

Liberté Égalité Fraternité





UMR0203 Functional Biology, Insects and Interactions (BF2i)

Mission and objectives

The BF2i laboratory is a joint research unit (UMR) involving INRAE (Plant Health and Environment Division, SPE) and INSA Lyon (Biosciences Department and Core foundation engineering program, FIMI). The unit's scientific objective is to understand the functions governing the interaction between certain groups of agronomically important insects (weevils, aphids), and their direct biological partners (host plants, symbiotic microorganisms).

An integrative, multi-disciplinary approach is used combining expertise in insect physiology and development, cell and molecular biology, functional genomics and epigenomics, global metabolic analyses, reconstruction and modeling of genetic and metabolic networks, and insect engineering.



The main objectives are to:

- use cutting-edge technologies adapted to the insect models studied in the laboratory to understand and elucidate the host-symbiont molecular dialogue;
- identify the key mechanisms involved in symbiont control and insect host development;
- define and develop new concepts and develop new tools to identify new effectors and targets for the control of insect crop pests.

The unit's work mainly focuses on:

- understanding the cellular and molecular dialogue between crop pest insects and their microbial symbionts during insect development and under stress conditions;
- reconstructing host-symbiont interaction networks to identify the metabolites/molecules/pathways whose disruption would provide sustainable methods for controlling insect pests;
- developing insect engineering-based methods that can provide an integrated approach to crop protection.

Centre Lyon-Grenoble Auvergne-Rhône-Alpes



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https://bf2i.insa-lyon.fr/en/

Direction

Federica Calevro, Director Pedro Da Silva, Deputy Director

Research topics

- Agronomy and environmental science
- Insect physiology
- Functional genomics of insectbacteria symbiosis
- Development of sustainable crop pest control methods

Key figures

• 11 principal investigators (researchers and

- (associate)-professors)
- 12 engineers and technicians
 10 PbD and next does
- 10 PhD and post-docs
- 3 research themes
- 3 experimental facilities

Keywords

- Insect
- Symbiosis
- Metabolism
- Innate immunity
- Development
 (Eni)Companyia
- (Epi)Genomics





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Topic-based groups

 <u>Symbiosis and Immune Signalling</u> (<u>SymSIm</u>)

- Trophic symbioses (SymT)
- Insect Engineering (InEn)





Research

The unit's research focuses on three themes:

Symbiosis and Immune Signalling (SymSIm) investigates the interactions between intracellular symbiotic bacteria and grain weevils belonging to the Sitophilus genus (Curculionidae). SymSIm uses an integrative, multi-disciplinary approach combining (epi)genomic analyses with molecular and cellular studies of host-symbiont interactions.

Trophic symbioses (SymT) investigates the interactions between hemipteran insects (mainly aphids) and their obligate and facultative microbial symbionts. SymT combines insect physiology and cell biology approaches with high-throughput studies (transcriptomics, metabolomics) in order to reconstruct the genetic, metabolic and developmental networks of insects.

Insect Engineering (InEn) formalises the operational research activities of BF2i. To date, crop protection has been based almost exclusively on chemical treatments. Discovering new solutions for agriculture has become essential to respond to societal, health and environmental concerns. InEn develops new entomotoxic substances and innovative strategies for the development of environmentally-friendly pest management in agrosystems.

Collaboration and expertise

The unit's main local academic partners are INSA Lyon laboratories (AMPERE, CREATIS, IMP, INL, LAMCOS, MAP), the UCBL laboratories (LBBE, LEM), the laboratories and research platforms of the BIOEENVIS research federation, and the IGFL unit. BF2i is a member of the technical and strategic committees of the Equipex+ InfectioTron and is associated with the E2M2 doctoral school.

Its national partnerships include research units of INRAE SPE Division (CBGP, DGIMI and PHIM in Montpellier, IGEPP in Rennes, ISA Institute in Sophia Antipolis). BF2i also jointly runs the national research network on aphids and associated organisms (BAPOA). Strong partnerships have been established with the University of Albi, the Centre for Molecular Biophysics in Orleans and the SOLEIL Synchrotron at Gif-sur-Yvette. Operational research is carried out in partnership with the companies Roquette, Adkalis and Genective and in collaboration with INSA Lyon Research & Development, Research Valorisation and Continuing Education subsidiary INSAVALOR, the INRAE partnership support service and the Lyon Saint-Etienne Technology Transfer Accelerator Company Pulsalys.

BF2i's international partnerships in Europe include the Max Planck Institute for Chemical Ecology in Jena, the universities of Bonn, Valencia and Oxford, Université Catholique de Louvain and KU Leuven. Outside Europe its main partners are the universities of Sao Paulo and Sao Jose do Rio Preto, and the University of Miami. BF2i is part of the PISI-Net (Plant-Insect-Symbiont-Interaction Network), an international research network (2RI) between France and Japan, supported by INRAE.

Scientific facilities

• A3M facility (Analyse Métabolisme Modélisation Moléculaire): open to collaborators, to the labs of BIOEENVIS research federation and as a service-provider, A3M focuses on the identification and quantification of amino acids and other metabolites from biological samples.

• Phytotron: a facility for the production of plants under controlled temperature and hygrometry conditions, open to collaborators, to the BIOEENVIS research federation and as a service-provider.

• Symagerie: a facility open to collaborators, specialised in histological techniques (using microtome and cryostat) and sample observation (epifluorescence photon microscopes, magnifiers).

Teaching

Seven professors and associate professors of BF2i, provide over 1,500 hours training per year at INSA Lyon: at FIMI (Core foundation engineering program) and Biosciences Department. At FIMI, the courses taught include chemistry, ecological transition and P2I (multidisciplinary Pathways for Initiation in Engineering). In Biosciences, they cover Biology, Statistics, Bioinformatics and Sustainable Development, and Corporate Social Responsibility. The laboratory's researchers and lecturer-researchers also teach in the BIOINFO@LYON Master degree at Lyon 1, at ENS de Lyon and at VetAgroSup.