

Title of Project: Integrative Biology

Principal Investigator: Dr. David Gavaghan

Aim(s) of Project:

- The Integrative Biology Project will build a Grid-based infrastructure to support the modelling of complex biological systems.
- The aim is to bring together knowledge on all the different levels of biological understanding – from gene function to physiology – to provide a coherent theory of biology. Advanced computer simulations will be used to help understand and treat illness, and the team includes world experts on the modelling of cancer and heart disease.
- The project will develop a simulation framework to support the development of the theory, and its application, while investigating the two diseases which together cause over 60 per cent of deaths in the UK: heart disease and cancer

Please provide a summary of the project proposal (max 1 page):

The goal of the project is to build a Grid-enabled development platform for integrative biology modelling. The project will build upon existing e-Science activities both within Oxford and throughout the UK to support life scientists in moving on to the next grand challenge: that of determining biological function from the wealth of biological data that is now available. The project will develop: Grid-enabled generic and standardised modelling and simulation tools allowing assimilation and synthesis of data for use in model development and parameter estimation; a robust and fault tolerant Grid infrastructure; and tools to allow seamless integration of HPC, cluster computing, distributed databases, computational steering, performance control, and visualisation of complex simulated data, in the biology domain.

The platform will allow clinicians and biologists to perform in-silico testing and development of novel experimental approaches, concentrating in this development phase on two major disease areas: cardiovascular disease and cancer. In cancer, it will be possible to grow virtual tumours, through the crucial stages of early development. In whole-heart modelling, the clinician will be able to explore in-silico the likely causes of commonly occurring heart conditions. For both disease areas, it will be possible to test the actions of new drugs, and design and optimise alternative treatment protocols such as multi-drug therapies, supporting the drive towards patient-centred care regimes. The project will be undertaken by a consortium comprising experimental, clinical, modelling and computational groups at seven Universities: Oxford, Nottingham, Auckland, Leeds, Sheffield, Birmingham and UCL. These are complimented by strong involvement from CCLRC and IBM.

Please list 3 deliverables that the project will contribute to the UK and/or international cancer informatics community

1. Comprehensive models of avascular tumour growth and Grid-enabled HPC simulation that can be used by clinicians and life-scientists to simulate the growth of colorectal tumours.
2. A re-usable Grid-infrastructure for multiscale complex system modelling using heterogeneous HPC resources in a Grid environment
3. A growing resource of accessible knowledge from cancer modelling.

Please describe how the project will incorporate and/or re-use existing informatics infrastructure and/or resources. If the project will not use any existing infrastructure or resources (e.g. data standards or ontologies) please explain why this is the case

Integrative Biology will utilise existing eScience and HPC infrastructures to provide an infrastructure for the clinicians and biologists.

Computational steering and visualisation from two existing projects – gViz and Reality Grid will enable the project to develop a simulation and visualisation framework to support the important work of the tumour-modelling group.

The project will draw upon the expertise of the data management group at CCLRC and the Biosimgrid project in Oxford to assist with developing data management capability.

Please describe the plans for the sharing of data and dissemination of knowledge that arise from the project:

The Integrative Biology project is yet to determine the scope and methods for the sharing of data generated from the project but anticipate extensive publications from the project team.

Contact details for liaison person should further information be required:

Telephone number : Sharon Lloyd 01865 283668

e-mail address : Sharon.Lloyd@comlab.ox.ac.uk