International workshop
"Modular composition and analysis of biological models"

Organisers: Élisabeth Remy (Chair) and Denis Thieffry

Scientific committee: Madalena Chaves, Tomas Gedeon, Pedro Monteiro, Heike Siebert

Scientific context and challenges

High-throughput sequencing technologies and multi-omics approaches generate a plethora of molecular data, opening unprecedented perspectives for understanding living systems. However, this technological revolution comes with a major challenge: developing the mathematical and computational tools necessary to fully exploit these pangenomic and multimodal data to infer, validate, and refine predictive models integrating cellular signaling pathways, gene regulatory networks, and epigenetic modifications.

Scientific challenges

The increasing complexity of biological models manifests at two levels:

At the intracellular level, it involves considering molecular networks comprising several hundred nodes. Defining the mathematical rules governing these systems and confronting them with experimental data represent considerable methodological and computational challenges, requiring the adoption of modular and compositional approaches.

At the intercellular level, complexity grows exponentially with dynamic communications between multiple cell types to accomplish specific biological functions, impacting immune response, tumor progression, or the emergence of therapeutic resistance. This involves composing and articulating different cellular models to obtain predictive global models.

Workshop objectives

This international workshop aims to bring together an interdisciplinary community of researchers (mathematicians, computer scientists, computational biologists) to:

- Develop innovative mathematical frameworks for generating predictive models of molecular networks.
- Promote modular approaches as solutions to increasing complexity challenges.
- Facilitate exchanges between disciplines to foster the emergence of new methods.
- Explore concrete applications in developmental biology, immunology, and oncology.
- Establish quality standards compliant with FAIR principles from an open science perspective.

Practical workshop organisation

Organised over four days, from May 26 to 29, 2026, the workshop will be hosted by CIRM, on the Luminy campus, in Marseille. During the first two days, invited speakers will present original results from their research. The following two days will be devoted to subgroup work, which will focus on the following themes:

Group 1: Composition of identical or different logical cellular models, taking into account cellular movement, proliferation, and death.

Group 2: Integration of signaling, regulation, and metabolism (cellular scale).

Group 3: Data integration for the development of cellular models, and tissue models (spatial data, organoids).

The three workshops will run in parallel in the morning, followed by plenary reports and cross-cutting discussions in the afternoon.

The program will also include mid-morning breaks, as well as mid-afternoon breaks, to allow space for more informal discussions.

A special session will be dedicated to the memory of Claudine Chaouiya, who made important contributions to the field and initiated with us the organisation of this workshop.

Invited speakers

Calzone Laurence (Curie, FR)
Chaves Madalena (INRIA, FR)
Feret Jérôme (INRIA, FR)
Gedeon Tomas (MSU, USA)
Glass Leon (McGill, CA)
Janody Florence (I3S, PT)
Monteiro Pedro (Univ Lisboa, PT)
Paulevé Loïc (CNRS, FR)
Ruet Paul (IRIF, FR)
Safranek David (Masaryk Univ, CZ)
Siebert Heike (Univ Kiel, DE)
Siegel Anne (CNRS, FR)
Tournier Laurent (INRAE, FR**)**