

Mathematical modeling of cell Biology

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Timetable: 20 hrs (2 two-hours lectures per week). Class meets every Monday and Wednesday from 14:30 to 16:30. First lecture on Monday, October 12, 2015. Room DEI/G, 3-rd floor, Dept. of Information Engineering, via Gradenigo Building.

Course requirements: Basic courses of linear algebra and ODEs. Basic experience with computer programming. Knowledge of cellular biology is not required.

Examination and grading: Final project.

Aim: The aim of this course is to provide an introduction to commonly used mathematical models of cellular biology. At the end of the course, the students should be able to build models of biological processes within the cell, to simulate and analyze them, and to relate the results back to biology. The focus will be on electrical activity and calcium dynamics in neurons and hormone-secreting cells, but will also discuss models of other cellular processes occurring in other cell types.

Topics: Biochemical reactions; Ion channels, excitability and electrical activity; Calcium dynamics; Intercellular communication; Spatial and stochastic phenomena (if time allows); Contractions in muscles; Circadian rhythms; Qualitative analysis of nonlinear differential equations.

References:

The following books will provide the core material, which will be supplemented by research articles:

1. C.P. Fall, E.S. Marland, J.M. Wagner, J.J. Tyson. *Computational Cell Biology*. Springer, NY, USA (2002).
2. J. Keener, J. Sneyd. *Mathematical Physiology*. Springer, NY, USA (2004).