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**EASTBIO DTP Foundation Masterclasses 2017-2018**

**Training Strand 2: Bioscience Skills**

**Dynamic Modelling for Systems Biology**

**Masterclass leader**: Professor Andrew Millar, University of Edinburgh

**Date**: 3 November 2017, 10:00-15:30

**Venue**: Dundee, WTB Seminar Rooms (TBC). This meeting room is accessed from the main James Black Centre reception (number 23 on the attached campus map) and is located on the mezzanine level opposite the lifts.

**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.

**Provisional schedule**

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| 10:00-10:30 | Arrival & Coffee/tea |
| 10:30 | Start |
| 12:30-13:30 | Lunch break |
| 15:30 | 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.

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