Talk Titles and Abstracts – Monday 9 January

13.30-13.50: **Guilia Celora** (University College London)

Talk Title: A model to study the impact of cell-cycle dysregulation on cancer cell survival in cyclic hypoxia

Abstract: In vivo observations show that oxygen levels in tumours can fluctuate on fast timescales. As a result, cancer cells can be periodically exposed to pathologically low oxygen levels; a phenomenon known as cyclic hypoxia. Using recent experimental data, we have built and calibrated a novel mathematical model of the cell-cycle that can predict cell-cycle dysregulation in cyclic hypoxia. In this talk, I will first introduce our modelling framework and then show how we can use a combination of analytical and numerical approaches to identify cell-cycle control strategies that favour proliferation and/or cell survival in different oxygen environments. Our results highlight how cyclic hypoxia may contribute to intra-tumour heterogeneity by selecting for slowly proliferative cancer cells.

13.50-14.10: **Yin Hoon Chew** (University of Birmingham)

Talk Title: Modular modelling of biological systems

Abstract: Biological systems such as plants and cells are complex. To model a whole plant or a whole cell, one approach at the frontier is modular modelling, i.e. breaking the system into smaller subsystems; representing each subsystem as a module at an appropriate level of details using an appropriate mathematical formalism; and combining the solutions from all modules during simulation. In this talk, I will present my previous work developing a whole-plant model of Arabidopsis and a whole-cell model of human embryonic stem cells using the modular approach. I will share some of the issues and challenges that we faced, and potential solutions.

15.10-15.30: **Eleanor Doman** (University of Manchester)

Talk Title: Modelling red blood cell flow within the maternal placenta

Abstract: The placenta is a specialised organ which develops during pregnancy enabling the transport of oxygen and other essential gases and nutrients from the mother to the fetus. Blood circulation within the placenta can be divided into two distinct but interlinked systems, i) the maternal circulation, and ii) the fetal circulation, with a membrane between, over which solute transport occurs. Oxygen travels through the maternal circulation either dissolved

within the blood plasma, or bound to haemoglobin carried by red blood cells. The presence of red blood cells within microvasculature, such as in the placenta, perturbs the flow of blood, resulting in a non-Newtonian flow dependent on the geometric properties of the vessels and the heterogenous make-up of the blood itself. In this talk I will discuss my work on constructing a reduced-order model to describe red blood cell flow though the maternal placenta.