RÉPUBLIQUE FRANÇAISE
Liberté Égalité Fraternité

INRAE

METAPROGRAMME DIGIT-BIO

Digital biology to explore and predict biological systems

Governance

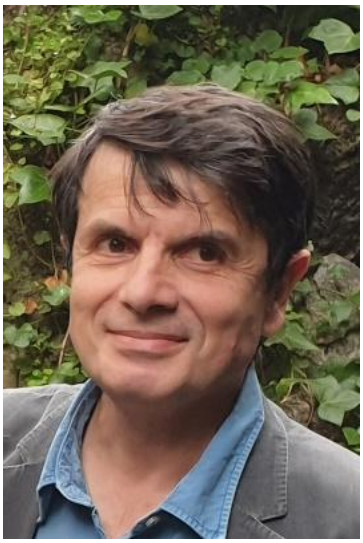
Management Team: Directors

Carole Caranta

Carole Caranta holds a DEA in Cellular Biology and Microbiology, a PhD in science, and is an accredited research supervisor (HDR, Aix-Marseille II). Employed on a research contract at INRA from 1992, she left for a year as a postdoctoral intern at INIA in Madrid in 1996 before returning to INRA as a researcher in 1997. She became a Research Director for the GAFL (Fruit and Vegetables Genetics and Breeding) Unit at INRA's PACA Centre in 2006. There, she worked on molecular interactions between plants and viruses. She served as Division Head for BAP (Plant Biology and Breeding) from 2012 to 2019, running the Carnot Institute Plant2Pro programme from 2016 to 2021.

When INRAE was created, she helped steer the strategic exploratory work that produced the INRAE 2030 strategic plan and was assigned particular responsibility for the workstream on mobilizing data sciences and digital technologies to help transition. In April 2021, she became the Institute's Deputy Director General of Science and Innovation.

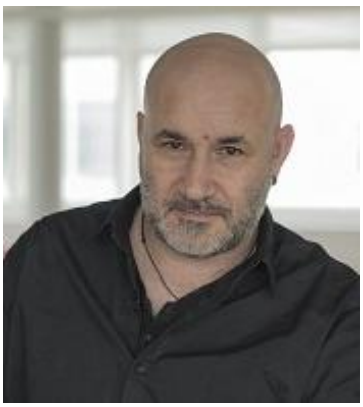
Hervé Monod



Hervé Monod Monod is a Research Director specializing in statistics and their application in genetics and agronomy. His work on design of experiments, analysis of longitudinal data, dispersion modeling, sensitivity analysis of complex models has led to participation in numerous joint projects with colleagues from other disciplines (genetics, biology, agronomy, and epidemiology in particular). As Director of INRA's MIA-Jouy Unit he worked with Sophie Schbath, then Director of the MIG Unit, to create the MaIAGE Unit in 2015 (INRAE, Jouy-en-Josas and University of Paris-Saclay). From 2016 to 2020, he was Director of the MIA (Applied Mathematics and Data) Division at INRA and of the GdR Mascot-Num network at the CNRS, working on stochastic methods of digital code analysis. Since 1 January 2020, he has been Director of the MathNum Division at INRAE, created from the merging of INRA and IRSTEA.

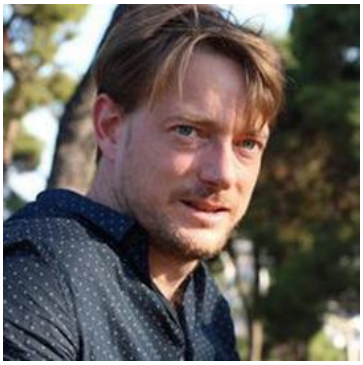
Steering Committee

Hugues Berry



Hugues Berry is a Research Director at INRIA and was appointed as the Institute's Deputy Director of Science in charge of research in digital biology and digital health in 2018. His remit is to implement INRIA's academic and industrial partnership strategy for the application of the digital sciences (applied mathematics, computer science, artificial intelligence) to biology and health, and to suggest possible new approaches to INRIA research teams working in these fields. A researcher at INRIA since 2004, first at Saclay and then Lyon, Hugues Berry previously worked as an assistant professor/lecturer in biology at the University of Cergy-Pontoise (2000 – 2004). As a computational cell biologist, his research uses mathematical and digital models to study the spatio-temporal dynamics of biochemical reactions.

Julien Chiquet



Julien Chiquet is a Research Director working in the MathNum Division at INRAE. His research is based in the Paris-Saclay Applied Mathematics and Informatics JRU at AgroParisTech and has recently been appointed to run the Unit. His specialisms are automatic machine learning and the application of computational statistics to the Life Sciences (genomics and ecology in particular). He is chief editor of Computo, a new journal from the French Statistical Society that promotes reproducibility in research, and is a part-time lecturer at the École Polytechnique.

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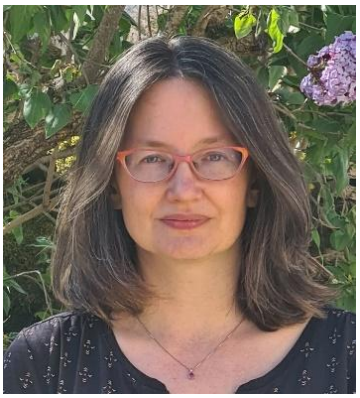
Anne Goelzer



Anne Goelzer is an autonomic control engineer employed as a research engineer in INRAE's MathNum division. She is a member of the Systems Biology team within the Applied Mathematics and Computer Science from Genomes to the Environment. In her research, she seeks to improve understanding and prediction of the behavior of living systems (such as plants or bacteria) in complex environmental conditions through the development, analysis and simulation of multiscale models (from the gene to the individual), drawing on her skills in the modeling and analysis of dynamical systems, control theory, convex optimization and biology.

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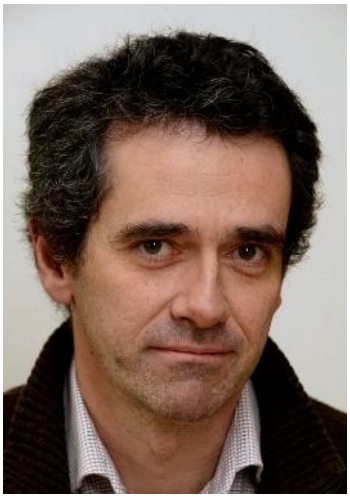
Centre : Jouy-en-Josas Antony

Philippe Andrey



A Biomathematician by training and an Associate Professor/ Lecturer until 2017 at the Université Pierre et Marie Curie, Paris, Philippe Andrey is a Research Director at INRAE in the BAP Division. He set up and heads the Modeling and Digital Imaging team at the Jean-Pierre Bourgin Institute at INRAE's Ile-de-France Versailles-Saclay Centre. His team's research seeks to decipher the complexity of developmental and morphogenetic processes in plants, using original strategies and approaches in mathematical or computer modelling and quantitative image analysis. Applications of his work relate to different systems at multiple sub-cellular to organ scales, and are developed through numerous joint projects with teams of biologists.

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Fabien Jourdan

Fabien Jourdan is a Research Director at the TOXALIM research laboratory in Toulouse, part of the ALIM-H Division. He co-directs the MeX (Metabolism and Xenobiotics) team, which comprises 20 scientists working on the metabolic impacts of food contaminants on human health. His main area of expertise is the development of digital solutions for the modeling of metabolisms at cell and tissue levels. Since 2021, he has run **MetaboHUB,** the French national infrastructure for metabolomics and fluxomics created in 2013 as part of the PIA initiative. Having previously served as President of the Francophone Network for Metabolomics and Fluxomics (RFMF), he is currently Secretary of the International Society of Metabolomics.

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Centre Occitanie-Toulouse

Christèle Robert-Granié

Christèle Robert-Granié is a Research Director in INRAE's Animal Genetics (GA) division. She works in the Genetic and Genomic Modelling (MG^2) team from the GenPhySE (Genetics, PHysiology and Livestock systems) JRU based at INRAE's Occitanie-Toulouse Centre and has been involved since 2018 in the management of the GA Division as a Deputy Head of Division. Her research seeks to perfect tools that have been developed using classic quantitative genetics methods, based on the polygenic model, and to propose statistical and genetic analytical methods to integrate data that has newly become available due to major advances in our knowledge of animal genomes. Her main research concerns the development of innovative and original genomic selection methods for the livestock species of particular interest to the department.

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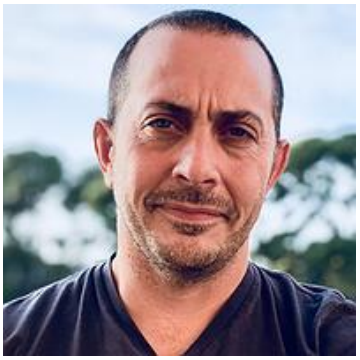
Centre Occitanie-Toulouse

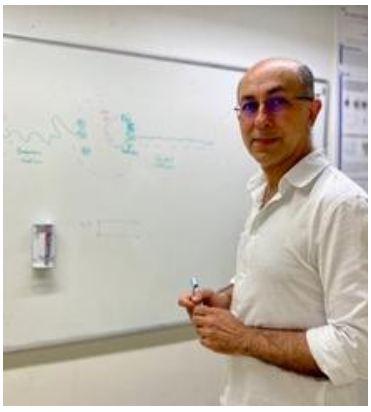
Gabriel Krouk



Gabriel Krouk is a Research Director at the Montpellier CNRS. A highly cited researcher in 2020, 2021 and 2022, his research is positioned at the interface between biology (mainly functional genomics) and modeling. Following on from his early findings on cross-talk between nutrient sensing and hormonal signaling in plants, his current work has led to recent discoveries on the combinatorial effect of Nitrogen and Phosphorus signaling on plant development and associated molecular responses. His research has also recently addressed very fundamental questions concerning the in silico simulation of biological phenomena (gene regulatory networks, phenotype prediction) and autonomous machine learning. Gabriel is co-founder and Chief Scientific Officer of BionomeeX ©, a spin-off from the CNRS and the University of Montpellier.

CNRS (UMR BPMP)

Human Rezaei



Human Rezaei is a Research Director and Head of the Unit of Virology and Molecular Immunology at INRAE, France. His research focuses on the molecular mechanisms of prion replication, particularly how biological information stored in protein conformations is perpetuated, evolves during replication, and facilitates tissue invasion.

Adopting an interdisciplinary approach, Human bridges prion biology with self-replicative complex systems, integrating methodologies from mathematics, molecular biophysics, biochemistry, and neuro-biophysics. His work extends beyond traditional prion studies to explore far-from-equilibrium systems, shedding light on the dynamics of protein macro-assemblies and their emergent properties in neurodegenerative diseases.

Since 2012, he has been recognized with multiple awards, including INRA-Laurier. Human actively mentors MSc and PhD students, fostering innovation at the intersection of protein assembly, system biology, and biophysics. His research is supported by leading scientific programs and international collaborations, reinforcing his significant contributions to understanding the complexity of protein assemblies, their structural evolution, and their implications in prion disease.

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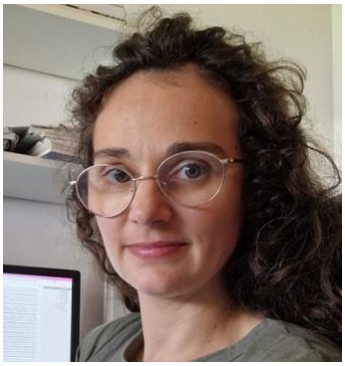
Centre Jouy en Josas

Caroline Baroukh



Caroline Baroukh holds a permanent research post in INRAE's Plant Health and Environment Division, working at the Interactions Laboratory for Plants, Microbes and the Environment (LIPME, INRAE-CNRS, Toulouse). She is an expert in the mathematical modeling of bacterial metabolisms and photosynthetic organisms. She also conducts her own experimental calibration of the mathematical models she develops. Her current research focuses on understanding the growth and virulence strategies of a variety of plant pathogens so as to develop new agricultural practices to minimize pathogen development in field crops.

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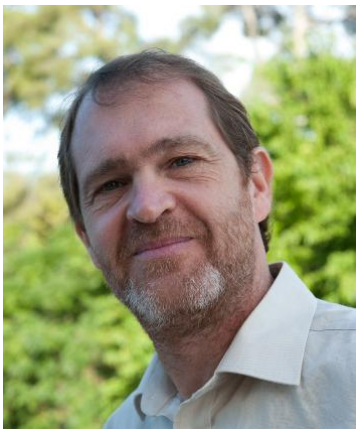
Thierry Simonneau



Thierry Simonneau is a Research Director at INRAE. For the past 35 years, he has worked in the AgroEcoSystem division on plant water use. He currently runs a team in the LEPSE (Ecophysiology of Plants under Environmental Stress Laboratory, Montpellier), working more widely on the impacts of drought and higher temperatures on the use of water and growth regulation in grapevines. He has a particular interest in exploring genetic diversity and agricultural techniques, with the aim of adapting grapevines to climate change. Quantitative dynamic modelling approaches based on biophysics have always been at the center of his work, as has the consideration of complex interactions between plants and their changing environments.

Firmly persuaded of the essential role played by mathematical and computer sciences, and now for the new generation of digital sciences, in the advances made in biological studies, he is a recurring participant in the running of INRAE programs that seek to create a dialogue between modeling and biology-agronomy.

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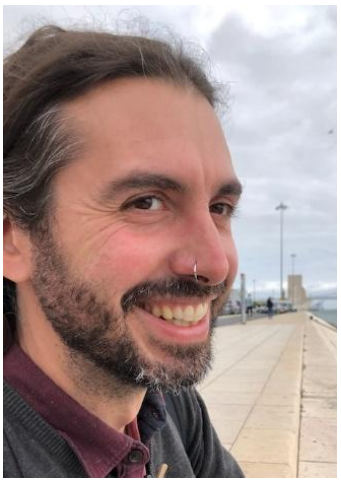
Benjamin Brachi



Benjamin Brachi is a researcher in INRAE's ECODIV division. He began his career studying the genetic bases of adaptation in the model plant Arabidopsis thaliana. In 2016, he joined the BIOGECO Laboratory, where his focus is the study of the natural variation within European White Oak populations. His current research concerns the quantification of the adaptive potential of oak populations faced with climate change, the assessment of the impact of dieback on genetic diversity, and the understanding of the role of biotic interactions in maintaining functional diversity within this dominant forest species. Benjamin uses tools such as quantitative genetics and population genomics, combining different 'omics' data, in particular genomics, transcriptomics and metabolomics, to explore the evolutionary processes that shape genetic diversity.

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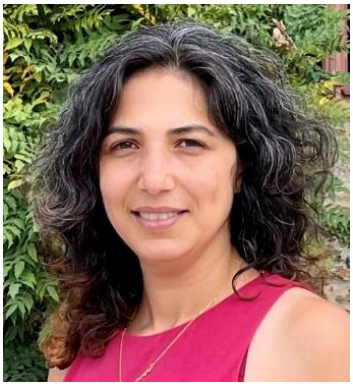
Masoomeh Taghipoor



Masoomeh Taghipoor is research engineer and deputy head of the MOSAR team at INRAE/AgroParisTech/Univ Paris-Saclay. Her research focuses on the development and application of mathematical models to extract maximum value from precision livestock farming data. She is particularly interested in understanding how animals respond to environmental challenges and how these challenges affect their behavior and welfare. Since 2022, Masoomeh has been co-leading the national WAIT4 project, which uses artificial intelligence to analyse animal activities and social interactions to identify behaviours that generate positive or negative emotions. Deeply convinced that interdisciplinary research is crucial for the future of animal science in the age of sensors and AI, she actively supervises MSc and PhD projects at the intersection of animal science, model development and data analysis.

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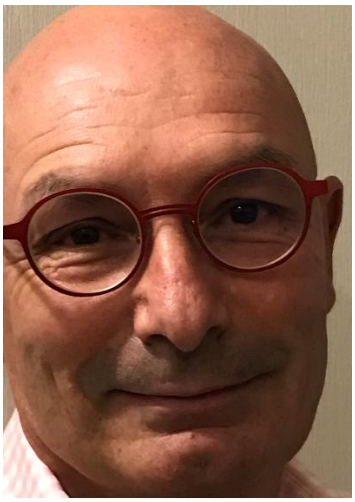
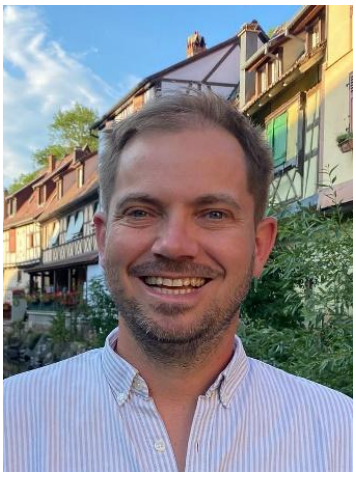
Michel Dojat



Michel Dojat is currently Research Director at Inserm and Deputy scientific director for digital biology and health at Inria. His major scientific fields are Neuroimaging, Neuroinformatics, Image and Signal analysis with a specific focus on Human Vision. He is involved in different AI in medicine projects and has developed specific tools for brain imaging analysis and ICU monitoring. He is the scientific manager, of FLI-IAM, a national project for the management of in vivo imaging data, metadata and processing pipelines. He contributes to specific actions for supporting data sharing for clinical and preclinical studies. He is cofounder and scientific advisor of Pixyl, an AI-based medical services company. He is IEEE senior fellow, associate editor Brain Imaging Methods (Frontiers in Neuroscience and Frontiers in Neuroimaging), past member of the editorial board of the Artificial Intelligence in Medicine journal (2003-13), regularly serves as reviewer for international journals (Neuroimage, TMI, HBM, Brain, …) and scientific committee member of international conferences (AIM, MICCAI, ISBI, …).

He received his engineer diploma in Material Physics from Insa (Lyon, Fr, 1982), a PhD in Computer Science (Paris, Fr, 1994) and a Habilitation à Diriger des Recherches (Grenoble, Fr, 1999). He has been supervising PhD students (21) and post-doctoral fellows (8). Publications: 137 (Web of Science), ISI-H index: 27, see https://orcid.org/0000-0003-2747-6845.

Olivier Chapleur



Olivier Chapleur is a graduate of the Ponts, Eaux et Forêts national engineering school, and works at INRAE in the PROSE (Biotechnicological Processes for the Environment) Unit. He develops research projects that combine molecular ecology techniques with those of statistics to optimize environmental biotechnology. In particular, he uses 'omics' high-throughput analytical approaches, such as metagenomics, metatranscriptomics and metabolomics, to study microbial communities involved in different bioprocesses and to understand their functioning. He then uses various statistical approaches to integrate the data generated. In addition to his PhD on the application of molecular biology to the methanization process, he elected to spend a year as a visiting scientist in both France and Australia to be trained in the statistical analysis of omics data. Since 2018, he has run the analytical section of the PROSE Unit, with a team that includes specialists in different analytical methodologies (e.g., analytical chemistry, microbiology, molecular biology, bioinformatics and biostatistics).

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Centre Jouy-en-Josas Antony

Marie-Laure Martin Magniette

division. She leads the Genomics Networks team at the Institute of Plant Sciences IPS2 and is a member of the Solstis team at the MIA JRU, Paris-Saclay. Working at the interface between statistical modeling and plant biology, her research seeks to understand plant responses to stress through the analysis and meta-analysis of omics data so that new strategies can be proposed for plant breeding under a changing climate.

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