Life Science Project Titles 2012-2013

Neuroscience Subject Area

(with Psychology subject area)

Life Science Projects 2012-2013

<table>
<tr><td colspan="2">Faculty Name: Professor Paul Benjamin

Room No: 3B15 Email: p.r.benjamin@sussex.ac.uk</td></tr>
<tr><td colspan="2">Project Title/Area:

Learning and Memory</td></tr>
<tr><td>Course requirements:

Second year neuroscience courses</td><td>No of places: 2</td></tr>
<tr><td colspan="2">Further Information:

This is a critical review type project. We will choose a topic in the general area of memory formation that is of mutual interest but it needs to be related to fundamental research on brain and behaviour rather than a clinical topic.</td></tr>
</table>

Life Science Projects 2012-2013

Faculty Name: Dr Majid Hafezparast

Room No: CRPC 5.21 **Email**: MH50@sussex.ac.uk

Project Title/Area:

Molecular genetic analysis of the role of RNA splicing in motor neuron disease

Course requirements:

Sound background knowledge of recombinant DNA techniques

No of places: 2

Further Information:

Amyotrophic lateral sclerosis (ALS), more commonly known as motor neuron disease, is a degenerative disorder of motor neurons (nerve cells involved in muscle movement) in humans. ALS is a fatal disease manifested by progressive muscle weakness, wasting and spasticity. It causes the death of over 100,000 individuals worldwide every year, mainly striking in mid-life (40s and 50s) and killing within 2-5 years following diagnosis. About 10% of all cases are inherited (familial ALS), the rest occurring seemingly at random (sporadic ALS). Mutations in the gene encoding Tar DNA binding 43 (TDP-43) protein have been identified to cause both familial and sporadic ALS. TDP-43 is a RNA helicase involved in transcription, RNA splicing, and translation.

As the clinical and histopatholgical features of sporadic and familial ALS are remarkably similar, it is likely that both types of this disease share the same molecular pathology or pathways which lead to motor neuron death. This is a laboratory based project aiming at understanding the role of TDP-43 in splicing of genes implicated in motor neuron disease. For this the student will be using a battery of molecular genetics techniques including DNA extraction, PCR, restriction digestion and DNA cloning.

Life Science Projects 2012-2013

Faculty Name: Dr Majid Hafezparast

Room No: CRPC 5.21 **Email**: MH50@sussex.ac.uk

Project Title/Area:

Involvement of MicroRNA in neurodegenerative diseases

Course requirements:

Sound knowledge of gene regulation, transcription, translation, and use of genome databases

No of places: 2

Further Information:

MicroRNAs are small non-coding RNA molecules that regulate gene expression by binding to mRNA and suppressing translation or promoting the degradation of the mRNA molecule. There is evidence that microRNAs could modify disease phenotype in some neurodegenerative diseases including motor neuron disease.

This project is a literature based study aimed at:

1) Reviewing the literature and identifying the microRNAs that have been implicated in neurodegenerative disease focusing on maximum two diseases (such as motor neuron disease, frontotemporal dementia, Alzheimer's, and Parkinson's disease)

2) Examining any possible link between the two diseases in relation to the specific microRNAs or their targets.

Life Science Projects 2012-2013

Faculty Name: Dr Majid Hafezparast

Room No: CRPC 5.21 **Email:** MH50@sussex.ac.uk

Project Title/Area:

Critical review of the literature on distal hereditary motor neuropathies (dHMN) and the role of axonal transport in dHMN and related diseases

Course requirements:	**No of places**: 1
Cell biology and molecular genetics	

Further Information:

Neurons are highly dependent on efficient transport systems for carrying organelles and macromolecule such as neurotrophic factor for distribution in the cell body, dendrites and axons. Molecular motor proteins dynein and kinesins mediate this transport and there is evidence implicating impaired axonal transport in several neurodegenerative diseases.

The distal hereditary motor neuropathies (dHMN) form a group of neurodegenerative diseases that share the common pathology of a length-dependent motor neuropathy. This is a literature based project aimed at critically analysing the data describing links between defects in axonal transport and dHMN and related diseases such as motor neuron disease and Charcot-Marie-Tooth disease.

Life Science Projects 2012-2013

Faculty Name: Dr Majid Hafezparast

Room No: CRPC 5.21 **Email**: MH50@sussex.ac.uk

Project Title/Area:

Critical review of the literature on clinical trials for motor neuron disease

Course requirements:	**No of places**: 1
Molecular genetics and Cell Biology	

Further Information:

Amyotrophic lateral sclerosis (ALS), more commonly known as motor neuron disease, is a degenerative disorder of motor neurons (nerve cells involved in muscle movement) in humans. ALS is a fatal disease manifested by progressive muscle weakness, wasting and spasticity. It causes the death of over 100,000 individuals worldwide every year, mainly striking in mid-life (40s and 50s).

There is no cure for motor neuron disease and it kills within 2-5 years following diagnosis. Despite many clinical trials, there is still a major need to find and effective drug for treatment of this disease. The only approved drug for treating ALS is riluzole and that has a limited effect on disease progression, increasing the life span by only about 2 months. The aim of this project is to critically review the literature on clinical trials for motor neuron disease and report on our current understandings of why these trials have failed and on proposed strategies for future drug discoveries to treat this devastating disease.

Life Science Projects 2012-2013

Faculty Name: Professor George Kemenes

Room No: 3B16 **Email:** G.Kemenes@sussex.ac.uk

Project Title/Area:

Neurobiology of snail learning and memory and behavioural decision-making, specific titles to be confirmed in discussion with students. Laboratory based research projects.

Course requirements:	**No of places**: 2
Principles of Neuroscience, Neural Circuits 2nd year courses or BSMS 202 Module, plus take Neuronal Plasticity and Gene Regulation as 3rd year option.	

Further Information:

Professor Kemenes' group investigates evolutionarily conserved mechanisms of learning and memory, such as the role of second messenger cascades (e.g., cAMP, PKA, CaMKII) and transcription factors (e.g., CREB) in short, medium and long-term memory. The students will work on different aspects of this general theme, using a combination of behavioural/pharmacological, physiological and molecular methods.

Recent relevant papers from the Kemenes lab:

Pirger Z, László Z, Kemenes I, Tóth G, Reglodi D, Kemenes G. (2010) J Neurosci. 30(41):13766-73. A homolog of the vertebrate pituitary adenylate cyclase-activating polypeptide is both necessary and instructive for the rapid formation of associative memory in an invertebrate.

Vavoulis DV, Nikitin ES, Kemenes I, Marra V, Feng J, Benjamin PR, Kemenes G. (2010) Balanced plasticity and stability of the electrical properties of a molluscan modulatory interneuron after classical conditioning: a computational study. Front Behav Neurosci. 4:19.

Wan H, Mackay B, Iqbal H, Naskar S, Kemenes G. (2010) Delayed intrinsic activation of an NMDA-independent CaM-kinase II in a critical time window is necessary for late consolidation of an associative memory. J Neurosci. 30(1):56-63.

Kiss T, Pirger Z, Kemenes G. (2009) Food-aversive classical conditioning increases a persistent sodium current in molluscan withdrawal interneurons in a transcription dependent manner. Neurobiol Learn Mem. 92(1):114-9.

Michel M, Kemenes I, Müller U, Kemenes G. (2008) Different phases of long-term memory require distinct temporal patterns of PKA activity after single-trial classical conditioning. Learn Mem. 15(9):694-702.

Nikitin ES, Vavoulis DV, Kemenes I, Marra V, Pirger Z, Michel M, Feng J, O'Shea M, Benjamin PR, Kemenes G. (2008) Persistent sodium current is a nonsynaptic substrate for long-term associative memory. Curr Biol. 18(16):1221-6.

Life Science Projects 2012-2013

Faculty Name: Professor George Kemenes

Room No: 3B16 **Email**: G.Kemenes@sussex.ac.uk

Project Title/Area:

Decision making and learning and memory in neural circuits, specific titles to be confirmed in discussions with students. Library and PubMed search based non-laboratory research projects.

Course requirements:	**No of places:** 4
Neural Circuits or BSMS 202	

Further Information:

These are 'Critical Review' type projects, that do not require direct laboratory work by the student, but involve deep-reading and critical assessment of the published literature in an area of the supervisor's and student's joint interest. Critical Reviews should not be seen as trivial or the 'soft-option', as they will involve the student in a great deal more thinking than many lab projects.

Life Science Projects 2012-2013

Faculty Name: Dr Sergei Korneev

Room No: 3B32 **Email:** s.korneev@sussex.ac.uk

Project Title/Area:

The role of natural antisense RNAs in the regulation of nitric oxide signalling in the CNS

Course requirements:	**No of places:** 2
Good background in Molecular Biology	

Further Information:

At the heart of this **lab-based experimental project** is a distinct class of natural antisense transcripts (NATs) that is likely to be involved in the control of the production of a very important signalling molecule known as nitric oxide or NO. NO has been implicated in a variety of physiological processes including memory formation and blood pressure regulation. Also it has been shown that inappropriate changes in the level of NO contribute to the development of serious pathological conditions in the brain. We will study expression patterns of certain types of NATs by using well-established molecular techniques such as RNA extraction, cDNA synthesis, polymerase chain reaction (PCR), quantitative real-time PCR etc.

Life Science Projects 2012-2013

Faculty Name: Dr Sergei Korneev

Room No: 3B32 **Email:** s.korneev@sussex.ac.uk

Project Title/Area:

The role of epigenetic mechanisms in neuronal plasticity

Course requirements:	**No of places**: 2
Good background in Molecular Biology	

Further Information:

The term 'epigenetics' describes potentially heritable changes in genome function that occur without a change in nucleotide sequence within the DNA. Recent studies have shown that epigenetic mechanisms play an important role in neuronal plasticity. This **literature-based experimental project** will involve a critical appraisal of published research on the role of DNA methylation and histone modifications in neuronal functions.

Life Science Projects 2012-2013

Faculty Name: Dr Sergei Korneev

Room No: 3B32 **Email:** s.korneev@sussex.ac.uk

Project Title/Area:

The role of short non-coding RNAs in neuronal functions

Course requirements:	**No of places**: 2
Good background in Molecular Biology	

Further Information:

Recent experiments, greatly facilitated by the availability of RNA and DNA databases, have identified a surprisingly large number of short non-coding RNAs in a variety of organisms as different as worms and mammals. Moreover, a significant role in the regulation of gene expression has been reported for a number of these unusual transcripts. This **literature-based experimental project** will involve a thorough analysis of available literature related to the field of non-coding RNAs with the focus on those molecules that are expressed in the central nervous system.

Life Science Projects 2012-2013

Faculty Name: Prof Corné Kros

Room No: CRPC 326 **Email**: c.j.kros@sussex.ac.uk

Project Title/Area:

Gradients in ionic currents of sensory hair cells in the cochlea

Course requirements: Principles of Neuroscience (Yr2)	**No of places**: 1

Further Information:

This project will concentrate on the analysis of kinetic properties of ion channels that shape the receptor potentials of sensory receptor cells in the inner ear. The student will conduct a literature search to look for differences between high- and low-frequency cells in order to gain insight into factors contributing to frequency tuning in the cochlea.

Life Science Projects 2012-2013

<table>
<tr><td colspan="2">Faculty Name: Prof Corné Kros

Room No: CRPC 326 Email: c.j.kros@sussex.ac.uk</td></tr>
<tr><td colspan="2">Project Title/Area:

Compare critically the properties of central synapses in the brain and peripheral sensory synapses</td></tr>
<tr><td>Course requirements:

Principles of Neuroscience (Yr2)</td><td>No of places: 1</td></tr>
<tr><td colspan="2">Further Information:

In this project the student will conduct a literature search and form a critical evaluation of emerging differences between central synapses and peripheral sensory synapses, particularly synaptic ribbons. Aspects to focus on could be optimization of particularly peripheral auditory synapses in terms of speed and fidelity of synaptic transmission.</td></tr>
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Life Science Projects 2012-2013

Faculty Name: Prof Corné Kros

Room No: CRPC 326 **Email:** c.j.kros@sussex.ac.uk

Project Title/Area:

Investigate the function and prevalence of spontaneous electrical activity in cells and tissues during development.

Course requirements:	**No of places**: 1
Principles of Neuroscience (Yr2)	

Further Information:

In this project the student will conduct a literature search and form a critical evaluation of the proposed developmental function of spontaneous action potentials (often accompanied by increases in intracellular calcium) in cells of a large variety of tissues and animals. As part of this project the student will compile a comprehensive database of species and tissue types for which this activity has been described.

Life Science Projects 2012-2013

Faculty Name: Prof Corné Kros

Room No: CRPC 326 **Email**: c.j.kros@sussex.ac.uk

Project Title/Area:

Perception of language and music by cochlear implant users.

Course requirements:	**No of places**: 1
Principles of Neuroscience (Yr 2)	

Further Information:

In this project the student will investigate and critically review current literature on the appreciation of music and the perception of language by people wearing cochlear implants. Comparing findings in people with inborn hearing defects with those who acquire sensory-neural deafness at a later stage could be particularly informative.

Life Science Projects 2012-2013

Faculty Name: Prof Corné Kros

Room No: CRPC 326 **Email**: c.j.kros@sussex.ac.uk

Project Title/Area:

Data analysis of patch-clamp electrophysiological recordings from mammalian auditory hair cells.

Course requirements:	**No of places**: 2
Course requirements: Principles of Neuroscience (Yr2), some aptitude for maths/physics	

Further Information:

These projects will concentrate on the analysis of kinetic properties of ion channels that shape the receptor potentials of sensory receptor cells in the inner ear. Sound vibrates the hairs on top of these cells, which modulates the opening probability of mechano-sensitive ion channels, resulting in tiny electrical currents in the order of picoAmps flowing into the cells. These currents start a chain of events involving other, voltage-sensitive, ion channels that the brain eventually interprets as sound. Experimental data that address different key questions of how sound transduction in the cochlea occurs will be provided for each of the two projects. The data come from either the mechano-sensitive or the voltage-sensitive ion channels and the student will analyze them using scientific graphing and analysis software. Some aptitude for mathematics or physics will help to get the most out of these projects.

Life Science Projects 2012-2013

Faculty Name: Dr Mark Maconochie

Room No: CRPC 4.10 **Email**: m.k.maconochie@sussex.ac.uk

Project Title/Area:

Effects of ototoxic drugs and retinoic acid on FGF expression in the developing cochlea

Course requirements:	**No of places**: 4

Further Information

Fgf3 and Fgf10 ligands are expressed in the developing inner ear. Initial expression either in localised regions of the epithelium (Fgf3) or throughout the otic epithelium (Fgf10) is followed by more restricted expression in inner ear nerves and the sensory patches these innervate.

(i) Ototoxic drugs lead to hair cell death in the innerear and in two projects on offer, the effects on Fgf3 and Fgf10 expression will be examined in vitro in the developing cochlea.

(ii) We have recently shown that the vitamin A derivative retinoic acid leads to downregulation of Fgf3 expression in the early inner ear epithelium (Cadot et al, Developmental Dynamics; DOI: 10.1002/dvdy.23748). However the effects on hair cell expression has not been examined. Furthermore, Fgf10 is also expressed in the developing cochlea. This project will investigate whether hair cell/neuronal expression of these ligands is similarly downregulated in the developing inner ear.

Life Science Projects 2012-2013

Faculty Name: Dr Mark Maconochie

Room No: CRPC 4.10 **Email:** m.k.maconochie@sussex.ac.uk

Project Title/Area:

Effects of noise damage on FGF expression in the developing inner ear

Course requirements:	**No of places**: 1

Further Information:

Noise damage in the mammalian inner ear is irreversible and leads to loss of the sensory hair cells in the cochlea. Furthermore, such hair cell loss is accompanied by loss of trophic support for their sensory neurons, which subsequently leads to loss of these cells as well. The effect of noise damage on Fg33 and Fgf10 expression in hair cells and neurons in the adult inner ear will be investigated in this project.

Life Science Projects 2012-2013

Faculty Name: Dr Mark Maconochie

Room No: CRPC 4.10 **Email:** m.k.maconochie@sussex.ac.uk

Project Title/Area:

Development of an otic transfection system

Course requirements:	**No of places:** 1

Further Information:

The analysis of gene function and regulation requires the delivery of DNA constructs into the otic epithelium, where the effect of misexpression constructs on the expression of other genes can be examined. DNA delivery into the chick inner ear epithelium can be achieved through electroporation. This project will examine whether this technology can be developed for the analysis of mouse otic epithelia as well for the analysis of gene function and expression in a system more applicable to understanding the causes of deafness in man.

Life Science Projects 2012-2013

Faculty Name: Professor Guy Richardson

Room No: CRPC-423 **Email:** g.p.richardson@sussex.ac.uk

Project Title/Area:

TESTING THE OTOTOXIC PROPERTIES OF POLY-BASIC PEPTIDES IN COCHLEAR CULTURES

Course requirements: PON, FNA, TIN, MCB desirable but not necessary.	**No of places**: 3

Further Information:

The ototoxic aminoglycoside antibiotics like neomycin and gentamicin selectively target and kill the sensory hair cells of the inner ear leading to permanent deafness. One theory suggests these drugs enter into hair cells via their transducer channels and then disrupt mitochondrial function leading to apoptosis. We have recently found that a peptide inhibitor of the Junc N-terminal kinase, D-JNKi1, also selectively targets and kills hair cells in cochlear cultures, probably as a consequence of the polybasic HIV-TAT sequence that is incorporated to make the peptide inhibitor cell permeable and is also known to act as a permeant blocker of the hair cell's mechanotransducer channel. In this project, a series of peptides based on the HIV TAT sequence with varying numbers and distributions of basic residues will be synthesised and their ototoxic potential will be tested. Fluorescent derivative of these peptides will then be made and used to determine whether they are able to selectively accumulate in hair cells via the mechanotransduction channels. This is a group project. Each student will test a different peptide and the data will be shared amongst the group for analysis and write up.

Life Science Projects 2012-2013

Faculty Name: Professor Guy Richardson

Room No: CRPC-423 **Email**: g.p.richardson@sussex.ac.uk

Project Title/Area:

EXPRESSION OF GENES FOR INNER EAR MATRIX MOLECULES ANDTHEIR CELL-SURFACE RECEPTORS DURING INNER EAR DEVELOPMENT

Course requirements:	**No of places**: 3
PON, FNA, TIN, MCB desirable but not necessary.	

Further Information:

Tecta is major-non collagenous protein of both the tectorial and otolithic membranes of the inner ear, and otoancorin is a cell-surface receptor that mediates the attachment of the tectorial membrane to the cochlear epithelium. The genes encoding Tecta and otoancorin are both expressed by non-sensory supporting cells in the inner ear, a cell type acts as progenitor for the hair cells that are regenerated in lower vertebrates following hair-cell loss. The aim of this study is to determine whether Tecta and/or otancorin act as markers for progenitor cells in the developing inner ear of the mouse. Inner ears from the embryos of transgenic reporter mice expressing EGFP from either the Tecta or the otoancorin locus will be serial sectioned and the expression patterns of these genes will be mapped in detail and compared with that of other markers for developing sensory patches. This is a group project. Students will use one or the other of the two reporter mice and test different prosensory markers. The data will be shared amongst the group for analysis and write up.

Life Science Projects 2012-2013

Faculty Name: Dr. Liz Somerville

Room No: JMS 4D20 **Email**: e.m.somerville@sussex.ac.uk

Project Title:

Social Brain Hypothesis/Dunbar's Number

Course requirements:	**No of places**: 2
NONE for literature review. Statistics for Biologists ESSENTIAL if you want to make this an experimental investigation (Dunbar's Number).	

Further Information:

Humans have large and expensive brains; explanations for this are many and various. **The Social Brain Hypothesis** (Dunbar, 2003), based on comparative data relating primate brain size and social group size, is one of the strong contenders – but how well is it holding up to further research? This project would be tackled as a critical literature review.

Dunbar's Number: Robin Dunbar has also proposed that human social group size should be about 150. This is supported by some cross-cultural observations. However, has the advent of social media completely changed our habits of association? This project could also be undertaken as a critical literature review or as a questionnaire-based experimental investigation into the effect of social media on human social group size.

Background reading: Social Brain

Dunbar, R.I.M. (2003) The Social Brain: Mind, Language & Society in evolutionary perspective. Ann. Rev. Anthropol. **32** 163-181

Background reading: Dunbar's Number

Dunbar, R.I.M. (2010) How many friends does one person need? Faber & Faber.

Further reading (both topics)

Dunbar, R.I.M., Gamble, C. & Gowlett, J. eds (2010) Social Brain, Distributed Mind. Proceedings of the British Academy **158.** OUP [BF 698.9.S63.SOC]

Life Science Projects 2012-2013

Faculty Name: Dr. Liz Somerville

Room No: JMS 4D20 **Email**: e.m.somerville@sussex.ac.uk

Project Title/Area:

Do people select for cuteness?

Course requirements:

NONE for literature review, but 2nd year courses in Evolution would be useful background. Statistics for Biologists ESSENTIAL if you want to make this an experimental investigation.

No of places: 2

Further Information:

In "A biological homage to Mickey Mouse" Stephen Jay Gould pointed out how Mickey becomes "cuter" over time. A similar change has been documented for teddy bears.

This project would investigate the generality of this phenomenon by drawing on one or more of a critical review of the literature, investigation of changes in artefacts or drawings, questionnaire surveys.

Background reading:

Gould, S.J. (1983) A biological homage to Mickey Mouse pp 81-91 in "The Panda's Thumb" Penguin (available on line at http://todd.jackman.villanova.edu/HumanEvol/HomageToMickey.pdf)

Hinde, R.A. & Barden, L.A. (1985) The evolution of the teddy bear. Animal Behaviour **33** 1371-3

Morris, P.H., Reddy, V. & Bunting, R.C. (1995) The survival of the cutest: who's responsible for the evolution of the teddy bear? Animal Behaviour **50** 1697-1700

Life Science Projects 2012-2013

<table>
<tr><td colspan="2">Faculty Name: Dr. Liz Somerville

Room No: JMS 4D20 Email: e.m.somerville@sussex.ac.uk</td></tr>
<tr><td colspan="2">Project Title/Area:

A critical literature review related to Human Evolution</td></tr>
<tr><td>Course requirements:

At least one of: Human Evolution; Cultural Evolution; Modern Human Evolution</td><td>No of places: 6</td></tr>
<tr><td colspan="2">Further Information:

Convince me that you have an interesting question relating to a biological or cultural aspect of Human Evolution which you wish to investigate by a critical literature review.

Background reading:

Lewin, R. & Foley, R. (2003) Principles of Human Evolution 2nd Ed. Blackwell. [Core/Short QP 1050 Lew]</td></tr>
</table>

Life Science Projects 2012-2013

Faculty Name: Dr. Liz Somerville

Room No: JMS 4D20 **Email:** e.m.somerville@sussex.ac.uk

Project Title/Area:

A critical literature review related to co-evolution between people and dogs

Course requirements:	**No of places**: 2
At least one of: Human Evolution; Evolution	

Further Information:

Dogs were the first domesticated species of mammals. In the course of their co-evolution with people, dogs have been selected intentionally for many traits and, possibly, also been subject to unintentional selection for a number of cognitive abilities.

Background reading:

Research on dog cognition:

http://www.eva.mpg.de/psycho/dog-cognition.php

Genetics:

Wayne, R.K. & vonHoldt, B.M. (2012) Evolutionary genomics of dog domestication. Mammalian Genome **23** 3–18

Further reading:
Shipman, P. (2011) The animal connection**:** a new perspective on what makes us human
Norton [GN 281 Shi]

Life Science Projects 2012-2013

Faculty Name: Dr. Kevin Staras

Room No: JMS 3B28 **Email**: k.staras@sussex.ac.uk

Project Title/Area:

Analysis of ultrastructural images related to functional synaptic vesicle pools in hippocampal slice

Course requirements:	**No of places**: 3
Principles of Neuroscience / Neural Circuits	

Further Information:

Chemical synapses are the key sites for information transfer between neurons in the brain. Characterizing their dynamic operation is a major goal in neuroscience, necessary for a complete understanding of the fundamentals of neuron-neuron signalling, learning and memory and mechanisms of dysfunction associated with disease conditions.

A critical step in transmission is the controlled release of chemical neurotransmitter from vesicles in the presynaptic terminal. As such, the mechanisms that regulate these vesicles and the dynamic events that lead to the release of their transmitter have become subjects of intense investigation. This effort has been aided by the advent of sophisticated fluorescence imaging methods and high-sensitivity probes which permit a direct readout of functional vesicle properties.

To date, most studies of synaptic operation have utilized cultured synapses or peripheral terminals. However, recent work in my laboratory has led to the development of novel fluorescence-based methods allowing, for the first time, the direct characterization of central hippocampal synapses in native tissue (Neuron 66:37-44, 2010; Nature Comms, In Press, 2011). Moreover, we have now successfully developed an approach which allows this functional synaptic readout to be transferred to the electron microscope permitting a unique opportunity to carry out novel and detailed investigations of synaptic structure-function relationships with nanoscale resolution.

The aim of this project is to analyse some of the electron microscope images looking at fundamental relationships between functional pools and spatial organization. The work will be heavily image-analysis-based and quite mathematical/quantitative.

Life Science Projects 2012-2013

Faculty Name: Dr. Kevin Staras

Room No: JMS 3B28 **Email:** k.staras@sussex.ac.uk

Project Title/Area:

The rise of optogenetics and their implications as therapeutic tools for nervous dysfunction / Optical methods to study neuroscience.

Course requirements:	**No of places**: 2
Principles of Neuroscience / Neural Circuits	

Further Information:

Optogenetics is a new buzz word in neuroscience research, combining the power of genetic manipulation with optical methods which allow the interrogation and manipulation of neural circuits. Supporters claim that they have major value not only for characterizing circuits at new levels of detail but also as a therapeutic approach to correct nervous dysfunction. Is it all hype or does this approach offer a new path for correcting neurological disorders?

A revolution is occurring in the development of methodologies for high resolution imaging and perturbation of neurobiological processes. This includes developments in 'diffraction-unlimited' light microscopes, advanced electron microscopes, nanoscale protein markers, controllable ion channels and genetic mapping approaches such as Brainbow. One argument is that these approaches are superseding conventional electrophysiological methods. Are the days of reading out neuronal properties by impaling them with electrodes, numbered? You need to engage with highly-technical literature and take an informed view on what will represent the future of neuroscience research approaches.

Life Science Projects 2012-2013

Faculty Name: Dr. Kevin Staras

Room No: JMS 3B28 **Email:** k.staras@sussex.ac.uk

Project Title/Area:

Synaptic imaging in slice or culture.

Course requirements:	**No of places:** 1
Principles of Neuroscience / Neural Circuits	

Further Information:

Powerful imaging methods are now available to 'read out' aspects of neuronal operation. These methods include the use of fluorescent probes for characterizing anatomy, Ca2+-sensitive dyes for recording activity and synapse-specific probes for detailing synaptic signalling. This project will employ some or all of these probes to examine neuronal and/or synaptic function in rat hippocampal neurons. Experiments will focus on looking at the relationship between pre and postsynaptic operation during synaptic transmission. This project will provide experience in handling hippocampal neurons or slice tissue, in a variety of fluorescence imaging approaches, in some basic electrophysiological recording techniques. A large part of the project will involve detailed analysis of digital images.

Life Science Projects 2012-2013

Psychology Subject Area

<table>
<tr><td colspan="2">Faculty Name: Professor Jenny Rusted

Room No: Pev 1 2b21 Email: j.rusted@sussex.ac.uk x8325</td></tr>
<tr><td colspan="2">Project Title/Area:

Cognitive ageing: effects of exercise, disease and age on memory and attention</td></tr>
<tr><td>Course requirements:

Some knowledge of cognitive psychology</td><td>No of places: 2</td></tr>
<tr><td colspan="2">Further Information:

A maximum of two places may be available to work on projects in my lab, broadly in the area described above. Projects may include an opportunity to process and analyse archive imaging data.</td></tr>
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