**Professor Rodney Douglas**

**Institute of Neuroinformatics, Zurich**

Thursday 27 November 2014

16h30

Wolfson Pavilion Lecture Theatre

**'Principles of Neocortical Self-Construction'**

Current scientific wisdom in Europe and the USA promotes exhaustive data collection projects as the necessary route to understanding the structure and function of the nervous system, and so of future neuromophic computers. These proposed exa- to zettabyte descriptions stand in stark contrast to the gigabyte of construction information available to the developing brain. This enormous disparity raises the question of how the elaborate information processing circuits of (for example) the neocortex construct themselves using the relatively small amount of information encoded in the genome of neuronal stem cells. Our approach to this intriguing question combines experimental observation of cortical development with simulation of a detailed model of the physical process itself. The entire simulated development plays out under the control of an abstract gene regulatory network inserted into the initial neuroepithelial cells. These cells then expand by mitosis, differentiation, and morphological specialization into the multi-layered connected neural networks of two example murine neocortical areas, which are composed of about 0.25M neurons. I will explain this process, and show how we are able to infer the control GRN from only sparse experimental data. I will argue that understanding such abstract principles of biological development can provide novel insights into brain organization and function, as well as offering novel approaches to future self-constructing computers and other manufacturing technologies.