EASTBIO DTP Foundation Masterclasses 2018-19

Dynamic Modelling for Systems Biology

Masterclass leader: Professor Andrew Millar, University of Edinburgh

Date: 14 January 2019, 11:00-16:30
Venue: Dalhousie Building, Room 2F13, University of Dundee.

Learning outcomes:
Participants will:
- Explain the conceptual reasons to use formal modelling in a biological investigation
- Install free software for editing network diagrams and for dynamic modelling
- Locate biological pathway diagrams and dynamic models in public, online resources
- Download an example of each in appropriate file formats
- Edit a pathway diagram in one of the standard, graphical languages of SBGN, of suitable quality for a published Supplementary Figure.
- Propose the structure of a small regulatory network to explain a dynamic pattern of gene regulation
- Obtain timeseries simulation results, from a gene network model in the standard SBML format
- Describe the effect of altering model parameters on the resulting gene expression pattern.
- Explain how altering an existing model could test a biological hypothesis.

Masterclass schedule:

11:00-11:30	Arrival & Coffee/tea
11:30	Start
14:00-15:00	Lunch break
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 in advance to make sure that they have the ability to install the required programmes mentioned and, if not, liaise with their IT, to do so in advance.

Participants should bring their own power supplies for their laptops. The University Wi-Fi can be accessed via 'The Cloud' in Dundee, which they can access by connecting to www.thecloud.co.uk; it is advisable to do that in advance of the course.

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