaching, Evolving interfaces, Front-end of nuclear fuel cycle, Back-end of nuclear fuel cycle.

Specific equipment:

- High-temperature devices, pressing devices, dilatometer, pycnometer
- Leaching flow reactor, Speciation software, hydrothermal device, oxygen-free glovebox
- µ-Raman, IR, ESEM, XRD (HT, grazing, XRR), ICP-OES

Partners

Areva NC - EDF - CEA (DEN, DTN, DAM, DSM) - ICGM - IEM - Univ. Lille 1 - Univ. Paris-Sud-11 - University of Michigan - ITU-Karlsruhe - FZ Jülich - IFA-Bucarest

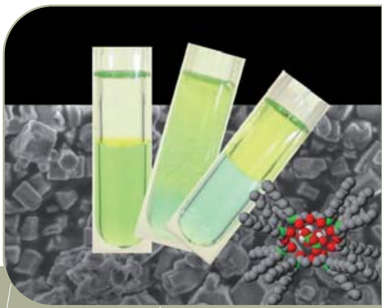
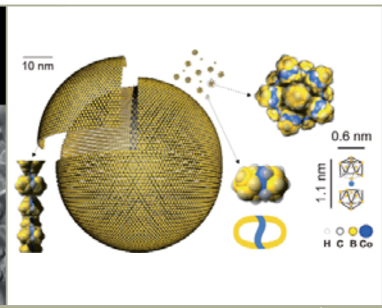
Examples of projects

- Actinide oxide sintering (AREVA-NC, CEA, CNRS) nicolas.clavier@icsm.fr
- Multiparametric study of actinide and lanthanide oxide dissolution (CEA, UM2, CNRS) nicolas.dacheux@univ-montp2.fr
- Solubility of uranium and thorium silicates (CEA, CNRS) nicolas.dacheux@univ-montp2.fr
- Thermodynamic and kinetic study of uranium based minerals (AREVA-NC, CEA, UM2). stephanie.szenknect@cea.fr

Selected publications/patents

- **Crystal chemistry of the monazite structure.** N. Clavier et al., J. Eur. Ceram. Soc., 31, 941-976, 2011.
- **Stability and structural evolution of $Ce_{1-x}Ln_xO_{2-x/2}$ solid solutions: a coupled µ-Raman / XRD approach.** D. Horlait et al., Inorg. Chem., 50, 7150-7161, 2011.
- **How to explain the difficulties in the coffinite synthesis from the study of uranothorite?** D. Costin et al., Inorg. Chem., 50, 11117-11126, 2011.
- **Multiparametric dissolution of thorium-cerium dioxides solid solutions.** L. Claparede et al., Inorg. Chem., 50, 11702-11714, 2011.
- **Kinetics of structural and microstructural changes at the solid/solution interface during dissolution of cerium(IV)-neodymium(III) oxides.** S. Szenknect et al., J. Phys. Chem. C, 116, 12027-12037, 2012.

Ions at active interfaces

Team
3 permanent staff members
4 non permanent staff members

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Themes

- Liquid/liquid cation extraction
- Ion complexation in liquid phase/supramolecular organisation
- Ionic flotation
- Foam, microemulsion, liquid interfaces

Competences

- Physico-chemistry of complex fluids
- Ionic separation
- Multi-scale physical-chemistry characterization of colloidal systems

Partners

Lille - Lyon - Bordeaux - Montpellier - Regensburg universities - MPI Potsdam - HZ Berlin - ICMA Barcelone - CEA - ILL Grenoble

Examples of projects

- ANR CATASURF (Lille)
- ANR CELADYCT (UPMC)

Selected publications/patents

- **Pickering emulsion stabilized by catalytic polyoxometalate nanoparticles: a new effective reaction medium for oxidation.** V. Nardello-Rataj, P. Bauduin et al, Chemistry- A European Journal, DOI: 10.1002/chem.201201799.
- **Kinetics of Triton-X100 transfer across the water/dodecane interface: analysis of the interfacial tension variation.** Gassin, Pierre-Marie; Martin-Gassin, Gaelle; MEYER, Daniel; Dufreche, Jean-Francois and Diat, Olivier, J. Phys.Chem C 116 (24), 2012, pp 13152-13160.
- **PalmitateLuciferin: A Molecular Design for the Second Harmonic Generation Study of Ion Complexation at the Air-Water Interface.** G. Martin-Gassin, G. Arrachart, P-M. Gassin, N. Lascoux, I. Russier-Antoine, C. Jonin, E. Benichou, S. Pellet-Rostaing, O. Diat and P-F. Brevet, J. Phys. Chem. C 116(13), 2012, pp 7450-7456.
- **A Theta-Shaped Amphiphilic Cobaltabisdicarbollide Anion: Transition From Monolayer Vesicles to Micelles.** P. Bauduin1, S. Prevost, P. Farràs, F. Teixidor, O. Diat and T. Zemb. Angew. Chem. Int. Ed., 50(23), 2011, pp 5298.
- **Liquid interface functionalized by an ion extractant: the case of Winsor III microemulsions.** C. Bauer, P. Bauduin, O. Diat and T. Zemb, Langmuir 27(5), 2011, pp1653-61.

Ion Separation by self-assembled Molecular Systems



Team 4 permanent staff members
9 non permanent staff members

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Themes

Design and synthesis of chelating for:

- Nuclear fuel reprocessing
- Decontamination of aqueous effluents
- Extraction and recycling of strategic metals

Supramolecular assembling in complex fluids and studies of extraction mechanism:

- Characterisation of self-assembled molecular systems
- Synergistic effects

Competences

- Organic synthesis, macrocycles, heterocycles,
- Hybrid materials,
- Ion separation/extraction processes (membrane liquid/liquid and solid/liquid)
- Physical and chemical characterization (SAXS, SANS, DLS…)

Specific equipment: ICP-OES, GC-MS, HPLC, ion chromatography, DLS, X-Ray Scattering / diffraction, 400 MHz NMR, IR

Partners

CEA (DEN, DSM) - TerraNova - FCBA - ICG - IEM - University of Montpellier - LCME - University of Savoie - IRCE Lyon - Hadath University oh Lebanon.

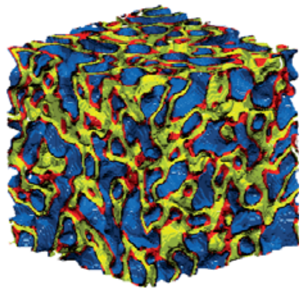
Examples of projects

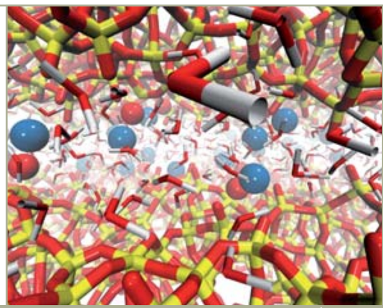
- Ligands for extraction of uranium in phosphoric medium (CEA/ AREVA) stephane.pellet-rostaing@cea.fr
- H4tpaen analogs for An/Ln separation (CEA) stephane.pellet-rostaing@cea.fr
- Synergistic mechanism of uranium extraction (CEA) sandrine.dourdain@cea.fr
- Recycling of strategic metals in ionic liquids (LabEx CheMISyst) stephane.pellet-rostaing@cea.fr
- Hydrothermal route for biomass conversion (CIFRE) stephane.pellet-rostaing@cea.fr
- Metal Recycling by extraction/electrodeposition process in ionic liquids » (ANR CD2I), stephane.pellet-rostaing@cea.fr

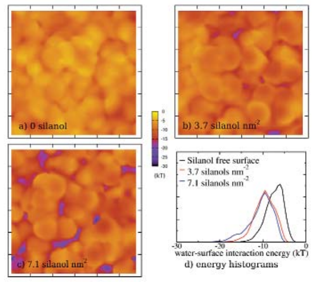
Selected publications/patents

- **Effect of stereochemistry of dicyclohexano-18-crown-6 on zinc isotope separation.** Y. Lin et al., New Journal of Chemistry 2010, 34, 388-390.
- **New insight into indium electrochemistry in a Tf2N-based room-temperature ionic liquid.** Y. Traore, et al., Electrochimica Acta, 2011, 58, 532-540.
- **Procédé de separation de l’americium des autres elements metalliques presents dans une phase aqueuse acide ou organique et ses application.** X. Heres, F. Burdet, J. Borrini, M.-T. Duchesne, M. Mazzanti, G. Bernier, S. Pellet-Rostaing, A. Favre-Réguillon, M. Lemaire, CEA FR 2968014, 1 juin 2012, PCT WO 2012/069573.
- **EDTA and DTPA modified ligands as sequestering agent for uranyl decorporation.** A. Leydier et al., Tetrahedron 2012, 68, 1163-1170.
- **Synergism by co-assembly at the origin of ion selectivity in liquid-liquid extraction.** S. Dourdain et al., Langmuir 2012, 28, 11319-11328.

Mesoscopic Modelling and Theoretical Chemistry







Team 3 permanent staff members
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Themes

Multi-scale Modelling of Complex Systems:
- From molecular descriptions to chemical engineering
- Statistical thermodynamics
- Weak interactions
- Equilibrium and dynamical properties

Separation systems:
- Electrolyte solutions
- Interface phenomena
- Electrochemistry
- Soft matter - microemulsion – phase diagram
- Nanostructured materials – porous materials

Competences

Simulation methods:
- Molecular dynamics
- Monte-Carlo simulations
- Brownian dynamics
- Chemical engineering

Theoretical methods:
- Statistical thermodynamics
- Integral equations – coarse-graining and coarse-grained models
- Non-equilibrium thermodynamics

Partners

CEA (DEN, DSM) - ANDRA - ICG - UPMC-Paris VI - Ecole Polytechnique - University Lyon 1 - IEMN (Lille) - University of Ljubljana (Slovenia) - Indian Institute of Science (Bangalore) - University of Copenhague - Australian National University (Canberra)

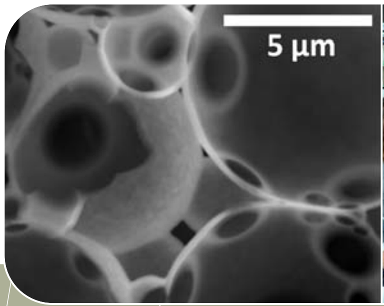
Examples of projects

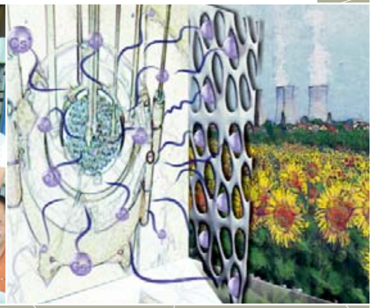
- Liquid-liquid extraction of rare earths
- Multi-scale description of clays for the storage of nuclear wastes
- Significance of electrolytic noise for nanotechnologies
- Separation properties of porous glasses
- Viscosity of electrolyte solutions

Selected publications/patents

- **Hydrophobic Transition in Porous Amorphous Silica.**
  B. Siboulet, et al. J. Phys. Chem. B 115, 7881 (2011)
- **Atomistic Description of Binary Lanthanoid Salt Solutions: A Coarse-Graining Approach.**
  J. Molina et al. J. Phys. Chem. B 115, 4329 (2011)
- **Ion-specific weak adsorption of salts and water/octanol transfer free energy of a model amphiphilic hexapeptide.**
  Ch. Dejugnat et al. Phys. Chem. Chem. Phys. 15, 6883 (2011)
- **A silicon nanowire ion-sensitive field-effect transistor with elementary charge sensitivity.**
  N. Clément et al. Appl. Phys. Lett. 98, 014104 (2011)
- **Salt exclusion in charged porous media: a coarse-graining strategy in the case of montmorillonite clays.**
  M. Jardat et al. Phys. Chem. Chem. Phys. 11, 2023 (2009)

Nanomaterials for Energy & Recycling processes Laboratory (LNER)



Team
5 permanent staff members
8 non permanent staff members

Team leader
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Themes

Design and synthesis of multiscale structured (nano , meso, micro) hybrid materials:

- Ionic partionning (removal, recycling)
- Behaviour under stress (chemical, irradiation)
- Shaping: coatings, monoliths

Competences

- Soft chemistry synthesis
- Physical-chemistry of colloidal systems
- Hybrid mesoporous materials characterization
- Solid-liquid interfaces

Specific equipment:

- Mesoporosity: gas-adsorption, water-adsorption
- Ionic analysis: ionic chromatography
- Coating: EPD, Quartz Crystal Microbalance, dip coating
- Thermal analysis: TDA/TGA; C, O, N, S analysis

cyrielle.rey@cea.fr

Partners

CTI - Specific Polymer - Areva NC - Comurhex - OTND - PEM - CEA

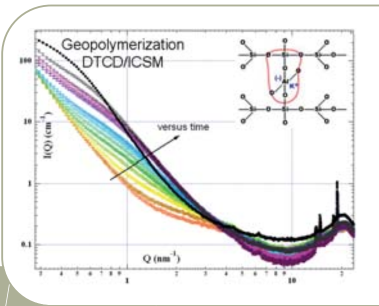
Examples of projects

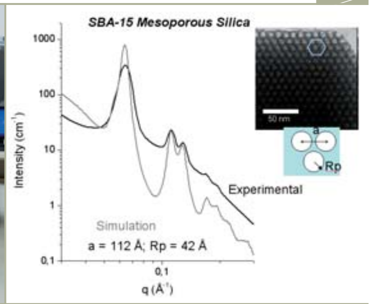
- Multiscale porous monoliths from emulsion templates and functionalization
  jeremy.causse@cea.fr
- Physical-chemistry of colloïdal systems: nanoparticle electrophoretic deposition; nanostructured materials as simulating nuclear fuel
  guillaume.toquer@enscm.fr
- Radiation damage behaviour of mesoporous materials Carbide ceramic nanocomposites using soft chemistry
  xavier.deschanels@cea.fr
- Hybrid materials to entrap selectively ionic species
  agnes.grandjean@cea.fr

Selected publications/patents

- **Synthesis of carbide compounds derived from colloidal oxide and carbohydrate**, X. Deschanels, et al., Progress in Colloid Polymer Science, 2010; 137: 47-52.
- **Wall thickness prediction in precipitated precursors of mesoporous materials**, A. Grandjean, G. Toquer , Th. Zemb, J. Phys. Chem., 2011; 115: 11525-11532.
- **Radiation damage of mesoporous silica thin films monitored by X-ray reflectivity and Scanning electron microscopy**, S. Dourdain, X. Deschanels, G. Toquer, C. Grygiel, I. Monnet, S. Pellet-Rostaing, A. Grandjean J.Nucl. Mat., 2012; 477:411-414.
- **Mesoporous materials in the field of nuclear industry: applications and perspectives**, P. Makowski, X. Deschanels, A. Grandjean, D. Meyer, G. Toquer, F. Goettmann, New J. Chem, 2012; 36: 531:541.
- **Extraction of radioactive cesium using innovative functionalized porous materials**, C. Delchet, A. Tokarev, X. Dumail, G. Toquer, Y. Barré, Y. Guari, CH. Guérin, J. Larionova, A. Grandjean, RSC Advances, 2012; 2: 5707: 5716
- **Surface Diels-Adler reactions as an effective method to synthesize Functional Carbon Materials**, H. Kaper, A. Grandjean, C. Weidenthaler, F. Schüth, F. Goettmann, Chemistry a European Journal, 2012; 18: 4099-4106.

Scattering and diffraction





Team 4 permanent staff members
1 non permanent staff members

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Themes

- Mesoporous material, multi-scale characterisation
- Kinetics of fabrication, functionalisation for ionic separation
- Water and solvated ion dynamics in confined media

Competences

- X-ray, neutron and light scattering
- Non-linear optics
- Solid and liquid surfaces

Partners

Lille - Lyon - Bordeaux - Montpellier - Regensburg universities - MPI Potsdam - HZ Berlin - ICMA Barcelone - CEA (DSM, DRT, DEN) - ILL Grenoble

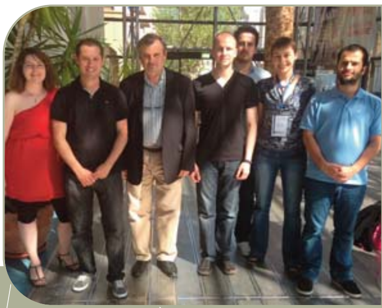
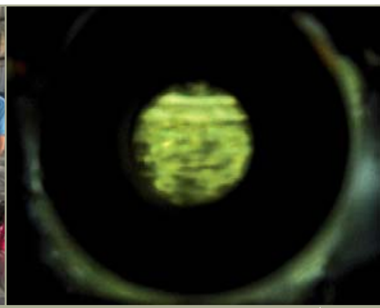
Examples of projects

- ANR CATASURF (Lille)
- ANR CELADYCT (UPMC)

Selected publications/patents

- **Structural evolution during geopolymerization, from early age to consolidated material.**
  P. Steins, A. Poulesquen, O. Diat and F. Frizon, Langmuir 28(22) (2012) pp 8502-10.
- **Determining the specific surface of hexagonal mesoporous materials using small angle scattering.**
  J. Cambedouzou and O. Diat, J. Appl. Cryst 45 (2012) pp662-673.
- **Impact of pore size and pore surface composition on the dynamics of confined water in highly ordered silica porous material.**
  I. Matar Briman, D. Rébiscoul, O. Diat, J-M. Zanotti, P. Jollivet, P. Barboux and S. Gin, J. Phys. Chem C 116(12), 2012, pp 7021-7028.
- **Thermotropic Phase Behavior of Choline Soaps.**
  Regina Klein, Helen Dutton, Olivier Diat, Gordon J. T. Tiddy, Werner Kunza, J. Phys. Chem. B, 115(14) (2011) 3838-3847.
- **NMR 1D-imaging of water infiltration into mesoporous matrices.**
  S. Le Feunteun, O. Diat, A. Guillermo, A. Poulesquen and R. Podor, MRI 29(3), 2011, pp 443-455.

Sonochemistry in complex fluids


Team 3 permanent staff members
5 non permanent staff members

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Themes

- Sonoluminescence in complex fluids
- Sonochemical dissolution of refractory materials
- Sonochemical synthesis of nanocatalysts
- Sonocatalysis
- Sonochemistry of actinides

Competences

- Power ultrasound technologies
- Solid/liquid interfaces characterisation
- Synthesis and characterisation of nanoparticles
- Catalytic AOP
- Emission spectroscopy

Partners

CEA/DEN - Areva - ICG - CMOS - University of Montpellier - LCME - University of Savoie - University of Lille

Examples of projects

- ANR NEQSON "Nonequilibrium sonochemistry" (ICG/CMOS, CEA/DEN)
- Sonochemical dissolution of actinide oxides (CEA/DEN, AREVA)
- Sonochemistry of uranium (AREVA)
- Colloids of plutonium(IV) (CEA/DEN)
- Sonoluminescence in complex fluids (LCME)

Selected publications/patents

- Ndiaye A. A. et al. **The origine of isotope effects in sonoluminescence spectra of heavy and light water**, Angew. Chem. Int. Ed., 2013, 52, 2478-2481.
- Navarro N. et al. **Procédé de dégradation par oxydation de composés organiques contenus dans un milieu liquide**, 25/07/2012 (N. REF: SP52402/PA).
- Virot M. et al. **Catalytic dissolution of ceria under mild conditions**, J. Mater. Chem., 2012, 22, 14734-14740.
- Ndiaye A. A. et al. **Nonequilibrium vibrational excitation of OH radicals generated during multibubble cavitation in water**, J. Phys. Chem. A, 2012, 116, 4860-4867.
- Chave T. et al. **Mechanism of Pt(IV) sonochemical reduction in formic acid media and pure water**, Chem. Eur. J., 2012, 18, 3879-3885.
- Pflieger R. et al. **Sonoluminescence of uranyl ions in aqueous solutions**, Chem. Eur. J., 2012, 18, 410-414.

Design of Membrane Materials and Multifonctional systems

DM³

iem Institut Européen des Membranes

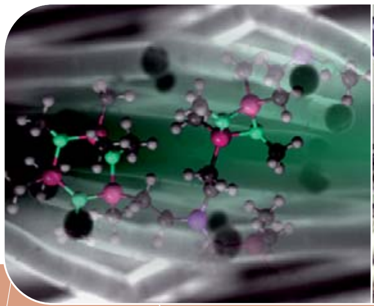
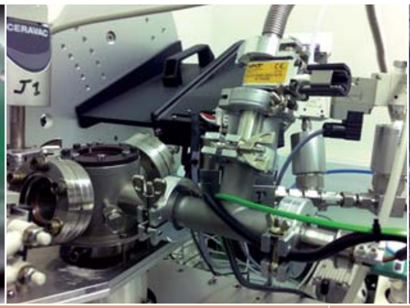
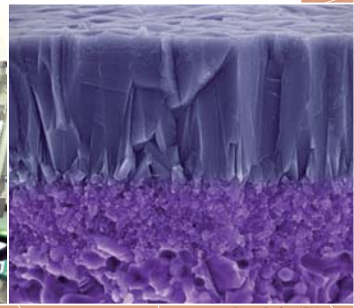

Photo D. Cot, IEM

Team

16 permanent staff members
30 non permanent staff members

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Themes

- H_2 production/purification/extraction and storage
- Gas & liquid phase separations and treatments
- Sensors (sugar/protein, cell/cell adhesion, cancer therapy,..)
- Ion-channels, water-channels, self-organized hybrid membranes
- Enzymatic & affinity membranes for on-chip membrane technology
- Fuel Cells and Bio-Fuel Cells
- Catalytic, photocatalytic & electrocatalytic membranes
- Safe materials and systems for nuclear reactors.

Competences

- Supramolecular, sol-gel, boron & silicon chemistries
- Molecular electro- & bio-electrochemistry
- Molecular precursors; Preceramic polymers; Hybrids; Oxides & Non oxides
- Plasma-assisted CVD & surface treatments; Atomic Layer Deposition
- Electrospinning; fiber extrusion; dip-& spin- coating; tape casting
- Microwave-assisted systems for synthesis and sintering
- Specific characterization methods for thin layers
- Pilots for liquid filtration, gas & vapor separations; catalytic reactors.

Partners

Air Liquide - Alstom - Areva - Arkema - CEA - CEA-Euratom - Chanel - Cirad - CTI SA - HEF - Imeca - PSA Peugeot Citroën - SAFRAN - Saint Gobain - Seb - Snecma - Solvay - Specific Polymers.

Examples of projects

- DYNANO, Europe FP7-ITN Marie-Curie, Dynamic interactive nanosystems for biomedical & biotechnological applications mihai.barboiu@univ-montp2.fr
- FUNEA, Europe FP7- ITN People, Functional Nitrides for Energy Applications, philippe.miele@univ-montp2.fr
- CARENA, Europe-FP7-NMP-Large, Catalytic membrane Reactors based on New mAterials for C1-C4 valorization anne.julbe@univ-montp2.fr
- MISHY, FUI Etat région LR, Membranes Innovantes pour la Séparation d'Hydrogène, vincent.rouessac@univ-montp2.fr
- HYBIOCEL, ANR France-Mexique 2012-2015, Hybrid biofuel cells based on microfluids for energy conversion sophie.tingry@univ-montp2.fr

Selected publications/patents

- **Catalytic membrane materials with a hierarchical porosity and their performance in total oxidation of propene.** C. YACOU, A. AYRAL, A. GIROIR-FENDLER, A. BAYLET, A. JULBE, Catalysis Today 156 (2010) 216-222.
- **Plasma Membranes.** S. ROUALDES, V. ROUESSAC, J. DURAND, in E. Drioli and L. Giorno Eds, Comprehensive Membrane Science and Engineering, Elsevier Health Science, 2010, chapter 3.5 (ISBN: 9780444532046).
- **An innovative powerful and mediatorless H_2/O_2 biofuel cell based on an outstanding bioanode**, A. CIACCAFAVA , A. DE POULPIQUET , V. TECHER , M.T. GIUDICI-ORTICONI , S. TINGRY, C. INNOCENT, E. LOJOU, Electrochem. Com. 23, 2012, 25–28.
- **Dynamic nanoplatforms in biosensor and membrane constitutional systems.** E. MAHON; T. AASTRUP; M. BARBOIU, Top Curr. Chem. 322 (2012)139-163.
- **High-Yield Synthesis of Hollow Boron Nitride Nano-Polyhedrons.** S. BERNARD, V. SALLES, J. LI, A. BRIOUDE, M. BECHELANY, U. B. DEMIRCI, P. MIELE, J. Mater. Chem., 21 (2011) 8694-8699.

Interface, physical chemistry and polymers

CNRS French-Russian Laboratory MEIPA

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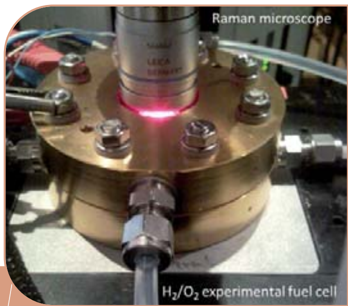

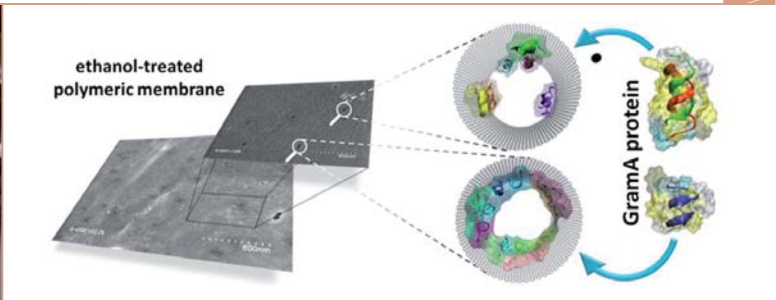

Team
15 permanent staff members
18 non permanent staff members

Team leader
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Themes

- Nanostructured and functionalized polymers
- Bioinspired membranes and surfaces
- Polymer membranes for chemical sensors
- Transport in polyelectrolyte membranes

Competences

- Polymer, membrane and thin film: synthesis and characterization
- Chemical sensors
- Vibrational spectroscopy and fluorescence
- Electrochemistry and transient methods
- Electromembrane processes

Specific equipment:

- AFM, Gel permeation chromatography, Rheometer, Dynamic Mechanical Analysis, Streaming potential, Liquid filtration set-up from the lab to pilot scale
- Patch-clamp
- Wettability measurements
- Electrochemical impedance spectrometer
- Raman, IR and fluorescence spectrometers
- Electrodialysis set-up

Partners

Arkema - Veolia - Polymem - Total - Imeca Process - Sanofi - Eurodia

Examples of projects

- Dynamic Interactive Membranes. ANR PNANO
  damien.quemener@iemm.univ-montp2.fr
- Block copolymer and polyelectrolyte self-assembly for membrane fabrication. ANR Blanc
  andre.deratani@iemm.univ-montp2.fr
- Implantable system for drug delivery for the treatment of deafness and tinnitus. Coll. Sanofi, CEA, CHU
  thierry.thami@iemm.univ-montp2.fr
- Water transport in PFSA membranes. ANR/CNRS
  stefano.deabate@iemm.univ-montp2.fr
- Coupled Ion- and Volume-Transfer Phenomena in Heterogeneous Systems. FP7 Marie Curie Actions
  philippe.sistat@iemm.univ-montp2.fr

Selected publications/patents

- Quemener et al. **Dynamic Interactive Membranes with Pressure-Driven Tunable Porosity and Self-Healing Ability** Angew. Chem. Int. Ed. 2012, 51, 7166 –7170.
- Dejardin et al. **Interface of Covalently Bonded Phospholipids with a Phosphorylcholine Head: Characterization, Protein Nonadsorption, and Further Functionalization** Langmuir, 2011, 27 (18), pp 11536–11544.
- Balme et al. **New Bioinspired Membrane Made of a Biological Ion Channel Confined into the Cylindrical Nanopore of a Solid-State Polymer.** Nano Lett., 2011, 11 (2), pp 712–716.
- Deabate et al. **In situ and operando determination of the water content distribution in proton conducting membranes for fuel cells: a critical review**. Energy Environ. Sci. 2012, 5, 8824.
- **Polyvinylidene fluoride membranes having superhydrophobic surface**, Deratani, A; Quemener, D; Bouyer, D; Pochat-Bohatier, C; Li, C-L; Wang, D-M PCT Int. Appl. (2012), WO 2012069760 A1 20120531. Fr. Demande (2012), FR 2967591 A1 20120525.

Membrane process engineering

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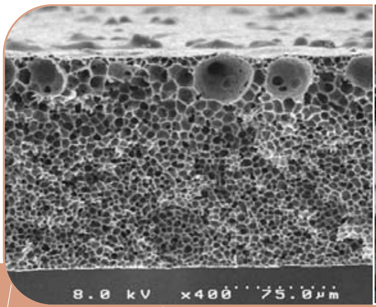

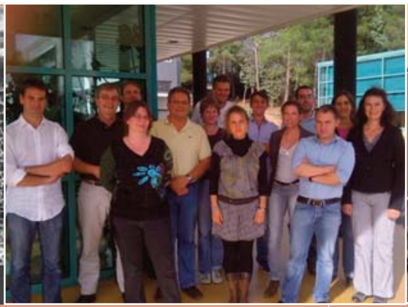

Team 15 permanent staff members
~ 25 non permanent staff members

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Themes

- Design and optimization of intensified membrane processes
- Membrane elaboration processes engineering for structural optimization of membranes
- Experimental multi-scale analysis of transfers
- Modeling and simulation of transfer and reaction mechanisms

Competences

- Chemical engineering
- Transfers modeling
- Water treatment
- Semi-industrial pilot units (of membrane processes for water and air treatment and membrane elaboration)

Partners

Veolia - Total - Ahlstrom - Areva - Renault - GDF-Suez - Remy Martin - Roquette - Immuno-search - Specific Polymers - Cardpool - Magpie Polymers - SCT…

Examples of projects

- FP7 european project ENDETECH (2012-2015), « Enzymatic decontamination technology »
  resp. José Sanchez, jose.sanchez@iemm.univ-montp2.fr
- ANR Copoterm, EcoTech, 2010-2014, Removal of metal ions by bloc thermosensitive copolymers
  resp. Catherine Faur, catherine.faur@iemm.univ-montp2.fr
- ANR DIVA (Programme Bio Energie), 2011-2014 Caracterization of digestates and their agricultural reuse way
  resp. Marc Heran, marc.heran@iemm.univ-montp2.fr
- ANR Internationale Franco-chinoise PETZECO (Programme Ecotech 2010), 2011-2014, Petrochemical Effluents Treatment by ZEolites Combined to Ozone
  resp. Stephan Brosillon, stephan.brosillon@iemm.univ-montp2.fr
- ANR Pomewiso, Elaboration of green membranes without organic solvent, CD2I, 2011-2014
  resp. Denis Bouyer, denis.bouyer@iemm.univ-montp2.fr

Selected publications/patents

- A. VENAULT, D. BOUYER, C. POCHAT BOHATIER, L. VACHOUD, C. FAUR, **Investigation of chitosan gelation mechanisms by a modeling approach coupled to local experimental measurement**, AIChE Journal, 58 (7), 2228-2240 (2012).
- PLANTARD G., JANIN T., GOETZ V., BROSILLON S., **Solar photocatalysis treatment of phytosanitary refuses: Efficiency of industrial photocatalysts Applied Catalysis B: Environmental**, 115– 116, 38– 44, 2012.
- F. ZAVISKA, P. DROGUI, A. GRASMICK, A. AZAIS, M. HERAN (2013), **Nanofiltration membrane bioreactor for removing pharmaceutical compounds**. Journal of Membrane Science, 429, pp 121–129.
- V. CHEA, D. PAOLUCCI-JEANJEAN, M.P BELLEVILLE, J. SANCHEZ. **Optimization and characterization of an enzymatic membrane for the degradation of phenolic compounds**. Catalysis Today, 2012, 193, 49-56.
- STOIAN A., SANCHEZ J., DRUON-BOCQUET S., GROUX H., **Dispositif d'analyse des effets d'au moins un paramètre relatif à une substance volatile**, EP2011 / 070287.

Themes

Competences

Partners

Selected pulications
patents

Examples
of projects

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