



eastbio
the East of Scotland Bioscience Doctoral Training Partnership



EASTBIO DTP Foundation Masterclasses 2019-20

Dynamic Modelling for Systems Biology

Masterclass leader: Professor Andrew Millar, University of Edinburgh

Date: 28 February 2020, 11:00-16:30

Venue: [Medical School, Teviot](#) - [01M.469 Teaching Room 12](#) - Doorway 3. Central area, University of Edinburgh (entrance form Teviot Place)

Learning outcomes:

Participants will:

- Explain the conceptual reasons to use formal modelling in a biological investigation
- Locate biological pathway diagrams and dynamic models in public, online resources
- Manipulate a pathway diagram in the standard, graphical language SBGN, suitable for a Supplementary Figure.
- Distinguish the structure of a small regulatory network from its parameter values, using each concept to understand (explain and predict) a dynamic pattern of biological regulation.
- Obtain timeseries simulation results, from a gene network model in the standard SBML format.

Masterclass schedule:

11:00-11:30	Arrival & coffee/tea, muffins
11:30	Start
14:00-15:00	Lunch break (sandwiches)
16:30	Close

Systems biology aims to integrate data on all components of a biology system into mathematical models that quantitatively recapitulate the data. Studying the models provides a new set of tools to understand complex dynamic behaviors, such as oscillations, and system-level properties, such as robustness. These in turn can be integrated in models at a larger scale: cell-level behaviors into an organ model, for example, in the heart model. From this understanding, systems biologists seek the general principles of operation that distinguish living from non-living systems (to paraphrase Waddington, 1976), or in engineering terms “the design space of evolution” (Kitano, 2007).

The data required for systems biology stretch the best experimental laboratories, extending the requirements of contemporary cell and molecular biology, usually in ways that seem natural to the researchers. Because of the past training of most of the relevant biologists, however, the requirement for mathematical modelling can appear more challenging. Our course aims to illustrate the reasons to model and to demonstrate the methods. We introduce the process of building a dynamic model and exploring its behavior: you can do a lot with one equation. We

illustrate the process using free software for graphical models (VANTED and SBGN-ED) and dynamic models (COPASI) in community-standard formats.

Requirements: All participants are requested to bring a laptop computer with rights to install applications. Participants will be emailed to install the required programmes in advance or, if they cannot, to liaise with their local IT team to do so.

For any queries, email enquiries@eastscotbiodtp.ac.uk.