

Biopharmaceuticals in Centre-Val de Loire region

Research Units and Core facilities in Biology and Health

A Research and Innovation Ecosystem
open for collaborations at regional,
national, European and
international levels

FROM RESEARCH TO BIOMANUFACTURING
DEVELOPING TOMORROW'S BIOMEDICINES



BIOPHARMACEUTICALS
Innovation Dynamics In Health
IN REGION CENTRE-VAL DE LOIRE

CO-FINANÇÉ PAR
**RÉGION
CENTRE
VAL DE LOIRE**



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and Core facilities
in Biology and Health**

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national, European and
international levels**



Home to sumptuous “chateaux” and cathedrals, the Centre-Val de Loire (CVL) region in France nurtures a recognised health ecosystem. The region holds a strategic position with regards to production of pharmaceuticals in France and has been a pioneer in supporting biopharmaceuticals research and development (R&D), with the launching of a dedicated programme in 2013. Given the high market growth of biopharmaceuticals worldwide, funding public-private collaborative projects on biopharmaceuticals R&D was both a strategic decision and an investment for the region. As such, these endeavours are in perfect alignment with recent national strategies to significantly increase the number of biopharmaceuticals produced in France in the coming years. Connecting academic researchers and companies and providing funding for collaborative R&D projects are crucial in achieving this goal, and they constitute the fundamental aspects of the Biopharmaceuticals programme.

Anchored in the regional Smart Specialisation Strategy, the Biopharmaceuticals programme aims at developing a Biopharmaceutical R&D hub in the CVL region building upon the expertise of multidisciplinary academic research units and industrial entities including startups, biotech companies and big pharmas. The University of Tours coordinates this programme in close collaboration with The University of Orléans, the CNRS, the INSERM, the INRAE, The CHU of Tours, the CHU of Orléans. This initiative stems from the MAbImprove Laboratory of Excellence, dedicated to therapeutic antibodies. Hervé Watier, Professor of Immunology at the University of Tours, is the scientific coordinator for both programmes.

Research projects with significant translational potential, helmed by academic researchers in collaboration with industrial partners, have received regional funding. In addition to R&D projects, cross-functional activities support actors of the biopharmaceuticals community in the fields of training, entrepreneurship, business intelligence and partnership development.

This portfolio promotes the expertise and know-how of public research centres, institutes, units, teams, and core facilities located in the Centre-Val de Loire. Our ambition is to build bridges for talents, collaboration, and innovation.

“Let’s build bridges, not walls” MLK

A handwritten signature in black ink, appearing to read 'C. Beaumont', with a long horizontal stroke extending to the right.

Catherine Beaumont, Vice President of
University of Tours for Research in Biology,
Health and Technology

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RESEARCH UNITS



DIRECTOR

Nathalie Giglioli-Guivarc'h

DEPUTY DIRECTORS

Marc Clastre & Vincent Courdavault

The Plant Biomolecules and Biotechnology (BBV) laboratory is developing several research projects on the characterization of specialized plant metabolisms by developing biotechnological and metabolic engineering processes aimed at producing metabolites of interest for pharmaceutical, cosmetic or agronomic applications.

These projects are based on molecular biology, cell biology, biochemistry and genomics and metabolomics approaches.

RESEARCH TOPICS

BBV lab is developing four research themes:

1. Study of plant specialized metabolisms and metabolic engineering for the bioproduction of molecules of pharmaceutical interest.
2. Development of plant cell cultures for the production of cosmetic bioactives.
3. Metabolomic screening of bioactive polyphenols in grapevine.
4. Study of the impact of climate change on the specialized metabolism of plants of pharmaceutical and agronomic interest

EQUIPMENT AND TECHNOLOGY

- HPLC-DAD, GC-FID, UPLC-DAD MS/MS systems
- HPTLC Autosampler and scanner
- FPLC protein purification system
- Gene gun
- Bioreactors (2-5L), access to 50L
- Epifluorescence microscope equipped with a digital camera
- Greenhouse, Conditioned rooms for plant in vitro cultivation (Cl.10000), Phytotron
- Confocal microscope
- PhotoBioreactor (2L)

INTERNATIONAL COOPERATIONS

Antioquia University, Medellin (Colombia), Max Planck Institute; University of Leipzig (Germany), Brock University; Harvard University (Canada), Brown University (USA), University of Helsinki (Finland), Centre for research in Agricultural genomics; Zaragoza University (Spain),

Wageningen University (Netherlands); Galway University (Ireland); Institute of medicinal plant development (China); Quaid-i-Azam University (Pakistan), University of Minho (Portugal); Politechnique University of Krakow (Poland); DTU (Denmark); ITTMadras (Chennai-India); CIMAP (Bangalore-India); John Innes centre (England)

ACADEMIC

PARTNERSHIPS

INRAE : Orléans, Tours-Nouzilly
Universités-CNRS : Tours (IRBI,UMR 7261), Orléans (ICOA UMR 7311), Poitiers (EBI), Rouen (EA4358, ESITPA), Strasbourg (IBMP, UPR2357; ICube UMR7357), Angers (GEIHP,EA3142), Nancy (LAE UMR 1121), Toulouse(LIPM UMR 2594), Bordeaux (MFP, UMR-CNRS 5234).

INDUSTRIAL

COLLABORATIONS

Axyntis
Sederma,
Cerience
Shiseido
FGTECH
Biomia

bbv@univ-tours.fr

DIRECTOR

Cécile Berri

DEPUTY DIRECTOR

Elisabeth Le Bihan-Duval

UMR BOA conducts research on bird physiology and genetics with the aim of contributing to the development of sustainable livestock systems. The research aims to characterize the genetic and molecular mechanisms that underlie the bird's major functions, to propose evaluation tools that can be used in selection programs and to improve rearing conditions, and to integrate knowledge by modeling so as to contribute to the transition from animal production systems to multi-performance. It coordinates two European projects on animal welfare in organic farming (H2020-PPILOW) and product quality (H2020-INTAQT).

RESEARCH TOPICS

Avian physiology and genetics

EQUIPMENT AND TECHNOLOGY

- Access to the Poultry Experimental Facilities of INRAE (PEAT, Nouzilly; EASM, Le Magneraud)
- Access to genetic models for understanding the determinism of traits of agronomic interest: divergent chicken lines on meat quality, digestion ability, growth, fertility...
- Physico-chemical analyzes: tools for measuring egg quality, plasma and near-infrared torch spectrometry, protein and lipid measurement chain, calorimetry, electromechanical (compression test), rheometer, thermography...
- Biochemistry: Protein purification and analysis, analytical and preparative chromatography material (HPLC, UPLC, CPG, Iatroscan), spectrophotometry, infra-red imaging, oxygraphe (mitochondrial respiration), Automated biochemical assays.
- Molecular biology: quantitative PCR.
- Histology : Microtome in freezing, right and inverted microscopes for visible analysis and fluorescence, camera, fluorescence slide reader, image analysis software.
- Cell culture facilities.
- Tools for measuring egg quality.
- automated epifluorescence microscope

INTERNATIONAL COOPERATIONS

- **Consortia H2020 PPILOW** (<https://www.ppiLOW.eu/>) et **INTAQT** (<https://h2020-intaqt.eu/>)
- **Belgium** : University of Leuven.
- **Canada** : University of Laval, University of Ottawa.
- **China** : Chinese Academy of Agricultural Sciences.
- **Italy**: University of Bologna.
- **Israel**: Agricultural Research Organization.
- **Spain** : University of Granada.
- **The Nederland** : University of Wageningen.
- **UK**: University of Edinburgh.
- **United states** : University of Delaware.
- **Thailand**: Suranaree university of technology

ACADEMIC PARTNERSHIPS

- Agrocampus.
- AgroParistech.
- CIRAD.

INDUSTRIAL COLLABORATIONS

- Instituts techniques : ITAVI, SYSAAF, ITAB, IFIP.
- Partnership within the Institut Carnot
- Carnot France Futur Elevage (F2E) :
- poultry breeding, animal nutrition, production groups,
- slaughtering /processing.

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Headcount: +160

CBM

Centre for Molecular
Biophysics
UPR4301



DIRECTOR
Matthieu Réfrégiers
DEPUTY DIRECTOR

Hélène Bénédicti & Igor Chourpa

Fostering interdisciplinary collaborations between physicist, chemists, pharmacologists and biologists, our researches focus on the understanding of the role and the mechanisms of actions of biomacromolecules in human health and the design of new macromolecules. They are applied to cancer, neurosciences, inflammatory diseases, theranostic clinical applications. The four teams of CBM develop re- search 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.

RESEARCH TOPICS

- Development of new contrasts agents
- Vectorization and formulation of nucleic acids (siRNA, pDNA, mRNA)
- Targets and innovative therapies (oncology, neurosciences, infectiology, immunology, vascular disorders, skin biology)
- Biomolecular engineering: post-translational modifications, chemical engineering of proteins, ribo-switches
- Basic mechanisms of life
- Translational studies (preclinic and clinical trial)
- Nanomedicine
- Bio-analytical / diagnosis technology

EQUIPMENT AND TECHNOLOGY

- MO2VING core facility (more details on page 28-33)
- Relaxometers, Granulometers / zetameters
- Automated peptide synthesizer
- Analytical, semi-preparative and preparative HPLCs
- RT-qPCR
- nanoBRET, Alphascreen, complementation assays, ITC
- Oxygen-controlled incubators
- In vitro 3D models
- QE measurements
- MALS and SEC-MALS
- Crystallization, Cryofixation
- Macro and micro luminescence in the far IR
- Laser scanning confocal Raman/fluorescence microspectrometers
- Fiber optics spectrometers (Raman, UV-vis) In vivo Raman spectrometer
- IR, UV-vis and fluorescence spectrophotometers

- Thermostatic reactor, IKA emulsifier (development pasty products)
- Atomic Absorption Spectrophotometer

INTERNATIONAL COLLABORATIONS

Argentina (La Plata), Estonia (Tartu), Germany (Heidelberg, Frankfurt, Leibnitz, Jena, Jülich, Klevé), Czech Republic (Pragues, Olo-mouc), Greece (Thessaloniki), Ireland (May-nooth, Dublin), NL (Delft), India (Kanpur), Italy (Firenze, Napoli), Japan: (Sendai), NZ (Otago), Poland (Wroclaw, Kielce), Portugal (Coimbra), Russian Federation (Moscow), Switzerland: (Geneva), Spain: (Madrid - Alcala), Cuba (Institut Finley), UK (London, Oxford), USA (Ann Arbor, Pittsburgh, Florida, New-York, Michigan, Nashville, St-Louis).

ACADEMIC PARTNERSHIPS

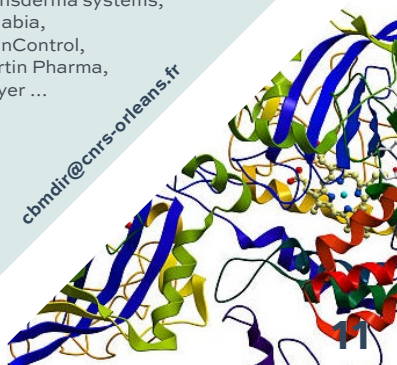
Numerous public research units from INSERM, CNRS, CEA, INRAE, Universities and hospitals in France
FRISBI, FLI, Institut Pasteur, BioCIS and Synchrotron SOLEIL.
Coordination of the CNRS
GDR AIM.

INDUSTRIAL COLLABORATIONS

Indatech,
Ondalys,
Servier,
Pierre Fabre,
Transderma systems,
Solabia,
SpinControl,
Bertin Pharma,
Bayer ...

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DIRECTOR
Mustapha Si-Tahar
DEPUTY DIRECTOR
Fabrice Gouilleux

The CEPR develops a continuum of research from the understanding of the mechanisms of respiratory infection and inflammation up to the development of drug delivery for their treatment. This includes molecular and technological studies and, preclinical and clinical investigations. The CEPR collaborates with academic and private partners (from startup to big pharma companies).

RESEARCH TOPICS

- Pathophysiology of respiratory infections
- Proteolytic Mechanisms in Inflammation,
- Pharmacology of inhaled pharmaceuticals
- Biology of innate T cells & Lung immunity (Infection and autoimmunity)

EQUIPMENT AND TECHNOLOGY

- Fluorescent and flow cell microscopes
- Static and Dynamic Light Scattering (SLS/DLS) equipment
- Spectrophotometers, spectrofluorometers
- Nanodrop, osmometer, tensiometer, densitometer
- HPLC equipments
- Flow cytometer (7 & 13 colors)
- In vivo imager (Lumina XR)
- Gamma camera
- Chamber for aerosol exposure (Vitrocell)
- «Smoking inhalation unit» for rodents
- Automated cellular imaging system (Incucyte)
- McIlwain tissue chopper

INTERNATIONAL COOPERATIONS

Universities of : Barcelona (ES); Belfast (UK); Melbourne (AU); Vancouver and Toronto (CA); Gdansk (PL); Louvain and Ghent (BE); Munich, Berlin and Braunschweig (DE); Leiden (NL); Galway (IR)

ACADEMIC PARTNERSHIPS

CHRU de Tours; LabEx MabiImprove (Tours-Montpellier); UMR INSERM 1253 (Tours); INRAe, UMR1282 ISP (Nouzilly); CBM CNRS UP4 4301 (Orléans); CEA (Fontenay aux Roses); Institut Pasteur (Paris et Lille) ; UMR7257 (Marseille); UMR7275 (Sophia Antipolis); Institut Pasteur (Paris et Lille) ; ICOA CNRS UMR 7311 (Orléans), BioCis, Institut Polytechnique (Paris), CIRI (Lyon), AFMB (Marseille)

INDUSTRIAL COLLABORATIONS

Diffusion Technique Française (DTF-aerodrug), www.aerodrug.com; Theradiag, Aerogen; LVMH, Nemera; Chiesi, Aptar Pharma, CSL Behring, Fisher & Paykel





Headcount: +180

iBrain

Imaging, Brain,
Neuropsychiatry
UMR 1253

Inserm

La science pour la santé
From science to health

université
de TOURS

DIRECTOR
Catherine Belzung
DEPUTY DIRECTORS

Frédéric Laumonier, Jean Michel Escoffre,
Marianne Latinus

Our Unit develops diagnostic tools and innovative therapies for psychiatric diseases. Our unit brings together researchers, research professors, clinicians, engineers and technicians with complementary expertise in clinical research: psychiatry, neuroscience, genetics and medical imaging; as well as in basic and clinical research: physics, chemistry, radiochemistry, acoustics, mathematics, psychiatry, neurosciences, genetics and medical imaging.

RESEARCH TOPICS

- Neurophysiology and cognition of autism spectrum disorder
- Neurobiological basis of antidepressant resistance
- Post-traumatic stress disorder
- Genomics and neuronal physiopathology of intellectual disabilities and amyotrophic lateral disorder
- Development of molecular imaging methods and of new biomarkers
- In-vitro and in-vivo metabolomics
- Ultrasound imaging and therapy
- Neurostimulation
- Biomedical image and data analysis
- Ground truth (anatomy, test object) and atlas creation

EQUIPMENT AND TECHNOLOGY

- Technical platform for cell biology: Primary cell culture room; Miltenyi Biotech, GentleMACS Dissociator; Leica MZ95 stereomicroscope; Leica CTR 5500 B confocal microscope; Evos M5000 microscope with on-stage incubator
- High-frequency and high-resolution digital Vevo 2100 ultrasound imaging platform (Visualsonics);
- Aixplorer ultrasound system (Supersonic imagine);
- Radiotelemetry devices for locomotor activity, ECG,
- Arterial blood pressure, EMG;
- Behavioral testing for cognition and emotion: Videotracking (Ethovision);
- Stereotaxic surgery;
- Optogenetic devices (Prizmatix);
- In vivo Calcium imaging (nVoke)
- 32 channels in-vivo electrophysiology (Axona);

ACADEMIC PARTNERSHIPS

Numerous public research units from INSERM, CNRS, CEA, INRAE, Universities and hospitals in France

INDUSTRIAL COLLABORATIONS

Fondation de France, Ligue Contre le Cancer, ARLSA, ADN.

Multinational companies: Carestream, Supersonic Imagine, IRLynx, Artann Laboratories, Knowm Inc., Juvitec Ltd, Acoustical Technologies Singapore Ltd, IT Nardoni, Philips Research Europe, Bracco Research SA, Storz Medical, Trust-Biosonics, Sanofi-Aventis, Roche, Merck, Siemens

SMBs: Cyclopharma, Vermon, ENCEFA

<https://ibrain.univ-tours.fr>



BIOPHARMACEUTICALS
Innovation Dynamics In Health
IN REGION CENTRE-VAL DE LOIRE

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Headcount: +80

ICOA

Institute of Organic and
Analytical Chemistry
UMR 7311



DIRECTOR
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DEPUTY DIRECTOR
Pierre Lafite

The main objective of the laboratory's research activities is finding and developing novel bioactive molecules having potential applications as drugs, PET imaging agents, probes for in vivo imaging, or as components of cosmetics formulation. The scientific approach to these new molecules involves design by molecular modeling techniques, preparation by organic synthesis, with a particular emphasis on heterocyclic compounds, carbohydrate derivatives and nucleoside analogs, extraction from plant material using high performance separation techniques and mass spectrometry analysis, and by enzymology, in order to identify and characterize the receptors of certain bioactive molecules.

RESEARCH TOPICS

- Chemoinformatics, modeling, IA
- Glycomolecules: from synthesis to enzymology
- Heterocyclic synthesis and medicinal chemistry
- Modified Nucleosides
- Extraction, analysis of bioactive molecules
- Chemical biology probes (PROTAC, fluorescence and covalent probes, metabolites)
- Imaging agents design (Near IR, IRM, TEP, ...)

EQUIPMENT AND TECHNOLOGY

- 400 and 500 MHz NMR spectrometers
- Orbitrap Ascend Tribrid HRMS mass spectrometer
- Q-ToF maXis HRMS mass spectrometer
- MALDI-TOF mass spectrometer
- Simple and Triple quadrupole MS mass spectrometers
- Separation techniques: UHPLC, SFC, GC, CE, HPTLC, CPC
- CPU computing cluster of 156 cores of calculation (6 nodes with 12 cores + 3 nodes with 28 cores)
- GPU computing cluster of 32 GeForce RTX 2080 and 2 GeForce RTX 3090 cards
- Flow chemistry (Uniqsis, Corning)
- Glass blowing workshop

COLLABORATIONS CLUSTERS AND RESEARCH INSTITUTES

Cosmetic Valley, Pharma Valley, Pôle DREAM. BRGM, INRAe Tours, CEA

COLLABORATIONS MAIN COMPANIES

Alban Muller, Genfit, Greenpharma, LVMH, Merck Santé, Servier, Shimadzu, Shiseido

COLLABORATIONS UNIVERSITIES

Jagellone (Poland), Bacau (Romania), Kaunas (Lithuania), Venise (Italy), Hassan II (Mohammedia) and Sultan Moulay Slimane (Beni Mellal, Morocco), Lisbonne (Portugal), St Andrews (Scotland), Hokuriku and Toyama (Japan)

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DIRECTOR
Dieudonné Togbé
DEPUTY DIRECTOR
Stéphane Mortaud

INEM studies the influence of exposome, including microbiota, on immuno-neuromodulation. To do so, INEM investigates the mechanisms of injury- and infection-induced lung inflammation and immune response modulation, and the effects of early exposure to pollutants on neuropathology and neuro-inflammation. INEM develops murine models of human diseases, associated with sophisticated technical in vivo and ex vivo investigations combining transcriptomic, proteomic and metabolomic analysis.

RESEARCH TOPICS

- Immune responses to infections and pollutants
- Allergy, respiratory infection, stress and immunity
- Inflammation, danger signals, infection and pulmonary pathologies
- Environmental pollutants and Neurotoxicity
- Neuroinflammation
- Emerging theme: Microbiota & Pathophysiology

EQUIPMENT AND TECHNOLOGY

- Analysis of lung function by plethysmography
- Access to TAAM animal facilities and germ-free isolators,
- Histology and hematology,
- Molecular and cellular biology; Multiplex,
- Flow cytometry and fluorescence microscopy,
- Behavioural analysis
- Certified ISO9001:2015 LRQA

INTERNATIONAL COOPERATIONS

- Universities of Sao Paulo Brazil (Joined laboratory), Cape Town South Africa, Birmingham UK, Louvain Belgium, Lausanne Switzerland, Murcia Spain.
- St Jude Children Research Hospital (USA).
- Imperial College London UK
- SiAF, Davos, Switzerland

ACADEMIC PARTNERSHIPS

- Universities of Orleans, Tours, Dijon, Lille, Marseille, Rennes, Strasbourg, Clermont-Ferrand, Le Mans
- INRAe Nouzilly, Jouy-en-Josas,

INDUSTRIAL COLLABORATIONS

- Artimmune, Orleans: Joined Laboratory ArtInem
- Key-Obs, Orleans
- Novartis Pharma, Switzerland
- Boehringer Ingelheim, Germany

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DIRECTOR
Sébastien Roger
DEPUTY DIRECTOR
Denis Angoulvant

The research unit studies the interactions between cells of the stressed tissue/organ (cardiac cells, normal and cancer epithelial cancer cells) and immune cells, with the objective of modulating immuno-inflammatory responses in hypoxia/ischemia, by developing new strategies using pharmacological drugs and antibodies targeting ion channels and purinoreceptors.

RESEARCH TOPICS

Role of purinergic signaling in inflammation and tissue remodeling in ischemia-reperfusion physiopathological conditions (Cardiac infarction, Organ transplantation, Cardio-kidney syndrome).

EQUIPMENT AND TECHNOLOGY

- Cell sorting and flow cytometry
- RT-qPCR
- Western blotting
- ELISA
- Hypoxic chamber
- Cell culture equipment
- Patch clamp
- Spectrofluorimetry
- Flow cytometry
- Ca²⁺ imaging
- Epifluorescence micro and macroscopy
- Platelet aggregation

SKILLS AND EXPERTISE

- Cell culture (human dendritic cells, cardiomyocytes, fibroblasts, renal tubular cells, endothelial cells, normal and cancer epithelial mammary, colorectal cells and human induced pluripotent stem cells (hiPSC))
- Cultures in hypoxic and ischemic conditions,
- B cell immortalization,
- Cell phenotyping,
- Cellular and tissue electrophysiology,
- Bio-clinical studies in transplant patients
- in vivo models of ischemia-reperfusion
- Isolation, characterization and study of Extracellular vesicles (exosomes, microvesicles...)

INDUSTRIAL COLLABORATIONS

GreenPharma, ArtImmune, Melkin Pharmaceuticals, KeyObs, MabSilico, Théradiag, Medtronic France, Hemarina

ISCHEMIA

Membrane Signalling and Inflammation in reperfusion injuries

UMR 1327

INTERNATIONAL COOPERATIONS

Spain (University of Murcia), Germany (University of Munster), Romania (University of Timisoara), Denmark (University of Copenhagen), Italy (University of Bari, University of Ferrara), UK (University of Dundee, University of Leeds, University of Sussex, University of York), USA (University of Birmingham, AL; University of Portland, OR), Mexico (National Autonomous University of Mexico), Canada (University of Toronto), China (Central south University, Changsha; Xinxiang medical University, Xinxiang)

ACADEMIC

PARTNERSHIPS

Local : Inserm: UMR1259, UMR1253, UMR1100, UMR1069 and EA7502 SIMBA

National : Inserm UMR1083/CNRS UMR6214 Angers, Inserm UMR1003 Lille, Inserm UMR1060 Lyon, Inserm UMR1087/CNRS6291 Nantes, Inserm UMR1046 Montpellier, CNRS UMR7370 Nice, CNRS UMR7355 Orléans, CNRS UPS44 TAAM-CIPA Orléans

Member of the Fédération Hospitalo-Universitaire « SURvival oPtimization in ORgan Transplantation » (FHU SUPPORT)

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DIRECTOR
Nathalie Winter
DEPUTY DIRECTORS
Isabelle Dimier-Poisson
Catherine Schouler
Patrice Valade

According to the «One Health» concept, the JRU ISP conducts its research from three complementary and interconnected angles:

- Understanding the host response(s) to infections
- Understanding how the pathogens respond to their environments
- Developing innovative prevention and control strategies

RESEARCH TOPICS

- Microbial infections (bacteria, virus, parasite) and protective immunity versus exacerbated inflammation
- Virulence mechanisms of pathogens, escape to the host and resistance to drugs; impact of microbiota -mainly gut- on the development, maturation and evolution of the immune response; evolution and adaptation of the pathogens communities to their environment(s)
- Decipher the functions of different microbiota
- Host-directed therapies and Innovative biotherapies, New vaccines, adjuvants and platforms

EQUIPMENT AND TECHNOLOGY

- Biosecurity laboratories of level 2 and 3 (BSL2 and BSL3)
- BioMark HD (medium-high throughput transcriptomic)
- Flow cytometry : analysis (BD LSR Fortessa X20) and sorting (MoFlo Astrios, Beckman)
- IVIS Spectrum (*in vivo* imaging, bioluminescence and fluorescence)
- Leica SP8 spectral confocal microscope with high resolution scanning
- Hypoxia chamber for cell culture and infections (HypoxyLab, 2B innov)
- Chromium Controller (10x Genomics) for single cell analysis
- New generation sequencing (MinION, Oxford Nanopore Technologies)

INTERNATIONAL COOPERATIONS

Canada (Universities of Laval, McGill, Montr al and Sherbrooke), Denmark (University of Aarhus), Germany (Freie University of Berlin, Friederich Loeffler Institute, Hannover Medical school, Universities of Munich and Wurzburg), UK (Animal and Plant Health Agency, Moredun Research Institute, Roslin Institute, UK Research Institute, University College of Dublin, University of Edinburgh, Wellcome Sanger Institute), Spain (University of Barcelona), Switzerland (University of Geneva)

ACADEMIC PARTNERSHIPS

ANSES, CNRS, INSERM, National veterinary schools, Pasteur Institute, Regional University Hospital of Tours, University of Orl ans

INDUSTRIAL COLLABORATIONS

- Adisseo, Bayer, Boehringer Ingelheim, CEVA, MG2MIX, Olmix, Phileo-Le-saffre, Zoetis
- Start-up : INVENesis France, Lovaltech, SPYDIAG
- Technical institutes : ALLICE, APIS-GENE, Idele, ITAVI

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Headcount: 45

DIRECTOR
Guillaume Beraud
DEPUTY DIRECTORS
Canan Ozsancak

- The LI²RSO gathers physicians, scientists, academic and non-academic researchers who share a common interest toward health sciences. It was created with an intention to favor translational research and innovation. The LI²RSO is structured around four research teams:
- InTherNa : Innovative Therapies & Nanomedicine, headed by Pr Chantal Pichon
- IPIC : Persistent Infections and Chronic Inflammation, headed by Pr Etienne Carbonnelle
- B-CLINE : Brain - Clinical & Experimental Neuroplasticity, headed by Dr Canan Ozsancak
- MÉDÉE : Modelling and Evaluation of Massive amounts of Data in Epidemiology and Health Economics, headed by Pr Guillaume Beraud

RESEARCH TOPICS

InTherNA: 1/ Nucleic acid drug therapy; 2/ Immunotherapy; 3/ Ciliopathies; 4/ Neuroscience and nervous system disorders
 IPIC: Microbiology, Bacteriology, Virology, Inflammation
 B-CLINE : Cerebral neuroplasticity during: 1/ normal and pathological development; 2/ lesional and post-lesional adaptation; 3/ normal and pathological aging.
 MÉDÉE : Mathematical modeling, health economics, epidemiology, data science, artificial intelligence

NATIONAL ACADEMIC PARTNERSHIPS

CEMCA, CNRS, UBO ; Institut Curie ; Institut Pasteur ; INRAE, Toulouse White Biotech ; IBM, Strasbourg ; MSC-Med, Paris Cité ; UCTBS, Faculté de Pharmacie, Paris Cité ; Institut Cochin, Paris ; CNRS, Orsay ; CEA Saclay ; GIN Grenoble ; MINT, Univ Angers ; IRMB, CHU Montpellier ; VRI, Créteil ; CEA, Fontenay ; INSERM U970 PARCC, Paris ; CRCM, Marseille ; Inserm U1236, Rennes ; CITHERA, Evry, Paris Saclay ; ART-TG, Evry ; CHU Henri Mondor, Paris ; CHU Kremlin Bicêtre ; CHU Bretonneau de Tours ; Inserm U1186, Villejuif ; IGMM, CNRS, Montpellier ; I2BC, CNRS, Gif sur Yvette ; Mitovasc INSERM 1083, CNRS 6015, CHU Angers ; UMR 1137 / UPRI AP-HP / Institut cochin / Institut Pasteur / UMR 1018 / CHU de Saint Etienne ; CHU Pitié Salpêtrière-Paris ; CHU Sainte Anne-Paris ; Clinique les Trois soleils (Boissise Le Roi) ; MINDIG, Rennes ; France Développement Electronique (FDE), Monswiller ; INSERM U1266 Institut de Neuropsychiatrie et Neurosciences de Paris ; INSERM U1127, CNRS UMR 7225, Sorbonne Université, Paris ; INSERM U1028, CNRS UMR 5292 Lyon Neuroscience Research Center, Univ Lyon 1 & Univ St Etienne ; UMR1095 EuroMov Digital Health in Motion, IMT Mines Alès & Université de Montpellier ; EA 6210 « Handicap, Activité, Vieillesse, Autonomie, Environnement, Université de Limoges ; Laboratoire Interuniversitaire de Biologie de la Motricité (LIBM), Université de Saint-Etienne

INTERNATIONAL COOPERATIONS

BIH La Charité, Berlin ; TRON, Mainz ; IBCH, PAN, Poznan, Poland ; University of Aveiro, Portugal ; University da Beira Interior, Covilhã, Portugal ; Cleveland University, USA ; Toronto University, Canada ; Univ libre de Bruxelles, Belgique ; Université de Genève, Suisse ; Université du Massachusetts, Faculté de médecine, USA ; Nursing and Health Sciences College, Flinders University, Australia ; Drexel University College of Medicine, USA ; Genome Institute of Singapore, Singapore ; Federal Fluminense University, Brazil ; University of California Davis, MIND Institute, USA ; Yale School of Medicine, USA ; Université de Reykjavic, Islande ; Université de Bâle, Suisse ; Université de Palerme, Italie

INDUSTRIAL COLLABORATIONS

Sanofi ; Aenitis ; TRON ; Image Guided Therapy ; EtheRNA ; Polytheragene SA ; Yposkesi ; Biaseparations-Sartorius ; Vermon ; Clarins ; Alban Mueller/Croda ; Cybernano, McSAF ; Precisions Nanosystems ; Myriad ; Overseed SAS ; GLYcoDiag ; Medtronic - Division Neuromodulation (Minnesota, USA) ; Boston Scientific - Division Neuromodulation (Californie, USA) ; Britannia Pharmaceuticals / Stada Group (Reading, UK) ; Amron Neuroscience, LLC (USA) ; Nuvelution TS Pharma Inc. (USA) ; Janssen Research & Development (USA)

guillaume.beraud@univ-orleans.fr



Headcount: +30

MAVIVHe

Morphogenesis and Antigenicity of HIV, Hepatitis and Emerging Viruses

UMR 1259



DIRECTOR
Fabrizio Mammano
DEPUTY DIRECTOR
Denys Brand

The research unit studies the intracellular traffic and the morphogenesis of HIV, the different hepatitis viruses (HBV, HCV, HEV) and emerging viruses (SARS-CoV-2, Zika, CHIKV, ...).

We also study the impact of the genomic variability of these viruses on infection outcomes such as chronic evolution, pathogenesis, antibody neutralization sensitivity or antiviral treatment resistance. The unit takes advantage of its expertise in viral morphogenesis to develop new original vaccine strategies.

RESEARCH TOPICS

- Human immunodeficiency virus: restriction factors, viral diversity and its impact on the immune system escape, transmission dynamics;
- Hepatitis B virus: entry, replication, morphogenesis, resistance to antivirals, neutralization;
- Hepatitis C virus: structure, morphogenesis, vaccine development
- Hepatitis E virus: infectious cycle, diversity, pathogenesis;
- SARS-CoV-2: neutralization by antibodies, replication of variants
- Other Emerging Viruses: virus replication and inhibition by antivirals

EQUIPMENT AND TECHNOLOGY

- Culture of various viruses in a BSL-3 containment laboratory;
- Techniques of viral neutralization;
- Electron Microscopy of virus morphology thank to the IBISA platform of the University;
- Production of lentiviral vectors;
- Virus culture in hypoxic conditions

INTERNATIONAL COOPERATIONS

Chiang Mai University (Thailand), Pasteur Institute in Phnom Penh (Cambodia), Howard Hugues Medical Institute (MD, USA), Vaccine Research Center (MD, USA), Rockefeller University (NY, USA), Stanford University (CA, USA) Gent University (Belgium), Several European institutions in the context of an EC sponsored program on antivirals

ACADEMIC PARTNERSHIPS

UMR INSERM and/or CNRS (CIRI Lyon, CRCL Lyon, IBCP Lyon, CRCI-NA Nantes-Angers, Institut de Biologie de Lille, IRIM Montpellier, CDR Saint-Antoine & Institut Saint-Louis, Paris), Institut Pasteur Paris, Sant  Publique France)

INDUSTRIAL COLLABORATIONS

ViroCoVax (start-up created by the unit), Replicor, BioMerieux, MAbSili-co, LoValTech

mavivh@univ-tours.fr

<https://mavivh.univ-tours.fr/>





Headcount: +40

DIRECTOR
Christophe Vandier
DEPUTY DIRECTOR
Olivier Hérault

Our research project multidisciplinary single team project focused on lipids acting in/on tumor niches, more particularly on energy/oxidative metabolism and calcium signaling, able to influence dysplasia, tumor progression and sensitivity of tumors to anti-cancer drugs. The objective of our bench to bedside research is to facilitate the transfer of fundamental knowledge to patients developing chemo-or hormone-resistant cancers, and/or metastases and/or cancer-induced cachexia.

RESEARCH TOPICS

- Oncology/Hematological malignancies: lipids in tumor microenvironment and prevention
- Impact of lipids on redox/energy metabolism of cancer cells in their niches
- Chemo/hormono sensitization of tumors to anti-cancer treatments
- Signal transduction, biology of cancer cells
- Role, mechanism of action of ion channels and transporters, calcium homeostasis
- Clinical nutrition: energy / nitrogen metabolism, cachexia, mitochondrial bioenergetics

EQUIPMENT AND TECHNOLOGY

- Energy/oxidative metabolism (Avatar® systems, Seahorse®, Omnilog®, Oroboros®)
- Microspectrofluorimetry/imaging and fluorescent probes
- Flow cytometry and cell sorting
- Electrophysiology (microelectrode, patch-clamp)
- RNA-seq, scRNA-seq, methylome, RT-qPCR, plasmid transfections
- CPG, HPTLC
- Fluorescence microscopes/macroscopy
- Time lapse
- Histopathology technical facility
- Indirect calorimetry
- Natural isotopic abundances by EA-IRMS
- Body composition by multi-frequency impedance and biphotonic absorptiometry

<https://n2c.univ-tours.fr>

N₂CO_x

Niche, Nutrition, Cancer
& Oxidative metabolism
UMR 1069



INTERNATIONAL COOPERATIONS

V. Baracos (Canada), S. ElBok (Tunisie), P. Buchanan (Ireland), D. Duarte (Portugal), L. Jan (USA), M. LuzCayuela (Spain), G. Escames (Espagne), V. Mazurak (Canada), F. Mollinedo (Spain), K. Nahdi (Tunisie), L. Pardo (Allemagne), L. Peterlin-Masic (Slovenia), J. Requejo-Isidro (Espagne), F. delRio (Mexique), M. Ruiz (Canada), N. Srairi-Abid (Tunisie) & M.Trebak (USA).

ACADEMIC PARTNERSHIPS

CNRS : CEMCA (Brest), CBM & ICOA (Orleans), ISCR-CORINT & IGDR (Rennes). **INSERM**: CRCI2NA (Nantes), CRCM (Marseille), NUMECAN / IRSET (Rennes), LNC (Dijon), CEPR/iBrain/MAVIVH (Tours), LBAI (Brest), IBV (Nice), SPC (Chatenay Malabry), CARMEN (Lyon), Mitolab (Angers), Curie Institute / CRSA (APHP, Paris). **University Tours**: SIMBA, LIFAT. **INRAe Nouzilly Tours**. **CHU Tours and CHU Orléans**.

Coordination: Canceropole Grand-Ouest: 3MC, NET, Hormone dependent cancers, Tumour Library Network. FSTM. FHU GOAL, FHU PRECICARE. INSERM FCRIN PEDS-TART. Working group «cancer-induced undernutrition» NACRe network. **Scientific advisory board and chairmanship**: OPALE Carnot institute, LabEx MabImprove, Francogyn, Oncocentre, FFCD, FILO, GETUG-Unicancer, AFU.

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BIOPHARMACEUTICALS
Innovation Dynamics in Health
IN REGION CENTRE-VAL DE LOIRE



Headcount: +120

DIRECTOR

Matthieu Keller

DEPUTY DIRECTOR

Joëlle Dupont, Nadine Gérard

Martine Migaud, Eric Reiter

The unit conducts basic and applied research on the reproductive function, adaptation and emotional, social and sexual behaviour of domestic animals (cattle, sheep, goats, horses, pigs and poultry) and model species (rats, mouse and quail).

The themes and methods used, including integrative and predictive biology approaches, contribute to the sustainability of farming systems while combining competitiveness, environmental protection and citizen expectations.

The UMR is made up of 8 research teams, 1 team project with Inria. It hosts 1 technologic platform and 3 technical facilities.

RESEARCH TOPICS

- Reproductive physiology
- Neuroendocrinology
- Animal behaviour

EQUIPMENT AND TECHNOLOGY

- PIXANIM platform (page 51)
- The PIC facility (Cell imaging platform of the PRC unit) brings together resources in photonic microscopy and image analysis.
- The Phenotyping-Endocrinology Laboratory is specialized in the measurement of reproductive hormone levels in mammalian and avian species in various biological substrates. It is equipped with an automatic dispensing machine, washers and microplate readers.
- The ISLANDe facility (Informatique Scientifique & ANalyses de Données for Scientific computing and data analysis) provides storage capacities for the scientific data generated in situ as well as an intensive computer infrastructure available for the INRAE center in Tours. ISLANDe provides omics data analysis to meet the needs of scientists in the research unit.

PRC

Physiology of
Reproduction and
Behaviour -UMR CNRS
7247 -INRAE 0085



Université
de TOURS

INRAE

INTERNATIONAL COOPERATIONS

- University of Munich (Germany)
- University of Duke and University of Illinois Urbana Champaign (USA)
- University of Milan and University of Bari (Italy)
- Swedish University of Agricultural Sciences (Sweden)
- University Agraria Antonio Narro Torreo (Mexico)
- Jagiellonian University (Poland)

ACADEMIC

PARTNERSHIPS

- University : Paris Cité, Sorbonne, Sorbonne Paris Nord, Paris Diderot
- Muséum National d'Histoire Naturelle
- Inserm
- Inria
- Institut Pasteur
- AgroParisTech
- Ecole Nationale Supérieure d'Agronomie de Rennes and Ecole Nationale Vétérinaire d'Alfort

INDUSTRIAL

COLLABORATIONS

ReproPharm Vet, Igyxos, MAbSilico, Synthelis, Eliance, Ceva, Siemens, IMV Technologies, Sysaaf, ITAVI

secretariat@umrprc@inrae.fr

<https://physiologie-reproduction-comportements.val-de-loire.hub.inrae.fr/>



BIOPHARMACEUTICALS
Innovation Dynamics in Health
IN REGION CENTRE-VAL DE LOIRE

DIRECTOR
Steeve Thany
DEPUTY DIRECTORS
Sabine Carpin
Sylvain Bourgerie

INTERNATIONAL COOPERATIONS

The international partners are distributed among several countries in Europe (Italy, Belgium, Netherlands, Spain, and Portugal), in USA (University of Florida, Oregon State University,...) and Canada, in Africa (Gabon, Tunisia, Egypt, Algeria,...), and other countries (Turkey, China, Japan). The collaborations are established in the framework of various projects or bilateral collaborations to share experimental setups or methodological skills or PhD/post-doctoral exchanges.

ACADEMIC PARTNERSHIPS

Numerous public research organisms from INRAE, CNRS, INSERM, CEA, Pasteur Institute, Universities, and University hospital centers in France.

INDUSTRIAL COLLABORATIONS

La Carbonerie, Yara, CAAHMRO, Alban Muller, Ceva.

The laboratory focuses on the biological, physiological, ecological and evolutionary mechanisms of animal and plant species in a context of global change. We have two main areas of interest : 1) plant adaptation to climate change and drought, using multidisciplinary approaches ranging from physiology and ecophysiology to ecology and epigenetics. 2) the adaptation of insects to their environment in a context of global change, including major issues such as invasive insects and insect vectors of human and animal diseases. Thus, the laboratory is organised into four teams on the campus of the University of Orléans. The «Trees and Responses to Water and Environmental Constraints, ARCHE», the team, 'Cellular Signalling'; The team, Biodiversity, Ecology and Evolution of Forest Entomofauna, BEEFE', and the last team, 'Neurobiology and Neuropharmacology of Ion Channels, NNIC'.

RESEARCH TOPICS

- Ecology of insect communities
- Evolutionary ecology of insect populations
- Cell signalling
- Phytomanagement
- Behavioural and cellular mechanisms of insects adaptation
- Arthropod vectors of human and animal diseases
- Epigenetic and Ecophysiology of trees
- Tree-insect interactions

EQUIPMENT

The laboratory has a range of equipment including :

- Climatic chambers
- In vitro culture chamber
- A Canaux-CELL electrophysiology platform (for testing compounds of pharmaceutical and veterinary interest).

Various laboratory equipment. As a INRAE USC, it has access to experimental equipment at the INRAE Ardon site.

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DIRECTOR
Jérôme Thibonnet

The themes of SIMBA focus on the discovery and synthesis of small molecules for therapeutic purposes in oncology and infectiology, derived from synthetic chemistry or plant/microalgae extracts. Two main axes guide our research: the first axis explores the synthesis or isolation of natural bioactive compounds, promoting the development of new synthetic pathways and ecological extraction processes. The second axis evaluates the biological properties of selected molecules, in collaboration with specialized teams in infectiology, oncology, and cosmetology. Synthetic molecules or those obtained through screening are subjected to pharmacomodulation to improve their biological properties.

RESEARCH TOPICS

- Design and novel molecular structures of interest: development of methodologies in heterocyclic chemistry and fluorine chemistry; applications/interfaces with biology & health.
- Green solvents for sustainable development: design, characterization, innovation in extractive sciences and synthesis, and applications.

EQUIPMENT AND TECHNOLOGY

- X-ray Single crystal diffraction
- X-ray Powder diffraction
- DAD HPLC chains, HPTLC-densitometry, GC-FID
- PLC-MS chain
- RX Fluorescence
- Centrifugal Partition Chromatography (CPC)
- Synthesis microwave
- Microplate reader
- Combiflash purification system
- TRA IR spectrometer
- SINAPTEC ultrasonic extractor and probe
- Smart DAC 400 Haushild

INTERNATIONAL COOPERATIONS

- Belgique : University of Leuven (UCL), University of Namur (CBO)
- Tunisie : University of Tunis El Manar, University of Carthage
- Canada : University of Laval
- Togo : University of Lomé
- Soudan : University of Gezira, University of Khartoum
- Morocco : University of Mohammed VI Polytechnic
- Italy : University of Sapienza (Rome)

ACADEMIC PARTNERSHIPS

ISP (Tours), N2C (Tours), CEPR (Tours), NMNS (Tours), EBI (Poitiers), LITEC (Poitiers), ISM2 (Marseille), IRIm (Montpellier), IBMM (Montpellier), ICMR (Reims), CEA le Ripault (Monts), BBV (Tours), National Chemotherapy Library

INDUSTRIAL COLLABORATIONS

- Orgapharm (Pithiviers)
- Indena (Tours)
- AquaEcoCulture (Lamballe)
- Gilson purification (Aven)
- COSMO International (Mougins)
- Transfaire La Manufacture



2

TECHNOLOGICAL RESEARCH ACCELERATOR





Headcount: 30

ART-ARNm Inserm US55 Technological Research Accelerator in RNA- based therapies

Inserm
La science pour la santé
From sciences to health



DIRECTOR
Chantal Pichon

ART-ARNm is an Inserm R&D laboratory dedicated to the development of innovative technologies fostering the clinical translation of RNA-based therapies and vaccines bridging. The ambition is to promote, accelerate and disseminate RNA technologies through a coherent range of collaborative projects to bridge the gap between researchers/clinicians and industries.

ART-ARNm has a solid network with accredited French and European integrators and platforms: TIBH (Toulouse), IVETH (Paris), Opto-oligo (Bordeaux), PPC (Montpellier), CITHERA (Evry), ETP Nanomedicine). It is also connected with well-known clinical centers (VRI (Créteil), Immune4Cure (Montpellier), BeCAT (La Charité, Berlin, Germany).

RESEARCH TOPICS

- Nanomedicine
- Design and production of different forms of RNA
- Vaccination
- Immunotherapies
- Rare diseases
- Tissue regeneration

EQUIPMENT AND TECHNOLOGY

Production of formulations: Microfluidic systems: Spark and Ignite NanoassemblR (Precision Nanosystems); Analytical workflow equipments: Nanodrop, Qbit, ÄKTA Pure™ chromatography (Cytiva), 5300 Fragment Analyzer system (Agilent), Zetasizer Ultra (Malvern Panalytical), PathFix (Sartorius), Videodrop (Myriade).

mRNA design and production: softwares and equipments for mRNA structure design, plasmid DNA amplification and purification, in vitro transcription and bio-production of mRNA including downstream purification processes.

In cellulo & in vivo validation

- BSL2 culture rooms for various cell types
- Electrophoresis systems
- Small animal models: mice, rat
- CytoFlex (Beckman Coulter, 3 Lasers, 9 detectors)
- Microscopes (Evotec, Zeiss)
- IVIS Fluorescence and bioimaging equipment
- Photo-acoustic and ultrasound imaging: Vevo LAZR Imager (Visual Sonics Fujifilm)
- CLARIOstar® Plus, multi-mode plate reader (Absorbance, fluorescence, luminescence, FRET/nanoBRET, HTRF).

INTERNATIONAL COOPERATIONS

BIH La Charité (Berlin, Germany); TRON (Mainz, Germany); IBCH, PAN (Poznan, Poland); University of Aveiro (Aveiro, Portugal); University da Beira Interior (Covilha, Portugal); Cleveland University (USA); Toronto University (Canada); Univ libre de Bruxelles (Belgique); Medical University of Warsaw.

ACADEMIC PARTNERSHIPS

CEMCA (Brest); Institut Curie; Institut Pasteur; Institut Cochin; TIBH, INRAe (Toulouse); IBMC CNRS (Strasbourg); MSC-Med CNRS (Paris Cité); UCTBS (Faculté de Pharmacie, Paris Cité); BioMAPS (Orsay); GIN (Grenoble); MINT (Angers); IRMB (CHU Montpellier). INEM (Orléans); CEPR (Tours) ; ART-TG (Evry); VRI (Créteil) ; CEA (Fontenay) ; INSERM U970 (PARCC, Paris) ; CRCM (Marseille) ; Inserm U1236 (Rennes), CITHERA (Evry, Paris Sclay), ART-TG (Evry). IRMB (CHU Montpellier); B3OA(Paris); RMeS (Nantes).

INDUSTRIAL COLLABORATIONS

Aenitis; Biaseparations-Sartorius; Cybernano; EtheRNA; Gilson; Image Guided Therapy ; McSAF ; Myriade ; Ose Immunotherapeutics; Polytheragene; Precisions Nanosystems; Sanofi ; TRON; URGO; Yposkesi.

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3

CORE FACILITIES





MO2VING

from MOlecular Organization
to in Vivo ImagING

MO2VING

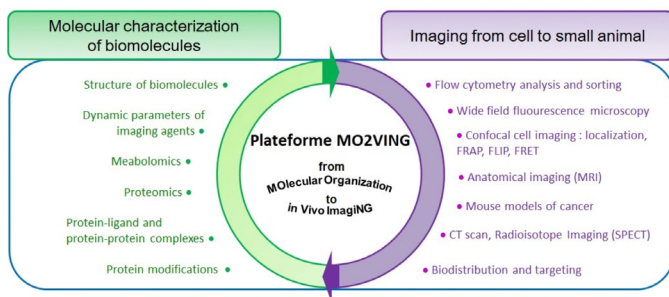


DIRECTOR
Guillaume Gabant

MO2VING is an IBI SA labeled facility specializes in both molecular characterization of biomolecules and imaging from cells to small animals. MO2VING brings together multiple areas of expertise and offers a comprehensive service offering ranging from molecules to animals. By promoting multimodal and multi-scale approaches, MO2VING makes it possible to integrate different levels of information to understand the functioning of a biological system. This service is open to the regional, national and international scientific community, from public laboratories or private companies. MO2VING comprises 5 sub-platforms:

- Nuclear Magnetic Resonance (NMR)
- Mass Spectrometry (MS)
- P@CYFIC (cellular imaging and flow cytometry)
- Magnetic Resonance Imaging and Spectroscopy (MRI and MRS)
- TAAM-In vivo Imaging

Services offer



TECHNICAL DIRECTOR
Hervé Meudal
SCIENTIFIC DIRECTOR
Karine Loth

Nuclear Magnetic Resonance is a highly efficient technique to analyze molecules at the atomic scale thanks to magnetic properties of some of their nuclei (mainly ¹H, ¹³C, ¹⁵N, ³¹P, ¹⁷O). MO²VING-NMR is equipped in order to ensure studies of a large panel of liquid-state compounds (from small organic molecules to proteins). Depending on the request of the users, the sub-platform can provide access to state-of-the art spectrometers in autonomy or with the help of an engineer, but also can perform all experiments and analysis needed for a user's research project.

RESEARCH TOPICS

- Checking quality/purity, stability and/or fold of the products
- Follow up of organic synthesis
- Characterizing contrast agents for medical imaging
- Analyzing a large diversity of biomolecules: small organic molecules, peptides, proteins, nucleic acids, polymers...
- Structure, dynamics and interactions of biomolecules
- Metabolomics

EQUIPMENT AND TECHNOLOGY

- BRUKER 400MHz equipped with a 10mm probe BBO (19F not available) and a 5mm BBFO (19F available). Manual utilization.
- BRUKER 600MHz equipped with a 5mm BBFO, a 5mm proton optimized triple resonance NMR inverse probe for structural biology, and a sample case.
- BRUKER 700MHz equipped with a 5mm proton optimized triple resonance NMR inverse cryoprobe for structural biology and metabolomics studies.



TECHNICAL DIRECTOR
Guillaume Gabant
SCIENTIFIC DIRECTOR
Martine Cadène

The Mass Spectrometry sub-platform is specialized in the analysis of biomolecules (whole proteins, peptides, oligonucleotides, glycans, polymers or small organic molecules), either pure or in complex mixtures.

RESEARCH TOPICS

- The analyses can be carried out for several purposes:
- To check the quality of a product resulting from organic synthesis, bioengineering, or biochemical purification,
- To determine the molecular formula of a compound,
- To identify and quantify proteins using bottom-up and top-down proteomic approaches,
- To identify and quantify metabolites using a metabolomics approach
- To characterize protein-ligand and protein-protein assemblies: kinetic constants, binding sites and partner identification.
- To characterize bioconjugates and protein modifications: nature, stoichiometry and localization

EQUIPMENT AND TECHNOLOGY

3 mass spectrometers:

- MALDI-TOF/TOF UltraFlex I (Bruker),
- HCT Ultra-ETD ion trap (Bruker),
- UHR-Q-TOF MaXis-ETD (Bruker) as part of the FR2708

These spectrometers can be coupled to one of 2 liquid chromatography systems: CapLC (Waters) and nanoUHPLC U3000 (Dionex)



TECHNICAL DIRECTOR
David Gosset
SCIENTIFIC DIRECTOR
Catherine Grillon

The P@CYFIC sub-platform allows for the study of various biological functions at cellular level. State of the art instruments and an engineer are available to help you design and/or perform your experiments (choice of fluorescent markers, conditions, and preparation of cell sorting, etc.).

RESEARCH TOPICS

The P@CYFIC sub-platform offers flow cytometry and fluorescence videomicroscopy for the exploration of cell viability, endocytosis, intercellular recognition, invasion, healing, angiogenesis, intracellular trafficking under normoxia, hypoxia or physioxia conditions. Flow cytometry enables the qualitative and quantitative analysis of cells, bacteria, organelles, particles or molecules under non-toxic conditions at high throughput. Size, granularity and any components or functions, likely to be revealed by a fluorescent probe, can be analyzed. Flow cytometry can also be used to purify sub-populations from a heterogeneous population, to remove dead cells from a culture and to sort cells for cloning. Videomicroscopy allows for the observation of various dynamic cellular phenomena (internalization, transmigration, rolling, adhesion, etc.) and the measurement of cell-cell or cell-particle interaction under flow conditions close to those of the bloodstream.

To complement these studies, intracellular localization, FRET for molecular interactions and FRAP or FLIP for the dynamics of molecules are offered with confocal microscopy. Confocal microscopy allows for the observation of intracellular elements in three dimensions. It performs virtual optical slices in the observed object and records the optical signals emitted in each plane.

EQUIPMENT AND TECHNOLOGY

FLOW CYTOMETRY

- BD FORTESSA X20 with 4 lasers, 18 parameters (Becton Dickinson).
- BD ARIA III S.O.R.P for cellular sorting, with 4 lasers, 18 parameters (Becton Dickinson).

FLUORESCENCE VIDEOMICROSCOPY

- AXIO OBSERVER Z1 workstation (Zeiss).
- ApoTome1 system, produce near confocal images. OrcaR2 digital camera
- AXIO OBSERVER Z7 workstation (Zeiss).
- ApoTome2 system, produce near confocal images. OrcaFlash4 digital camera
- Flow adhesion chamber workstation

CONFOCAL MICROSCOPY

- LSM980 Meta and AiryScan2 system (Zeiss), with 6 excitations wavelengths between 405nm to 630nm.

TECHNICAL DIRECTOR
Frédéric Szeremeta
SCIENTIFIC DIRECTOR
Sandra Meme

The platform offers studies on small animals and/or the analysis and quantification of MR spectra and images. Nuclear Magnetic Resonance Imaging (NMR) has been a recognised tool in biomedical and pharmaceutical research for some twenty years. It has the advantage of being non-invasive and atraumatic. Two different and complementary methods based on the principles of NMR can be used for biological investigation:

- Magnetic Resonance Imaging (MRI) uses the signal from protons in water molecules. This provides anatomical and morphological information about tissue physiology.
- Magnetic Resonance Spectroscopy (MRS) detects signals from endogenous molecules whose concentrations are much lower than those of water, such as ¹³C or ³¹P. This gives access to metabolic information in physiological or physio-pathological situations.

RESEARCH TOPICS

The platform offers imaging sequences (morphological, diffusion, perfusion, angiography, etc.) and localized spectroscopy (¹H, X nuclei) adapted to longitudinal in vivo studies on small animals (rabbits, rats, mice, Honey Bee, Drosophila) to characterize pathologies development and to monitor therapies. It also offers analysis and quantification of in vivo MRI spectra and images. The team has an expertise in radiomic (image) texture analysis. A research engineer is available to optimize and carry out the experiments, and also to develop coils adapted to any small animal organ and double tuned coils for X nuclei spectroscopy. An assistant engineer is available for cells cultures, animal preparation and surgery for several model induction (cancers, neurodegenerative pathologies, inflammation...). Potential users can follow a quick training course offered by the team or can acquire their own images and spectra if they are autonomous on the imaging-spectrometers.

EQUIPMENT AND TECHNOLOGY

- 2 Bruker imaging-spectrometers : BioSpec 94/20 (9,4T) and PharmaScan 70/16 (7T),
- 2 isoflurane anaesthesia systems for small animals,
- Stereotaxis machine,
- Ventilated cabinet for small animals (16 cages)

TECHNICAL DIRECTOR
Julien Sobilo
SCIENTIFIC DIRECTORS
Stéphane Petoud & Sara Lacerda

The MO²VING sub-platform “In Vivo Imaging – TAAM” has the mission of addressing the needs of the scientific community for the phenotyping and functional exploration of rodents (transgenic or mutant animals, models of inflammation and cancer, and potential for gene therapy studies). The in vivo imaging modalities include CT scan, radioisotope imaging (SPECT), photonic imaging by bioluminescence and near-infrared fluorescence and ultrasound imaging coupled with photoacoustics.

We design customized protocols for each client, to provide adapted studies on drug efficacy and targeting evaluation using the different techniques that are available, as well as in vivo and ex vivo biodistribution.

EQUIPMENT AND TECHNOLOGY

- Bioluminescence and near-infrared fluorescence imaging: IVIS Lumina and IVIS Lumina II (Revvity)
- Radioisotope imaging: (NanoScan SPECT/CT, Mediso RS2D)
- Photo-acoustic and ultrasound imaging: Vevo LAZR Imager (Visual Sonics Fujifilm)
- CT Scan: Skyscan 1278 (Bruker)

CANCER MODELS

TAAM develops cancer models generated from human or murine cells or from tumoral tissues, that can be implemented in immuno-competent or immuno-compromised animals. Several bioluminescent cancer cell lines are available. Cells provided by the clients can also be used if they are type 1 GMOs.

CNRS-TAAM

Typing and Archiving of Model
Animals



The TAAM is a support and research unit, which offers a wide range of services around model rats and mice for fundamental, biomedical and pharmaceutical research. For almost 70 years, 50 engineers and technicians have been applying their skills and expertise daily at the service of the scientific community by:

- Offering a range of high-tech services around 6 poles of expertise: exploration through multimodal in vivo imaging, bespoke colony management, management of axenic and gnotobiotic colonies, cryopreservation and assisted reproduction, genetic and microbiological analysis and distribution of models in France and abroad.
- Responding to researchers' expectations by innovating.
- Contributing to the transfer of knowledge by training students and by participating in scientific and technical training programmes designed for research laboratory engineers and technicians.

Covering a surface area of 8500 m², the TAAM unit has an infrastructure and state of the art, high-tech equipment that operate 24/7. The TAAM maintains high health, regulatory and ethical standards within these installations. The TAAM has been ISO 9001 certified since January 2008 and NFX50-900 certified since 2014. The entire staff of the TAAM is committed to providing its clients with a service of quality in full respect of the rules of ethics and animal welfare to which they are all profoundly attached.

NATIONAL INFLUENCE

The TAAM contributed to the founding of the National Infrastructure in Biology and Health, PHENOMIN (<https://www.phenom.fr/en-us/>), granted in 2011 by the Investissements d'Avenir program dedicated to the Phenogenomics of the mouse. The infrastructure groups 3 complementary centres: the TAAM, the Clinical Institute of the Mouse (ICS) in Strasbourg and the Immunophenomics Centre (CIPHE) in Marseilles, all at the service of the scientific community for the use of murine models in Research. The assignments and achievements of PHENOMIN consist of 1) providing services for academic and industrial scientific communities and 2) creating a unique resource of animal models, both for fundamental research and biotechnological, biopharmaceutical innovation

PHENOMIN-TAAM constitutes a part of CELPHEDIA (Creation, Breeding, Phenotyping, Distribution and Archiving of model organisms, <https://celphedia.eu/en/>), a national operational research infrastructure distributed over the French territory. Its mission is to support academic and industrial scientific community to accelerate discoveries in biology and improve biomedical research. To this end, CELPHEDIA operates in 3 main activities with respect of ethical principles and animal welfare 1) standardized service offers, in the areas of creation, functional exploration, archiving and distribution of animal models, necessary for fundamental research and preclinical approaches: rodents with the mouse as the leader, non-human primates and non-mammals including aquatic vertebrates. 2) Research and development activity for new technological offers. 3) Training courses adapted to users' needs either for the use of animals in research with respect to institutional regulations or to develop specific technological skills.

INTERNATIONAL INFLUENCE

The TAAM has contributed for over ten years to the EMMA (European Mouse Mutant Archive) program which has now been integrated into the Pan-European Infrastructure INFRAFRONTIER (<https://www.infrafrontier.eu/>), an agent for the preservation and distribution of mouse models which the scientific community has recognised as being of scientific interest.

<https://www.taam.cnrs.fr/?lang=en>

contact-taam@cnrs-orleans.fr



BIOPHARMACEUTICALS
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Pole Bespoke colony management

For over 60 years, the TAAM's renowned installations and technical expertise, together with its extensive catalogue of mouse lines, have made it a major player in the field. Our pole –Bespoke colony management– is constantly evolving to adapt to the demands of research (renewing equipment and installations, increasing housing capacity, adapting to specific needs...). The TAAM zoo-technicians deploy their skills at your request and offer a wide range of services: generations of cohorts, monitored mating, customised regimen, experimentation ... Our genetic and microbiological analysis process ensures continuous, reliable and standardised monitoring of genetically-modified mouse or rat models. The TAAM offers three types of housing for murine models of various health statuses.

EQUIPMENT

Health statuses proposed for housing rat or mouse lines:

- Axenic / Gnotobiotic
- SOPF* (Specified and Opportunistic Pathogen Free)
- SPF* (Specified Pathogen Free)
- Conventional

Various types of facilities and caging systems: 8 500 cages

- Open cages
- Individually Ventilated Cages (IVC)
- Isolators

* SPF and SOPF statuses are defined according to the reference lists proposed by FELASA recommendations: Federation of European Laboratory Animal Science Associations.

Pole Management of axenic and gnotobiotic colonies

For over 40 years, the TAAM has offered axenisation of mouse lines by aseptic hysterectomy and developing embryo transfer. Axenisation consists in obtaining animals which are free of any micro-organisms that are detectable by the laboratory's diagnosis systems (axenic or Germ Free animals). The axenic model allows the scientific community to work on microbiota, an increasingly relevant topic in view of the recent discoveries on the importance of intestinal flora in so many, varied fields. Guaranteeing axenia needs great scientific exactitude and a perfect command of the process which includes checks at every key step, as well as regular monitoring of the animals' health status.

EQUIPMENT

80 isolators – 300 m²

Pole Assisted reproduction Rederivation

The TAAM proposes its expertise in the field of murine model rederivation, a key step in breeding and distributing models, in view of the health constraints applying to entry into an animal facility. The technique of embryo transfer makes it possible to obtain animals with a SOPF (Specified and Opportunistic Pathogen Free) status. In certain cases, the technique of aseptic hysterectomy may also be used. This service may also be provided by IVF (in vitro fertilisation) with “fresh” sperm from a single reproducer. The service provision is validated by health monitoring leading to a SOPF status certificate.

SERVICES ON OFFER

4 000 strains

- Mouse rederivation
- Rat rederivation
- Saving mouse lines from one male (IVF)
- Health certificate included in the service
- Possibility of hosting lines in our dedicated Rat/Mouse quarantines before the service provision
- Possibility of housing lines in our dedicated Rat/Mouse breeding zones, after service provision

EQUIPMENT

We are equipped with an extensive stock of Rat/Mouse isolators and able to host a large number of lines.

Cryo-recovery

The TAAM proposes its expertise in cryo-recovery of strains from embryos (rat/mouse) or frozen sperm (mouse). These services are provided using the technique of In Vitro Fertilisation (IVF) and are performed so as to obtain animals with a SOPF health status.

SERVICES ON OFFER

- Cryo-recovery from embryo straws
- Cryo-recovery from frozen sperm straws

Pole Imports and exports

For its clients, the TAAM handles the transfer of murine models in frozen (embryos, sperm) or “breathing” format in France and abroad. In the context of the European consortium EMMA, the TAAM ensures the distribution of models which have been made available for the scientific community. The TAAM unit works with the carriers and various institutional services:

- The Customs authorities,
- The DDPP 45 (Direction Départementale de la Protection des Populations du Loiret – the Direction of the Protection of the Population of the Loiret Department),
- The CCI of the Loiret (Chamber of Commerce and Industry).

Pole microbiological diagnostics and genetic analysis

Microbiological Diagnostics: The TAAM unit offers reliable, accurate health diagnostics, in accordance with all FELASA recommendations, which meet the expectations of the scientific community: parasitological and bacteriological analyses, serological tests (about 40 000 tests/year).

EQUIPMENT

- The microbiological diagnostic service is equipped with a dedicated animal facility for housing the animals in ventilated racks. All care is taken not only to ensure their welfare but also to avoid any contamination whilst awaiting results of analyses (<72h).
- Autopsy of animals and all samples are performed under a specially adapted dissection hood. Macroscopic and microscopic examinations are conducted under a binocular loupe and phase contrast microscopes.
- Microbiological analyses are performed on both liquid and solid media in various temperature and aerobic conditions. Colonies are identified by mass spectrometry.
- Serological analyses employ MFIA technology (Multiplexed Fluorometric Immunoassay™).
- Certain microbial agents are detected with PCR analyses.
- The TAAM can take charge of live animals and ventilated rack filtering systems or can propose a non-invasive method: the TAAM-KIT.

Genetic analysis: Services of PCR test genotyping of genetically modified mouse and rat models (transgenic, Knock-Out, Knock-In, conditional Knock-Out, mutant...) are offered to the whole scientific community, to researchers from public and private institutions. These protocols may be provided by the client or developed by TAAM unit from the sequence of genetic modification to be highlighted. Since 1996, researchers have been able to consult a catalogue of PCR protocols for over 900 genetic modifications. Over 25000 genotyping operations are performed every year, and their results delivered within 10 working days.

Pole In vivo imaging

The pole of Exploration by multimodality in vivo imaging is a national and European resource of imagery, at the service of biological, biomedical and pharmaceutical research. A unique range of multimodal in vivo 2D or 3D imaging devices (radiology, radio-isotopic imaging, bioluminescence, fluorescence and photo-acoustic), makes possible finely tuned, non-invasive explorations in human pathology mouse models. The pole offers its scientific and technical skills in its specialist fields of murine model phenotyping, cancerology, infectiology, inflammation and drug vectorisation, to the scientific community of public or private researchers at large. For more information, please see MO2VING-In Vivo Imaging – TAAM (Page 33).

SCIENTIFIC MANAGER
Olivier Hérault
MANAGER
Emeline Dupont

The CRB-T is a structure of the Tours CHRU, attached to the Research platform. A Scientific and Ethical Committee deals with scientific and ethical issues concerning the CRB-T (optimisation of preparation techniques, monitoring of consent regulations, etc.).

RESEARCH TOPICS

- To help investigators set up their projects when they require biological samples to be taken
- Carry out the technical procedures requested
- Guarantee the traceability and proper conservation of biological resources
- With the agreement of the collection managers, make collections available to other research projects
- Hosting collections for health purposes, in particular the Tumour Library of the Tours University Hospital Centre (CHRU)
- Participating in national and European networks to share biological resources and harmonise practices.

The CRB-T implements a quality approach in order to meet the requirements of its clients (sponsors, investigators, laboratories, etc.) as effectively as possible and to carry out the tasks assigned to it.





PITAM / CePiBac

Pilot centre for
Therapeutic Antibodies
Monitoring / Centre Pilote de
suivi Biologique des
traitements par Anticorps

DIRECTOR

Gilles Paintaud

DEPUTY DIRECTOR

Theodora Bejan-Angouvant



To enable analysis of antibody dose-concentration-effect relationships in clinical or preclinical studies, Tours University Hospital, in association with Inserm UMR1327 ISCHEMIA (formerly EA4245) of Tours University, has developed a department of mAb monitoring where the following validated techniques are performed:

- measurement of serum concentrations of therapeutic monoclonal antibodies
- pharmacokinetic and pharmacokinetic-pharmacodynamic (PK-PD) modelling to estimate individual pharmacokinetic and pharmacodynamics parameters (half-life, clearance, IC50, etc.).

RESEARCH TOPICS

- Development and validation of in-house ELISA methods
- Development of innovative pharmacokinetic and PK-PD models adapted to the monoclonal antibody and the disease treated.
- Study of the individual sources of variability of the dose-concentration-effect relationship: target-antigen mass and disease activity, genetic polymorphisms, associated treatments, demographics, and exploration of other potential sources of variability.

EQUIPMENT AND TECHNOLOGY

- ELISA equipment
- Monoclonal antibodies and fusion proteins currently measured in biological fluids: adalimumab, atezolizumab, basiliximab, bevacizumab, cetuximab, eculizumab, etanercept, infliximab, nivolumab, panitumumab, pembrolizumab, ramucirumab, rituximab, tocilizumab, trastuzumab and vedolizumab. In development: mepolizumab and ravulizumab.
- Population PK and PK-PD modelling using the nonlinear mixed-effects modeling software Monolix

Scientific Director: David Ternant

Operational Manager: Céline Desvignes (celine.desvignes@univ-tours.fr)



PST-ASB

Core facility for Biological Systems Analyses



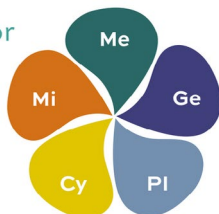
Set up in 1995, the core facility for Biological Systems Analyses is a major cross-disciplinary infrastructure at the University of Tours. It brings together most of the heavy equipment and corresponding skills in two major areas of biological analysis, and to a lesser extent materials analysis, namely Imaging and Chemical Analysis. This facility is divided into five departments corresponding to specific technological areas:

- Microscopy department (electronic and confocal)
- Metabolomics and chemical analyses department (NMR, infrared spectrometry, mass spectrometry, biological and medical MRS)
- Genomics analysis department (genetic, genomic, and transcriptomic)
- Preclinical Imaging department (rodents and non human primates imaging)
- Cytometry department (cytometry and cell sorting)

This workflow enables an integrative and correlative approach to life sciences: from the microscopic to the molecular scale. Each department provide the resources and skills needed to carry out user-led-projects, and therefore the facilities are actively monitoring technological developments in close coordination with the areas of excellence defined by the University.

Core Facility for

Biological
Systems
Analyses



Microscopy

Metabolomics

Genomics

Preclinical Imaging

Cytometry

<https://pst-asb.med.univ-tours.fr/>



SCIENTIFIC DIRECTOR
Philippe Roingeard
TECHNICAL DIRECTOR
Pierre-Yvan Raynal
SECRETARY
Isabelle Sausseureau

The microscopy department pool equipment and competencies in microscopic imaging for internal and external users or services requestor from public or private sector. The core facility received the IBiSA label (Biology, Health and Agronomy infrastructures) in 2015.

ANALYSES

- MET analysis of cells and tissue, electron immunomicroscopy.
- MET and SEM analysis of particules (bacteria, virus, DNA, liposome, macromolecule)
- Surface characterization, elementary analysis and spectral mapping using SEM and EDS probe
- 3D reconstruction from serial TEM sections
- Localization of tagged cellular elements (viral proteins, signalling factors, etc.) by confocal laser scanning microscopy
- 3D volume reconstruction and quantification of markers colocalization from confocal microscopy images
- Time-lapse confocal analysis of living cells

EQUIPMENT

Electronic microscopy :

- JEOL JEM-1400Plus Transmission Electron Microscope (TEM) 120 kV: magnification from x50, resolution 0,2 nm-lanes. With: Cryo Transfer Tomography Holder Fischione (Model 2550), Scanning TEM module (BF/DF detectors), EDS detector 65 mm², software Aztec, CMOS GATAN OneView camera (16 MPx), electronic tomography (GATAN Latitude Image analysis).
- JEOL JEM-1011 Transmission Electron Microscope (TEM) 100 kV: magnification from x50, resolution 0,2 nm-lanes. With: CMOS GATAN Rio 9 camera (9 MPx).
- Zeiss ULTRA Plus Field Emission Scanning Electron Microscope (SEM) With: SDD (EDS) detector and SAMx softwares (for elementary analysis, quantification and spectral cartography), cryo preparation and cryo transfer GATAN ALTO 2500.
- Equipment for the preparation of samples: LEICA Ultracut UCT et UC7 ultramicrotomes, LEICA EM UC7/FC7 Cryo-Ultramicrotome, LEICA ICE high pressure freezer (HPF), LEICA EM AFS2 Freeze Substitution Processor, THERMO Vitrobot semi-automated vitrification (cryo-plunge), JEOL JUC-5000 Sputtering apparatus, GATAN Precision Etching Coating System (PECS), SPI VacuPrep II evaporator, CORDOUAN Elmo glow discharge.

Photonic microscopy

- LEICA SP8 gSTED Confocal microscope with high resolution scanning: lenses (10x, 20x, 40x, 63x, 100x), lasers sources (WLL (8 tunable wavelengths between 470 and 670 nm), UV (405nm), Ar (458, 476, 488, 496, 514nm)), 4 detectors (2 PMT, 2 HyD), FRAP module, FLIM LEIC FALCON module, gated-STED (2D) super-resolution system (660nm laser depletion), motorized stage XYZ, Thermostatic chamber/CO₂ regulation (for living cells), Image analysis station LEICA LAS-X v2.0, deconvolution software SVI Huygens.

IBiSA • Infrastructures
en Biologie
Santé et
Agronomie

Core Facility for

Biological
Systems
Analyses



PST-ASB

Metabolomics and Chemicals Analyses Department



SCIENTIFIC DIRECTOR

Patrick Emond

CO-DIRECTOR

Lydie Nadal-Desbarats

The metabolomics and chemicals analyses core facility is a technical platform bringing together equipment and skills in Nuclear magnetic resonance spectroscopy (NMR) and mass spectrometry (MS). It is available to users from the University of Tours and from external organizations (public and private sectors).

EQUIPMENT

- NMR Spectrometer 600 MHz Bruker – cryoprobe and samplet jet
- NMR Spectrometer 300 MHz Bruker
- UHPLC-MS TQ – Xevo TQ-XS
- UHPLC-HRMS – Thermo Q-Exactive

ANALYSES

- Chemical analysis of synthetic products or natural extracts
- RMN 1D (1H, 13C) – 2D (homo – heteronuclear)
- HRMS et HRMS2
- Quality Control: Identification, quantification of secondary compounds during batches production.
- Biological quantifications: quantitative analyses (biological fluids, cell and tissue extracts)
- Drug assessment (stability, pharmacokinetic)
- Biochemistry quantification: energy metabolism, tryptophane metabolism, organic acids, acylcarnitines, steroids, neurotransmitters, TMA, TMAO.
- Metabolomics and lipidomics analyses for clinical, preclinical and basic research ((biological fluids, cell and tissue extracts): targeted and non-targeted approaches

<https://metabolomique.med.univ-tours.fr/>

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BIOPHARMACEUTICALS
Innovation Dynamics in Health
IN REGION CENTRE-VAL DE LOIRE



SCIENTIFIC DIRECTOR
Patrick Vourc'h
CO-DIRECTOR
Jean-Michel Drezen



Inserm

La science pour la santé
From science to health

The Genomics department brings together equipment and skills in genetics, genomics, and transcriptomics. It is available to users from the University of Tours and from external organizations (public and private sectors). It is located in two sites, Grandmont and Tonnellé, with complementary equipment. Grandmont site equipment is mainly dedicated to evolutionary biology research and ecophysiology. Tonnellé site equipment is mainly intended to support research and activity transfer of biomedical field.

EQUIPMENT

Tonnellé site:

- Miseq and NextSeq 550 sequencing platform (Illumina), University and CHRU of Tours
- Microarray scanner (Agilent)
- Real time PCR CFX384 and CFX96 (Biorad)
- Automated pipetting platform (Qiagen) – CHRU Tours
- 3500xl Genetic Analyzer (Applied Biosystem), 16-capillary array – CHRU Tours
- Automated nucleic acid extraction platform (Qiagen) – CHRU Tours

Grandmont site:

- QuantStudio 6 Flex (Applied Biosystems)
- epMotion 5070 (Eppendorf)
- Mastercycler PRO VAPO. PROTEC (Eppendorf)
- STORM 840 (Amersham Bioscience)
- QIAxcel Advanced (QIAGEN)
- Thermomixer C (Eppendorf)

ANALYSES

- Sanger Sequencing
- Automated extraction of nucleic acid (DNA and RNA) and qualification
- Automated plates preparation with pipetting robot
- Polymorphism analysis (SNP, microsatellites genotyping) with High Resolution Melting (HRM) method
- Quantitative PCR and RT-PCR (96 and 384 well) (Technology using fluorescent markers or fluorescent probes).
- Analysis of amplicon with microfluidic platform
- Analysis of DNA fragments size with Genescan
- DNA sequencing in capillary sequencer
- CGH array and microarray
- Next-generation DNA sequencing (medium and high throughput)



SCIENTIFIC DIRECTOR
Laurent Galineau
TECHNICAL DIRECTOR
Sophie Serriere

The In Vivo Preclinical Imaging department is a multimodal technical platform dedicated to non-invasive imaging of rodents and non-human primates. Modalities include Positron Emission Tomography (PET) and Computed Tomography (CT) Imaging as well as UltraSound (US) Imaging. The facility is open to internal and external research teams including private partners.

EQUIPMENT

- PET/CT Imaging:
 - IRIS PET/CT (Inviscan) dedicated to rodents.
 - IRIS XL PET/CT (Inviscan) dedicated to non-human primates
- Twilite blood sampling system (SWISSTRACE) with PMOD software
- Stereotactic frames
- US Imaging:
 - Vevo 2100 Ultrasound imaging platform (Visualsonics) with MS250 (18MHz) and MS550 (40MHz) probes.
 - Vevo LAZR-X Ultrasound imaging platform (Visualsonics) with photoacoustic module (680-900 nm and 1200-2000 nm) and, UHF29X (20 MHz) and UHF57X (40 MHz) probes.

ANALYSES

The department offers tailored services from design to data analysis. The equipment enables anatomical imaging as well as functional imaging of a variety of processes (vascularization, blood flow, hypoxia, energy metabolism, inflammation, protein density, tumor proliferation...) relevant in neurosciences, oncology, cardiology...



IRIS PET-CT imaging system (INVISCAN) dedicated to rodents (mice, rats)



SCIENTIFIC DIRECTOR
Christophe Paget
TECHNICAL DIRECTOR
Roxane Lemoine

The Cytometry and Single Cell Immunobiology department belongs to the Core Facility for Biological Systems Analyses (PST-ASB, University of Tours). Our facility is specialized in flow cytometry / cell sorting as well as new omics technologies (proteomic and transcriptomic) at the single-cell level. These technologies enable to tackle fundamental, applied and clinical research problems in the fields of immunology, oncology, inflammation, infectious diseases and/or neurosciences.

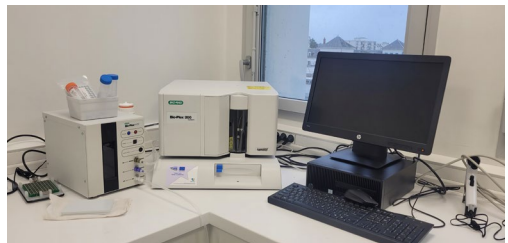
This department is open to the regional, national and international scientific community, including public laboratories (Inserm, INRAE, CNRS, Universities...) and private companies.

EQUIPMENT AND ANALYSES

- 1 flow cytometer / cell sorter FACS Melody (BD Biosciences) with 3 lasers (blue, red, violet), 9 colors, 4-way cell sorting, cloning module, under biosafety cabinet. Many applications: phenotype, cell cycle, viability, proliferation, apoptosis, cell functions and cell enrichment to single-cell transcriptome and proteome analysis.
- 1 Bioplex 200 Biorad (Luminex technology) for multiplex proteomic and genomic analysis. Proteomic -> detection and quantification of up 100 analytes (cytokines, chemokines, metabolites...) from 15µl of sample (serum, supernatants, biologic fluids...). Genomic -> quantification of up to 80 genes directly from samples (cells, tissues, virus, bacteria, blood, FFPE...) without need for RNA extraction, reverse transcription and PCR amplification.
- 1 Chromium Controller (10X genomics) to perform single-cell partitioning and barcoding to uncover molecular insights and resolve highly complex biological systems, including gene expression (RNA-Seq), cell surface proteins (CITE-Seq), immune clonotype (TCR/BCR-Seq), antigen specificity, CRISPR perturbations and chromatin accessibility (ATAC-Seq).



Cell sorter BD Melody



Bioplex 200 Biorad



PST-A

Scientific and Technical
Animal Platform

DIRECTOR
Laurent Vecellio
DEPUTY DIRECTOR
Jérôme Montharu



The Scientific and Technic Animal Platform is a department dedicated to scientific research using animal models. It offers animal facilities for researchers to conduct their projects using different animals' species. The PST-A can conduct preclinical studies in Biological Level Safety 1 and 2 for industrial and academic partners.

EQUIPMENT

- Animal housing and experiments
- Surgical equipment
- Mechanical ventilator
- Anesthetic gas
- Monitoring devices
- Images facilities in collaboration with University of Tours platforms (gamma camera, PET Scan, Echography, Lumina)

SCIENTIFIC EXPERTISE

- Animal Project design and management
- Animal welfare
- Ex vivo model
- Evaluation of drug efficacy and safety
- PK, PD
- Evaluation of medical devices
- Training course for rodents and rabbits in accordance with the legislation for the use of animals in research

TECHNICAL EXPERTISE

- Clinical examinations on vigilant animals
- Clinical examinations on anesthetized animals
- Administration of substances to vigilant animals
- Administration of substances to anesthetized animals
- Sampling of substances from vigilant animals
- Sampling of substances from anesthetized animals
- Surgical interventions

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BIOPHARMACEUTICALS
Innovation Dynamics in Health
IN REGION CENTRE-VAL DE LOIRE

SALSA

Synthesis and Analysis for the Health, Agronomy and well-being

DIRECTOR

David Da Silva

CO-DIRECTOR

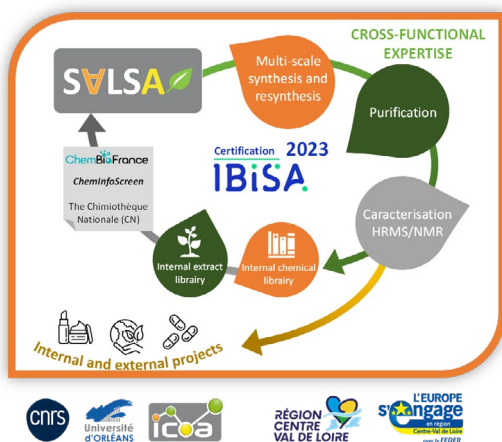
Cyril Colas

The SALSA platform is the reunification of three existing ICOA platforms:

- Synthesis platform + NMR service
- Analytical Techniques Platform (PTA)
- HRMS Platform

Thus, the SALSA facility responds specifically, on a single site, to the needs of internal and external users, both academic and industrial.

It offers numerous possibilities for quality services using a variety of resources, cutting-edge technologies and original methods of organic synthesis and analytical chemistry through capacities in separative techniques, spectroscopy and mass spectrometry, in the field of life science and more particularly in health, agronomy and well-being.



TECHNICAL DIRECTOR
Sophie Front
SCIENTIFIC DIRECTOR
Frédéric Buron

ICOA's synthesis platform is a common service to all the Institute's teams and aims to provide practical support to research teams. It covers the field of glycochemistry as well as the chemistry of peptides, heterocycles, nucleosides or imaging agents. Teams can request the re-synthesis of a starting product in large quantities or the synthesis of reaction intermediates to assist PhD or post-doctoral students. They may also request the repetition of syntheses to verify conditions and optimise them, or the re-synthesis of a final product to complete biological tests or other products to exemplify a patent. The synthesis platform can work with a team to help mature a project. It can also propose to move towards «Scale-up». The synthesis platform can also answer to requests for external services. NMR service can be requested to characterize small organic compound.

EQUIPMENT AND TECHNOLOGY

- Rotary Evaporator R220 SE – Buchi
- CombiFlash Reveleris System
- Reactor Unistat tango – Optimus
- Ozonator
- H-Cube ThalesNano
- Freeze dryer
- Photoredox
- Chiller and Rotary Evaporator
- Nuclear Magnetic Resonance – Bruker 400 MHz
- Nuclear Magnetic Resonance – Bruker 250 MHz

MISSIONS

- Synthesis of non-commercial starting products (scale-up to 50-100 g, depending on the number of steps)
- Repetition of syntheses to check conditions, optimisation
- Resynthesis and purification of a product of interest for biological testing
- Synthesis of new examples of molecules by known routes to strengthen a patent during the priority year
- Providing reference samples as required to the Institute's analytical department



Nuclear Magnetic Resonance – Bruker 400 MHz



Rotary Evaporator R220 SE - Buchi

SCIENTIFIC DIRECTOR
Cyril Colas

The main responsibility of ICOA's Analytical Techniques Platform, is to offer an analytical support to the Institute's organic synthesis teams. Additionally, it is open to academic and industrial partners, proposing external analytical services. Furthermore, it allows the realization of chromatographic separations coupled to various detection techniques: LC-UV, LC-UV-ELSD, LC-UV-MS, SFC-UV or GC-FID in order to separate synthesized compounds, to detect possible impurities and to identify them by mass spectrometry. This requires the optimization of the separation and the identification conditions applied to a diverse variety of molecules, including those synthesized in the laboratory such as heterocycles, sugars or nucleosides. A preparative liquid chromatography system with UV and ELSD detections allows the isolation and the purification of various products (few mg) in which later, can be investigated for possible biological activities. The platform is also equipped with optical spectroscopy instruments: IR, UV, fluorometer and polarimeter.

EQUIPMENT

Chromatography service

- UHPLC-MS/MS – Thermo Scientific U3000 + TSQ Endura (triple quadrupole)
- UHPLC-MS – Thermo Scientific U3000 + ISQ (simple quadrupole)
- Hybride UHPLC-SFC UV/ELSD + fraction collector – Shimadzu
- HPLC-UV/ELSD – Agilent 1100
- Preparative HPLC – Interchim PuriFlash 4250
- HPTLC – CAMAG
- GC-FID – Shimadzu 2025

Spectroscopy Service

- UV-Vis Spectrometer – Shimadzu UV-1800
- Spectrofluorimeter – Horiba FluoroMax+
- IRTF Spectrometer – Thermo Scientific Nicolet iS10
- Polarimeter – Jasco P2000 Jasco

Interactions studies

- MicroScale Thermophoresis – NanoTemper Monolith NT.115 Pico



UHPLC-MS-MS – Thermo Scientific U3000 + TSQ Endura



Hybride UHPLC-SFC UV/ELSD + fraction collector – Shimadzu

TECHNICAL DIRECTOR

Cyril Colas

SCIENTIFIC DIRECTOR

David Da Silva

The HRMS platform is the result of the Research Federation «Physics and Chemistry of Life» (PCV) created in 2004 between ICOA and CBM laboratories.

The HRMS platform offers services ranging from therapeutic, diagnostic innovation and molecular diversity to bioactive and cosmetic applications using HRMS.

- A wide range of services on a single site, including drug discovery studies, pharmacokinetics (ADME-Tox), characterization of synthetic non-invasive biological imaging agents, and biotherapeutics (mAb, ADC).
- Plant extraction to in-tubo activity screening (96-well plates with UV-visible or fluorescence reading), via characterization of the primary metabolites (sugars, amino acids) and specialized metabolites (phenolic acids, flavonoids, terpenes, alkaloids) of these complex mixtures using high-resolution mass spectrometry with diverse fragmentation modes (CID, UVPD). In order to explore the molecular diversity of samples, mass spectrometers can be hyphenated to various separative techniques (UHPLC, SFC, GC, ZipChip, CE, TLC) and ionization sources: ESI, APCI, SICRIT (plasma ionization) and AP-MALDI.

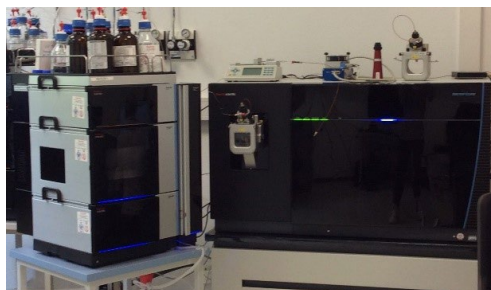
EQUIPMENT

Mass Spectrometry

- Orbitrap Ascend Tribrid (Thermo Scientific) HRMS mass spectrometer
- UHR Q-TOF maXis (Bruker) HRMS mass spectrometer
- MALDI-TOF Autoflex Speed (Bruker) mass spectrometer:

Sample preparation

- Liquid handler – Vantage (Hamilton)
- Plate reader – ClarioStar Plus (BMG Labtech)



Orbitrap Ascend Tribrid (Thermo Scientific) HRMS mass spectrometer



Liquid handler – Vantage (Hamilton)



PIXANIM

Phenotyping by in/ex vivo
Imaging from animal to
molecule

DIRECTOR
Xavier Druart
DEPUTY DIRECTOR
Valérie Labas



Summary of the research centre: PIXANIM is an experimental and analytical platform, serving a large community of academic and private actors, to support agronomic and medical research, training and innovation. It allows the functional exploration of the different biological systems of an animal, from the entire animal to the biomolecule, including all intermediate scales.

EQUIPMENT

- MRI 3 Teslas scanner from Siemens (Magnetom Verio®)
- CT-Scan from Siemens (Somatom® Definition AS 128)
- Confocal laser endomicroscopy Cellvizio Dual Band® Mauna Kea Technologies
- Kratoscope Kaer Labs®
- Ultrasound Ultrasonix SonixTouch®
- MALDI-TOF RapifleX TissueTyper Mass spectrometer & Biotyper Bruker Daltonics
- Orbitrap Ascend Tribrid with FAIMS Mass spectrometer coupled to the Vanquish Neo UHPLC system
- LTQ Velos Pro Orbitrap Mass spectrometer coupled to the nanoUPLC Ultimate 3000 RSLC system (ThermoFisher)
- Liquid chromatographer Evosep One Proteogene
- HPLC Ultimate 3000 system ThermoFisher
- ImagePrep sprayer Bruker Daltonics for mass spectrometry imaging
- M5 sprayer HTX Technologies for mass spectrometry imaging
- Isoelectric focusing systems : Multiphor II (Amersham Biosciences) and Protean IEF cell (Biorad)
- Electrophoresis systems : SE 660 (Amersham Biosciences) and Mini-PROTEAN (Biorad)

RESEARCH TOPICS

PIXANIM supports both agronomic research into efficient production systems that respect the welfare and health of animals and the environment, and medical research based on animal models for preclinical research, biomarker research and the development of new therapies. PIXANIM supports fundamental and/or applied research as part of systemic studies ranging from the scale of the whole animal to that of the molecule. In addition to its analysis and innovation activities, PIXANIM offers initial and continuing training for researchers and doctors in the fields of surgery, imaging and proteomics.



https://www6.val-de-loire.inrae.fr/pixanim_eng/

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The Plate-forme d'Infectiologie Expérimentale (PFIE) is a benchmark not only in France but also at European level for the management of infections in BSL1, BSL2 and BSL3 (Biosafety level / containment) on most livestock, laboratory animals and wildlife. The PFIE is one of the largest confined experimental units at INRAE (Institut national de recherche pour l'agriculture, l'alimentation et l'environnement) with around 50 employees (including a Veterinary Doctor dedicated to the platform). PFIE is part of the Animal Health Department and is located at the INRAE Val de Loire Research Center in Nouzilly, near to Tours (Indre et Loire, 37). PFIE is part of the National Infrastructure « EMERGIN » (<https://www.emergin.fr/>).

The PFIE is known as a strategic platform and has been awarded the 'Collective Scientific Infrastructure (CSI)' label by INRAE. The entire platform is ISO9001 certified. PFIE is also part of the National INRAE certification ISO14001 (PFIE is not yet certified but involved in the process of certification). PFIE is a member of the Carnot Institute «France Futur Elevage (F2E)». It provides the scientific community with decades of unique experience in the field of infectious animal diseases (mainly zoonotic) and in the development of new infectious animal and human models, as well as biomedical approaches. Together with the Infectiology and Public Health Joint Research Unit (UMR ISP), the PFIE forms the Tours Animal Health Unit (PSAT). This joint research unit has expertise in a range of pathogens and animal models, which complements our own. The PFIE has an Animal Welfare Structure (SBEA), headed by the PFIE's designated veterinarian and health officer. The PFIE reports to the Val de Loire Animal Experimentation Ethics Committee (CEEA) (no. 19).

MISSIONS

- Carrying out experimental protocols in BSL, BSL2 and BSL3 facilities, in isolators, in conventional facilities. The purpose of containment is both to protect animals from external contamination (intercurrent diseases) and to protect humans and the environment from contamination by the pathogens under study. The PFIE hosts imaging equipment, which enables in vivo exploration of the animal studied, combined with an anaesthesia and surgery platform (CIMAC) and a veterinary haematological and biochemical analysis platform.
- Producing (breeding) and/or supplying animals and animal by-products (e.g. eggs, sera): of defined genetic status (breeds, lines); of known health status: SOPF (Specific and Opportunistic Pathogen Free), SPF (Specific Pathogen Free), SSC (Controlled Health Status), axenic or gnotoxenic animals; of appropriate physiological status (e.g. pregnant animals).

EQUIPMENT

The PFIE's infrastructure includes

- Facilities, most of which are in BSL2 and BSL3 containment
- Specific technical installations
- Equipment.

All these buildings have the technical installations and equipment required for their operation, depending on their containment level:

- Air treatment systems
- Systems for thermal and/or chemical treatment of liquid effluents;
- Autoclaves
- Cold rooms, refrigerated airlocks, freezers (-20°C and -80°C)
- Animal housing equipment, adapted to the different animal species
- Surgery and autopsy rooms
- Laboratories L2 and L3...

DIRECTOR
Emmanuelle Helloin

The CIRM-BP is a microbial resource centre (mBRC) dedicated to animal and human pathogenic bacteria. Set up in 2006, it is based at the INRAE Val de Loire centre within the Animal Health Pole of Tours (Pôle Santé Animal de Tours, PSAT) constituted by the Infectiology and Public Health (ISP) joint research unit and the neighboring Plate-Forme d'Infectiologie Expérimentale (PFIE), France's largest experimental infectiology facility. It therefore benefits from a scientific environment with a wealth of expertise in the fields of pathogen knowledge, infection mechanisms and their control.

The activity of the mBRC is dedicated to the characterization, conservation and distribution of risk class 2 and 3 pathogenic bacterial strains and of their genomic DNA.

Due to its expertise and ISO 9001 certification, CIRM-BP is a partner of choice for the management of biological resources used or collected in scientific projects, guaranteeing their quality, their sustainability and, if desired, their visibility and their accessibility. The mBRC also offers the identification and characterization of strains of pathogenic bacteria, the study of their biodiversity and the characterization of the antibacterial potential of molecules or extracts of interest.

PLATFORM SERVICE

- Access to microbiological resources perfectly characterized taxonomically and compliant with ABS
- Isolation of bacterial strains,
- Identification and phenotypic characterization of strains of class 2 and class 3 pathogenic bacteria,
- Bacterial identification by MALDI-TOF mass spectrometry,
- Molecular identification and typing of bacterial strains,
- Preparation of genomic DNA,
- Determination of the virulence gene repertoire of the strains,
- Determination of the susceptibility and resistance profile of bacteria strains to antimicrobials (inhibition diameters, MIC),
- Conservation of strains for the exclusive benefit of depositors (paid service),
- Characterization of the antibacterial potential of molecules or extracts of interest on panels of pathogenic bacteria.



UMR1282 ISP DIRECTOR
Nathalie Winter
HEAD OF THE IMAGING & INFECTIOLOGY TEAM
Julien Pichon

The “Imaging & Infectiology” (IMI) team is an imaging facility specializing in the exploration of infectious processes. The team has multidisciplinary scientific expertise, focusing in pathogens (parasite, bacteria or virus) monitoring in their environment, characterizing infectious pathophysiology and studying host-pathogen interactions. It benefits from the combination of a range of complementary methodological approaches, enabling multi-scale exploration from the whole animal down to the single cell on a wide panel of species (poultry, rodents and livestock). IMI provides infrastructures for the study of living organisms in level 2 confined laboratories (BSL2). Located on the Nouzilly site of INRAE, the IMI team is open to external requests on a wide range of biological issues.

EQUIPMENT AND TECHNOLOGIES

IN & EX VIVO IMAGING

- Fluorescence and Luminescence IVIS Spectrum imager from PerkinElmer (BSL2)

HISTOLOGY

- Leica TP1020 and Medite TES99 automatic benchtop for paraffin inclusion,
- Leica CM3050S cryomicrotomes and Leica RM2235 and Histocore autocut R microtomes,
- Leica ST5020 automatic slide stainer

MICROSCOPY

- Nikon Eclipse 80i fluorescent/brightfield microscope : objectives (2x, 10x, 20x, 40x, 60x), CMOS camera
- Zeiss AxioVert200M widefield fluorescent microscope : objectives (5x, 10x, 20x, 40x, 63x), LED excitation, 50fps 7 megapixel camera, motorized stage XYZ, Thermostatic chamber/CO2 regulation (BSL2)
- Leica SP8 spectral confocal microscope with high resolution scanning: objectives (20x, 40x, 63x, 100x), lasers sources (UV (405nm), Ar (458, 476, 488, 496, 514nm)) 561 and 633nm, 4 detectors (2 PMT, 1 HyD), motorized stage XYZ, Thermostatic chamber/CO2 regulation, Image analysis station LAS-X (BSL2)

CYTOMETRY & CELL SORTING

- BD Fortessa X20 (Becton Dickinson) analyzer with 5 lasers, 20 parameters analyzed simultaneously (BSL2)
- MoFlo Astrios EQ high speed cell sorter for cellular sorting, with 4 lasers, 18 parameters analyzed simultaneously, 6 subpopulation sorted simultaneously in tubes, multi-well plates, for cloning (BSL2)

OTHERS APPROACHES

- Chromium Controller for single cell analysis from 10X Genomics (BSL2)
- Hypoxia chamber for cell culture and infections - Hypoxylab from Oxford Optronix (BSL2)

DIRECTOR
Hugo Chardon



Unique in Europe, the Bio3 Institute is a biotechnology training center and a shared technical platform designed as a bioproduction mini factory. Born from a partnership between the IMT Group and the University of Tours, funded by the Investments for the Future and the regional council, the 2200m² facility is furnished with industrial and semi-industrial equipment distributed on three levels available to students, academics and industrialists. The Maupas Foundation also supports the platform through contributions from its industrial founders (GREPIC, etc.). The Bio3, whose scope covers Biotechnologies, Biopharmaceuticals and Bioactives cosmetics, is an asset for pharmaceutical and cosmetic industries as well as academics.

TRAINING

Each year, more than 350 trainees benefit from the Bio3 Institute's technical facilities for initial training (from baccalaureate to master/engineer's degree) and further education. The facility also hosts a summer school for foreign students. Digital innovation is at the heart of Bio3's activities, with the creation of mixed reality teaching scenarios and the development of e-learning modules dedicated to biopharmaceuticals (therapeutic antibodies, other recombinant proteins, vaccines, plasma-derived drugs, MTI, including regulatory affairs). As an educational mini-factory, Bio3 Institute enables bioproduction operators, technicians and engineers to be trained under real-life conditions. "Learning by doing" is a real strength of our educational programs, ensuring continuity between research, scale-up and industrialization.

TECHNICAL PLATFORM

The Bio3 Institute is also a center of resources and expertise aiming to support and host R&D projects for academics and companies. As an example, the Climbin consortium (coordinated by the University of Tours and grouping Servier, Indatech, Ondalys, and the University of Nancy) is currently using the facility to develop an on-line analytical process control solution that addresses the need to optimise and automate cell culture systems. The deeptech company McSAF, specialised in bio-organic and bioconjugate chemistry, is now hosted in the facility. This platform is therefore in line with the strategy of the «Plan Innovation Santé France 2030», which aims to accelerate the development of the biomanufacturing sector.



<https://www.groupe-imt.com/en/place/bio3-institute-tours/>

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EQUIPMENT

Constructed as a mini educational factory, with a flow from the reception of raw materials to the release of the finished product, including the analytical control areas associated with Quality Control, Bio3 provides training in a wide range of skills adapted to biotherapies production. The facility complies with regulatory flows (materials, products, and personnel) with several pilot laboratories:

- Cell culture zone (UpStream Processes): PSM, Incubator, bioreactors from 2L to 50L reusable or single-use technology.
- Product purification zone (DownStream Processes): frontal filtration, depth filtration, tangential filtration, centrifugation, preparative chromatography.
- Fill & finish zone: pharmaceutical shaping, filling and freeze-drying, sterilization, isolator
- Quality control (QC): several areas with all the necessary equipment are reserved for analysis. They can therefore be used for both physico-chemical and microbiological controls, from incoming raw material to finish product and environmental control.

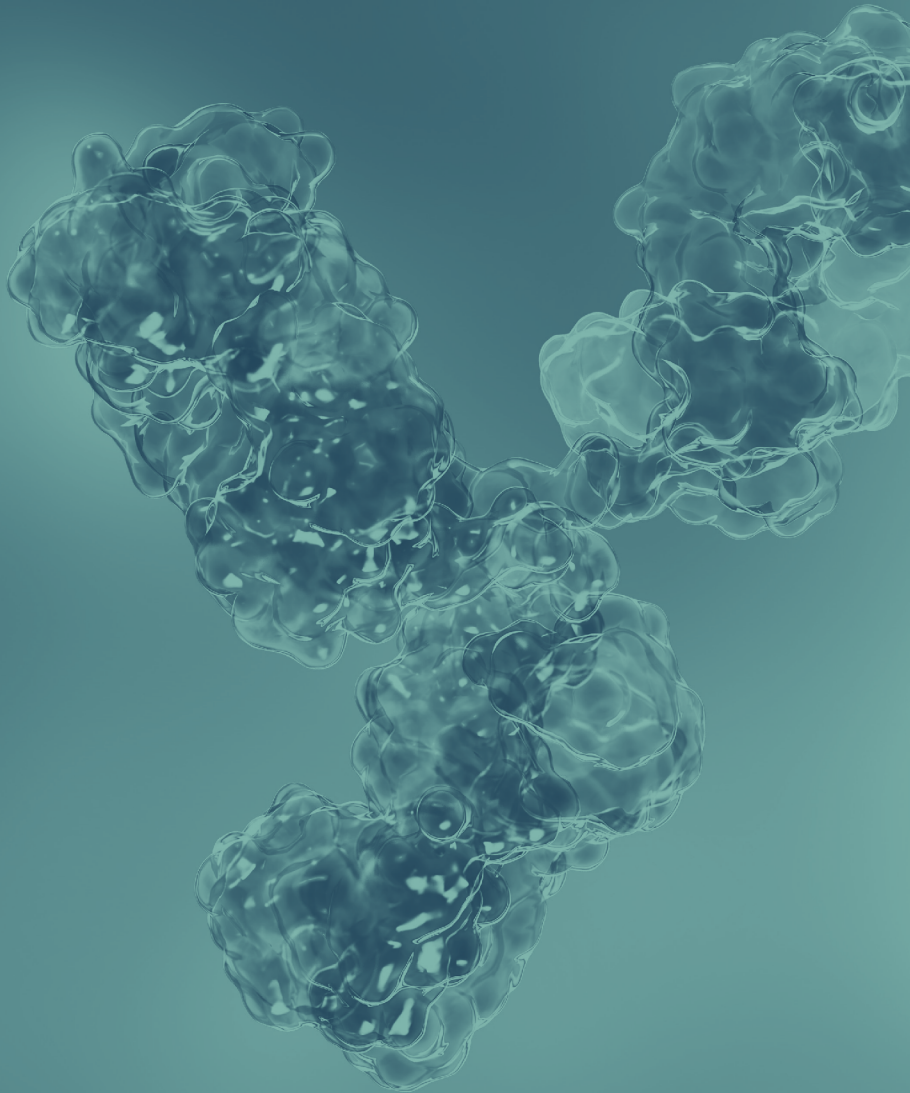
These laboratories are supplied by a reception area, a warehouse (raw materials, consumables, and packaging items), a weighing center and a cloakroom (staff). One floor is dedicated to technical training, with an air handling unit (AHU) and water treatment unit.

The characteristics of the building and our «GMP like» status mean that we can provide training as close to reality as possible, while retaining the flexibility required for our training, testing and development activities.

Bio3's digital twin also opens up new perspectives. It enables us to anticipate tomorrow's reality for research and for biotech operators: flow optimization, interactive processes, virtual and augmented reality simulation, etc.

PARTNERS







4 APRIL 2024

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