



JISC Project Plan

Overview of Project

1. Background

Neuroscience is a multidisciplinary activity involving participants collaborating from the mathematical, physical and life sciences as well as the medical sciences. It is dependent upon information technologies, computational capabilities and access to a range of instruments. As such it is an ideal exemplar as a disciplinary-based collaborative project that will enhance the currently available e-infrastructure to support emerging methods of research and the changing nature of the scholarly communications lifecycle.

The neuroscientists involved in the collaboration from Oxford (Emptage) and Southampton (Newland, O'Connor) are focused on specific issues such as the study of the molecular basis of synapse formation, plasticity and the regulation of neuronal morphology in the normal and diseased brain. They are examining the mechanisms of an activity-dependent form of neural plasticity known as long-term potentiation (LTP). LTP is widely regarded as the synaptic substrate for certain forms of learning and memory. By understanding the details of synaptic transmission following the induction of LTP they aim to gather insight into the processes that underlie memory formation. They also research into modeling muscular, neural and systems responses to understand signal processing in neural networks that control limb movement. Microscope image analysis is key to all the groups involved. The meta-application of these elements of research are in health, disease and for life-long living.

The experimental approaches used often combine high-resolution live cell fluorescent imaging methods with electrophysiology enabling monitoring of neurotransmission at individual synapses. Within the laboratory facilities include multi-photon and confocal microscopes. A significant component of the Oxford group's research is engaged in developing instrumentation, software and chemical tools with which to investigate the nervous system. This multidisciplinary approach has led to the formation of an extensive network of collaborators with whom the neuroscience researchers routinely interact.

Although focused on specific areas of neuroscience each group has a broad set of collaborations across the Universities, nationally and internationally including other groups within the neurosciences and other disciplines. Active collaborations include the development of novel caged compounds (Stuart Conway, Chemistry, Oxford), laser beam conditioning (Tom Brown, Physics, St Andrews), micro-optics (Mark Schnitzer, Biophysics, Stanford, USA), GaN on chip laser arrays (Federica Causa & John Taylor, Electrical Engineering, Bath), single molecule tracking software (Victor Burlakov, Materials, Oxford) Bayesian statistical modeling (Chris Yau & Peter Donnelly, Statistics, Oxford) and immunogold electron microscopy (Beulah Leitch, Biological Sciences, Otago, New Zealand; Anton Page, Biomedical Imaging Unit, Southampton), signal processing methods for electrophysiology and video imaging (Christopher James, Electrical Engineering, Southampton), neural responses to olfactory cues (Suleiman Sharkh, Akeel Shah, Engineering Sciences, Southampton using data gathered by groups in Toulouse and Manchester) and measuring system responses using Wiener modeling (Bob Allen, David Simpson, Brian Mace, Emiliano Rustighi, Institute of Sound and Vibration Research, Southampton).

Within any experimental science there is a considerable amount of time and effort spent in the articulation of the experimental process through the generation of the idea, management of raw information that will be used to prove or disprove the original hypothesis, the analysis and then the publication of the results. We have not yet succeeded in building a computational system which is capable of supporting the researcher through the whole process due in no small part due to the

limited way in which IT designers and providers have approached this area. There is often the assumption that a researcher in one particular field or discipline will use the same research methods and tools as all others within that field. This is clearly not the case across discipline fields, or indeed even within a single research group. Tools and technologies that support researchers must therefore be sufficiently flexible that they can be individually tailored. A major issue in such collaborations is the ability to feed in inputs from people and processes at different sates of the so called life cycle.

This is the approach we intend to take with NeuroHub – an open system which has been built around a simple set of APIs and interfaces with a selection of services for researchers to choose from. Examples of these services may include workflow monitoring, event logging, social metadata, annotation service, search, naming and identity anonymisation, user registration, distributed data query, job execution, text mining and research object management. This list represents an anticipated set of services but is neither limiting nor prescriptive.

With each part of the research lifecycle it is desirable that tools built are able to be used where necessary and when a new tool arrives that supersedes it the old is easily discarded and the new used in its place. Through careful consideration of how an application may be wrapped in a web 2.0 presentation layer we will allow researchers to choose how they want to do their research, where necessary building in both commercial and open source applications so that the entire research process can function as intended smoothly without unnecessary interruptions through IT and other support processes not working as they should. The system developed must integration of a large number of physical and IT systems into something that approaches how the normal researcher sees computers and IT, generally the desktop or web browser and sets of independent applications that perform individual functions on the data that is presented to them. They must also seamlessly connect into other parts of the campus infrastructure such as institutional groupware solutions and repositories. This will also allow for the federation of different subject specific frameworks utilising the same tools but sharing the same underlying methodologies they have built within their communities and allowing interdisciplinary work.

A particular part of the Oxford Group's experimental work is the use of both optical and electron microscopes. The outputs from these systems will be directly connected into the data platform so that generation of metadata is automatically generated and associated with images recorded. This will require adaption of the custom control software that is used with these systems. It is clear though that the underlying mechanisms generated will be able to be reused on other imaging systems both optical and electron. This area offers opportunities to develop virtual instrumentation services that will enable researchers to share images from specific microscopes. Something which at this time they need to work hard to be able to do – although it is possible to transform an image into a shareable format this cannot be done without a lot of analysis, and hence the raw data is not captured for the collaborator unless they happen to have the same piece of equipment.

In Southampton the focus is on the integrative analysis of brain function/dysfunction. They model aspects of this across levels of biological organization. These models must integrate across levels ranging from molecule, cells, tissue, systems and animals (behaviour). A tool that would assist in this integration is one based on key words representing key aspects of the work that would develop understanding of given problem based inputs that span across these levels from outside datasets.

The ability to provide “what-if” simulation of models would allow the neuroscientists to use relatively simple minded model systems that clearly inform on the more complex biology of mammals and humans. Iteration and non-hypothesis driven cross referencing of such data and models would then help to understand/reveal previously unappreciated connections and biological significance. A challenge the neuroscientists face is in applying appropriate techniques to score the significance of inputs to provide a profile of likelihood of significance.

Finally the ability to visualise the results of complex and often simple but large data sets would reduce inefficiencies in the research cycle. Tools that help lead to digestible display of essentially negative results or complex less easily rationalized data sets (e.g. lists of molecules or drugs or animal mutants

that have no effect would likely be a huge useful resource) can relatively easily be provided and packaged in an easily usable form within NeuroHub.

Neuroscience is one of the strategic themes of both Southampton and Oxford Universities (www.neuroscience.ox.ac.uk, www.SONG.soton.ac.uk) and as such can only expect to grow. This collaboration builds on the e-Research South consortium (www.eResearchSouth.ac.uk) that is a regional e-Research activity with Oxford, Southampton and Reading Universities as the three HEI partners together with STFC. The University commitments to the discipline and the ongoing e-Research South activity provide the basis for sustainability of the activity.

2. Aims and Objectives

This project will develop a set of sustainable tools and framework that will allow neuroscientists to efficiently and effectively use existing e-Infrastructure and by doing so will enable a more productive research cycle, streamlining the laboratory experience from conception of experiment to publication of the research results.

The objectives of the project are:

- to provide a framework which provides user-composable tools with which researchers can construct their own research information environment.
- to provide an integration layer for microscopes and other laboratory equipment.
- to deliver a new community to use existing e-infrastructure.

3. Overall Approach

The Methodology section of the project proposal (paragraphs 19 to 26) is relevant to the overall approach and is referenced here.

We will capture user requirements from the neuroscience research groups involved in the project. We will do this by “embedding” members of the project team with the groups so that they can better understand the work of the neuroscience researcher and how the NeuroHub framework will best work for them.

We will build on the myExperiment source code to build a framework and develop tooling for the specific pieces of functionality identified by the user requirements that have been gathered. The scope of the software development work will be guided by user requirements.

A critical success factor will be adoption and uptake of the framework by neuroscientists and the positive impact NeuroHub will have on their research.

4. Project Outputs

Outputs and deliverables: Together with the open source framework and integration tools that are adaptable to other domains, the project will create best practice reports and training materials. The project, as a whole, will deliver a new community to use existing e-Infrastructure and will add to that e-Infrastructure through the development of integration layers for microscopes and other laboratory equipment.

More specifically the project will deliver the following:

- An open source software framework for neuroscientists
- 4 releases of the software that is developed
- 3 training sessions including training materials and manuals
- 2 workshops
- Report on use case testing and evaluation

5. Project Outcomes

Benefits to the consortium: Within the participant university departments the benefits will be two fold. Firstly the individual research groups will be able to capture their collective knowledge in the new projects and those that would like to change over to using the developed components. Secondly within the groups that are participating there will be an increased ability to collaborate due to the increased knowledge of their own research. This will build into a significant representation of the overall body of knowledge within the relevant research community allowing easier building on new proposals.

Wider Research Community: through the wider release of the tools that we are building within the project including interfaces between the presentation layer and the underlying applications will allow whichever application that a researcher is wishing to use will be able to be connected. For those applications that do not have web services interfaces then using the 'hosting' service will allow them to be deployed as services rather than standalone specialised applications.

6. Stakeholder Analysis

Stakeholder	Interest / stake	Importance
Neuroscience Community	Will use framework and benefit from project outcomes	High
Partner institutions	Project will benefit Neuroscience which has been identified as a "strategic theme".	Medium
JISC	NeuroHub is a flagship project within the IE programme	
E-Research Community		
Computational Platform providers	The NeuroHub framework will bring "customers" to these providers	Medium
Application Vendors	NeuroHub will integrate Application Vendor products	
University Library Services	NeuroHub will integrate Library Services in its information environment	
Institutional Repository Providers	NeuroHub will integrate with repositories increasing usage	
Research Administration departments	NeuroHub aims to provide assistance in the experiment lifecycle which feeds into proposal writing	
Data and Dataset Service providers	NeuroHub will be a consumer of Data services	

7. Risk Analysis

Risk	Probability (1-5)	Severity (1-5)	Score (P x S)	Action to Prevent/Manage Risk
Staffing				
Difficulty in recruiting appropriate staff for the project.	2	2	4	Write up the job description and advertise promptly making it attractive to potential candidates. We already have a pool of existing and prospective staff to take on this

				work.
Critical member of the team resigns during the project	2	4	8	In the best scenario, staff from other projects could be integrated. The documentation of user needs, analysis, design, coding and procedures will allow management of this risk.
Organisational				
Lack of engagement and unrealistic expectations of research groups.	2	2	4	The research groups are keen to participate in the project and the Project Plan will clearly detail outputs and outcomes.
Collaboration across geographically dispersed sites	2	4	8	The project manager role will include coordination activities including regular face to face meetings and use of online and phone conferencing. All three sites have Access Grid facilities.
Project misses deliverables or milestones	2	2	4	The project manager and team will have a clear project plan which will be updated as the work progresses.
Technical				
Domain language issues and transfer of appropriate knowledge to developers	4	3	12	The team is experienced with multidisciplinary working and the importance of spending time at the start to share technical language on both sides.
Problems with integrating the different services into the NeuroHub framework	2	3	6	Components, principles and methodology of the existing myExperiment will be applied to develop the open framework used for the NeuroHub.
IPR	1	3	3	Will be covered as part of the consortium agreement.
Learning & adoption curve for NeuroHub system too high for users	3	4	12	System will be developed for easy adoption via user testing and feedback. QA workpackage will also pick up issues early on in time for changes.
Software difficulties	1	5	5	Project has direct access to experienced staff plus contacts with the original developers of the services, e.g. ADVISE at Leeds
A complete NeuroHub system cannot be released within the time constraints of the project	2	3	6	The absence of a complete solution is not an indication of failure, as one aspect of the project is to investigate potential implementation problems. The evaluation report will address the issues that could not be resolved.

8. Standards

The project website will comply with all accessibility and mark-up standards. The metadata required to describe, administer and preserve the research data will comply with research community standards as well as those available at the JISC Standards Catalogue. The rest of the technical development work required to integrate existing services, will be based on Service Oriented Architecture (SOA) design characteristics, principles and standards.

Name of standard or specification	Version	Notes
HTML		
CSS		
XML		
HPC Basic Profile		

9. Technical Development

We will adopt various methodologies from myExperiment as mentioned in the project proposal.

10. Intellectual Property Rights

Under their general policies on intellectual property all collaborating institutions claim ownership of a range of intellectual property rights with commercial potential. Results arising from projects would therefore usually be shared and owned in the first instance by the collaborating parties as the employing institutions. The collaborating institutions will seek to maximise the commercial potential of their intellectual property through a variety of means. The outputs from this project will be freely available to the UK HE community through provision of grid services and dissemination of best practice. The project will operate under a collaboration agreement that will be developed at the beginning of the project.

The project will make use of myExperiment source code which is licensed using the BSD license.

Project Resources

11. Project Partners

University of Oxford, Lead Partner, Project Management and Development
Contact: Anne Trefethen, anne.trefethen@oerc.ox.ac.uk

University of Southampton, Development
Contact: David De Roure, dder@ecs.soton.ac.uk

University of Reading, Development
Contact: Mark Baker, Mark.Baker@computer.org

12. Project Management

The project will be lead and managed by the Oxford e-Research Centre. The Project Manager role will be split between two project members, one more concerned with technical management of the project and the other more concerned with management of budgets, reporting and collaboration.

The Project won't adopt a specific project management framework, but will impose structure on the running of the project. Specifically the project plan will be authoritative and will describe what the project is doing at any point—not a post-hoc report that has to catch up with the project. There will be

a change management process for changing the project plan involving requests for change which must be approved by the project's executive board.

The Executive Board will comprise the PI and co-PIs on the project, together with the Project Managers. The Executive Board will be responsible for the programme and financial management of the project. The Executive Board will be review every quarter to ensure that it is meeting the needs of the programme and that resources are used most effectively. The Executive Board will have monthly meetings alternating face-2-face and teleconferencing.

The project will also have an Advisory Board. It was initially thought that the Advisory Board will be the Advisory Board of the e-Research South consortium, but this is to be reconsidered to allow for wider representation from the Neuroscience community. The Advisory board will meet twice per year, one face-to-face meeting and one via telecom or AccessGrid.

The members of the project team are:

- Neil Caithness, Project Manager (Coordination) 20% FTE (Oxford), neil.caithness@oerc.ox.ac.uk
- Steven Young, Project Manager (Technical) 40% FTE (Oxford), steven.young@oerc.ox.ac.uk
- John Pybus, Senior Developer 40% FTE (Oxford), john.pybus@oerc.ox.ac.uk
- Kang Tang, Developer 100% FTE (Oxford) kang.tang@oerc.ox.ac.uk
- David Spence, Developer 100% FTE (50% Oxford, 50% Reading), d.r.spence@reading.ac.uk
- Victor Burlakov, Domain Scientist 50% FTE (Oxford) victor.burlakov@materials.ox.ac.uk
- David Newman, Developer 100% FTE (Southampton), drn05r@ecs.soton.ac.uk

13. Programme Support

The session on project management at the first programme meeting will be of use to the project.

14. Budget

The budget is attached as Appendix A. [NeuroHubProjectPlanBudget.pdf]

Detailed Project Planning

15. Workpackages

The Work package plan is attached as Appendix B. [NeuroHubProjectPlanWorkpackages.pdf]

16. Evaluation Plan

Timing	Factor to Evaluate	Questions to Address	Method(s)	Measure of Success
Regular Executive Board meetings	Adherence to the Project Plan			
Code releases at scheduled times during the project	Best practice in software development		Quality assurance testing	
	Engagement with Neuroscience community		Survey, IE framework usage logs	

17. Quality Plan

Output Timing	Quality criteria	QA method(s)	Evidence of compliance	Quality responsibilities	Quality tools (if applicable)
Scheduled with code releases		Quality assurance			
Ongoing after first code release		Use case testing and evaluation			
Scheduled with code releases		External Code Review			

18. Dissemination Plan

Timing	Dissemination Activity	Audience	Purpose	Key Message
Ongoing	Website	E-Research community		
Ongoing	Website	Neuroscience community		
Ongoing	Website	General Public		
Ongoing	Information Environment deployed	Neuroscience community		
Year 1, Year 2	Workshops			
Regular intervals	Training Sessions	Users		
As required	Presentations at Neuroscience meetings			

19. Exit and Sustainability Plans

Project Outputs	Action for Take-up & Embedding	Action for Exit
Open Source Framework	Promote code releases and foster an open source community	Ensure code is deposited and available for other developers
Training Materials and Manuals	Use in training sessions	Deposit training materials in wider training libraries with CCP4, EU INSTRUCT, NGS and NeSC Training teams.
A new community using e-Infrastructure through the NeuroHub Information Environment	Promote usage, provide training	Seek local institutional support for continued running of NeuroHub IE

Project Outputs	Why Sustainable	Scenarios for Taking Forward	Issues to Address
Open Source Framework	Software developers will build upon our work	Self-sustaining open source community	

Project Acronym: NeuroHub
Version: 1.0
Contact: Neil Caithness and Steven Young
Date: 30 June 2009

Training Materials and Manuals	Anticipated ongoing need for training for Information Environments	Community embedded activity	Materials become outdated and need refreshing
Deployed NeuroHub Information Environment	Available infrastructure for continued service if community has actively engaged with the NeuroHub IE	Local institutional support Community support	Ongoing running costs Ongoing development work required

Appendixes

Appendix A. Project Budget

File: NeuroHubProjectPlanBudget.pdf

Appendix B. Workpackages

File: NeuroHubProjectPlanWorkpackages.pdf