

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