



THE WHITE ROSE GRID e-Science Centre

CARMEN

CARMEN – Cracking the code of the brain

The White Rose Grid (WRG) and York University are partners in one of the final large-scale demonstrator projects to be funded under the EPSRC e-Science programme.

This £4M project, called CARMEN (**C**ode **A**nalysis, **R**epository and **M**odelling for **e-Neuroscience**) is developing a distributed computer system that will enable **neuroscientists** to analyse, store and share their data across the UK. The project will draw heavily from the experience that York has developed, under other e-Science projects, for complex, high-volume distributed search in Grid systems.

expertise in computing science and in studies of the brain.

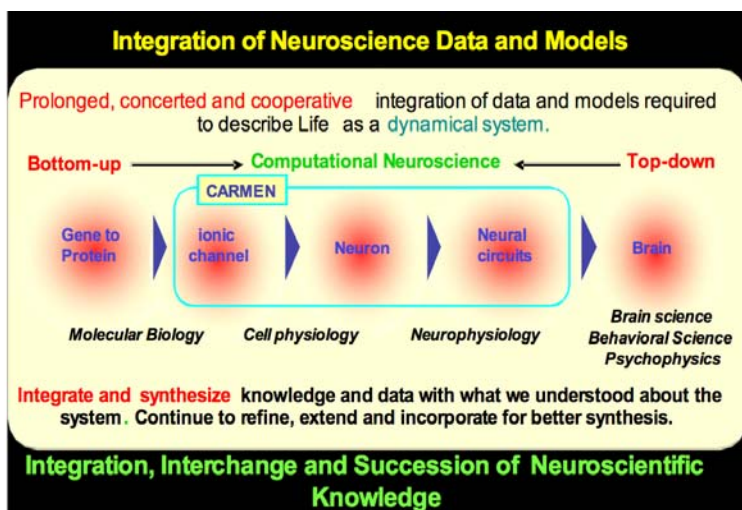
The project also involves neuroscientists in Germany, Japan and the USA, and a number of commercial companies who are interested in both the computing challenges and the way the project can help their studies of the brain.

The project has arisen because advances in research techniques have meant that studies of the activity of the brain now produce vast amounts of data.

Neuroinformatics is an emerging science that specialises in the analysis and interpretation of this information. This science has the potential to have a major impact on our understanding of the function of the brain and, thereby, provide insight into the causes and treatment of major disorders, such as epilepsy and schizophrenia.

The project will allow neuroscientists to use the latest methods to analyse their data. The use of Grid technologies will allow neuroscientists to store, share and combine data from multiple sources, providing a deeper level of insight than can be gained from views of single data sets. Even while they are collecting the data it will be possible for remote collaborators to perform analysis and provide advice on how to modify and steer the experiment.

The project provides particular challenges for computer scientists who specialise in managing large amounts of data so that it can be shared, integrated and analysed by distributed groups of scientists. Professor Paul Watson, Director of the North-East e-Science Centre based at Newcastle University said "Work in the field of e-Science over the last five years has given us tools and techniques to start to tackle the deluge of new data that being generated by science. Neuroscience provides perhaps the ultimate challenge – vast amounts of data collected by scientists worldwide that could hold the key to cracking the neural code. Doing so would have a huge impact across a range of sciences, including neuroscience, medicine and computer science."



Computer Science meets Neuroscience

CARMEN is a major collaboration between neuroscientists and computer scientists aiming to provide new Grid-based computer services that will drive forward our understanding of the way nerve cells communicate and store information as a code.

The project brings together a consortium of 19 investigators from 11 UK universities with



The computing infrastructure will be built as collaboration between computer scientists at York and Newcastle. A key component is the use of data search technology (SDE) from a previous e-Science project, DAME, which has been used to search Aero-engine data for Rolls-Royce. Both the architectures for data management and the distributed search techniques will be redeployed in this novel domain to help neuroscientists perform detailed searches across neuron spike train signals.

One of the major objectives of the CARMEN project is to analyse the code that the brain uses to convey information. Nerve cells (also known as neurones) communicate by sending impulses down a long axon (similar to an electrical wire) to connect with many other neurones to cause them to be excited or inhibited. This can be considered to be similar to the connections between transistors on a computer microprocessor. However, unlike computers, which send impulses at very high rates (measured in gigahertz or billions of times per second), neurones generally send impulses at less than 10 times per second. Neuroscientists have known for a long time that both the pattern of this activity and the fact that many neurones working at the same time are important for the information that they convey. CARMEN will provide the methods to help reveal how this is achieved.

The economic and health benefits of making better use of neuroscience data is reflected in the fact that the Organisation for Economic Cooperation and Development (OECD) has identified neuroinformatics as having major potential for delivering new science and wealth creation. In November 2005 an international neuroinformatics network was established with its executive in the Karolinska Institute in Stockholm, Sweden. It is expected that CARMEN will become an important component of this international activity.

“Neuroinformatics is an emerging science that specialises in the analysis and interpretation of this information. This science has the potential to have a major impact on our understanding of the function of the brain”

The full list of participating Universities and investigators involved with the CARMEN project:

Lead Partners

Newcastle : Professor Colin Ingram,
Professor Paul Watson

York : Professor Jim Austin

Stirling : Professor Leslie Smith

Associate Partners

Newcastle : Dr Stuart Baker,
Dr Markus Kaiser,
Dr Phil Lord,
Dr Evelyne Sernagor,
Dr Tom Smulders,
Professor Miles Whittington

St Andrews : Dr Anne Smith

Cambridge : Dr Stephen Eglen

Leicester : Dr Rodrigo Quian Quiroga

Manchester : Dr Stefano Panzeri

Sheffield : Dr Kevin Gurney,
Dr Paul Overton

Plymouth : Professor Roman Borisyuk

Warwick : Professor Jianfeng Feng

Imperial Coll : Dr Simon Schultz

Further Information

Contact:

Professor Jim Austin
(email: austin@cs.york.ac.uk)

Tom Jackson
(email: tom.jackson@cs.york.ac.uk)

Department of Computer Science
University of York, YORK, YO10 5DD