VISIT TO IMPERIAL COLLEGE, THE CENTRE FOR SYNTHETIC BIOLOGY AND INNOVATION AND THE ENERGY FUTURES LABORATORY 7 July 2010

A group of about 20 Members and Guests assembled at Imperial College for a dual visit to the Centre of Synthetic Biology and Innovation and the Smart Energy Laboratory Division of the Energy Futures Laboratory. Members and Guests were split into two groups for an hour in each of the respective Centres. The visit was co-ordinated by Liveryman Professor Richard Kitney assisted by his colleague Professor Paul Freemont to both of whom go our grateful thanks.

Centre for Synthetic Biology and Innovation

The Centre is at a relatively early stage of a five year research program funded by an EPSRC Science and Innovation award that aims to support new research activities in areas of national strategic importance. The Centre is both multidisciplinary and multifaculty; is based in the Faculty of Engineering and works closely with the Departments of Bioengineering and Life Sciences.

Professor Freemont gave an introductory talk which set a perspective for the more detailed presentations that followed. This started by contrasting the dimensions of major engineering artefacts with those that apply to biological systems typically nanometric, Angstrom and ultimately biological cell related scales. The essential function of DNA in its capacity of long term storage of codified genetic instructions which influence the development of all known living organisms was explained, and coupled to a description of the intercellular process by which DNA interacts with an RNA intermediary to promote protein synthesis.

Professor Freemont concluded his introductory talk by explaining how the biological information in a genome as encoded in its DNA may be used as a measure of biological complexity. As an example a comparative table indicated the genome difference between bacterial and human life forms.

Professor Kitney then explained the procedure by which a cell, typically a bacterial cell, can be created from a naturally occurring cell by reconstructing its DNA using biochemical methods. Such cells will have their own working characteristics and may be used in combination with other similarly constructed cells to form 'parts' and thence 'devices' (human defined functions) and ultimately systems which meet specified requirements. Such progressions are analogous to conventional systems engineering. The scope of application is very broad typically ranging over biofuels, complex drugs, simple control mechanisms, computing and biosensors.

Such is the global interest in Synthetic Biology that it has proved desirable to establish recognised standards for DNA synthesised products. Thus the trademarked designation 'BioBrick' has come into being. This refers to a specific 'brand' of open sourced genetic parts subject to acceptance by an open technical standards setting process headed up by The Biobricks Foundation. This is in turn supported by a Registry of Standard Biological Parts maintained at the Massachusetts Institute of Technology. To-date several thousand Biobrick parts are registered.

Professor Kitney's presentation was then complemented by two further presentations by other staff members of the Synthetic Biology Centre. The first of these looked forward to new levels of sophistication in synthetic biological application and stressed the need for a unified framework for synthetic modular design. This placed an emphasis on the need for predictive composable models to assist the creation of systems from genetic parts, allied to the production of working design tools necessary to support a synthetic biological equivalent of C.A.D. The second described the use of a synthetic biology device which acts as a sensor for the detection of a surface infection and by monitoring its progress gives early warning of any tendency for the infection to spread.

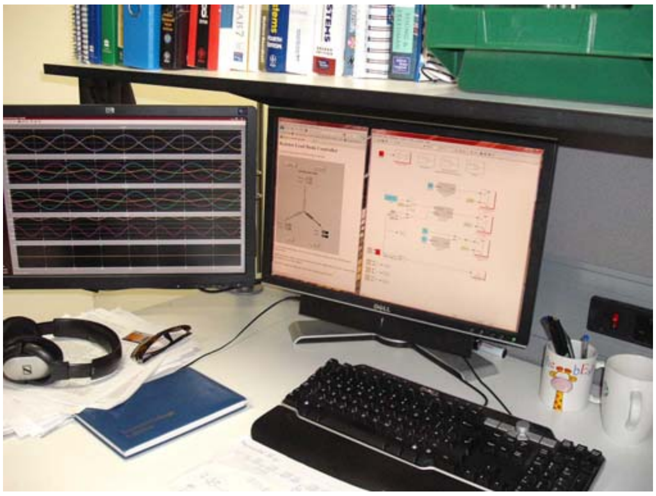
It is well recognised that the artificial manipulation of living cells gives rise to a range of societal and ethical issues. For this reason a team from the London School of Economics which specialises in the social, economic and ethical dimensions of synthetic biology works in parallel with Centre staff from the outset of research projects and addresses concerns of policy and regulation.

This part of the visit concluded with a brief visit to the so called 'Wet Labs' to observe ongoing experiments.

The Smart Energy Laboratory

The Smart Energy Laboratory opened in June 2009 and is funded by a bequest from Maurice Hancock a former alumnus and Senior Lecturer at Imperial. The

Laboratory provides facilities that enable students and researchers to explore how smarter forms of control and co-ordination will enable the energy systems of the future to match low-carbon energy generation to the needs of customers. The laboratory is serviced by an energy supply from the national grid which passes through banks of inverters to form viable supplies for a range of electrical experiments. These include the simulated creation of grid networks. These enable methods of control and operation to be investigated and thereby promote a better understanding of how new technologies affect grid operation and its response to postulated situations. This includes integrating energy systems to include offshore renewable supplies. Such network analysis is supported by mathematical modelling.



Computer Based Work Station

Demonstrations were given which indicated how grid responses may be evaluated and displayed on computer screens at dedicated work stations. That shown above is typical. These included a study of how a load bearing system reacts to the imposition of a specifically located fault, and how the nature and location of the fault may be determined.

The visit was rounded off with an informal reception which was a fitting end to a most instructive and inspirational event.

Peter Chapman