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INSB - Institute of Biological Sciences

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CBM - UPR4301

Center for Molecular Biophysics

The Center for Molecular Biophysics **CBM** is a CNRS laboratory (Unité Propre de Recherche) funded and managed by the CNRS and affiliated with the University of Orleans.

The Center was founded in 1967 to foster interdisciplinary collaboration between physicists, chemists and biologists. Our research focuses on the understanding of the role and the mechanisms of action of biomacromolecules.

At the interface between physics, chemistry and biology, the researchers are investigating the structure, dynamics and interactions of biomacromolecules at the molecular, cellular and organism level. This approach entails searching for the molecular causes of biological dysfunctions which trigger the development of diseases.

The center is also recognized for its research in biomedical imaging.

The research activities are organized in **4 teams**:

- Molecular, Structural and Chemical Biology
- Cell biology, Molecular targets and Innovative therapies
- Chemistry, Imaging and Exobiology
- Theoretical and Computational Biophysics



Site of the CBM on the CNRS campus of Orleans La Source © CBM

Staff

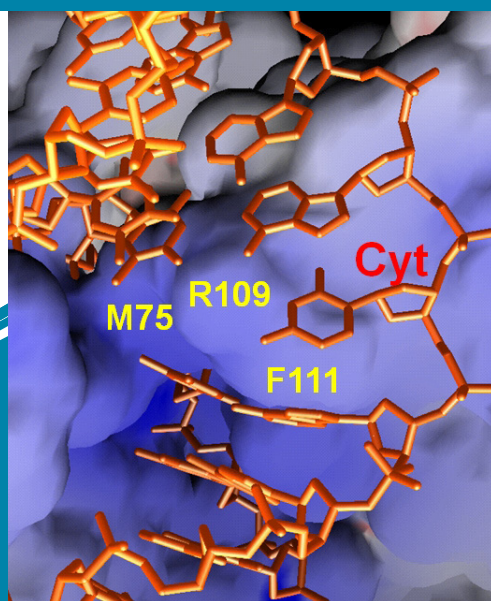
- 25 senior CNRS researchers
- 3 senior INSERM researchers
- 19 faculty members
- 30 PhD students and post-doctoral researchers
- 16 contractual scientists
- 39 CNRS engineers, technicians and administrative staff
- 1 INSERM technician



Keywords

Physical chemistry, biophysics, molecular biology, cellular biology, biochemistry, NIR, glycobiology, molecular genetics, structural biology, crystallography, proteomics, molecular dynamics, modelisation, astrobiology, flow cytometry, cellular imaging, biophotonics, MRI, MRS, NMR, mass spectrometry, optical spectroscopy, proteins, nucleic acids, molecular interactions, vectorology, gene therapy, angiogenesis, endothelial cells, vaccination, immunotherapy, therapeutic targets, apoptosis, contrast agents, lanthanides, peptide synthesis, oligonucleotides synthesis, fluorescent probes.

Interaction between an enzyme of DNA repair and a damaged of DNA molecule analysed by crystallography © CBM



Research Training



CBM is part of the **Doctoral school «Health, biological sciences and chemistry of Life»**, and contributes to Master training in "Health, biological sciences and chemistry of Life" at the University of Orleans:

- «**Biology - Biochemistry**», master in: «Molecular and cellular biology»
- «**Chemistry**», master in: «Conception, synthesis and analysis of molecules of biological interest»

and to the French-Polish Master degree of Biotechnology.

COLLABORATIONS: include the main French research institutions as well as numerous foreign laboratories. A sizable collaboration with Poland was built through a cooperation agreement between the Jagellonne University of Krakow, the University of Orleans and CNRS.

CNRS Regional Office Centre Limousin Poitou-Charentes



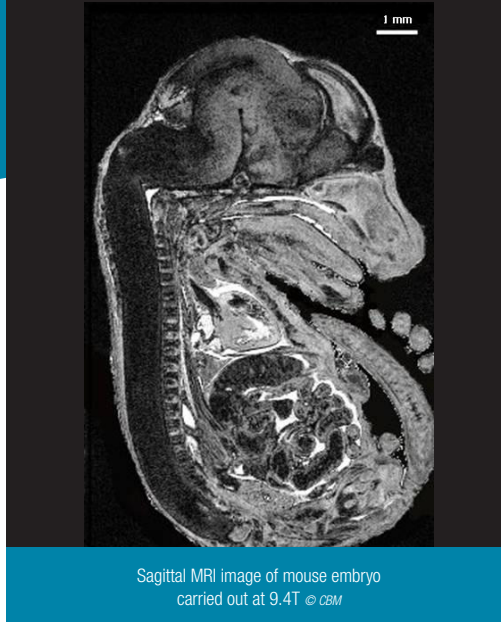
Research Focus

Team: Molecular, Structural and Chemical Biology

Research aims at understanding biological phenomena at the molecular level, to provide the needed basis for the conception of novel therapeutic and investigative tools. Using biochemistry, molecular & structural biology (NMR, crystallography, mass spectrometry, MD simulations) and synthetic chemistry approaches, biomolecular structures and mechanisms are elucidated, structure-function relationships are determined, and relevant (bio)molecules are identified, designed, and synthesized. Fundamental and drug discovery aspects are explored, with a focus on DNA and RNA transactions in gene expression and repair, membrane transport and signal transduction in metastasis, and chemical synthesis of proteins with applications in the biology of disulfide-rich peptides and in glycobiology.

Team: Cell biology, Molecular targets and Innovative therapies

Molecular and cellular approaches as well as animal models are exploited to decipher biological processes occurring in various pathologies. Efforts are made to: identify therapeutic targets against cancer, aging and central nervous system diseases, to develop tissue models in adequate microenvironment, and to conceive therapeutic strategies. Major axes are: cell signaling and neuro-receptor as targets in neurofibromatosis; apoptosis, autophagy, cell differentiation, intra-tumor hypoxia and tumor growth inhibition; co-transcriptional surveillance of mRNA processing and packaging reactions for mRNP formation; mRNA as vaccines and non-viral gene therapy.



Sagittal MRI image of mouse embryo carried out at 9.4T © CBM

Experimental facilities

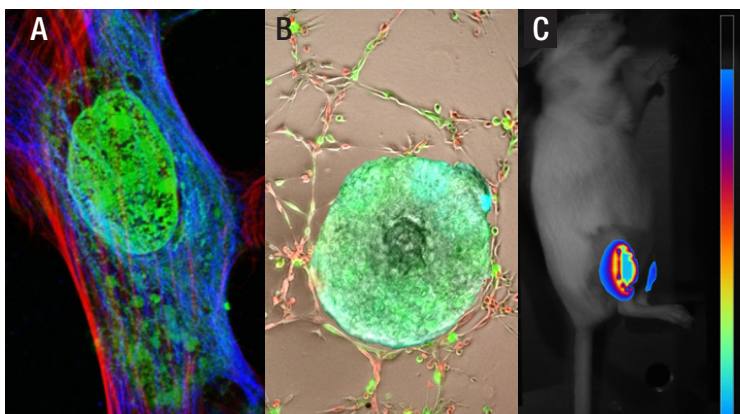
Peptides and oligonucleotides synthesizers, Phosphoimagers (STORM and TYPHOON), NMR (400, 600 and 700 MHz), X-ray generator, Mass Spectrometers (electrospray ion trap, MALDI-TOF, NanoESI high resolution), Circular dichroism spectrometer, Optical microscope, Atomic force microscope, Raman spectrometer, Flow cytometers and Cell Sorter (FACS), Fluorescence video-microscopy, MRI (7T and 9.4T), Relaxometer (10 kHz - 80 MHz), Macroscope, spectrofluorimeter Vis - NIR, Luminescence lifetime (ns - ms), crystallization robot "mosquito Crystal".

Team: Chemistry, Imaging and Exobiology

The CIE team comprises various disciplines, involving synthetic and coordination chemistry, biology, physics and exobiology, all linked by a common theme centred around imaging. The last decade has seen a spectacular evolution of imaging techniques in medical, biological and other areas in which chemistry has a pivotal role. Our team has gained international recognition in three, partially interconnected axes: lanthanide luminescence and probes for biological optical imaging, MRI contrast agents and small animal MR imaging and exobiology, where imaging of ancient carbonaceous biosignatures in rocks in their mineral and elemental context is of prime importance.

Team: Theoretical and Computational Biophysics

The theoretical biophysics group pursues research projects in the field of molecular and cellular biophysics, which rely on methodological concepts from non-equilibrium statistical physics, applied mathematics and computer simulations.



Determination of new therapeutic targets at the cellular (A), vascular (B) and small animal (C) level © CBM

