

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Unpublished cryo-EM structure of the bacterial transcription termination protein Rho, one of the many pharmacological targets that are studied at CBM © CBM

RESEARCH TOPICS

CHEMISTRY AND IMAGING

Inorganic and organic chemistry are used to design and synthesize imaging agents as new diagnostic tools. These agents are metal-based optical, PET, SPECT and MRI probes that will specifically target biomarkers of pathologies. Novel agents based on single molecules or nanometric objects with multimodal and theranostic capabilities are also being developed, with the aim of using new imaging approaches to characterize preclinical models of disease.

THERAPEUTIC TARGETS AND INNOVATIONS

Fundamental studies are conducted to discover molecular mechanisms and signalling pathways deregulated in various pathologies, thus enabling the identification of new therapeutic targets. New pathology biomarkers are researched on patient in collaboration with university hospitals. Innovative therapeutic strategies based on biomolecules (nanobodies, affibodies, nucleic acids) are developed and optimized through the use of chemobiology.

BIOMOLECULAR ENGINEERING

This theme brings together a number of research areas enabling the optimization and exploitation of biomolecules or more complex living systems to gain a deeper understanding of biological processes and develop innovative applications. These include: the development of riboswitches for synthetic biology, monitoring the various post-translational modifications of therapeutic antibodies, and the development of a chemical toolbox for the creation of proteins that can be modified at specific sites by combining chemical synthesis and recombinant production, the development of new organoid models under controlled microenvironments, and the custom production of biosensors based on living yeast.

FUNDAMENTAL MECHANISMS OF LIFE

This theme is explored through a range of research topics: understanding the functional consequences of post-translational modifications of proteins, the study of transcriptional mechanisms of transcription termination, the impact of pesticides and the emergence of life under extreme conditions.

VECTORIZATION AND FORMULATION

New ionizable lipids, traceable by imaging and injectable nanoparticles as well as injectable and controllable nanoparticles targeting specific cells or organelles are being developed for the innovative formulations using microfluidics. An autologous protein bioproduction project is underway to develop an effective and innovative therapy for human inflammatory diseases.

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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, macro-scope, 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, Raman microspectroscopy, MALS, granulometry, BLI.

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 »

and also from the Faculty of Pharmacy at the University of Tours:

- Galenic Pharmacy
- Analytical Chemistry
- Professional Bachelor in Industrial Cosmetology

COLLABORATIONS

include the main French research institutions as well as numerous foreign laboratories.

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

