

# Modeling dynamical systems in biology

**Lecturer**

Didier GONZE (Coordinator)

**Course mnemonic**

BINF-F404

**ECTS credits**

5 credits

**Language(s) of instruction**

Unknown

**Course period**

First term

**Campus**

Plaine

## Course content

Mathematical modeling and numerical simulations are commonly used to study dynamical behaviours of biological systems. We will introduce the theoretical concepts required to build and to analyse such mathematical models: chemical and enzyme kinetics, non-linear differential equations, stability analysis, phase plane, bifurcations, attractors. The development of models will be illustrated for various cellular processes: gene regulatory networks, metabolic networks, cellular signalling. A particular attention will be given to the relationships between regulatory circuits and dynamical behaviours (homeostasis, oscillations, multi-stability). Several systems will be studied through numerical simulation on a computer. An introduction to metabolic modeling (5h) will be given by Karoline Faust (KU Leuven).

## Objectives (and/or specific learning outcomes)

Introduction to modeling dynamical systems in biology: we will show how mathematical models help to understand the behaviour of biological systems at the molecular and cellular levels.

## Pre-requisites and co-requisites

### Course having this one as co-requisite

CHIM-F422 | Modélisation des rythmes du vivant | 5 crédits

## Teaching method and learning activities

Theory + exercises + practicals

## References, bibliography and recommended reading

- > Brian Ingalls (2018) Mathematical Modeling in Systems Biology: An Introduction (MIT Press)
- > Uri Alon (2019) An Introduction to Systems Biology: Design Principles of Biological Circuits (Chapman & Hall/CRC Computational Biology Series)

## Course notes

Université virtuelle

## Other information

### Place(s) of teaching

Plaine

### Contact(s)

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## Evaluation method(s)

written examination

### Main language(s) of evaluation

English

## Programmes

### Programmes proposing this course at the faculty of Sciences

MA-BINF | Master in Bio-informatics and Modelling | finalité Research/unit 1