

CENTRE DE BIOPHYSIQUE MOLÉCULAIRE

Founded in 1967, the Center fosters 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 mechanisms of biological functions and dysfunctions that trigger the development of diseases. The four teams of CBM develop research in the fields of structural, molecular and cellular biology, chemical biology, biomedical imaging, exobiology and theoretical biophysics. This scientific diversity is an important feature of CBM.

The presence of broad range of large instrumentation dedicated to these multidisciplinary research areas is another significant characteristic of the Centre. The availability of state of the art equipment and scientific and technical expertise in protein NMR, mass spectrometry, optical spectroscopy, cellular and small animal imaging, etc., all within the same laboratory makes CBM a unique place to address fundamental biological questions from an interdisciplinary point of view.

Unpublished cryoEM structure of the bacterial transcription termination protein Rho, one of the many pharmacological targets that are studied at CBM © CBM

RESEARCH TOPICS

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.

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.

CHEMISTRY, IMAGING AND EXOBIOLOGY

We combine research in 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. The laboratory 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.

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.

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INSTRUMENTATION

NMR (400, 600 and 700 MHz), mass spectrometers (electrospray ion trap, MALDI TOF, nanoESI high resolution), MRI (7T and 9.4 T), photoacoustic imaging, confocal microscope, flow video-microscope, flow cytometers and cell sorter (FACS), microfluidic nanoassembler, microscope, spectrofluorimeter Vis-NIR, luminescence lifetime (ns – ms), relaxometer (10 kHz - 80 MHz), atomic force microscope, Raman spectrometer, circular dichroism spectrometer, X-ray generator, pipetting and crystallization robots, phosphoimagers, peptides synthesizers.

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.
- «Physics: Fundamental and applications » master in: « Matter and Radiation »

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.

KEY FIGURES

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senior CNRS researchers
faculty members

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PhD students
and post doctoral scientists

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CNRS engineers, technicians
and administrative staff

