Faculty Name: **Professor Claudio Alonso**
Room No: **CRPC 411** Email: c.alonso@sussex.ac.uk

Project Title/Area:

microRNA-mediated regulation of Hox genes during development

Course or Module requirements:	No of places: 2	Project Type:
Developmental Biology, Genetics		Experimental (lab-based)

Further Information:

The *Hox* genes encode a family of evolutionary conserved transcriptional regulators that control the development of embryonic and adult structures at specific coordinates along the antero-posterior axis of the animal body. My laboratory investigates the molecular mechanisms regulating the activity of the *Hox* genes, in *Drosophila* and mammals. Previous work in my lab and in other groups has established that specific small regulatory RNAs such as microRNAs (miRNAs) can regulate *Hox* activity, but the mechanisms underlying these interactions are still not fully understood.

This project will investigate such molecular mechanisms and their biological roles during development in regards to their effect on Hox gene expression in *Drosophila*. The selected student will develop a lab-based project seeking to identify miRNAs that are able to regulate Hox gene expression during Drosophila development. For this the student will employ a combination of bioinformatic, molecular, developmental, genetic and transgenic tools. The results of this work are likely to provide valuable information on the mechanisms by which miRNAs regulate the activity of gene networks during development.

Keywords: Development, *Hox* genes, microRNAs (miRNAs), *Drosophila,* embryogenesis
Remarks: High interest in gene regulation and developmental biology is required, previous lab experience in Molecular Biology and/or Genetics is desirable.

Project Title/Area:

The molecular basis of Hox gene regulation: an evolutionary approach

Course or Module requirements:	No of places: 2	Project Type:
Developmental Biology, Genetics		Literature / Data Analysis

Further Information:

The *Hox* genes encode a family of evolutionary conserved transcriptional regulators that control the development of embryonic and adult structures at specific coordinates along the antero-posterior axis of the animal body. My laboratory investigates the molecular mechanisms regulating the activity of the *Hox* genes, in *Drosophila* and mammals. Previous work in my lab and in other groups has established that Hox genes in Drosophila and mammals undergo different forms of RNA processing (e.g. alternative splicing, alternative polyadenylation) so as to produce different RNA isoforms from single genes. Intriguingly, variation in RNA isoforms is predicted to lead to different regulatory interactions with RNA regulators such as microRNAs and RNA-binding proteins. However relatively little is known about the patterns of Hox RNA processing in other animal groups.

This project will investigate this problem seeking to compare and contrast the roles of RNA processing in *Drosophila* with those detected in (i) other insects, (ii) other invertebrates, and (iii) vertebrate *Hox* genes. The selected student/s will develop this work employing a computational approach based on bioinformatics integrated with the analysis of molecular, developmental, and genetic data in the literature. The results of this work are likely to provide valuable information on the mechanisms by which RNA regulation relate to complex patterns of gene expression during development and evolution.

Keywords: Development, Evolution, *Hox* genes, RNA, *Drosophila,* mammals.
Remarks: High interest in gene regulation, developmental biology and evolution is required; previous lab experience in Computational Biology, Bio/informatics, Molecular Biology and/or Genetics is desirable.

Faculty Name: **John Armstrong**
Room No: JMS 3B28 Email: j.armstrong@sussex.ac.uk

Project Title/Area: **Invasive growth and differentiation in Fission Yeast**

Course requirements:	No of places: 2

Further Information:
Fission yeast is usually considered a model single-celled eukaryote. However, we found that it can differentiate into elaborate multicellular structures which invade the growth medium. This switch in form is critical for infection for pathogenic fungi, which are much harder to study. We have identified groups of genes required for the process. The project will involve studying these by methods such as in vivo microscopy and molecular genetics, to understand the role of each, and hence to learn about this crucial process in pathogenic fungi.

Reference:
Dodgson, J., Brown, W., Rosa, C. A. and Armstrong, J. (2010) Reorganisation of the growth pattern of *Schizosaccharomyces pombe* in invasive filament formation. Euk. Cell **9**, 1788-1797.

Project Title/Area: **Centrosomes as controllers of eukaryotic development**

Course requirements:	No of places: 3

Further Information:
Centrosomes are best known as the structures on which the spindle is formed in mitosis. However they also have several other functions. Every cell inherits an 'old' centrosome then builds a new one, hence each daughter inherits either the old or new one at the next division. Since the old and new centrosomes may differ, they can carry information to trigger different development of each daughter. In which species and processes does this occur, where might it be discovered in future, what are the underlying mechanisms and how do they relate to the complex structure of centrosomes?

Reference:

Centrosome asymmetry and inheritance during animal development.

Pelletier L, Yamashita YM.

Curr Opin Cell Biol. (2012) 24:541-6

Faculty Name: **John Atack**
Room No: Chichester 2, Lab 317 Email: J.Atack@Sussex.ac.uk

Project Title/Area:
Expression and purification of protein(s) suitable for assay development
(Drug discovery, pharmacology, biochemistry)

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

Further Information:
Within the Translational Drug Discovery Group, the production and purification of proteins is a key aspect the early stage drug discovery process. Purified proteins are used for X-ray crystallographic studies and/or assay development and/or compound screening and characterisation. This project will require the student to produce and purify such proteins.

Project Title/Area:
Development and characterisation of an assay suitable for drug discovery
(Drug discovery, pharmacology, biochemistry)

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

Further Information:
A crucial aspect of the drug discovery process is the use of in vitro biochemical or biophysical assays to identify novel compounds that interact with the protein of interest. The primary requirement for such an assay is that it is robust, reliable and reproducible. This project will require the student to establish and characterise an in vitro assay and undertake an initial evaluation of compounds derived from publications.

Project Title/Area:
Neuroinflammation in Alzheimer's Disease – Bad Guy or Good Guy?
(Drug discovery, pharmacology, biochemistry, neuroscience)

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

Further Information:
There is little doubt that neuroinflammation occurs in the brains of patients suffering from Alzheimer's disease (AD). However, it is unclear whether the neuroinflammatory response is part of the problem or part of the solution to the problem of AD. This project will review the Pros and Cons for both sides of the argument.

Project Title/Area:
The Pharmacology of Ketamine – The journey from horse tranquiliser and party drug to antidepressant and beyond
(Areas: Drug discovery, pharmacology, biochemistry)

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

Further Information:
Ketamine is widely known as a drug of abuse but experimental studies in man have linked the pharmacology of ketamine to schizophrenia and treatment-resistant depression. This project will review the pharmacological evidence to suggest that ketamine and related drugs may provide novel therapeutic approaches to these disorders.

Project Title/Area:
New therapeutic approaches to Schizophrenia
(Areas: Drug discovery, pharmacology, biochemistry, neuroscience)

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

Further Information:
Schizophrenia comprises three symptom domains; positive, negative and cognitive. While the positive symptoms (paranoia, auditory hallucinations etc) are well treated with existing antipsychotics, the negative symptoms (e.g., anhedonia) and cognitive symptoms (e.g., reduced executive function) have very few treatment options. This project will review the current state of the art with respect to novel therapeutic strategies to address this very large unmet medical need.

Faculty Name: **Jonathan Bacon**
Room No: **4D19** Email: **j.p.bacon@sussex.ac.uk**

Project Title/Area: **A project for students aiming to become Biology GCSE and A-Level teachers – *Microscopy of Living Organisms***

Course or Module requirements:	No of places:	Project Type:
None, but you need to be fairly committed to a teaching career, and be willing to teach a practical class in a school setting, and our first-year Cell Biology practical.	**5 students working independently, but in the same lab.**	**Experimental**

You may remember the Cell Biology practical you did in January last year, in which you used our lab microscopes to examine a range of living organisms: bacteria, blue-green algae, green algae, moss, ciliates, rotifers, tardigrades.

In this project, you will:
1. Become expert at using a simple binocular microscope, and be able to identify, explain and demonstrate the biology of a wide range of living unicellular and small multicellular organisms, from sources you will prepare yourself – pond dipping, hay infusions, collecting mosses etc.
2. Investigate the national GCSE and A-level curricula to determine how these observations of living organisms may relate to the specifications in the areas of Biodiversity, Classification and Evolution.
3. Each student would specialise in one particular group (suggestions are tardigrade natural resistance to desiccation, rotifer locomotion, flatworm maze learning to food sources, commensalism between hydra and ciliates, woodlouse response to a humidity gradient) devise novel reliable experimental approaches that could be used in a classroom setting to teach aspects of the GCSE or A-level curricula.
4. Establish your own YouTube channel of movies of microorganisms that you have made with your mobile phone viewing down the microscope. For an example of a previous year's videos, check out
http://www.youtube.com/channel/UCldxmVnBuHd9m7_G6hcqePg
5. Devise a two-hour practical, which you will deliver to a group of GCSE or A-level Biology students in their local secondary school.
6. Improve the microscopy practical that I continue to run for our first-year Cell Biology students, and work as a demonstrator on this practical – for which you would be paid.

Starting reference:
Microscopy Practical Handbook for the first-year Cell Biology Module

Faculty Name: **Dr Jonathan Baxter**
Room No: G4:03 Email: jon.baxter@sussex.ac.uk

Project Title/Area:
Using yeast genetics to analyse chromosome instability mutations / Genome stability

Course or Module requirements:	No of places: 1	Project Type: Experimental (including data analysis).
Genetics and Genomics		

Further Information:

Chromosomal instability (CIN) is observed in nearly all solid tumours. Identifying the genetic changes that underlie CIN is an important goal in cancer biology. The lab uses yeast genetics to examine CIN in cycling cells. In this project we will use the yeast colony-sectoring assay to assess the severity of CIN in cells carrying selected mutations in genes involved in chromosome replication and segregation.

Project Title/Area:
Analysing the dependency of cohesin and condensin mutations in cancer/ Genome stability

Course or Module requirements:	No of places: 1	Project Type: Experimental (including data analysis)
Genetics and Genomics		

Further Information:
Cohesin and condensin are both SMC type complexes that play distinct but related roles in chromosomal stability. Cohesin mutations are also commonly found in a number of cancers. Our research also indicates that condensin could also have a role carcinogenesis. In this project we will use the expanding cancer databases to examine if there is any correlation between the incidence of cohesin and condensin mutations in individual cancers

Faculty Name: **Alessandro Bianchi**
Room No: 2C37 Email: a.bianchi@sussex.ac.uk

Project Title:
Requirements and consequences of DNA replication fork stalling at telomeres

Course or Module requirements:	No of places: 1-2	Project Type: Experimental

Further Information:
Telomerase and telomere maintenance contribute to ageing and to the development of carcinogenesis. The action of telomerase at telomeres is tightly controlled by the telomeric complex, which also aids the DNA replication fork to travel through the telomeric DNA repeats. It has been proposed that telomere dysfunction might lead to replication problems at telomeres, with stalling of the replication fork and consequent creation of aberrant DNA structures. Recent evidence in fission yeast, where replicative problems at telomeres were first identified, suggests that these structures might function as a substrate for telomerase to carry out rapid telomere elongation, counteracting replication defects. We will create fission yeast strains bearing an intact and functional telomeric complex but with an engineered DNA barrier to stop progression of the replication fork through a single telomere. The aim of the project will be to investigate whether replication fork stalling at this telomere will lead to mis-regulation of telomerase. We will also utilise reporter strains where we have introduced telomeric sequences internally into the fission yeast genome to investigate the genetic requirements for efficient replication though the telomeres. Fission yeast is an ideal model system for human telomere biology and a rewarding experimental system for a student project.

Project Title/Area:
Regulation of SUMO-modification of telomeric proteins in fission yeast

Course or Module requirements:	No of places: 1-2	Project Type: Experimental

Further Information:
The covalent linkage of a small protein called SUMO onto proteins is a type of post-translational protein modification that is common in the regulation of many activities involved in DNA transactions, including the regulation of telomerase action. Our laboratory has recently demonstrated that the main target of this protein modification (SUMOylation) at fission yeast telomeres is telomeric protein Tpz1. We have shown that linkage of SUMO onto Tpz1 is responsible for leading to inhibition of telomerase activity at telomeres and that a particular protein, a so-called E3 SUMO ligase (Pli1), is responsible for the attachment of SUMO onto Tpz1. The aim of the project will be to try to determine what activities are responsible for directing Pli1 to telomeres.

Project Title/Area:
Control of the MRN complex at telomeres

Course or Module requirements:	No of places: 1-2	Project Type: Experimental

Further Information:
The MRN complex (Mre11/Rad50/Nbs1) regulates the action of the checkpoint kinase ATM in the response to DNA damage and in particular to double-stranded DNA breaks. One of the main function of telomeres is to protect chromosome ends and to avoid them from being recognized as breaks. Interestingly, and somewhat paradoxically, the MRN complex has also been shown to promote telomerase action at telomeres and the occurrence of telomere-telomere fusions at dysfunctional telomeres. Thus, although the MRN complex is recruited to telomeres, its action has to be kept in check to prevent activation of ATM and the DNA damage response. We have identified a conserved protein motif in several telomere proteins from different species that we propose serves to control Nbs1 and thus somehow to prevent ATM activation. The project will aim to characterise the molecular mechanism used by these telomeric proteins to inhibit and modulate MRN action at telomeres.

Faculty Name: **Keith Caldecott**
Room No: Email:k.w.caldecott@sussex.ac.uk

Project Title/Area:
Role of the BRCA1 tumour suppressor gene in the maintenance of genome stability

Course or Module requirements:	No of places: 2	Project Type: Literature

Further Information:

Project will involve literature search and assimilation of current knowledge/ideas on the molecular function of BRCA1 and how those roles relate to the activity of this protein as a tumour suppressor

Project Title/Area:
Role of the BRCA2 tumour suppressor gene in the maintenance of genome stability

Course or Module requirements:	No of places: 2	Literature

Further Information:

Project will involve literature search and assimilation of current knowledge/ideas on the molecular function of BRCA2 and how those roles relate to the activity of this protein as a tumour suppressor

Faculty Name: **Tony Carr**
Room No: Email: A.M.Carr@sussex.ac.uk

Project Title/Area:
Optimising the use of a protein degradation system for analysing gene function

Course or Module requirements:	No of places: 2	Project Type: Experimental

Further Information:

Manipulating the level of a specific protein in living organisms allows the rapid and powerful analysis of phenotypes. Our laboratory has implemented a system that promotes protein degradation upon the addition of a common substance (auxin). This works by adding a tagging sequence to the gene of interest in order that the encoded protein is fused to a protein domain that directs the whole fusion protein for ubiquitin-mediated degradation when it is bound to auxin. It is also necessary to express a second protein that mediates the association between the tagged construct and the degradation machinery.

However, this is only moderately effective in *S. pombe* (our chosen experimental organism) when compared to other organisms.

We plan to attempt optimise the efficiency of the protein degradation tools for fission yeast by modifying various components of the system. This will include modifying the tag that is associated with the protein of interest and modifying the additional protein that mediates interaction with the degradation machinery.

The method we will use is based on Recombination-Mediated Cassette Exchange (Gene. 2008 Jan 15;407(1-2):63-74). These systems rely on the expression of bacterial recombinase and the introduction of two compatible recombination target sites (~30 base pairs) into the organism of interest.

This project, **which is designed for those students who are aiming to go on to postgraduate research,** will expose the student to molecular genetics and the manipulation of the yeast chromosomal sequences. It will also, if reasonably successful, introduce students to the analysis of proteins by western blotting.

Project Title/Area:
What is the protein Dna2 and what does it do

Course or Module requirements:	No of places: 1	Project Type: Literature

This project will be a literature survey with the aim of summarising all current information on an important, but relatively understudied protein that is involved in DNA replication and DNA repair. It will be of **interest to students who enjoy synthesising information and have a strong interest in the presentation of scientific information**.

The student will be expected to read a significant number of primary papers and understand the basic concepts of replication and DNA repair in order to assimilate information and synthesis this into a coherent review of what is known about Dna2, its role in repair and replication. It is possible that, if this review is of sufficient quality, it may be submitted for publication, although this is entirely dependent on the ability and, organisation and application of the student.

Faculty Name: **Maria Clara Castellanos**
Room No: 5D1 Email: m.c.castellanos@sussex.ac.uk

Project Title/Area:
Measuring pollination effectiveness

Course or Module requirements:	No of places: 1-2	Project Type: Experimental (with data analysis)

Further Information:

The effectiveness of a floral visitor as a pollinator depends on several factors, including the frequency of visitation, the number of pollen grains carried on the body, and the behaviour at the flower. Often pollination biologists use only one or a few of these aspects to infer and compare the effectiveness of pollinators. This project will use an autumn-flowering plant (common ivy) to test if the different aspects of floral visitation that are easy to measure are in fact correlated with pollen deposition on stigmas and propose an efficient way of measuring pollination effectiveness in a generalist plant. Ivy is an interesting plant for this study because flowers are visited my many species of insects, yet it has been argued that only a few are doing most of the pollination, mainly wasps.
Fieldwork will be done on campus or in the vicinity and needs to start as soon as the term starts.

Project Title/Area:
Ancestral floral traits that predetermine the evolution of hummingbird pollination

Course or Module requirements: Evolutionary biology	No of places: 1	Project Type: Literature and data analysis

Further Information:

Hummingbird-pollinated flowers have evolved repeatedly in the new world flowering plants, but they have not appeared at random across lineages. Mapping floral traits on a mega-phylogeny of the angiosperm families it seems clear that ancestral traits such as fused petals or floral symmetry can function as pre-adaptations and facilitate/constrain the evolution of this form of pollination. However, modern phylogenetic analysis requires the lowest phylogenetic resolution possible. This project will involve searching the published literature for information on hummingbird pollination at the genus level. The student will learn how to map traits on a phylogeny and apply phylogenetic analysis for evolutionary hypothesis testing.

Project Title/Area:
Developing interactive activities for the communication of science to school children

Course or Module requirements:	No of places: 2	Project Type: Literature / outreach

Further Information:

This project is appropriate for outgoing students interested in learning the skills of communicating science to a young audience. The specific topic of the activities will be within the area of plant-animal interactions or other aspects of plant ecology and evolution, and will emphasize what it means to be a scientist and do research.
The student will need to design, implement and deliver one or more interactive lectures that are engaging and informative at the right age level (9-11 year-olds). This will require using different resources such as demonstrations, short videos, hands-on exercises, and so on. There will be extra support from the School Engagement office, as well as the opportunity for attending training sessions offered at the University for students engaged in science outreach. The developed activity will then be delivered in a nearby primary school.

Faculty Name: **Chris Chan**
Room No: G3.05 Email: koklung.chan@sussex.ac.uk

Project Title/Area:

Understanding the cause of common fragile site

Course or Module requirements:	No of places: 1	Project Type: Experimental

Further Information:

The maintenance of genome stability is crucial for all life forms especially in multicellular organisms like humans. Nevertheless, there are regions in the human genome prone to rearrangements such as common fragile sites (CFSs). However, the underlying mechanism of this high propensity of genome rearrangement at CFSs is still unclear. It has been speculated that the collision of transcription and replication machineries may lead to the localised genome instability. In this project, we aim to alter gene transcription activities at CFSs by CRISPR technique to investigate their effects on the expression of CFS breakage. This project is expected for students who aim for future postgraduate study.

Faculty Name: **Neil Crickmore**
Room No: JMS 3B12 Email: n.crickmore@sussex.ac.uk

Project Title: **Understanding Bt toxin specificity I**

Course or Module requirements:	No of places: 1	Project Type: Experimental (lab based)

Further Information:

Bacillus thuringiensis is a bacterium that produces protein toxins active against a wide range of insects. We are particularly interested in one particular family of these toxins (Cry2A) since there are a large number of members of this family with diverse host ranges. This project will investigate the toxicity of various members of this family against the mosquito *Aedes aegypti*. Based on the results obtained predictions will be made about which aspects of the toxin are important for activity against this insect. These predictions will then be tested through protein engineering. Techniques to be used will include molecular biology, entomology, microbiology and protein biochemistry.

Project Title: **Understanding Bt toxin specificity II**

Course or Module requirements:	No of places: 1	Project Type: Experimental (lab based)

Further Information:

As well as producing insecticidal toxins Bt also produces toxins active against some human cancer cells. This project will work towards understanding how structurally very similar toxins have such diverse activities. We will work with two toxins the mosquitocidal Cry2Ac and the cancer cell active Cry41Aa. The plan will be to make hybrids between the two toxins, and/or other mutations, with the aim of identifying regions/residues involved in activity against each host. Techniques to be used will include molecular biology, entomology, microbiology and protein biochemistry.

Project Title/Area: **Understanding Bt toxin specificity III**

Course or Module requirements:	No of places: 1	Project Type: Experimental (lab based)

Further Information:

When the Cry41Aa cancer cell active toxin from Bt is treated with trypsin it becomes toxic to the HepG2 cell line, but is inactive against other lines such as HL60 and HeLa. When however it is treated with a different protease (proteinaseK) it becomes active against HL60. This project will investigate how this differential activation can affect toxicity. This could potentially lead to the design of toxins that can target particular cell type. Techniques to be used will include protein biochemistry, mass spectrometry and perhaps some molecular biology.

Project Title/Area: **How best to classify Bt toxin genes?**		
Course or Module requirements:	No of places: 1	Project Type: Experimental (data analysis)
Further Information: As a species *Bacillus thuringiensis* produces several hundred different toxins each with its own activity towards particular insects. These toxins are currently classified based upon whole toxin sequence comparisons. As a result of genome sequencing projects many new putative toxins are being identified and as we learn more about structure/function relationships for these proteins it has become clear that the existing classification system is not as useful as it once was. This project will involve data collection and analysis and will aim to recommend an improved method of classification. The ability to program would be helpful but not essential.		
Project Title/Area: **Structure/function relationships in Bt toxins**		
Course or Module requirements:	No of places: 1	Project Type: Experimental (data analysis)
Further Information: As a species *Bacillus thuringiensis* produces several hundred different toxins each with its own activity towards particular insects. In theory there should be enough data out there to start making strong associations between sequence motifs and toxicity towards a particular host. This project will aim towards identifying processes that can be used to make such associations. Some knowledge of statistical methods would be helpful but not essential. The project will involve setting up a database either in Excel or some other format.		

Faculty Name: **Prof. Aidan Doherty**
Room No: 4-12 (Genome Centre)
Email:ajd21@sussex.ac.uk

Project Title/Area:
Characterisation of distribution of components of the NHEJ DNA double-strand break repair pathway in prokaryotic and archaeal genomes using comparative genomics.

Course requirements: Bioinformatics, Biochemistry, Genetics or Biomedical science	No of places:1-2	Data analysis /Literature

Further Information:
Even though there has been significant biochemical and structural characterisation of the main components of prokaryotic non-homologous end joining (NHEJ) DNA repair pathways, there has not been a recent survey of the prevalence and distribution of these components within the microbial kingdoms.

Using the Microbial Genome Database for Comparative Analysis (MBGD) as a starting point, the project will involve surveying sequenced microbial genomes for the main components of NHEJ, reporting back on their occurrence, operonic linkages, and gene ordering. This data-mining will help us to identify new genes and model organisms for further study, as well possibly determining new as of yet undiscovered accessory proteins for NHEJ processing of DNA in prokaryotes.

References:
1. Aravind, L., and Koonin, E.V. (2001). Prokaryotic homologs of the eukaryotic DNA-end-binding protein Ku, novel domains in the Ku protein and prediction of a prokaryotic double-strand break repair system. Genome Res. *11*, 1365-1374.
2. Della, M., Palmbos, P.L., Tseng, H.M., Tonkin, L.M., Daley, J.M., Topper, L.M., Pitcher, R.S., Tomkinson, A.E., Wilson, T.E., and Doherty, A.J. (2004). Mycobacterial Ku and ligase proteins constitute a two-component NHEJ repair machine. Science *306*, 683-685.
3. Bartlett, E.J., Brissett, N.C. and **Doherty, A.J.** (2013)
Ribonucleolytic resection is required for repair of strand displaced NHEJ intermediates
Proc. Natl Acad. Sci. 110, E1984-91.

Project Title/Area:
Identification of associations between PrimPol and other biological pathways using in silico analysis

Course requirements: Bioinformatics, Biochemistry, Genetics or Biomedical science	No of places: 1-2	Data analysis /Literature

Further Information:
Recent work from my laboratory has implicated a novel family of polymerases in the replication of DNA in eukaryotes, including humans. The aim of this project is to use on-line tools to identify new information about the association between PrimPol and other DNA metabolism genes/proteins and also investigate its expression/mutation human diseases using available databases.

The project includes the following methodologies:

-Bioinformatic analysis of potential DNA repair genes in eukaryotic genome using sequence analysis, prediction of protein domains, functional prediction, blast / fasta.
-Data mining on PrimPol: expression, protein-protein interactions, genome comparisons ertc.

1. Rudd, S., Glover, L., Jozwiakowski, S.K., Horn, D., & **Doherty, A.J. (2013)** PPL2 translesion polymerase is essential for the completion of chromosomal DNA replication in the African trypanosome. Mol. Cell 52, 554-565
2. Bianchi, J., Rudd, S. Jozwiakowski, S.K., Bailey, L., Soura, V., Taylor, E., Stevanovic, I., Green, A.J., Stracker, T.H., Lindsay, H.D. & Doherty, A.J. (2013) PrimPol bypasses UV photoproducts during eukaryotic chromosomal DNA replication. Mol Cell, 52, 566-573

Project Title/Area:
Molecular roles of a novel eukaryotic polymerase, PrimPol, in DNA replication

Course requirements: Bioinformatics, Biochemistry, Genetics or Biomedical science	No of places: 1	Experimental

Further Information:
Recent work from my laboratory has implicated a novel family of polymerases in the repair of DNA in eukaryotes, including humans. The aim of this project is to elucidate the structure and function of these novel enzymes. This research will delineate the molecular role played by these enzymes in repairing DNA in eukaryotic cells. The outcome will directly impact on our understanding of the cellular mechanisms that propagate and repair DNA and will inform the development of diagnostic tools to identify mutations associated with human diseases and develop novel inhibitors that can treat disease and infection.

The project will involve the use of a variety of biochemical and molecular biology techniques (e.g. cloning, protein purification and DNA replication assays) to elucidate the mode of action of these novel DNA polymerases.

Reference

3. Minesinger BK, Wiltrout ME, D'Souza S, Woodruff RV, Walker GC. (2009) Eukaryotic translesion polymerases and their roles and regulation in DNA damage tolerance. Waters LS, Microbiol Mol Biol Rev. 73, 134-54.
4. Rudd, S., Glover, L., Jozwiakowski, S.K., Horn, D., & **Doherty, A.J. (2013)** PPL2 translesion polymerase is essential for the completion of chromosomal DNA replication in the African trypanosome. Mol. Cell 52, 554-565
5. Bianchi, J., Rudd, S. Jozwiakowski, S.K., Bailey, L., Soura, V., Taylor, E., Stevanovic, I., Green, A.J., Stracker, T.H., Lindsay, H.D. & Doherty, A.J. (2013) PrimPol bypasses UV photoproducts during eukaryotic chromosomal DNA replication. Mol Cell, 52, 566-573

Faculty Name: **Jessica Downs**
Room No: G3.19 Email: j.a.downs@sussex.ac.uk

Project Title/Area:
Analysis of the SWI/SNF chromatin remodelling complex and its contribution to cancer

Course or Module requirements: Cell Regulation and Cancer	No of places: 4	Project Type: Literature

Further Information:

Genes encoding the SWI/SNF chromatin remodelling complex are frequently mutated in cancer. In this project, the biological function of the complex will be explored through the literature, and the mutation spectrum and pattern of one of the subunits will be analysed using cancer databases.

Faculty Name: **Adam Eyre-Walker**
Room No: JMS 5b21 Email: a.c.eyre-walker@sussex.ac.uk

Project Title/Area: **The forces and factors that affect heritability.**

Course or Module requirements: Evolutionary biology	No of places: 4	Project Type: Experimental (including data analysis)

Further Information:
Heritability is a measure of the proportion of the variance in a trait, such as height, that can be ascribed to genetic variation. As such the heritability should depend on factors that are expected to affect the level of genetic variation within a species including the mutation rate, the strength of selection and genetic drift. In these projects students will test (i) whether heritability is correlated to the level of DNA sequence diversity across species; (ii) whether heritabilities are correlated to rates of mutation; (iii) whether heritabilities vary between species in systematic ways. All projects will include the compilation of data from the scientific literature and the analysis of the data using simple statistical methods.

Project Title/Area: **Is there nepotism in the awarding of research council grants?**

Course or Module requirements:	No of places: 2	Project Type: Experimental (including data analysis) /Literature

Further Information:
A large amount of science is funded by the government through research council grants. These grants are awarded on a competitive basis – individuals or organisations submit applications to the research councils and committees within the councils decide which projects to fund. The committees are largely made up of academics. The project will test whether research grants are more likely to be awarded to universities who have a member on the committee. The project will involve the curation of data from the research councils and some simple statistical analysis.

Project Title/Area: **Who pays for Open Access publishing?**

Course or Module requirements:	No of places: 2	Project Type: Experimental (including data analysis) /Literature

Further Information:
In the past the cost of publishing the scientific journals, and hence the scientific literature, was largely paid for by academic libraries through journal subscriptions. However, in recent times there has been a push to make the scientific literature available to everyone through open access. The cost of publishing in this model is born by the researcher. The researcher may get the funds to publish the research through a research grant or research council, departmental funds or their own personal funds. The object of the project is to investigate who is paying open access fees in the Life Sciences in the UK. The project will involve the design of a survey, emailing the survey to likely respondents and analysing the results.

Faculty Name: **Jeremy Field**
Room No: JMS 5b16 Email: j.field@sussex.ac.uk

Project Title/Area:
Reproduction and behaviour in primitively eusocial wasps and bees

Course or Module requirements:	No of places: 3	Project Type: Experimental
Animal Behavioural Ecology (Year 2) and Social Insects (Year 3) would both be useful but are not essential		

Further Information:

Many primitively eusocial wasps and bees nest in relatively small colonies of <10 individuals. Depending on the interests and availability of the student (summer vacation and/or Autumn term-time), the projects will involve one or a mixture of the following:

1. **Altruism and relatedness:** This project will compare the foraging effort of workers when the queen is their mother versus when she is unrelated following nest takeover by a foreign queen. This could involve behavioural observations over the summer using sweat bees that nest on the campus; or work in the Autumn term using previously gathered video recordings of paper wasp behaviour.

2. **Reproductive skew and relatedness:** This will involve DNA microsatellite genotyping of adults and offspring from sweat bee (*Lasioglossum*) or paper wasp (*Polistes*) nests using PCR, allowing offspring to be assigned to parents. The aim will be to test whether workers are more likely to attempt to lay eggs of their own if they are unrelated to the queen.

3. **Evolutionary history of social strategies:** This will involve sequencing different species of *Microstigmus* wasps and using the data to build a phylogenetic tree. The phylogeny will then be used to investigate the evolutionary history of social traits such as group size; and gradual versus bulk feeding of offspring.

Project Title/Area: Social Behaviour: Reproductive skew in animal societies

Course or Module requirements:	No of places: 1	Project Type: Literature
Social Insects (Year 3) and Cooperation & Conflict (Year 3) would be useful but are not essential		

Further Information:

Reproductive skew is said to be highest when only one member of a social group reproduces (e.g. the queen in a wasp nest), and lowest if reproduction is shared equally between group members (e.g. some communally-nesting birds). High skew is a key feature of eusocial insect and cooperatively-breeding vertebrate societies. Over the past 25 years, several models predicting what ecological and genetic factors determine skew have been proposed, and this project will involve reviewing the literature to evaluate whether published empirical data support the models.

Project Title/Area: Cuckoos and Kin: mechanisms underlying discrimination		
Course or Module requirements: Behavioural ecology (Year 2) would be useful but is not essential	No of places: 1	Project Type: Literature
Further Information: Animals vary in the extent to which they can discriminate kin/nest-mates from non-kin/non-nest-mates. Examples include nest guards in social insect colonies that use cuticular hydrocarbon cues when deciding which individuals to let in to their nests; and birds detecting whether their eggs have been replaced by the eggs of conspecific or heterospecific cuckoos: some birds are good at identifying foreign eggs while others rarely do so. This project will involve reviewing potential mechanisms involved in the discrimination of foreign intruders, and the circumstances when they are likely to apply.		

<table>
<tr><td colspan="3">Faculty Name: Tara Ghafourian
Room No: BMS4B15 Email: t.ghafourian@sussex.ac.uk</td></tr>
<tr><td colspan="3">Project Title/Area: Antioxidant and anticancer activity of flavonoids and their interaction with proteins</td></tr>
<tr><td>Course or Module requirements: Suitable for final year students</td><td>No of places: 2-3</td><td>Project Type: Experimental (including data analysis)</td></tr>
<tr><td colspan="3">Further Information: Compounds such as flavonoids are known for their antioxidant and anticancer properties which has been linked with their health benefits. The aim of this study is to use computer software to analyse protein binding of many flavonoid compounds using ligand-protein docking. The protein binding affinities can then be cross-referenced with antioxidant or anticancer behaviour of these compounds. Of particular interest is binding to P-glycoprotein and several protein kinases.</td></tr>
<tr><td colspan="3">Project Title/Area: Drug-induced hepatotoxicity</td></tr>
<tr><td>Course or Module requirements: Suitable for final year students</td><td>No of places: 2</td><td>Project Type: Experimental (including data analysis)</td></tr>
<tr><td colspan="3">Further Information: Drugs can cause hepatic toxicity via different mechanisms. The aim of this project is to analyse hepatotoxicity of many drugs and find models that can link these toxicities with the molecular structures of drugs.</td></tr>
</table>

Faculty Name: **Georgios Giamas**
Room No: JMS 3C6 Email: g.giamas@sussex.ac.uk

Project Title/Area:
Elucidate the role of LMTK3 in tumour microenvironment remodelling using Three-Dimensional (3D) cell co-culture models

Course or Module requirements: Cancer / Cell Biology	No of places: **2**	Project Type: **Experimental**

Further Information:

LMTK3 is an oncogenic Receptor Tyrosine Kinase (RTK) implicated in numerous types of cancer including breast, lung, gastric and colorectal. Initially, we described LMTK3 as a regulator of Estrogen Receptor alpha (ERα). Moreover, we have demonstrated the contribution of LMTK3 in breast cancer invasion and migration via cross-talk between RTKs and integrins. Recently, we showed a new scaffolding function of LMTK3 that results in cancer progression through chromatin remodelling.

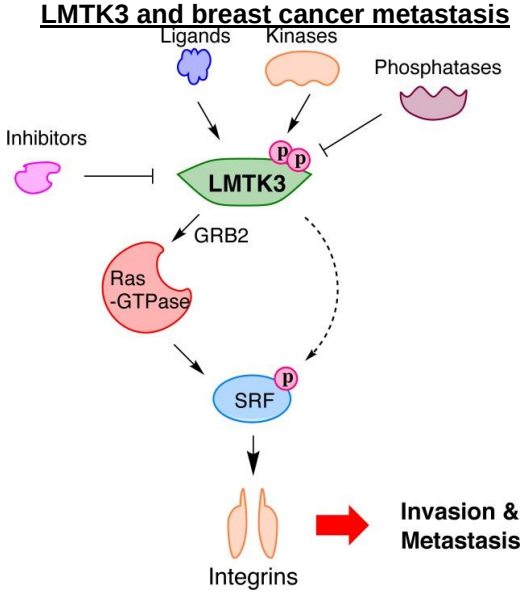
The tumour microenvironment (TME) consists of a variety of cell types (i.e. fibroblasts, bone marrow-derived cells, blood vessels, immune cells, lymphocytes, etc) that constitute the cellular environment in which the tumour exists. Since TME has been recognized as a key contributor for cancer progression and drug resistance therapies targeting the host compartment of tumours have begun to be designed and applied in the clinic.

In order to mimic the heterogeneity of tumours, various models have been established the last decade. Amongst them, three-dimensional (3D) co-cultures, closely resembling *in vivo* tissues, represent a *bona fide* models currently used in cancer research.

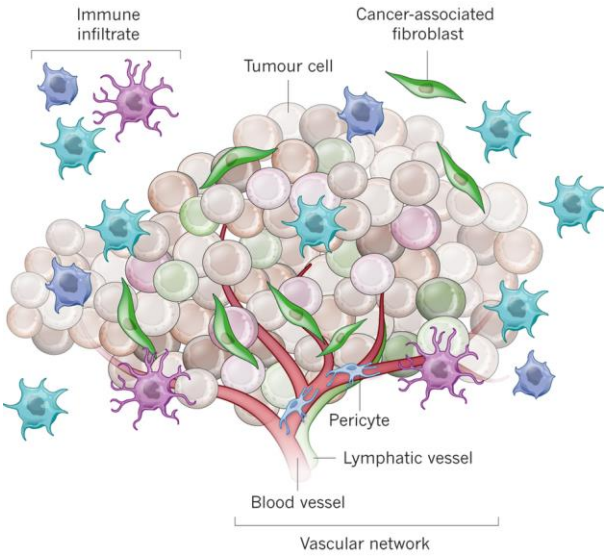
In this project, students will use different 2D and 3D cell culturing protocols in order to investigate the role of LMTK3 (and potentially other important proteins) in the remodelling of TME. A variety of molecular, cellular and biochemical techniques will also be employed including: SDS-PAGE, Western Blotting, Co-immunoprecipitation (Co-IP) assays, real-time quantitative PCR (qRT-PCR) and others.

(Students will be acknowledged in any papers published using data from this study).

LMTK3 and breast cancer metastasis



The complexity of the tumour microenvironment



References:

- *Xu Y. et al. 'LMTK3 Represses Tumour Suppressor-Like Genes through Chromatin Remodeling in Breast Cancer'. Cell Reports 2015 Aug 4;12(5):837-49.*
- *Xu Y. et al*. 'The kinase LMTK3 promotes invasion in breast cancer through GRB2-mediated induction of integrin β_1'. Sci Signal. 2014 Jun 17;7(330):ra58.
- *Stebbing J. et al.* 'LMTK3 is implicated in endocrine resistance via multiple signaling pathways'. Oncogene. 2013 Jul 11;32(28):3371-80.
- *Giamas G. et al.* 'Kinome screening for regulators of the estrogen receptor identifies LMTK3 as a new therapeutic target in breast cancer'. Nat Med. 2011 Jun;17(6):715-9.

Project Title/Area:

Examining the mitochondrial proteome in cancer
(another topic on translational cancer research could be available as well)

Course or Module requirements: Cancer/ Cell Biology	No of places: **1**	Project Type: **Literature** (including data analysis)

Further Information:

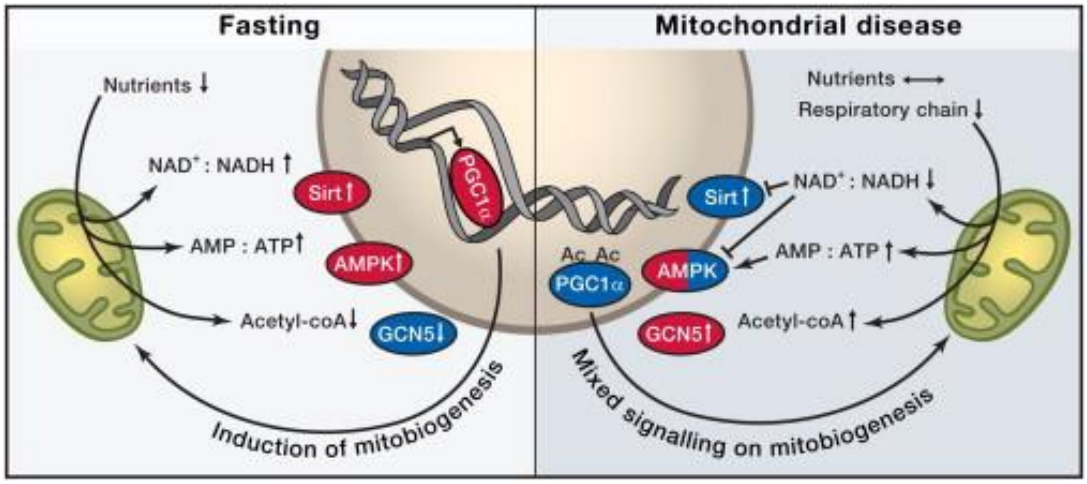
Mitochondria are dynamic organelles that exert a great variety of vital functions, generating ATP and many biosynthetic intermediates as well as regulating cellular stress responses such as apoptosis, necrosis and autophagy. Given their essential role in in the regulation of fundamental cellular functions, mitochondrial dysfunction has been recognised as a key factor in a myriad of diseases, including cancer.

Apart from mutations of the mitochondrial DNA, the proteomic portraits of mitochondria (overexpression, loss of expression, post-translational regulation, or expression of a mutated protein) have also been massively implicated in tumorigenesis and tumour progression.

Advances in mass spectrometry (MS)-based quantitative proteomics have been widely applied in cancer research, allowing large scale, robust and confident identification of biochemical networks implicated in cancer.

Students will investigate the recent advances in this field and discuss future perspectives.

(Students will be acknowledged in any papers published using data from this study).



References:

- Nunnari J and Suomalainen A. 'Mitochondria: in sickness and in health'. Cell. 2012 Mar 16;148(6):1145-59.
- Samir Hanash and Ayumu Taguchi. 'The grand challenge to decipher the cancer proteome'. Nat Rev Cancer. 2010 Sep;10(9):652-60.
- Gstaiger M and Aebersold R. 'Applying mass spectrometry-based proteomics to genetics, genomics and network biology'. Nat Rev Genet. 2009 Sep;10(9):617-27.
- Verma M. et al. 'Proteomic analysis of cancer-cell mitochondria'. Nat Rev Cancer. 2003 Oct;3(10):789-95.

Faculty Name: **Prof Martin Gosling / Dr Henry Danahay**
Room No: Chichester 2 2R215A Email: m.gosling@sussex.ac.uk

Project Title/Area:
The effects of respiratory viruses upon the mucociliary function of human airway epithelium

Course or Module requirements:	No of places: 2	Project Type: Experimental (including data analysis)
Students with a strong interest in undertaking a project in the cell biology area (Biochemistry/BioMedSci/Virology/Immunology)		

Further Information:
Lung epithelial cells are a key part of pulmonary innate host defence providing a barrier which prevents air-born noxious particles from entering the bloodstream. These specialised cells are dynamic, and can respond rapidly when challenged by upregulating/downregulating genes and changing their function profoundly.
This project aims to characterise the response of human primary epithelial cells to viral challenges – the project will use a variety of molecular, biochemical and functional experimental techniques.

Project Title/Area:
Electrophysiological characterisation of voltage-gated sodium channels involved in pain sensation

Course or Module requirements:	No of places: 1	Project Type: Experimental (including data analysis)
Neuroscience/BioMedSci/Biochemistry/Pharmacology		

Further Information:
Voltage gated sodium channels (VGSCs) are responsible for the initiation and propagation of action potentials in all nerves, including nociceptive sensory neurones. There are 9 genes which encode VGSCs alpha subunits (SCN1A – SCN9A) giving rise to the channel superfamily, NaV1.1 – NaV1.9. Studies in humans with congenital sensitivity or insensitivity to pain have highlighted the NaV1.7 and NaV1.8 family members as having a key role in pain sensation.
This project will undertake a basic electrophysiological and pharmacological characterisation of NaV1.7 or 1.8 stably expressed in a recombinant cell line. The project will involve cell culture and patch clamp electrophysiological techniques.

Project Title/Area:
Airway lumen pH – a key defect in cystic fibrosis?

Course or Module requirements:	No of places: 1	Project Type: Literature
Physiology/Biochemistry/Pharmacology		

Further Information:
The lack of CFTR function is the underlying genetic cause of cystic fibrosis. However how the defective channel leads to the pulmonary pathophysiology is not fully defined. A body of evidence suggests that airway lumen pH is abnormal/dysregulated in CF. This project will critically review the literature with the aim of identifying potential drug targets to impact upon airway lumen pH.

Faculty Name: **Prof Dave Goulson**
Room No: 4D20 Email: D.Goulson@sussex.ac.uk

Project Title/Area: **Effect of diet and pesticide exposure on larval development in a solitary bee, *Osmia bicornis***

Course requirements: E&E/Biology	No of places: 1	Experimental

The decline of bees and other pollinators has received much attention recently, not least because of our increasing reliance on insect-pollinated food crops. Human-driven changes to the natural environment, such as habitat loss or pesticide exposure have been implicated in bee declines, but most research to date has focused on just two species; honeybees and bumblebees. In this project we will study the combined effects of poor diet and early-life exposure to pesticides on the development and survival of a less well studied bee, *Osmia bicornis*. The project will involve both field and laboratory work, setting up trap nests and collecting bees in Stanmer Park and manipulating food/pesticide exposure and monitoring larval development in the lab. Summer fieldwork required.

Project Title/Area: **Quantifying changing pesticide use and exposure of bees in the UK over time**

Course requirements: E&E/Biology	No of places: 1	Experimental

There is great concern that pesticides may be contributing to ongoing declines of bees and other wildlife. This project will use the very large database of pesticide usage in the UK which is maintained by Defra (PUSSTATS), to analyze how patterns of pesticide usage have changed over time. The project will then assess toxicity of each compound, and factors such as mode of use and persistence, to calculate an overall risk index per year for pesticides to bees (and perhaps also other insects), and whether this has increased or decreased over time. Good numeracy and competence with spreadsheets are required!

Project Title/Area**: How has earthworm abundance changed over time?**

Course requirements: E&E/Biology	No of places: 1-2	Experimental

Further Information:

Earthworms play an important role in maintaining soil health and drainage characteristics. They are likely to be heavily impacted by farming practices such as ploughing and use of pesticides. However, we have no long-term data set on how their abundance has changed. Here we will locate old studies in which populations of worms have been assessed in particular sites in the past, and return to those sites to resample worms in the present, so that we can test whether worm abundance has changes substantially over time. Summer fieldwork required. Own car would be very helpful.

Project Title/Area: **Impact of rootling by feral pigs on insect communities at the Knepp rewilding project, W Sussex**		
Course requirements: E&E/Biology	No of places: 1	Experimental

Further Information:

Knepp is a 3,500 acre rewilding project, and which natural ecological processes are being allowed free-reign. Pigs, deer, cattle and ponies live 'wild' on the estate. One obvious ecological effect of these large grazers is the rootling by pigs, a process that has not happened in the UK since wild boar were exterminated many hundreds of years ago. The pigs turn over large areas of turf with their snouts, creating bare patches of soil. This project will assess the value of these areas for invertebrates; do they provide nesting opportunities for solitary bees and wasps? Are they used for basking by butterflies? Surveys of bee nesting sites and use by basking insects will be carried out, comparing rootled areas with non-rootled areas. For this, you will need to be able to get to Knepp (by car, bus or bike). Simple accommodation may be available on site.

This project would need to be done in the summer.

Project Title/Area: **Investigating the effects of pesticides on hoverfly larvae**		
Course requirements: E&E/Biology	No of places: 1-2	Experimental

Further Information:

There is growing evidence that some classes of pesticides may be having significant impacts on wildlife. Much attention has been paid to the impacts of pesticides on bees, but other wild insects are also likely to be affected. Here, we propose to investigate the impact that neonicotinoid insecticides may have on the aquatic larvae of hoverflies such as *Eristalis* sp. The immature stages of these insects live in nutrient-rich puddles/ponds, grazing on bacteria. Aquatic habitats are frequently contaminated with neonicotinoids. We will put out larval habitats contaminated with different levels of neonicotinoids, and quantify their colonisation by hoverflies. We will also do simple toxicity trials by exposing larvae experimentally to different concentrations of the pesticides. The overall aim is to ascertain if field-realistic levels of exposure are likely to result in measureable harm to these important pollinating insects.

This project would need to be done in the summer.

Faculty Name: **Dr Paul Graham**
Room No: **3d10** Email: **p.r.graham@sussex.ac.uk**

Project Title/Area: **What cognitive processes underlie human navigation?**

Course or Module requirements:	No of places: **5**	Project Type: **Experimental**
This project is ideal for neuroscience students		

Further Information:

Navigation is a fundamental behaviour for all animals and there are actually broad similarities in the navigation strategies of small and large brained navigators. We know lots about the detailed behavioural strategies of small brained navigators (and how this relates to the real world). For vertebrates, we know lots about the kinds of computation undertaken in specialist circuits in the brain (Nobel prize 2014) but very little about how this relates to natural behaviour. The aim of this project is to investigate natural scale spatial behaviour in humans and relate this to cutting edge theories in cognitive neuroscience.

We will use simple, freely available technology (phones, gps etc.) to track day-to-day movements of subjects. Then, based on this, we will examine the spatial knowledge of these subjects. How good are they at recognising locations, drawing accurate maps, and guiding routes? We will use eye tracking to relate spatial knowledge to how we look at scenes. Some people claim to have a bad sense of direction (but actually rarely get lost) whereas some people have a good sense of direction. We can ask if these two groups of people use space differently and have different types of spatial knowledge. What's more we can relate this to what we know about the neural circuits underpinning mapping and route taking.

Faculty Name: **Dr Majid Hafezparast**
Room No: PC5.21, CRPC Building Email: m.hafezparast@sussex.ac.uk

Project Title/Area:
Cloning of a selected set of genes for investigating the underlying molecular mechanisms of neurodegenerative disease

Course or Module requirements:	No of places: 3	Project Type: Experimental (including data analysis)
Sound background knowledge of Molecular Genetics techniques		

Further Information:

Neurons are a group of highly specialised cells with long processes, which could extend a meter or longer in humans. Fast intracellular transport is therefore pivotal for the appropriate distribution and processing of organelles, macromolecules and signalling endosomes, and for normal function of neurons and their survival. The main proteins involved in this transport are motor protein complexes known as cytoplasmic dynein and kinesins. Defects in the functions of these proteins have been shown to contribute to a range of neurological diseases including motor neuron disease, Huntigton's disease, Alzheimers disease, and Parkinson's disease.

Cytoplasmic dynein requires adapter proteins such as Bicaudal homolog 2 (BICD2) and RAB6 for moving along the microtubule tracks and for transporting its cargo. The dynein motility on the microtubules is also influenced by acetylation and de-acetylation of the microtubules. The aim of this project is to clone cDNAs of Histone deacetylase 6 (HDAC6), microtubule acetyle transferase, BICD2 and RAB6 for generating fusion fluorescent proteins and imaging in wild type and mutant fibroblasts. Each student will take on one of these genes. The project involves bioinformatics, designing oligo-primers for reverse-transcription polymerase chain reaction (RT-PCR), RT-PCR, recombinant DNA techniques and gel electrophoresis.

Project Title/Area:
Investigations into the role of dysregulation of alternative translation in motor neuron disease

Course or Module requirements:	No of places: 1	Project Type: Literature
Sound knowledge of gene regulation, transcription, and translation		

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.

We have evidence that TDP-43 is likely involved in alternative translation of genes implicated in ALS. Alternative translation is a process in which two or more proteins are translated from a single mRNA transcript using alternative translation initiation codons. The aim of this project is to identify genes that undergo alternative translation in the central nervous system. The project will involve literature mining and use of databases such as TISdb (http://tisdb.human.cornell.edu) to catalogue the candidate genes whose alternative translation is likely regulated by TDP-43. These findings will be evaluated experimentally in future studies.

Project Title/Area:
Critical review of the literature on clinical trials for motor neuron disease

Course or Module requirements:	No of places: 1	Project Type: Literature
Neuroscience 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.

Faculty Name: **Liz Hill**
Room No: 4B14 Email:e.m.hill@sussex.ac.uk

Project Title/Area

Literature based project on some aspect of environmental pollution and its effects on human or wildlife health

Course or Module requirements:	No of places: 5	Project Type:
none		Literature

Further Information:

I am open to suggestions after discussions with the student. The main point is that this is not just a summary of the literature but also involves some original work such as analysis of experimental evidence or an evaluation of future research needs etc.

Faculty Name: **Geeta Hitch**
Room No: JMS2B2 Email:g.hitch@sussex.ac.uk

Project Title/Area:
Knowledge, perceptions, and attitudes of junior doctors toward antimicrobial prescribing in UK hospitals

Course or Module requirements:	No of places: 1	Project Type:
Knowledge of medical microbiology		Literature

Further Information:

Between 20% and 50% of antibiotic use is either unnecessary or inappropriate and decreasing it is a necessary first step to curb antibiotic resistance. However, there are many factors which play a part in the manner in which antibiotics are prescribed and used in hospitals. This literature-based project will involve a critical appraisal of published research on the knowledge, perceptions, and attitudes of junior doctors toward antimicrobial prescribing in UK hospitals in order to identify crucial factors which are key drivers in unnecessary or inappropriate antibiotic use and implementation of effective strategies to improve antibiotic use towards better patient outcomes.

Project Title/Area: **Knowledge, perceptions, and attitudes of general practitioners toward antimicrobial prescribing in UK**

Course or Module requirements:	No of places: 1	Project Type:
Knowledge of medical microbiology		Literature

Further Information:
Between 20% and 50% of antibiotic use is either unnecessary or inappropriate and decreasing it is a necessary first step to curb antibiotic resistance. However, there are many factors which play a part in the manner in which antibiotics are prescribed and used in community. This literature-based project will involve a critical appraisal of published research on the knowledge, perceptions, and attitudes of general practitioners toward antimicrobial prescribing in community in order to identify crucial factors which are key drivers in unnecessary or inappropriate antibiotic use and implementation of effective strategies to improve antibiotic use towards better patient outcomes.

Project Title/Area: **Knowledge, perceptions, and attitudes of antimicrobial pharmacists toward antimicrobial prescribing by junior doctors in UK**

Course or Module requirements:	No of places: 1	Project Type:
Knowledge of medical microbiology		Literature

Further Information:

Between 20% and 50% of antibiotic use is either unnecessary or inappropriate and decreasing it is a necessary first step to curb antibiotic resistance. However, there are many factors which play a part in the manner in which antibiotics are prescribed and used in hospitals. This literature-based project will involve a critical appraisal of published research on the knowledge, perceptions, and attitudes of antimicrobial pharmacists toward antimicrobial prescribing by junior doctors in UK
in order to identify crucial factors which are key drivers in unnecessary or inappropriate antibiotic use and implementation of effective strategies to improve antibiotic use towards better patient outcomes.

<table>
<tr><td colspan="3">Faculty Name: Bill Hughes
Room No: 5B17 Email: william.hughes@sussex.ac.uk</td></tr>
<tr><td colspan="3">Project Title/Area: Social cooperation and conflict</td></tr>
<tr><td>Course or Module requirements:

C1020 Animal Behavioural Ecology</td><td>No of places: 2</td><td>Project Type: Experimental</td></tr>
<tr><td colspan="3">Further Information:
Sociality and symbiosis are fundamental to practically all of life and are characterised by a delicate balancing act between cooperation and conflict of the interacting individuals. Some interactions, such as ant colonies, may outwardly seem models of cooperation but are in reality ridden by conflict. Others that appear paradigms of conflict, such as parasite infections, may include elements of cooperation. This project will use social insects to investigate the division of labour by which cooperative benefits are achieved, the dynamics of conflicts, or the ways in which symbionts and sociality interact.</td></tr>
<tr><td colspan="3">Project Title/Area: Pollinator pathogens</td></tr>
<tr><td>Course or Module requirements:

C1020 Animal Behavioural Ecology</td><td>No of places: 1</td><td>Project Type: Experimental</td></tr>
<tr><td colspan="3">Further Information:
There is growing concern about declines in the populations of many pollinator insects and the potential implications of these declines for both food security and ecological biodiversity. Although the causes of pollinator declines are multifactorial, one of the major causes in many cases is exposure to existing or emergent pathogens. This project will study the occurrence, transmission and effects of diseases in bees, or investigate methods by which we may be able to enhance their resistance to disease.</td></tr>
<tr><td colspan="3">Project Title/Area: Predator personalities</td></tr>
<tr><td>Course or Module requirements:

C1020 Animal Behavioural Ecology</td><td>No of places: 2</td><td>Project Type: Experimental</td></tr>
<tr><td colspan="3">Further Information:
One of the most important advances in the science of animal behaviour in recent year has been the realisation that many animal species show consistent individual differences in behaviour (‘personalities’) that are likely to be of great ecological, evolutionary and conservation importance. However, there has been little study of animal personalities in large apex predators. This project will investigate either lion personalities in Zambia (based near Livingstone), megafauna prey personalities in South Africa (Mossel Bay), or white shark personalities in South Africa (Mossel Bay). It will require 4-6 weeks of fieldwork at the relevant study site during the summer vacation. Students selecting this project need to be able to: 1) carry out the work during a specified 4-6 week period in the summer holiday, and 2) self-fund their travel to/from the study site, and their accommodation and subsistence costs during their fieldwork. Accommodation and meals will be organised with our collaborators. Details of the costs are available on request.</td></tr>
</table>

Project Title/Area: **Shark parasites**		
Course or Module requirements: C1020 Animal Behavioural Ecology	No of places: 1	Project Type: Experimental (including data analysis)
Further Information: Parasites are a major force in the evolution and ecology of animals, by either directly impacting the fitness of their host or indirectly impacting host fitness by vectoring other microbial parasites. However, the impact of parasites on marine apex predators is very poorly known. White sharks are charismatic apex predators of significant conservation concern which host a diversity of little-studied ectoparasitic copepods on their gills, nostrils, mouth, eyes and body surface. This project will use a digital library of white shark photos and videos to quantify the prevalence and intensity of copepod parasite infections on white sharks, and examine how these correlate with the age, health and the behaviour of sharks.		

Faculty Name: **Prof George Kemenes**
Room No: JMS 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 discussions with the students.**

Course or Module requirements: Medical Neuroscience, Principles of Neuroscience, Neural Circuits or BSMS 202 Module	No of places: 3	Project Type: Experimental (including data analysis) /Literature

Further Information: Professor Kemenes investigates evolutionarily conserved mechanisms of learning and memory, such as the role of second messenger cascades (e.g., cAMP, PKA, CaMKII), transcription factors (e.g., CREB, C/EBP) and receptors (e.g., NMDA, AMPA) in short, medium and long-term memory. He is also investigating the links between behavioural decision-making and learning. The students will work on different aspects of this general theme, using a combination of behavioural/pharmacological and molecular methods.

Recent relevant papers from the Kemenes lab:

Ford L, Crossley M, Williams T, Thorpe JR, Serpell LC, Kemenes G. Effects of Aβ exposure on long-term associative memory and its neuronal mechanisms in a defined neuronal network. Sci Rep. 2015 May 29;5:10614. doi: 10.1038/srep10614.

Interneuronal mechanism for Tinbergen's hierarchical model of behavioral choice. Pirger Z, Crossley M, László Z, Naskar S, Kemenes G, O'Shea M, Benjamin PR, Kemenes I. Curr Biol. 2014 Sep 8;24(17):2018-24.

Naskar S, Wan H, Kemenes G. pT305-CaMKII stabilizes a learning-induced increase in AMPA receptors for ongoing memory consolidation after classical conditioning. Nat Commun. 2014 May 30;5:3967. doi: 10.1038/ncomms4967.

Pirger Z, Naskar S, László Z, Kemenes G, Reglődi D, Kemenes I. Reversal of age-related learning deficiency by the vertebrate PACAP and IGF-1 in a novel invertebrate model of aging: the pond snail (*Lymnaea stagnalis*). J Gerontol A Biol Sci Med Sci. 2014 Nov;69(11):1331-8. doi: 10.1093/gerona/glu068.

Nikitin ES, Balaban PM, Kemenes G (2013) Nonsynaptic plasticity underlies a compartmentalized increase in synaptic efficacy after classical conditioning. Curr Biol. 23:614-9.

Korneev SA, Kemenes I, Bettini NL, Kemenes G, Staras K, Benjamin PR, O'Shea M (2013) Axonal trafficking of an antisense RNA transcribed from a pseudogene is regulated by classical conditioning. Sci Rep, 3, 1027:1-5.

Kemenes G (2013) Molecular and Cellular Mechanisms of Classical Conditioning in the Feeding System of *Lymnaea.* In: Invertebrate Learning and Memory (eds. Randolf Menzel and Paul R. Benjamin), Handbook of Behavioural Neuroscience (ed. Joseph P. Huston). San Diego: Academic Press, pp. 251-264.

Project Title/Area**: "Nature or nurture": How does the interaction between genetically encoded information and learning shape the behavioural phenotype?**

Course or Module requirements: Medical Neuroscience, Principles of Neuroscience, Neural Circuits or BSMS 202 Module	No of places: 2	Project Type: Experimental (including data analysis) /Literature

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. Professor Kemenes is also happy to supervise projects based on ideas developed by the students, provided they fall into the broad area of memory function and dysfunction.

Faculty Name: **Ildiko Kemenes**
Room No: 325 CRPC Email: I.Kemenes@sussex.ac.uk

Project Title/Area:
Memory lapses during consolidation

Course requirements: Principles of Neuroscience, Neural Circuits	No of places: 2	Experimental

Further Information:

Reports of temporary amnesia (or lapses) during memory consolidation are widespread, but it is not clear whether these lapses serve a functional role. It has already been shown on a snail model system that, lapses occur at critical time points corresponding to changes in molecular mechanisms underlying transitions between different phases of memory.
Students will look at electrophysiological recordings and will analyse the data produced by experienced scientists in the lab. There will be some opportunity to get involved in the experiments but the main emphasis will be on the analysis and interpretation of the data.

Project Title/Area:
Memory consolidation

Course requirements: Principles of Neuroscience, Neural Circuits	No of places: 1	Experimental

Further information:
Memory consolidation, the progressive post-acquisition stabilization of long-term memory that takes place during sleep or wakeful quiescence is a major current topic of research. In my lab we are focusing on the cellular molecular level changes related to memory formation using the pond snail (*Lymnaea stagnalis*) as a model system. In our recent studies we discovered that disturbance at certain times after learning disrupts memory while at other times it has no effect. In this project students will conduct behavioural and/or pharmacological experiments to look at the periods of vulnerability and will also investigate whether snails also need “sleep” for memory consolidation.

Project Title/Area: **Brain aging**		
Course requirements:	No of places: 1	Literature
Further Information: With the expansion and general availability of medical techniques and services the average age limit rapidly increased in the last century and some predict the average lifespan to reach 105 years by 2020. While there are numerous scientific advances supporting physiological wellbeing there is much less known about the normal aging of the brain. Considerable effort has been invested in the research of age related neurodegenerative changes such as Alzheimer and Parkinson's disease, but much less is known about the neuronal processes during normal aging leading to different degrees of dementia This project will aim to discuss and give a comprehensive overview of the findings related to changes on the circuit and synaptic level in the aging brain.		
Project Title/Area: **Visualizing and manipulating the memory trace**		
Course requirements: Principles of Neuroscience, Neural Circuits	No of places: 1	Literature
Further Information: A fundamental goal of neuroscience is to understand how the brain encodes and stores information. Historically, neuroscientists have focused on understanding the nervous system using the individual neuron or synapse as its focus of analysis. However, as pointed out by Richard Morris and colleagues (Annual Review of Neuroscience, 2000), "it is a big leap from the synapse to the behaving animal and the chasm in between is the neural network". Therefore, an ideal way to understand the neural basis of memory is to identify and manipulate these specific memory circuits (or traces) in intact, behaving animals. Until very recently, however, studies of this kind were not possible. However, the development of new tools is now allowing researchers to conduct these studies. The purpose of this project will be to provide an overview of the recent developments on the methods used to examine how neuronal systems mediate different types of memory and contrast them with more conventional approaches.		

Faculty Name: **Dr Sergei A Korneev**
Room No: CRPC 423 Email: s.korneev@sussex.ac.uk

Project Title/Area:
The role of non-coding RNAs in the regulation of nitric oxide signalling in the CNS

Course or Module requirements:	No of places: 2	Project Type:
Good background in Molecular Biology		Lab-based experimental project

Further Information:
At the heart of this **lab-based experimental project** is a distinct class of non-coding RNAs that is 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.

Project Title/Area:
The role of epigenetic mechanisms in neuronal plasticity

Course or Module requirements:	No of places: 3	Project Type:
Good background in Molecular Biology		Literature-based experimental project

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, histone modifications and non-coding RNAs in neuronal functions.

Faculty Name: **Prof Corné Kros**
Room No: CRPC 325 Email: c.j.kros@sussex.ac.uk

Project Title/Area: **Perception of language and music by cochlear implant users**

Course or Module requirements: Principles of Neuroscience (Yr 2) or Medical Neuroscience (Yr 2)	No of places: 2	Project Type: Literature

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, arguably the most successful bionic devices used in medicine. Comparing findings in people with inborn hearing defects with those who acquire sensory-neural deafness at a later stage could be particularly informative.

Project Title/Area: **Investigate the function and prevalence of spontaneous electrical activity in cells and tissues during development**

Course or Module requirements: Principles of Neuroscience (Yr 2) or Medical Neuroscience (Yr 2)	No of places: 1	Project Type: Literature

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.

Project Title/Area: **Drug ototoxicity: mechanisms and prevention**

Course or Module requirements: Principles of Neuroscience (Yr 2) or Medical Neuroscience (Yr 2)	No of places: 2	Project Type: Literature

Further Information:
Ototoxicity, leading to permanent hearing loss, is an unfortunate side effect of important and useful drugs, such as the aminoglycoside antibiotics and the anticancer drug cisplatin. The student will conduct a literature search and formulate a critical evaluation of the putative mechanisms of the ototoxicity of these drugs, and consider ways in which this side effect could be reduced or prevented.

Faculty Name: **Leon Lagnado**
Room No: CRPC 5.08 Email: l.lagnado@sussex.ac.uk

Project Title/Area: What is the function of the synaptic ribbon?

Course or Module requirements:	No of places:	Project Type:
Principles of Neuroscience / Neural Circuits		Literature

Further Information:

The first stages of vision and hearing involve the transmission of signals across specialized synapses containing a structure called a "ribbon". What are the functions of the synaptic ribbon and how can they be investigated?

Project Title/Area:
Testing optical reporter proteins of neural activity

Course or Module requirements:	No of places:	Project Type:
Principles of Neuroscience / Neural Circuits	2	Experimental (including data analysis)

Further Information:

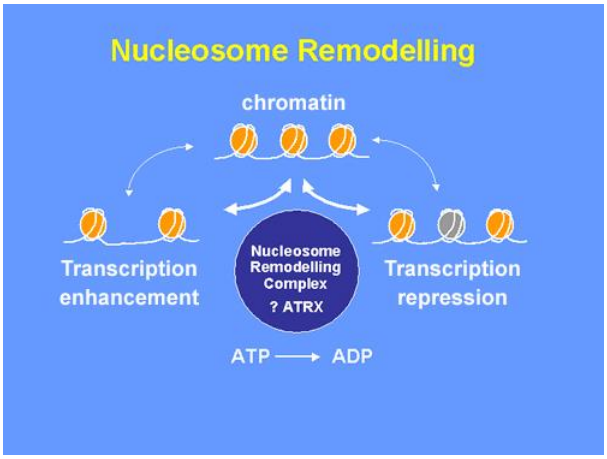
Protein-based fluorescent reporters of neural activity are now a key tool in Neuroscience because they allow activity to be imaged across populations of neurons in intact circuits and live animals. These reporters are being continuously developed by protein engineers designing new variants of proteins that change their fluorescence in response to binding calcium or neurotransmitters, or changes in membrane voltage. In this project we will use cultured neurons to characterize the properties of at least two reporter proteins that offer promise for imaging neural activity: a voltage-sensitive protein and a calcium-sensitive protein. The project will also involve computer-based image analysis.

Faculty Name: **Erika Mancini**
Room No: 3C18 Email:erika.mancini@sussex.ac.uk

Project Title/Area:
Chromatin Remodeling Factor in Human Disease: Structural Studies of ATRX by Cryo-EM

Course or Module requirements:	No of places: 1	Project Type:
Structural Basis of Biological Function Protein Form and Function		Experimental (including data analysis)

Further Information:



The aim of this project is to help with the on-going efforts to obtain a structural characterization of chromatin remodelling protein ATRX by Cryo-Electron Microscopy.

Chromatin remodelling (CR) proteins[1] are key regulators of transcriptional activity and accumulating genetic evidence suggests that their mutation often causes complex multi-system diseases and cancer[2]. One of the CRs being studied by Dr Mancini is the human ATRX. Mutations in the coding region of the ATRX gene give rise to a mental retardation syndrome known as X-linked alpha thalassemia mental retardation (ATR-X) syndrome[3]. It is characterized by severe learning difficulties, a characteristic facial appearance, abnormalities of genital development and alpha thalassemia. In this syndrome, the alpha thalassemia is due to down-regulation of alpha globin gene expression and this points to a role of ATRX in regulating transcription. ATRX is a large (280-kDa) protein that is widely expressed throughout development. It contains two highly conserved subdomains. At the N terminus is an extended PHD-like domain that is most closely related to domains found in the de novo methyltransferase. At the C terminus is a helicase/ATPase domain that classifies ATRX as a member of the SNF2 family of molecular motors. The functional importance of the PHD-like and helicase domains has been confirmed by the fact that nearly all inherited ATRX mutations fall within these two regions of the protein[4]. The prospective student will be purifying ATRX constructs and subjecting them to Cryo-Electron Microscopy

1.Lèangst, G. & Becker, P.B. Biochim Biophys Acta 1677, 58-63 (2004).
2.Huang, C., Sloan, E.A. & Boerkoel, C.F. Curr Opin Genet Dev 13, 246-52 (2003).
3.Gibbons, R.J., Picketts, D.J., Villard, L. & Higgs, D.R. Cell. 80, 837-45 (1995).
4.Gibbons, R.J. et al. Nature genetics. 24, 368-71 (2000).
5.Thoma, N.H. et al. Nat Struct Mol Biol 12, 350-6 (2005).6.Durr, H., Korner, C., Muller, M., Hickmann, V. & Hopfner, K.P. Cell 121, 363-73 (2005).

Project Title/Area:
Roles for CHD4 and CHD5 chromatin remodelers in DNA Damage Repair

Course or Module requirements:	No of places: 2	Project Type:
Structural Basis of Biological Function Protein Form and Function		Literature

Further Information
Utilizing energy from ATP hydrolysis, chromatin remodelling ATPases serve as the gatekeepers of genomic access and are essential for transcriptional regulation, DNA replication and cell division. In recent years, a vital role in DNA Double Strand Break (DSB) repair has emerged, particularly within complex chromatin environments such as heterochromatin, or regions undergoing energetic transactions such as transcription or DNA replication. The student will provide an overview of what is understood about ATP-dependent chromatin remodelling enzymes in the context of the DNA damage response for chromatin remodellers CHD4 and CHD5.

Faculty Name: **Miguel Maravall**
Room No: CRPC 5.03 Email: m.maravall@sussex.ac.uk

Project Title/Area: **Human Recognition of Arbitrary Temporal Patterns in Touch and Hearing**

Course or Module requirements:	No of places: 3	Project Type: Experimental (including data analysis)
Principles of Neuroscience • Neural Circuits		

Further Information:

Making sense of the world requires the capacity to recognise patterns that unfold over time, such as a passage of speech or a melody. We want to understand human and mammalian capacities for remembering and recognising temporal patterns, and ultimately to understand how neurons work together to achieve those capacities. To this end we have created a sensory sequence recognition task that can be performed by mice and by humans. We have found that humans can quickly learn a target stimulus, which was meaningless to start with and is defined only by its temporal patterning. The stimulus can be recognised whether presented as a tactile vibration sequence delivered to the fingertip or a noisy sound sequence delivered through headphones. We want to improve our understanding of these abilities – e.g. how sequence learning transfers and generalises, and how different senses are pooled to generate a multimodal sensation of a temporal pattern.

In this project you will run experiments in our lab, recruiting human participants and recording their responses using custom-written programs and apparatus. You will have the option of helping to develop these tools, and of learning to perform sophisticated data analysis on the results. A previous project on this topic has generated publishable data. A quantitative background and/or a desire to learn analysis software would be helpful for this project.

Project Title/Area: **Hierarchies of Temporal Processing in the Cerebral Cortex**

Course or Module requirements:	No of places: 1	Project Type: Literature
Principles of Neuroscience • Neural Circuits		

Further Information:

As we explore an environment, incoming information is constantly being integrated with our previous sensations and with memories that help us make sense of the situation. This accumulation of information allows us to make sense of speech, movies, textures, or indeed any stimulus extended in time and whose meaning depends on context. How this temporal integration occurs at the level of neuronal circuits is surprisingly poorly understood. It is known that a hierarchy of temporal integration exists in humans: “higher” parts of the cortex involved in object recognition and which respond to global properties of an object (e.g. a spoken word sentence or paragraph) accumulate information over longer time scales than sensory parts of the cortex, which respond only to instantaneous sensory information. In our lab we have designed a project addressing circuit mechanisms of temporal integration in the mouse, but how temporal integration in humans relates to temporal integration in other mammals is not known with precision.

This final year project will compare findings on temporal integration in the human and mouse brain. You will critically review the literature to help us understand how time scales in different species relate to each other. This may help to elucidate whether common mechanisms regulate the accumulation of information across species, an important and neglected issue in sensory and systems neuroscience. You will discuss your readings and assessments at our lab meetings / journal clubs.

Project Title/Area: **Neuroscience Demonstrations for Science Exchange and Education**		
Course or Module requirements:	No of places: 1	Project Type: Communication

Further Information:

Our lab has a history of science exchange and communication with the public through media and public presentations, most recently at the Brighton Science Festival. We would now like to enhance our neuroscience experimental demos. Up to now these have included simple sensory illusions and experiences, but we would like to create further activities that illustrate principles of experimental neuroscience. These should be feasible to demonstrate in schools or science festivals as well as at the University.

This is a public communication project particularly appropriate for students with an interest in careers in media, science communication and outreach, or science education. You will help to create and develop demo activities for the lab and will test them at one or two local venues and/or as a Widening Participation activity. You will be able to gain experience and training in science outreach and will have the opportunity to interact with different groups of people who could be candidate audiences: schoolchildren, prospective students or the general public.

Faculty Name: **Sabita Menon**
Room No: JMS 3B20 Email:S.R.Menon@sussex.ac.uk

Project Title/Area:
The crisis of multidrug resistant bacteria-how did we get here? Where do we go from here?

Course or Module requirements:	No of places:1	Project Type: Literature

Further Information:

This is a 'Critical Review' type project, and involves deep-reading and critical assessment of the published literature in the area of study.

The resistance among bacteria to different antibiotics has emerged as a major public health crisis globally at a terrifying rate. As a consequence of decrease in efficiency of treating common bacterial infections, and tremendous pace in the development of new resistance mechanisms in bacteria among other factors, there has been a dramatic decrease in bacterial response to standard treatment. The consequences include prolonged illness, higher expenditures for health care, and a higher risk of death. Once established, multidrug-resistant organisms persist and spread worldwide, causing clinical failures in the treatment of infections and public health crises.

These project will explore the reasons for and consequences of multidrug resistance in bacteria from the biological, social and economic perspective and will try to explore the ways forwards in combatting it.

Project Title/Area:
Educational value of 'lecture capture' within the undergraduate curriculum.

Course or Module requirements: None, but you need to be fairly committed to a teaching career	No of places: 2	Project Type: Experimental

Further Information:

As new and emerging technologies are almost part of the daily lives of students, universities are actively working to embed technologies into the university learning experience. One such initiative used by several universities across the developed countries is providing students with online access to recordings of lectures, or 'lecture capture'. Lecture capture is an umbrella term describing any technology that allows instructors to digitally record a lecture (using Audio/Video, screen captures or PowerPoint Slides) and making it available for students. Such recordings help students to improve and expand on their notes, study for exams, catch up on classes, and clarify lectures.
This project will examine the impact of 'video-recording' of lectures on learning and student experience .Data will be collected using structured interviews with final year students to try to get a qualitative assessment of how students in the School of Life Sciences at the University of Sussex utilise the recordings and whether this has changed during the course of their degree.

Project Title/Area:
The crisis of multidrug resistant bacteria-how did we get here? Where do we go from here?

Course or Module requirements:	No of places:1	Project Type: Literature

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Project Title/Area:
Educational value of 'lecture capture' within the undergraduate curriculum.

Course or Module requirements: None, but you need to be fairly committed to a teaching career	No of places: 2	Project Type: Experimental

Further Information:

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Faculty Name: **Prof. Tony Moore**

Room No: 4B16 Email: a.l.moore@sussex.ac.uk

Project Title/Area:
A critique of current treatments for trypanosomiasis/Ebola

Course or Module requirements:	No of places:	Project Type:
None	2	Literature

Further Information:

T. brucei is a parasite that causes human African sleeping sickness and nagana in livestock and is transmitted by the tsetse fly. The development of chemotherapy and the continued search for new unique therapeutic targets for African trypanosomiasis are urgently required since current treatments, which are poorly targeted, have unacceptable side-effects and efficacy. The objective of this literature critique will be to review what is understood about this neglected and other related diseases such as Chagas disease and Ebola, where it is found, what treatments are available, what research is required in order to eradicate this and related diseases. Although these diseases are currently restricted to South America and the Sub-Saharan region of Africa current predictions from global warming suggest that these diseases may become much more widespread than previously envisaged and latest information from the World Health Organisation recommends urgent research be undertaken

Project Title/Area:
Title **Development of resistance to agrochemicals by fungal pathogens**

Course or Module requirements:	No of places:	Project Type:
None	1	Literature

Further Information:
The development of resistance to agrochemicals by plant fungal pathogens is an international problem that affects all major crops. Indeed fungicide resistance is an important factor in the successful cultivation of cereals in the UK. It is estimated that the UK market for fungicides in cereals is approximately £200m (worldwide $3bn) with winter wheat being the main crop. Fungicides are used against a number of diseases, the major one of winter wheat being caused by *Septoria tritici*. The main chemical classes of fungicides used to treat UK cereals include the sterol biosynthesis inhibitors (eg triazoles) and the quinone-outside (Qo) inhibitors. The most important and successful group of the Qo fungicides that have proved effective in the control of plant pathogens are the strobilurin fungicides which are specifically targeted to the mitochondrial cytochrome bc_1 complex thereby inhibiting fungal respiration. Unfortunately resistance to this fungicide often develops resulting in an inability to control fungal pathogens through continued application thereby affecting crop production on a global scale. The objective of this review will be to critically review the reasons for increased fungicide resistance, what is the global impact of such an increase and the nature of the research which is required to combat such as effect.

Project Title/Area:
A critique of mitochondrial dysfunction and its role in neurodegenerative diseases

Course or Module requirements:	No of places:	Project Type:
None	1	Literature

Further Information:

Mitochondrial dysfunction has long been associated with neurodegenerative disease. Therefore, mitochondrial protective agents represent a unique direction for the development of drug candidates that can modify the pathogenesis of neurodegeneration. This literature review should focus on the evidence available which indicates that mitochondrial dysfunction plays a central role in the pathogenesis of Alzheimer's, Parkinson's and Huntington's diseases and amyotrophic lateral sclerosis. It would also be interesting to debate the potential therapeutic efficacy of metabolic antioxidants, mitochondria-directed antioxidants and the introduction of genes to overcome mitochondrial lesions. Since antioxidants preferentially target mitochondria, a major source of oxidative damage, they may well prove to be promising therapeutic candidates for neurodegenerative diseases.

Faculty Name: **SIMON MORLEY**
Room No: 2C25 Email: s.j.morley@sussex.ac.uk

Project Title/Area:

Does Mnk1/2 play a role in glioblastoma cell spreading?

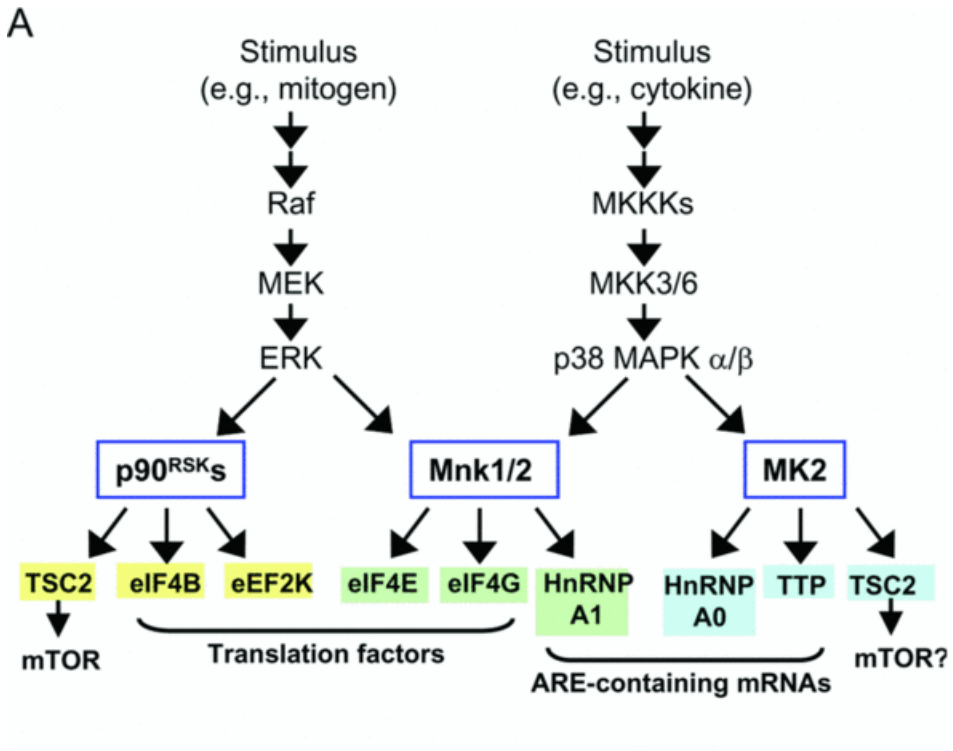
Course requirements: **Cell regulation and Cancer/ Cell Biology**	No of places: 2	Literature

Further Information:

Kinases such as Mnk1/2 are regulated by signalling through both the ERK and p38 MAPK pathways. Recent work has suggested that Mnk1/2 have a role in cell migration in neuronal systems, and are essential for metastasis of tumour cells. However, although these kinases are known to target protein synthesis initiation factors, their role in cell spreading in glioblastoma is unclear.

Protein synthesis is carried out in three stages (initiation, elongation and termination), with the initiation stage of translation generally accepted as a major site of regulation of gene expression. This pivotal role reflects the regulated binding of mRNA to the ribosome, a process that modulates both quantitative and qualitative aspects of protein synthesis by recruiting specific mRNAs for translation. This step in the initiation of protein synthesis, often dysregulated under conditions of loss of growth control is facilitated by the assembly of initiation factors into a multi-protein complex known as eIF4F. In turn, the activity of the eIF4F complex is regulated by phosphorylation mediated by a number of cross-talking signalling pathways including mTORC1, Mnk1/2 kinases, and by the inherent structural properties of the recruited mRNA.

The students will study the literature to determine whether Mnk1/2 has a role in glioblastoma cell spreading and investigate potential new combination therapies which target mTORC1/Mnk1/2 kinases in this process.



Project Title/Area: **Does FMRP play a role in cell spreading?**

Course requirements: **Cell regulation and Cancer/ Cell Biology**	No of places: 1	Literature

Further Information:

FMRP plays a role in neurite outgrowth and we have preliminary evidence that it has a role to play in regulating protein synthesis and cell spreading in fibroblasts.

Protein synthesis is carried out in three stages (initiation, elongation and termination), with the initiation stage of translation generally accepted as a major site of regulation of gene expression. This pivotal role reflects the regulated binding of mRNA to the ribosome, a process that modulates both quantitative and qualitative aspects of protein synthesis by recruiting specific mRNAs for translation. This step in the initiation of protein synthesis, often dysregulated under conditions of loss of growth control is facilitated by the assembly of initiation factors into a multi-protein complex known as eIF4F. In turn, the activity of the eIF4F complex is regulated by phosphorylation mediated by a number of cross-talking signalling pathways including Mnk1/2 kinases, and by the inherent structural properties of the recruited mRNA.

FMRP is found bound to target mRNAs which are translationally repressed due the presence of CYFIP1, which prevents access of eIF4G to eIF4E (see below). This complex can be remodelled in response to incoming signals and CYFIP1 becomes associated with the WAVE complex, allowing eIF4F complex formation on target mRNAs.

Students will learn to culture mammalian cells which stably over-express FLAG-tagged FMRP. Signalling pathways will be selectively inhibited with cell-permeable drugs and cells allowed to spread. Students will prepare cell extracts and analyse signalling pathways and the post-translational modification of FMRP using SDS-PAGE/Western blotting or IP and mass spectrometry. Confocal microscopy will be used to monitor cell spreading and morphology under conditions defined by these studies to help us understand the role of FMRP in cell spreading in fibroblasts.

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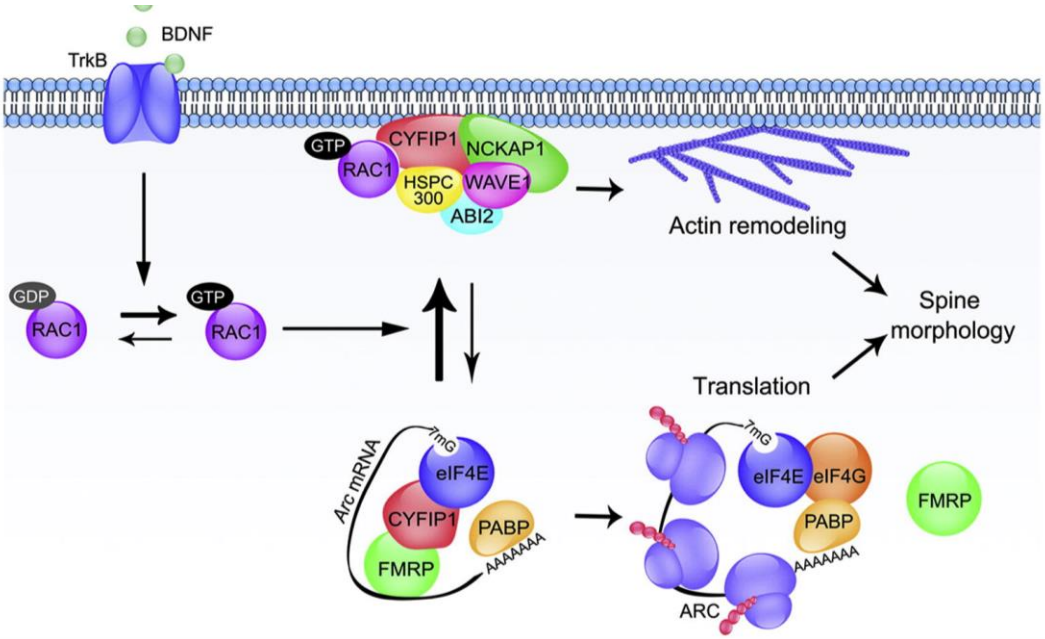

Project Title/Area: **CYFIP1 and tumour cell metastasis**

Course requirements: **Cell regulation and Cancer/ Cell Biology**	No of places: 2	Literature

Further Information:

CYFIP1 plays a role in neurite outgrowth and we have preliminary evidence that it has a role to play in regulating localised protein synthesis and cell spreading in fibroblasts.

Protein synthesis is carried out in three stages (initiation, elongation and termination), with the initiation stage of translation generally accepted as a major site of regulation of gene expression. This pivotal role reflects the regulated binding of mRNA to the ribosome, a process that modulates both quantitative and qualitative aspects of protein synthesis by recruiting specific mRNAs for translation. This step in the initiation of protein synthesis, often dysregulated under conditions of loss of growth control is facilitated by the assembly of initiation factors into a multiprotein complex known as eIF4F. In turn, the activity of the eIF4F complex is regulated by phosphorylation mediated by a number of cross-talking signalling pathways including Mnk1/2 kinases, and by the inherent structural properties of the recruited mRNA.

FMRP is found bound to target mRNAs which are translationally repressed due the presence of CYFIP1, which prevents access of eIF4G to eIF4E (see below). This complex can be remodelled in response to incoming signals and CYFIP1 becomes associated with the WAVE complex, allowing eIF4F complex formation on target mRNAs.

Little is known about the post-transcriptional regulation of CYFIP1 and the literature project will investigate what is known about CYFIP1 and WAVE complex assembly to help us understand the role of FMRP in cell spreading in tumour cells.

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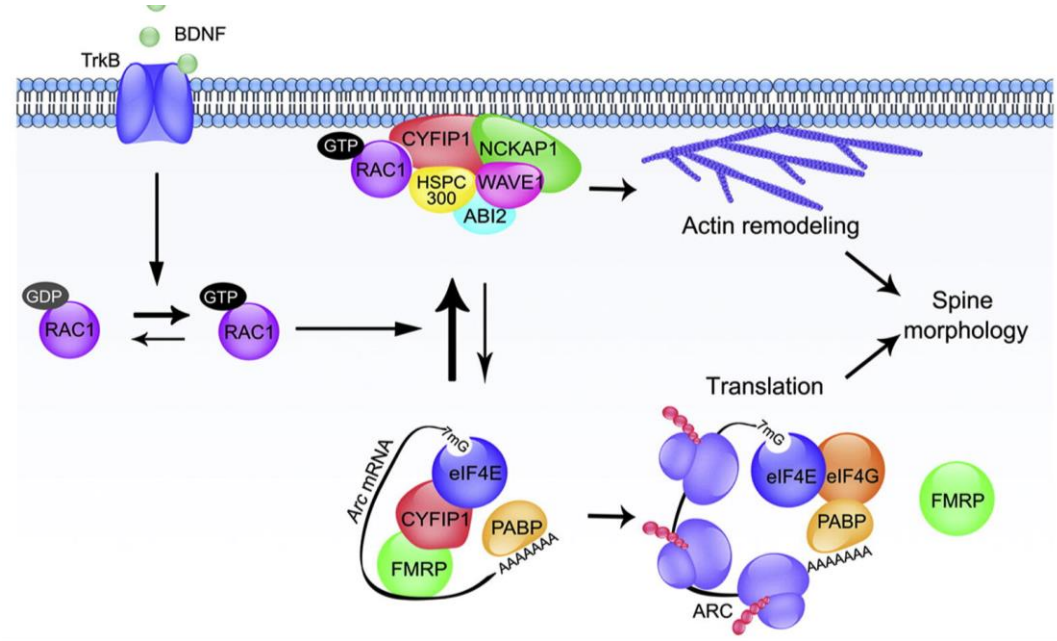

Faculty Name: **Ted Morrow**
Room No: 5B18 Email: ted.morrow@sussex.ac.uk

Project Title/Area:
Sexual antagonistic traits in fruit flies

Course or Module requirements:	No of places: 2	Project Type: Experimental (including data analysis) /~~Literature~~

Further Information:

Traits shared between the sexes may experience sexually antagonistic selection where high trait values are favoured by selection in one sex but disfavoured in the other. We have in the lab a set of Drosophila melanogaster lines that show genetic variation for adult fitness. A subset of these lines have genotypes that produce high fitness in one sex and low fitness in the other – as such they can be used to investigate which phenotypic traits may experience sexually antagonistic selection. Which traits will be measured for the projects can be discussed with the supervisor, so there is some flexibility in the exact direction of the projects but possible traits include: locomotory behaviour, body size, ageing, reproductive organ morphology, gamete size. You should be prepared to work for extended (but intermittent) periods in the lab when flies are available. Microscope work is essential. You will receive training in sexual conflict theory, experimental design, laboratory culture and crosses of fruit flies as well as in hypothesis testing using statistics, and in effectively communicating your project to others.

You should have some background knowledge of the following areas:
Evolution
Genetics
Behaviour

Project Title/Area:
Heritability of personality

Course or Module requirements:	No of places: 1	Project Type: Experimental (including data analysis) /~~Literature~~

Further Information:

Personalities may be defined simply as a within individual consistency in any measurable behaviour. The genetics of personality traits are not well known but in model organisms they have been shown to have genetic components. This project is flexible and could include conducting personality tests in human volunteers and/or lab work on our model organism the fruit-fly, where microscope work will be necessary. You will be trained in some simple quantitative genetic methods, as well as experimental design, data analysis and interpretation.

This project is particularly flexible and would suit someone with high level of independence and ambition, but you should have background knowledge of the following areas:
Evolution
Genetics
Behaviour

Faculty Name: **Jo Murray**
Room No: **G3-02** Email: **j.m.murray@sussex.ac.uk**

Project Title/Area:
Smc5/6 complex and genome stability

Course requirements:	No of places: 3	**Literature**
Genetics and Genomics C7110		

Further Information:
The Smc5/6 complex is an essential complex related to cohesin and condensin and required to regulate homologous recombination. In this project the Smc5/6 complex will be investigated using online resources such as pombase, ncbi and Sanger Centre websites. A search for regions of sequence conservation will be carried out for individual proteins within this complex with a view to identifying conserved protein modifications. Smc5/6 components in human cancer lines will be profiled. Each student will develop a unique project by focusing on a particular protein, modification, or aspect of Smc5/6 biology. The results of initial analyses will form the basis of the report, supported by a systematic literature search to provide background and to identify possible experimental evidence that could add weight to the database analyses.

Project Title/Area:
Regulation of Recombination

Course requirements:	No of places: 2	**Experimental**
Genetics and Genomics C7110		

Further Information:
How cells overcome problems during replication is important for genome stability and replication stress is an early driver of carcinogenesis. We use fission yeast to investigate how cells restart replication after stalling. Using a site-specific replication fork barrier we have shown that replication restarts using homologous recombination but this restart leads to chromosome rearrangements.

The aim of the project is to characterise how replication restarts using homologous recombination and to follow the fate of the chromosome rearrangements.

Faculty Name: Ruth Murrell-Lagnado
Room No: CRPC 5th floor Email:R.Murrell-Lagnado@sussex.ac.uk

Project Title/Area:

The role of the Sigma1 receptor in the regulation of intracellular calcium homeostasis

Course or Module requirements:	No of places:	Project Type:
Molecular/Cellular biology/Neuroscience background preferable	2	Experimental

Further Information:

The Sigma1 receptor exerts a protective action on cells; it promotes cell proliferation and inhibits apoptosis. It is upregulated in cancer cells and downregulated in neurodegenerative disease. Many ligands, including those in clinical use, target this receptor. Its mechanism of action, however, is not well understood. This project will examine the regulation of Ca2+ signalling within cancer cell lines by Sigma1R. Molecular and cellular biology techniques will be utilized including transfection and maintenance of cancer cells, western blot analysis of Sigma1R and its interacting partners and Ca2+ measurements using Ca2+ sensitive dyes and Ca2+ binding proteins.

Project Title/Area:
Lysosome function and dysfunction in health and disease

Course or Module requirements:	No of places:	Project Type:
Molecular/Cellular biology/Neuroscience background preferable	1	Literature

Further Information:
Lysosomes are acidic membrane bound organelles involved in degradation and recycling of extracellular and intracellular material. In addition they have many other signalling functions and are involved in processes such as autophagy, secretion, energy metabolism and cell death. Changes in lysosomes structure and function are associated with both rare inherited diseases and common diseases such as cancer and neurodegeneration. Targeting these changes has therapeutic potential in the treatment of the disease. This project will evaluate the experimental evidence contributing to our understanding of lysosome function at the molecular and cellular level and then focus on one or more disease types and the potential for therapeutic intervention targeting lysosome dysfunction.

Faculty Name: Dr Matt Neale
Room No: G3.09 Email: m.neale@sussex.ac.uk

Title: Genetic modification in the budding yeast, *S. cerevisiae*.
Area: Molecular Biology and Genetics

Suggested course requirements: Molecular Biology; Molecular Genetics,	No of places: Up to 2	100% Lab

Further Information:

The genetic modification of experimental model organisms for the purpose of characterising and testing gene function is one of the main tools in modern molecular biology and genetics. In the model organism, *S. cerevisiae*, this process is called genetic transformation. In our laboratory, in order to understand gene function, we routinely make numerous combinations of gene mutations and knockouts within the simple model organism, *S. cerevisiae*. As such, it is often a rate-limiting step in our analyses.

This lab-based project will follow up on the recent advances made by previous students aiming to characterise and further optimise the efficiency of generating genetic transformants in *S. cerevisiae*. This project will have a direct impact on the Neale lab's research by improving our generation of desired genomic mutations.

Accomplished students will work alongside a postdoctoral worker or PhD student, and have the opportunity to design and implement a strategy to delete, modify by mutation, and/or alter the transcriptional regulation of a gene involved in DNA recombination. Potential targets will be clarified nearer the time, but likely examples would be those involved in DNA repair and/or histone and chromatin remodelling.

The project will suit a candidate interested in problem-solving, with an aptitude for lab-based experimental work, and an interest in further developing their molecular biology laboratory skills.

Students opting for a lab-based project are expected to be highly motivated, first class students, capable of working conscientiously within a professional research laboratory.

Title: Computational analysis of DNA recombination in meiosis
Area: Meiosis, DNA repair and Genome Stability

Suggested course requirements: Molecular Biology, Molecular Genetics, Genetics & Genomics/Bioinformatics	No of places: Up to 2	Computer-based 100%

Further Information:

During meiosis, high levels of genetic recombination occur, generating haploid genomes that are a complex mixture of the parental genetic information. Understanding what defines the frequency and distribution of recombination is of great interest because it influences the range of genetic variation and alters the potential rate of evolutionary change.

The aim of this project is to use a combination of computer applications (MATLAB, Excel, SnapGene, DNAStar, Perl scripts, Python etc) and experimental datasets to investigate the relationship between sites of recombination and other components of the chromosome (transcription, histones, methylation marks, protein binding sites etc,) using the budding yeast, *S. cerevisiae* as a model system.

These projects are suited to a Life Sciences student who is interested in computer-based analysis of biological data, and who is confident in learning to use various computer applications and adept in the principles of computer programming.

While guidance will be given by PhD and postdoctoral workers, the student will be expected to work autonomously, so prior experience of the applications/computer programming methods will be of a clear advantage.

Title: Literature project about DNA repair, cell cycle checkpoints and cancer
Area: Biology, Cancer and Genetics

Suggested course requirements: Genome Stability, Genetic Diseases & Cancer; Molecular Genetics;	No of places: Up to 2	Literature 100%

Further Information:

Genes involved in DNA repair are often mutated in cancer tissue. The goal of this literature project will be review the various pathways involved in DNA repair and cell cycle checkpoints—in particular comparing the specific mechanisms used in different stages of the cell cycle and during the process of meiotic recombination.

In recent years, the advent of high throughput DNA sequencing has dramatically increased the frequency of identifying such gene mutations in a whole range of cancer samples. Summarising and discussing which DNA repair genes and checkpoint pathways are often mutated in cancer cells—and why—will also be a key part of this literature project.

The student will be required to bring in personal critique, and to frame their report around a question, such as: “The pros and cons of DNA repair”; “What are the benefits of cell cycle checkpoints?”; “What influence does mutation and DNA repair have on evolutionary change?”

In future work these literature/computer studies will provide the basis for investigating how unique point mutations might affect gene and cellular function in a mammalian cell culture system and/or genetically tractable model organism (e.g. *S. pombe* or *S. cerevisiae*).

Students opting for a literature project are expected to work autonomously, pulling in their required information from a variety of the most relevant sources.

Faculty Name: **Dr Sarah Newbury**
Room No: 2.08, Medical Research Building Email: s.newbury@bsms.ac.uk

Project Title/Area:
Illuminating the genetic basis of osteosarcoma

Course requirements: Biochemistry, Biomedical Science	No of places: 1 (lab based)

Osteosarcoma is a deadly form of bone cancer which develops from cells responsible for forming the bone matrix. It is the most common primary bone cancer, with an incidence rate of 4% of all malignancies in children up to 14 years. Osteosarcoma is also common in domestic dogs, particularly large breeds such as Irish Wolfhounds, Great Danes and St. Bernards with approximately 10,000 new cases per year. Treatment of both humans and dogs includes amputation (where possible) and chemotherapy. Despite advances in the treatment of other cancers, 5-year survival rates of osteosarcoma patients have remained at about 58% for 20 years. A new approach to treatment of this disease is therefore timely. The project aims to build on our recent findings where we have shown that the exoribonuclease XRN1 is downregulated in many human osteosarcoma cell lines. We are now interested in determining whether the XRN1 is misexpressed in other human and canine ostesarcoma cell lines or cell lines derived from the related Ewings sarcoma.

The aim of the project is to assess the expression and localisation of XRN1 in in human and canine osteosarcoma cell lines. Specific aims are to:
(1) To use quantitative RT-PCR to assess the expression levels of XRN1 in osteosarcoma and Ewings sarcoma cell lines.
(2) To use immunocytochemistry to assess the expression of XRN1 in these cell lines

Techniques to be used include: tissue culture, qRT-PCR, Immunocytochemistry, fluorescence microscopy, Western blotting.

Project Title/Area:

Investigating the role of the 3'-5' exoribonuclease Dis3L2 in tissue growth and development.

Course requirements: Biochemistry, Biomedical Science	No of places: 1 (lab based)

Imaginal discs are similar to stem cells in that they carry all the information required to make the adult tissue. Our recent work has shown that the 3'-5' exoribonuclease *dis3L2* affects the growth and proliferation of wing imaginal discs that are destined to grow into the wing of the fly. The *Drosophila* imaginal disc provides an excellent model system to investigate growth and proliferation as many of the key signalling pathways are conserved in mammals. Our recent results show that knockdown of *dis3L2* results in larger imaginal discs and wings. This suggests that *dis3L2* affects expression of genes controlling proliferation at the post-transcriptional level. Since the control of proliferation is important in the development of cancer, this result may have relevance for cancer treatments.

The aim of this project is to use genetic and molecular biology approaches to investigate the pathways leading to proliferation that are affected by Dis3L2.
Specific aims are:
(1) To examine the genetic interactions between dis3L2 and other proteins involved in RNA turnover such as the uridyltransferase Gld2.
(2)To use quantitative RT-PCR to assess the effects of *dis3L2* knockdown on potential target mRNAs and microRNAs.

Techniques to be used include:
RNA interference, quantitative RT-PCR, *Drosophila* genetics, Western blotting, microscopy.

Faculty Name: **Jeremy E. Niven**
Room No: CRPC 3.27 Email: J.E.Niven@sussex.ac.uk

Project Title/Area:
Colony-level in turning bias the wood ant, *Formica rufa*.

Course or Module requirements:	No of places: 4	Project Type:
Comparative Animal Physiology		Experimental

Further Information:
Although handedness has historically been associated with humans, there is increasing evidence that insects possess handedness. Recent work from my laboratory demonstrated for the first time that insects possess handedness. Remarkably, this handedness was found to exist in both large-brained insects, such as the locust, and small-brained insects, such as the wood ant. Surprisingly, we found that ants colonies differed in their overall handedness, uncovering an entirely new form of handedness: colony-level handedness. Recently, we have discovered that these ants also show biases when they choose a direction to turn within a 'Y' maze. This raises the possibility that there may be colony-level biases in turning that exist within the wood ant population. This project offers a unique opportunity to assess colony-level biases in wood ants.

Further Reading:
Bell AT, Niven JE. (2014). Individual-level, context-dependent handedness in the desert locust. *Curr Biol*. 24:R382-3.
Niven JE, Buckingham CJ, Lumley S, Cuttle MF, Laughlin SB. (2010). Visual targeting of forelimbs in ladder-walking locusts. *Curr Biol*. 20:86-91.

Project Title/Area:
Is brain size correlated with field metabolic rate in mammals?

Course or Module requirements:	No of places: 1	Project Type:
Comparative Animal Physiology		Data analysis

Further Information:
An organism's size correlates with many aspects of both morphology, physiology and life history. One striking correlation is between body size and basal metabolic rate, and another is between the body size and brain weight. However, when body size is taken into account, basal metabolic rate explains little about brain size. One reason may be that basal metabolic rate represents a minimum but is not a realistic estimate of the metabolic of animals in their natural environments. An alternative estimate of the metabolic rate is the field metabolic rate, a measure of the realistic amounts of energy consumed over periods of days that may involve both activity and inactivity. Surprisingly, there is not (as yet) an analysis of whether the field metabolic rates correlate with brain weight. This project would involve obtaining data from field metabolic rates and brain weights from the literature and analysing them to assess whether there is a correlation.

Further Reading:
Streidter G. (2005). *Principles of Brain Evolution*. Sinauer Associates.
Nagy KA. (2005). Field metabolic rate and body size. *J Exp Biol*. 208:1621-1625.

Faculty Name: **Professor Ali Nokhodchi**
Room No: Arundel 407 Email:a.nokhodchi@sussex.ac.uk

Project Title/Area: **Insulin Delivery Systems: advances and challenges/drug delivery**

Course or Module requirements:	No of places: 1	Project Type:
Students need to have biochemistry and biology knowledge		Literature

Further Information:
Insulin has a vital place in drug therapies for insulin-dependent diabetes mellitus and for many patients with non-insulin-dependent diabetes mellitus. The only drug delivery rout for insulin which can control the blood glucose is via injection. It would be highly advantageous if insulin could be administered via other routs of drug delivery such as oral, pulmonary, skin or nasal. Researchers have focused on exploring different formulation approaches to tackle issues associated with other routes of drug delivery. In this literature review, the report should cover properties of insulin, different types of diabetes, how to overcome the diseases, different types of insulin delivery available on the market, what are the challenges in insulin delivery and how to tackle these problems, novel drug delivery systems such as insulin pumps, inhaler, skin patches nanoparticles.

Project Title/Area: **Blood brain barrier: advances and challenges for improved drug delivery**

Course or Module requirements:	No of places: 1	Project Type:
Students need to have biochemistry and biology knowledge		Literature

Further Information:
Brain is the most delicate organ of human body. The development of new therapeutic approaches to treat diseases such as Parkinson, encephalitis, neurological disorders, multiple sclerosis, stroke, and tumor is a difficult challenge, and there is no effective treatment for almost all the brain diseases. In most of the cases, the major cause of the failure in the development of drugs to treat brain diseases is the presence of BBB. Drug delivery science plays major role in designing new approaches to change the permeability of this barrier. In this literature based study, the report should cover anatomy and physiology of BBB, transporters of BBB, drug delivery approaches nanoparticles, liposomes, drug modifications and permeability changes. The report should also cover recent studies that highlighted the need for an integrated approach to achieve the correct balance of permeability, a low potential for active efflux, and the appropriate physicochemical properties that allow for drug partitioning and distribution into brain tissue.

Project Title/Area: **Novel manufacturing of biodegradable implants for musculoskeletal tissue engineering**

Course or Module requirements:	No of places: 1	Project Type:
Students need to have basic biochemistry and biology knowledge		Literature

Further Information:
The repair and reconstruction of musculoskeletal tissues using biodegradable scaffold materials has emerged as one of the most promising approaches in tissue engineering. Various studies to optimise and process biodegradable and biocompatible polymeric carriers to manufacture biodegradable polymeric implants has been reported. Articular cartilage as well as the underlying subchondral bone is severely affected by osteochondral defects (OCD). OCD is treated as a lesion within the cartilage which can eventually lead to osteoarthritis. This results in severe pain and in adverse scenario, disability for millions of people in UK. This also incurs significant economic loss (cost). The osteochondral defects are more likely to make osteoarthritic degenerative changes. Therefore, there is an ongoing need for the development of effective methods and process that can be used in current treatment of osteochondral defects and can be cost effective as well as efficient. Manufacturing of biodegradable/ bio-absorbable three dimensional osteochondral scaffolds with highly porous structure and interconnected pore network, suitable surface chemistry and mechanical properties can be done by adopting an advanced processing technologies. The report should cover recent advances in the treatment of musculoskeletal disease.

Project Title/Area: **Effect of ground compressed sugars-leucine on aerosolization performance of dry powder inhalation containing salbutamol sulphate**

Course or Module requirements:	No of places: 1	Project Type: Experimental (including data analysis)

Further Information:
Dry powder inhalation formulations usually show low fine particle fraction (low bioavailability) due to lack of detachment of drug from carrier surfaces during inhalation process. In order to improve the detachment of drug particles from carrier surfaces, mannitol or lactose will be mixed with leucine at different concentrations and compressed as tablets. The tablets will be ground to get particle size between 63-90 micron. The resultant powders will be mixed with salbutamol sulphate. After mixing, the formulation will be incorporated in capsules and aerosolization test will be carried out using inhaler and MSLI. Particle will be characterised fully using SEM, HPLC, DSC, FT-IR and laser particle size analyser.

Project Title/Area: **Application of extrusion and spheronization technology in producing sustained release liquisolid pellets**

Course or Module requirements:	No of places: 1	Project Type: Experimental (including data analysis)

Further Information:

Achieving good bioavailability for oral drugs is one of the major struggles in pharmaceutical industry. Liquisolid technology is a relatively new and novel oral drug delivery system, confronting such issue. In brief the active pharmaceutical ingredient (API) is solubilized in a liquid vehicle and incorporated in a carrier, which is coated with nano-size coating material to give it a dry solid appearance. The technology can be manipulated to produce enhanced and sustained drug release. The project will mainly focus on sustained release. It has been suggested that liquisolid technology can potentially contribute to the next generation oral-solid dosage form. Its simplistic approach and cost effectiveness are its key advantages. The project will cover:
Experimental description:

- Making liquisolid compact (tablet/capsule/pellets)
- Dissolution test
- Particle size analysis
- XRPD, DSC, SEM
- Investigating various parameter affecting drug release profile

Faculty Name: **Prof. Mark O'Driscoll**

Room No: G4.04 (*Genome Building*) Email: m.o-driscoll@sussex.ac.uk

Project Title/Area:

Acute Myeloid Leukaemia (AML); a review of its origin, genetics, clinical progression, and current treatment strategies.

Course or Module requirements:	No of places:	Project Type:
Would likely best suit a Biomedical Science student.	**1**	**Literature**

Further Information:

http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=519

Molecular landscape of acute myeloid leukemia in younger adults and its clinical relevance. Blood. 2016 Jan 7;127(1):29-41. PMID: 26660431.

This project will also involve data collation, extrapolation and interpretation from various sources such as:
http://www.cancerresearchuk.org/health-professional/cancer-statistics

and

https://clinicaltrials.gov/

Project Title/Area:

Hodgkin's lymphoma; a review of its origin, genetics, clinical progression, and current treatment strategies.

Course or Module requirements:	No of places:	Project Type:
Would likely best suit a Biomedical Science student.	**1**	**Literature**

Further Information:

http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=98293

Familial predisposition and genetic risk factors for lymphoma. Blood. 2015 Nov 12;126(20):2265-73. PMID: 26405224.
This project will also involve data collation, extrapolation and interpretation from various sources such as:
http://www.cancerresearchuk.org/health-professional/cancer-statistics

and

https://clinicaltrials.gov/

Project Title/Area:

***RAS*opathies; an overview of their molecular basis, clinical presentation, natural history and current management strategies.**

Course or Module requirements:	No of places:	Project Type:
Would likely best suit a Biomedical Science student.	**1**	**Literature**

Further Information:

https://rasopathiesnet.org/rasopathies/syndromes/

This project will also involve data collation, extrapolation and interpretation from various sources such as:
http://www.cancerresearchuk.org/health-professional/cancer-statistics

and

https://clinicaltrials.gov/

Project Title/Area:

Serous Ovarian Carcinoma: a review of its molecular-genetic basis and genome stability, its clinical progression, and current rational treatment strategies.

Course or Module requirements:	No of places:	Project Type:
Would likely best suit a Biomedical Science student.	**1**	**Literature**

Further Information:

http://www.cancerresearchuk.org/about-cancer/type/ovarian-cancer/about/types-of-ovarian-cancer

This project will also involve data collation, extrapolation and interpretation from various sources such as:
http://www.cancerresearchuk.org/health-professional/cancer-statistics

and

https://clinicaltrials.gov/

Faculty Name: **Antony Oliver**
Room No: **GDSC, G4.02** Email: **antony.oliver@sussex.ac.uk**

Project Title/Area:

Cloning, expression, purification and crystallisation of proteins involved in DNA damage repair or checkpoint pathways.

Course or Module requirements:	No of places:	Project Type:
C7114 Structural Basis of Biological Function	**One (1)**	**Experimental**

Students selecting this project can expect to clone, express (in E.coli) and purify a recombinant protein — that is functionally important, in either a defined DNA repair pathway, such as Homologous Recombination (HR) or Non-Homologous End-Joining (NHEJ), or alternatively in the DNA-damage checkpoint signalling cascade. If protein of sufficient quantity and quality is produced, the student can also expect to setup crystallisation trials using our in-house robotic systems, and potentially collect X-ray diffraction data on any resultant protein crystals.

This project would ideally suit a student selecting final year modules C7124 Protein Form and Function and/or C7129 Genome Stability, Genetic Diseases and Cancer – and who wishes to continue their studies / career in a research-based laboratory environment, providing invaluable experience in basic cloning techniques, protein expression and protein purification, and an introduction to the discipline of X-ray crystallography and Structural Biology.

Project Title/Area:

Direct detectors and phase plates; the resolution revolution in electron microscopy

Course or Module requirements:	No of places:	Project Type:
C7114 Structural Basis of Biological Function	**One (1)**	**Literature**

Two recent technological advances have been made in the area of structural biology:

1) Direct electron detectors and 2) Phase plates

The student should source and read the current literature about these recent advances in methodology, and concisely summarise these in their Final Year Project Report. They should also aim to critically assess their potential impact on existing Structural Biology techniques – and also examine the potential benefits to the scientific community as a whole, as these methods develop and mature and become more widespread.

This literature-based project would ideally suit a student selecting the final year module C7124 Protein Form and Function – and who has a keen interest in Structural Biology methods and techniques.

Project Title/Area: **CRISPR - Cas9 technology and the gene-editing revolution; where are we headed?**		
Course or Module requirements:	No of places: **One (1)**	Project Type: **Literature**
The advent of CRISPR-Cas9 technology has enabled the facile editing of genetic information. The burning question is now largely an ethical one – i.e. do we / should we allow germ-line modification in order to treat genetically-inherited diseases? – and what defines the boundaries of where we should stop? The student should source and read the current literature about this recent advance in molecular biology methodology, and concisely summarise this n their Final Year Project Report. They should also aim to critically assess the impact on molecular biology, the potential benefits to the scientific community as a whole, as well as the general population.		

Faculty Name: **Daniel Osorio**
Room No: JMS 3B31 Email: d.osorio@sussex.ac.uk

Project Title/Area:
Cuttlefish Camouflage & Visual Behaviour

Course or Module requirements:	No of places: 2	Project Type: Exp

Further Information:
Cuttlefish like many cephalopods display and great range of coloration patterns for camouflage and communication. These projects may involve analysing the coloration patterns and other behaviour of cuttlefish at Brighton Sealife Centre. N.B. There may be experimental work but we cannot guarantee having animals so may also depend upon using film obtained previously. These projects are suitable for students interested in behaviour and visual perception. They involve some advanced statistical methods.
NOTE: Projects on the aquaculture or biology of aquatic animals may also be available at the Sealife Centre. Those interested should talk to me.
References: Zylinski, S, How, M J, Osorio, D, Hanlon, R T and Marshall, N J (2011) *To be seen or to hide: visual characteristics of body patterns for camouflage and communication in the Australian giant cuttlefish Sepia apama.* American Naturalist, 177, 681-690;
Zylinski, S, Osorio, D and Johnsen S. (2016). Cuttlefish see shape from shading, fine-tuning coloration in response to pictorial depth cues and directional illumination. Proceedings B. *in press.*

Project Title/Area:
Colour Measurement and Modelling for clinical and biological applications.

Course or Module requirements:	No of places: 1 - 2	Project Type: EXP

Further Information:
Colour measurement in photographic has wide potential for applications from healthcare to research on animal colour vision and colour signalling. We will use a new image based software system for colour measurement and compare the performance to measurements based on traditional spectrometry. This project is suitable for those interested in the uses of colour either for clinical applications, biological research, or even man-made objects. An interest in light and photography would be useful. (ask for references

Project Title/Area:
Literature Projects. Brain and Vision Science, or
Eyes, eyespots and Visual Communication in Birds

Course or Module requirements:	No of places:	Project Type: LIT

Further Information:
I can supervise literature projects on any aspect of systems or cognitive neuroscience, especially concerning vision and the visual system, or evolutionary and comparative subjects.
Eyespots and eyes are important communication signals directed at and used by birds, but remain controversial. This project will take a comparative approach to take a new view of why ‘bulls eye’ patterns are so common in visual signals
Please ask for further details.

Faculty Name: **Mark Paget**
Room No: JMS2C6 Email: m.paget@sussex.ac.uk

Project Title/Area: **Antibiotic discovery - microbiology**

Course or Module requirements: None	No of places: 2-3	Project Type: Experimental

Further Information:
The unstoppable emergence of antimicrobial resistance in pathogenic bacteria has generated worldwide health emergency. Key to meeting this challenge is the discovery of new antibiotics. In an attempt to identify new antibiotics, students will isolate bacteria from natural environment including soil samples and test these for the production of antimicrobial compounds. The focus will be on isolating rare actinobacteria using selective media and on the discovery of compounds with antimycobacterial activity that might be useful in the fight against tuberculosis. Techniques – general microbiology, media preparation, asceptic technique, bioassays, preliminary isolation of bioactive compounds.

Project Title/Area: **Antibiotic discovery – molecular biology**

Course or Module requirements: none	No of places: 1-2	Project Type:

Further Information:
The actinobacteria are a major source of antibiotics and genome sequencing has revealed that most strains have the potential to produce >20 bioactive compounds. However, most of these pathways are not expressed under normal growth conditions. We are interested in developing new ways to reactivate these pathways, focusing on how stress induces antibiotic production. Students investigate how mutations in global regulators of transcription can stimulate antibiotic production. Techniques - PCR, cloning, general microbiology.

Project Title/Area: **Bioinformatic analysis of transcription initiation in actinobacteria**

Course or Module requirements: Regulating the transcriptome preferred	No of places: 1	Project Type: Experimental (data analysis)

Further Information:

New methods to identify 5’ ends of transcripts and recent developments in our understanding of the structure and function of actinobacterial RNA polymerase has led to new opportunities to understand how transcription initiates. This project will involve the construction of a database of promoter elements and its analysis to identify novel regulatory elements that play a key role in initiation in these industrially and medically important bacteria.

Faculty Name: **Prabha Parthasarathy**
Room No: **3B32, JMS** Email: **P.Parthasarathy@sussex.ac.uk**

Project Title/Area: **Recent advances in infectious diseases**

Course or Module requirements: **None but those who have taken the module " Medical Microbiology" would have an advantage**	No of places: 4	Project Type: **Literature**

Project type: Literature review, collation and analysis of data in existing literature

Background

There are four literature based projects which would focus on different aspects of infectious diseases such as epidemiology, prevention, treatment OR diagnosis. The topics would be related to recent advances or challenges that we face in the understanding of infectious diseases. Although there is no specific course requirement, knowledge of Medical Microbiology would be advantageous. The projects would involve data extraction and analysis of current literature. Given below are few broad descriptions of the tentative projects, the final project being in a more specific area with specific aims.

Should elderly people be given the PCV 13 vaccine instead of PPV? : *Streptococcus pneumonia* is a gram positive bacteria commonly associated with serious infections such as pneumonia in extreme age groups. Currently, there are two vaccines that are available for prevention of disease. Adults above 65 receive the PPV vaccine, while children below 2 years receive the PCV 13 vaccine. PCV 13 was introduced in 2010 and replaced its precursor PCV 7. The advantage of PCV 13 was a better coverage of common serotypes associated with infections. Preliminary data suggests a marked decline in incidence of the disease and hence, it is believed that the vaccine has a potential use in other age groups. This project aims to critically evaluate the literature to address this issue and determine the potential of PCV-13 in the elderly.

Antibiotics and antimicrobial resistance in Long term care facilities: Long term facility refers to a facility that provides rehabilitative, restorative, and/or ongoing skilled nursing care to patients or residents in need of assistance with activities of daily living. Infections due to antibiotic resistance bacteria pose a major problem in long term care facilities. Yet, not much is known about the risk factors, epidemiology and outcomes of infections due to these drug resistant bugs. This project aims to systematically review the available literature with the aim to understand the impact of this group of antibiotic resistance in long term care facilities.

Evaluation of the current diagnostic methods for *Legionella pneumophila* with special emphasis on the role of urinary antigen testing: *Legionella pneumophila* is the causative agent of pneumonia and is responsible for several outbreaks in the hospital and community. The detection of this bacterial agent is important as it triggers a range of epidemiological investigations targeted at identifying the source. It is also associated with a higher mortality in high risk patients. Unlike many other bacteria, Legionella is not easy to cultivate and hence laboratories have had to rely on alternative methods of diagnosis. One such method which is popular is the urinary antigen testing. Several other methods are also available such as PCR, ELISA etc. Some novel methods such as mass spectroscopy have also been tried. The aim of this project is to review the literature to look at the different methods available for detection of Legionella, evaluate their performance and determine the impact these have made in clinical practice.

Knowledge, attitude and perceptions towards antibiotics amongst university students, with special focus on medical and pharmacy students: Antibiotic resistance is a growing problem worldwide. Antibiotic resistance reduces the therapeutic options and increases the cost of treating any infection. The problem is further aggravated by the lack of new antibiotics appearing in the market. Antibiotic misuse is one of the factors cited to promote resistance. In order to curb antibiotic misuse, several strategies are in place to educate the public. In addition, it is also important to understand the attitudes of prescribers of antibiotics and educate them. This study is aimed at university students and looks at the adequacy of the curriculum towards educating medical and pharmacy students. It aims to determine the areas of lack of knowledge and review strategies in place to improve the knowledge of future prescribers of antibiotics.

Faculty Name: **Dr Frances Pearl**
Room No: JMS 4D8 Email: **f.pearl@sussex.ac.uk**

Project Title/Area:
Assessing the structural impact of activating mutations in cancer

Course or Module requirements:	No of places: Up to 3	Project Type: Data analysis Literature

Further Information:

Using statistical methods we have identified ~500 hotspot mutations in 300 oncogenes that are likely to contribute to the progression of cancer and which are documented in the MoKCA database http://strubiol.icr.ac.uk/extra/mokca/

This project will involve running different computer programs and scanning the literature to try and identify how these mutations activate the proteins.

Project Title/Area:
Which truncating mutations in cancer cause activation of the protein product?

Course or Module requirements: Ability to program is required	No of places: 1	Project Type: Data analysis

Further Information:

Normally as a cancer develops a truncating mutation will result in the complete ablation of the protein product through nonsense-mediated decay. However, in a small number of cases a truncating mutation will cause activation and disregulation of the truncated protein.

This project will involve writing a simple computer program to identify patterns in truncating mutations to try and identify when truncating mutations cause activation of a protein

Project Title/Area:

Resistance mutations

Course or Module requirements:	No of places: 1	Project Type: Literature

Further Information:

This is a literature-based project. We have collated a list of chemo and personalised therapies that are used to treat cancer and the proteins that they inhibit.
This project will involve scanning the literature and online databases to identify which mutations in these proteins result in drug resistance.

Project Title/Area: **Missing evolutionary pathways in model organisms**		
Course or Module requirements:	No of places: 1	Project Type: Data analysis
Further Information: We want to compare the different pathways present in the 6 model organisms in the SLORTH database. http://rails.biochem.susx.ac.uk:4000/welcome/index This project will use computer programs to map all the different pathways in the model organisms to identify, which are present in each. We will then analyse these data to identify how the orthologues and pathways differ between these 6 species.		

Faculty Name: **Mika Peck**
Room No: 5D24 Email:m.r.peck@sussex.ac.uk

Project Title/Area: 6 Projects - Behaviour, ecology and conservation of the brown-headed spider monkey (*Ateles fusciceps fusciceps*) and the mantled howler monkey (*Allouata palliate*)

Course or Module requirements:	No of places: 4	Project Type: Experimental (including data analysis) /Literature
Proven interest in conservation biology/animal behaviour		

Further Information:

Ecuador

Field research projects at the newly established Tesoro Escondido Spider Monkey Reserve with subprojects to include:

1. Assessing the response of *Ateles fusciceps fusciceps* to playback recordings to optimise rapid population assessments.
2. Using acoustic survey methods to assess abundance of mantled howler monkeys (*Alouatta palliata)*
3. Dietary preferences of *Alouatta palliata* in the Ecuadorian Chocó.
4. Tree species preference as sleeping sites for Ateles fusciceps fusciceps.
5. Human-Wildlife Conflict – Field survey of large felids using camera trapping plus local perspectives and priorities in the Ecuadorian Chocó (Spanish language required)

Special requirements:

1. Must cover flight, travel, insurance and local living costs for a minimum of 4 weeks in Ecuador (see http://www.tesororeserve.org/ for details).
2. Interview with Dr Mika Peck on 8 April 2016 – email to arrange a suitable time
3. (Spanish language ability required for Human Wildlife Project #5)

UK

6. UK based: Assessing population abundance of *Alouatta palliata* from grids of field acoustic recorders

Faculty Name: **Andrew Penn**
Room No: **CRPC 5.10** Email: **A.C.Penn@sussex.ac.uk**

Project Title/Area:
Cloning human disease mutations in NMDA receptor subunits

Course or Module requirements:	No of places:	Project Type:
A medical or biological science, in particular genetics or neuroscience	**1**	**Experimental**

Further Information:

The normal function of our brains depends fundamentally on the ability of neurons to communicate with each other at connections called synapses. Synaptic release of the neurotransmitter glutamate excites postsynaptic neurons by activating three major types of glutamate receptor ion channels (iGluRs): AMPA, Kainate and NMDA receptors. NMDA receptors in particular make essential contributions to synaptic plasticity and neuronal excitability and dysregulation of these processes are widely considered to be major factors in mental and seizure disorders respectively. Interestingly, an increasing number of familial and *de novo* mutations are being discovered in human NMDA receptors of individuals with epilepsy and intellectual disability. Studying the impact of these mutations on NMDA receptor function and expression will provide an important insight into the pathogenesis of these diseases. In this project, you will clone a variety of human NMDA receptor disease mutants and research the links between them and the reported clinical phenotypes.

Bibliography:

Yuan et al. (2015) Ionotropic GABA and Glutamate Receptor Mutations and Human Neurological Diseases*. Mol. Pharmacol*. 88(1):203-17

Project Title/Area:

Cloning CRISPR/Cas9 constructs to knockout NMDA receptor subunits

Course or Module requirements:	No of places:	Project Type:
A biological science, in particular genetics or neuroscience	**1**	**Experimental**

Further Information:

The normal function of our brains depends fundamentally on the ability of neurons to communicate with each other at connections called synapses. Synaptic release of the neurotransmitter glutamate excites postsynaptic neurons by activating three major types of glutamate receptor ion channels (iGluRs): AMPA, Kainate and NMDA receptors. NMDA receptors in particular make essential contributions to synaptic plasticity and neuronal excitability. For example, knocking out the obligatory GluN1 subunit depletes NMDA receptors from synapses and prevents synaptic plasticity and behavioural learning. Genome editing tools that are particularly suited to single-cell manipulations provide the opportunity to study cell-autonomous impact of changes in gene expression independent of their effects on development or activity of neural circuits. Cutting edge developments have included the use of clustered regularly interspaced short palindromic repeats (CRISPR) to knockout gene expression in single mammalian postmitotic neurons. In this project, you will design and clone guide RNA (gRNA) sequences into CRISPR/Cas9 vectors for targeted knockout of various human NMDA receptor subunits and critically evaluate the method as a tool for genome editing.

Bibliography:

Incontro et al. (2014) Efficient, complete deletion of synaptic proteins using CRISPR*. Neuron*. 83(5):1051-7

Faculty Name: **Michael Pettit**
Room No: 3B18 Email: m.pettit@sussex.ac.uk

Project Title/Area:
Systematic review of the evidence for the gastro-protective effect of proton pump inhibitors in patients prescribed clopidogrel.

Course or Module requirements:	No of places: 1	Project Type: Literature (including data analysis)

Further Information:

Clopidogrel is commonly prescribed for cardiovascular problem and can cause gastric bleeds. Proton pump inhibitors are often co-prescribed. These drugs interact and can reduce the efficacy of clopidogrel.

What is the evidence that co-prescription favours benefit over risk?

Project Title/Area:
Systematic review of the comparative efficacy and risk of the use of Warfarin versus the New Oral Anticoagulant drugs (NOACs) for the treatment of atrial fibrillation

Course or Module requirements:	No of places: 1	Project Type: Literature (including data analysis)

Further Information:

New treatments are available for use as anticoagulants. Warfarin has been the gold standard for many years. What is the comparative risk/benefit ratio?

Project Title/Area:
Systematic review of the evidence for use of IV ranitidine for the prophylaxis of stress ulcers in post-surgical patients.

Course or Module requirements:	No of places: 1	Project Type: Literature (including data analysis)

Further Information:

Intravenous raniditine is commonly prescribed for the prophylaxis of stress ulcers. What is the evidence for efficacy? What are the risks?

Faculty Name: **Dr Roger Phillips**
Room No: CRPC PC315 Email:r.g.phillips@sussex.ac.uk

Project Title/Area:
The role of Eater receptor in haemocyte attachment during metamorphosis

Course or Module requirements:	No of places: 2	Project Type:
Eucaryotic Genetics		Experimental

Further Information:
Eater is a member of the Nimrod family of peptidoglycan binding; scavenger receptors in Drosophila which is related to the Human von Willebrand factor. It is required in haemocytes for aspects of phagocytosis and for adhesion of haemocytes in the larval sessile patches (Bretscher et al 2015). We have shown that eater is also required for haemocyte attachment to degenerating epithelia during metamorphosis. We will further explore this requirement using in vivo temperature regulated expression of eater in animals which are deficient for the endogenous eater gene.
The role of Eater in adhesion is described in Bretscher A. et al, 2015, The Nimrod transmembrane receptor Eater is required for hemocyte attachment to the sessile compartment in Drosophila melanogaster. Biology Open (2015) 4, pp 355–363.
Haemocyte migration and adhesion is reviewed in Ratheesh A. et al, 2015, Drosophila immune cell migration and adhesion during embryonic development and larval immune responses. Current Opinion in Cell Biology 2015, 36:71–79

Project Title/Area:
Construction of a FRET biosensor for RhoL GTPase

Course or Module requirements:	No of places: 1	Project Type:
Molecular Genetics		Experimental

Further Information:
We have recently shown that the Rho family GTPase, RhoL has a role regulation of the innate cellular immune response during metamorphosis in Drosophila. In order to detect RhoL activity in living cells we will prepare a FRET biosensor construct and express this in haemocyte like Drosophila S2 cells.
The construction and application of Rho FRET sensors is reviewed in Donnelly S. et al. 2014 Rho GTPase isoforms in cell motility:Don't fret, we have FRET. Cell Adhesion & Migration 8:6, 526--534
Drosophila haemocyte cell biology is reviewed in Wang L. et al 2014 Drosophila as a model to study the role of blood cells in inflammation, innate immunity and cancer. Frontiers in Cellular and Infection Microbiology January 2014 Volume 3 Article 113 pp1-17

Faculty Name: **Chrisostomos Prodromou**
Room No: G4.20 Email: chris.prodromou@sussex.ac.uk

Project Title/Area: **Isolation of intact Tel2-TTI1-TTI2 complex from Saccharomyces cerevisiae and collection of electron microscopy data for structure determination**

Course or Module requirements:	No of places: 1	Project Type: Experimental

Further Information: Hsp90 involvement in the assembly of snoRNPs, RNA polymerases, PI3-kinase-like kinases, and chromatin remodeling complexes depends on the TTT (Tel2-Tti1-Tti2), and R2TP complexes-consisting of the AAA-ATPases Rvb1 and Rvb2, Tah1 (Spagh/RPAP3 in metazoa), and Pih1 (Pih1D1 in humans)-that together provide the connection to Hsp90.
Using antiserum against the TTT complex of S. cerevisiae we will isolate purified TTT complex for analysis by EM. We will also construct strains of S. cerevisiae that overexpress one or more of the TTT components that is His-tagged to improve yields and quality of the purified complex. Complex will be analyzed by EM towards a structural reconstruction.

Project Title/Area: **Data collection by EM and structure refinement of a Hsp90-Braf-Cdc37 complex**

Course or Module requirements:	No of places: 1	Project Type: Experimental

Further Information: Hsp90 is responsible for the activation of specific protein kinases that are often responsible for driving cancer. The structure of the Hsp90-Braf-Cdc37 complex remains unknown. Braf is the most commonly mutated gene in cancer. We have an expression system from which we can isolate such complex. We will use EM to reconstruct the structure of this kinase complex

.

Project Title/Area: **Interaction studies between mutants of Cdc37 and Braf**

Course or Module requirements:	No of places: 1	Project Type: Experimental

Further Information: Hsp90 is responsible for the activation of key signalling kinases. Delivery to Hsp90 is mediated by the co-chaperone Cdc37. We would like to engineer Cdc37 for crystallization studies. Such mutants must be tested for binding to Braf kinase. Interacting proteins will be screened for crystallization and crystals, if obtained, will be used to solve the structure of such a complex.

Faculty Name: **Professor Francis Ratnieks**
Room No: **Laboratory of Apiculture & Social Insects (LASI), Old Ancillary Building**
Email: **F. Ratnieks@Sussex.ac.uk**

Project Title/Area: **1. Nestmate recognition and guarding in honey bees (experiment)**

Course or Module requirements: Background in ecology, animal behaviour/behavioural ecology recommended; year 3 module in Social Insects recommended though not required.	No of places: 2-3	Project Type: Experimental (including data analysis) /Literature

Further Information:
Details: Research project working with guard bees at the entrances of bee hives to investigate mechanisms of nestmate recognition and adaptive responses of guards to intruders. The project will investigate a specific, focused question/hypothesis within this. Field work is done in autumn (late September to late November) when it is still warm enough for the bees to be active, in the apiary of the Laboratory of Apiculture & Social Insects, c. 50m from the JMS building.
Prerequisites & Further Information: Interest/knowledge of animal behaviour/behavioural ecology, field work, studying the behaviour of live animals. A schedule that allows the student to spend several days per week doing field work. Field work must be completed by mid to late November as the bees are not active in the colder weather.

Project Title/Area: **2. Honey bee and hover fly foraging efficiency on ivy flowers (experiment)**

Course or Module requirements: Background in ecology, animal behaviour/behavioural ecology recommended; year 3 module in Social Insects or Animal Plant Interactions recommended though not required.	No of places: 2-3	Project Type: Experimental (including data analysis) /Literature

Further Information:
Details: Ivy is a common plant that flowers in the autumn and is the main source of nectar and pollen in autumn. There are large patches on campus. Ivy flowers attract a large number of insects or all types, especially honey bees, hover flies, and wasps. The project will investigate the efficiency of honey bee and hover fly foraging (e.g., number of flowers visited per minute, time taken to locate flowers, nectar rewards in flowers, number of foraging bees, number of competing insects) across the period that ivy is in bloom (Late September to mid November) to determine how this changes, and how honey bees and hover flies change their foraging strategy in response to changes in the numbers of flowers. Field work will take place on ivy growing on campus and in Falmer village within c. 5 minutes walk of the JMS building.
Prerequisites & Further Information: Interest/knowledge of animal behaviour/behavioural ecology, ecology, insect-plant relations, field work, studying the behaviour of live animals. Field work must be completed by mid to late November as the bees are not active in the colder weather.

Project Title/Area: **3. Effect of wind speed on flower handling and foraging of honey bees (experiment)**

Course or Module requirements: Background in ecology, animal behaviour/behavioural ecology recommended; year 3 module in Social Insects or Animal Plant Interactions recommended though not required.	No of places: 2-3	Project Type: Experimental (including data analysis) /Literature

Further Information:
Details: The project will investigate the effect of wind, produced artificially using fans, on the ability of flower-visiting insects to handle flowers. Although this project could, potentially use a variety of insects and flowers, for practical reasons it will likely focus on honey bees, as these are abundant in the autumn, and borage flowers, as borage flowers are highly attractive to honey bees and are available in the autumn.
Prerequisites & Further Information: Interest/knowledge of animal behaviour/behavioural ecology, ecology, insect-plant relations, field work, studying the behaviour of live animals. Field work is done in autumn (late September to late November) when it is still warm enough for the bees to be active, in the apiary of the Laboratory of Apiculture & Social Insects, c. 50m from the JMS building.

Project Title/Area: **4. Decoding honey bee dances to investigate honey bee foraging (experiment)**		
Course or Module requirements: Background in ecology, animal behaviour/behavioural ecology recommended; year 3 module in Social Insects or Animal Plant Interactions recommended though not required.	No of places: 1-2	Project Type: Experimental (including data analysis) /Literature
Further Information: *Details*: Research project working with honey bees in which students decode waggle dances to determine where in the landscape bees are foraging. The project will investigate a specific, focused question/hypothesis within this. Because the waggle dances are videotaped in the summer and autumn, the project is not weather or season dependent. Laboratory work should be completed by the end of November/early December. *Prerequisites*: *Prerequisites & Further Information*: Interest/knowledge of animal behaviour/behavioural ecology, ecology, insect-plant relations, lab/desk work. This project may be suitable for students who want to begin in the summer vacation.		

Further Information & Meetings to Find Out More

In past years, over half of the year 3 projects carried out in my lab have also been published as scientific papers, which is an advantage for students who would like a career in science. If you are thinking of doing one of my projects or want to find out more, please come to one of the two scheduled short meeting at my lab at which I will give further information and sign forms.

Meeting 1. 1300-1330/45, Thursday 7 April 2016
Meeting 2. 1300-1330/45, Friday 8 April 2016

The meeting will be in my lab (LASI) in the Old Ancillary Building. It is a bit hard to locate. The best way to get there is via the south car park of the Innovation Centre. You will see a wooden building with a path beside it leading to a white door (the back door of the lab) in a single story brick building. You will also see bee hives, which will tell you that you are in the right place. Below is a map.

How to Get to The Laboratory of Apiculture & Social Insects (LASI)

Red shows how to drive from the A27 road. Blue shows how to walk from Falmer station or from the front of the BSMS Building (46). LASI is located in the Old Ancillary Building. The easiest access is via the car park (P2) of the Innovation Centre (44). The IC postcode is BN1 9SB. On the edge of the IC car park is a brown shed with a gate to its left with a gravel path leading to LASI's white door in a 1-storey brick building. There is limited parking at LASI. Visitor parking at P4.

Faculty Name: **Guy Richardson**
Room No: CRPC 423 Email: g.p.richardson@sussex.ac.uk

Project Title/Area:

Testing potential oto-protective agents using zebrafish larvae and mouse cochlear cultures

Course requirements:	No of places:	
Neuroscience	5	Experimental

Further Information:

Certain commonly used medications (e.g., the aminoglycoside antibiotic gentamicin; the anti-cancer cis-platin) are known to be ototoxic and selectively kill the sensory hair cell in the inner ear leading to deafness and balance disorders. Recent work has indicated (i) that the aminoglycoside antibiotics selectively enter into hair cells via the mechano-electrical transducer (MET) channels that are present in the hair bundles of these cells and (ii) that the lateral line organs of zebrafish larvae can be used to screen for oto-protective agents. Using the latter system we have discovered a number of compounds that protect sensory hair cells from aminoglycosides antibiotics, some of which block the hair cell's MET channel and other of which do not. The aim of the project is to test whether or not these compounds block the accumulation of Texas Red conjugated gentamicin in the hair cells of the zebrafish lateral line organs and mouse cochlear cultures. This is a group project. Each participant will test a specific compound, and the data sets generated will be shared amongst the group for analysis, discussion and presentation.

<table>
<tr><td colspan="3">Faculty Name: Mark Roe
Room No: 2R314A Email: m.roe@sussex.ac.uk</td></tr>
<tr><td colspan="3">Project Title/Area: X-Ray Crystallography of small molecule inhibitors of AMPA</td></tr>
<tr><td>Course or Module requirements: None</td><td>No of places: 3</td><td>Project Type: Experimental</td></tr>
<tr><td colspan="3">Further Information:

This project will involve the student crystallising the protein/inhibitor complex, collecting data, solving and refining the structure with a view to explaining the basis of binding of the inhibitor and exploring ways that the binding could be improved.</td></tr>
</table>

Faculty Name: **Dr. Christopher Sandom**
Room No: JMS 5B7 Email: C.Sandom@Sussex.ac.uk

Project Title/Area:
Where and how is rewilding being applied in the UK?

Course or Module requirements: Conservation Biology I, Conservation Biology II	No of places: 2	Project Type: Experimental (including data analysis)

Further Information:
Rewilding is an emerging field in conservation biology. It poses that the restoration of natural processes such as predation, herbivory and hydrology can return ecosystems to more self-restoring and self-sustaining states. Rewilding is an innovative idea that can be applied in many different ways, including: species reintroduction, natural processes mimicking, and drainage channel blocking. This project will examine where and how rewilding is being applied in the UK. Specifically the project will involve gathering data from protected area management plans and/or online material to answer questions, such as: Is rewilding being applied in Britain's conservation areas? What methods of rewilding are being actively implemented? Is rewilding associated with particular habitat types, regions or other landscape features?

Students wanting to participate in this project should: have a good background in conservation science, understand the key ideas behind rewilding, have the patience and enthusiasm for the project to allow them to read and collect data from a large number of management plans and/or online material, and have a basic understanding in the theory and use of statistics and GIS.

Faculty Name: Velibor Savic
Room No: JMS 2C29 Email:v.savic@bsms.ac.uk

Project Title/Area:

Bystander effect and its effect on DNA damage response

Course or Module requirements:	No of places: 1	Project Type: **Experimental** (including data analysis) /Literature

Further Information:
Cells can communicate various signals to their neighbours. There is data showing that during DNA damage, cells can communicate stress signals to neighbouring cells, altering their biology. We would like to explore to what extent physically and temporally this signal can affect neighbouring cell population. We will damage a set of cells, co-culture them with naive cells and look for biological changes dependant on proximity to the damaged cell – source of stress signalling. The project will involve basic mammalian tissue culture experience, performing quantitative immunofluorescence through high content imaging and analysis of large data sets.

Project Title/Area:

Long-term DNA damage "memory" in cells

Course or Module requirements:	No of places: 1	Project Type: **Experimental** (including data analysis) /Literature

Further Information:
Recently it has been shown that the cells have the potentially to have long-term "memory" of previous genomic stress. Moreover, this memory makes them more resistant to subsequent stress. To test this, we would damage a population of cells and re-damage them at defined time intervals, to see if the respond differently due to previous genomic insults. The project will involve basic mammalian tissue culture experience, performing quantitative immunofluorescence through high content imaging and analysis of large data sets.

Faculty Name: **Dr Jorn Scharlemann**
Room No: JMS 5B25 Email: j.scharlemann@sussex.ac.uk

Project Title/Area:
Climate change and biodiversity

Course or Module requirements:	No of places:	Project Type:
Ecology and Environment/Biology/Zoology Environmental Research Skills or willingness to learn statistical data analysis	2-3	Experimental (including data analysis)

Further Information:

Many biological systems are changing because of climate change, e.g., plants are flowering earlier, birds are migrating and laying eggs earlier, butterflies emerge at different times. Such changes in the phenology, the timing of biological events, can be either recorded through empirical observations or data gathered from museum collections. Natural history museums provide an ideal source for phonological data. This project will collect data on phenological events, such as egg laying, from natural history museums and correlate these data with climatic information from weather stations to assess how species respond to changing temperatures and precipitation, and if there are differences among taxonomic groups or geographical regions?

This project will involve finding and extracting data from museum records either directly from specimen labels/registers or from online databases (e.g. GBIF), building a database in Excel or Access, and performing statistical analyses. This project requires attention to detail, and provides an opportunity to learn about databasing, GIS and statistical analysis. There is no requirement to have any computer programming skills in advance of the project, but a general level of confidence with IT will help.

Parmesan C & Yohe G (2003) A globally coherent fingerprint of climate change impacts across natural systems. *Nature*, 421, 37-42.
Root TL, Price JT, Hall KR, Schneider SH, Rosenzweig C, Pounds JA (2003) Fingerprints of global warming on wild animals and plants. *Nature*, 421, 57–60.
Walther GR, Post E, Convery P et al. (2002) Ecological responses to recent climate change. *Nature*, 416, 389–395.
Andrew et al. (2013) Assessing insect responses to climate change: What are we testing for? Where should we be heading?. *PeerJ* 1:e11

Project Title/Area:
Agriculture and biodiversity, own project

Course or Module requirements:	No of places:	Project Type:
Ecology and Environment/Biology/Zoology Ideally Resource Management (year 2)	2 - 3	Literature

Further Information:

The human population is projected to increase to 9 billion people, requiring a doubling of food production. How can we feed 9 billion people while minimising the impacts on nature. John Beddington, former chief scientific advisor to the UK government called this nexus of climate change, water shortages and increase food demand the “perfect storm”. How can we tackle these interconnected issues for a sustainable future Earth.

I am happy to discuss ideas with individuals who are interested in a project involving all or some of these issues.
Please note: you must come and discuss your ideas with me before opting for this project.

Faculty Name: **Prof. Louise Serpell**
Room No: CRPC 4.06 Email: L.C.Serpell@sussex.ac.uk

Project Title/Area: **Molecular basis of Alzheimer's disease**

Course or Module requirements:	No of places:	Project Type:
PFF an advantage	2-3	Experimental (including data analysis)

Further Information:
Alzheimer's disease is characterised by the self-assembly and deposition of two major proteins, tau and Abeta. Our lab are aiming to understand the molecular basis for neurodegeneration by studying the roles of these proteins at the molecular and cellular levels using a range of techniques. On one hand, we use biophysical techniques, electron microscopy and X-ray diffraction to study the self-assembly of the misfolding proteins. On the other, we are examining the effects of Abeta and tau on neuronal cells and using western blotting and confocal and electron microscopy to understand how they cause cellular dysfunction and cell death.

The projects will relate to ongoing projects being conducted by PhD students and postdocs in the Serpell Lab.

Project Title/Area: **Amyloid fibrils as functional materials**

Course or Module requirements:	No of places:	Project Type:
PFF an advantage	1	Experimental (including data analysis)

Further Information:

Amyloid fibrils can be formed by many different proteins and are best known for their relationship to diseases collectively known as Amyloidoses. However, the fibrils that form are extremely stable and resemble spider silk. This project will aim to exploit the highly organised and resilient structures to develop new nano-materials for potential applications. The projects will include biophysical techniques, electron microscopy and X-ray fibre diffraction to explore the structures of the resulting fibrils.

The projects will relate to ongoing projects being conducted by PhD students and postdocs in the Serpell Lab.

Project Title/Area: **Protein misfolding in disease**

Course or Module requirements:	No of places:	Project Type:
PFF an advantage	1-2	Literature

Further Information:

This literature project will relate to protein misfolding that is related to a large number of diseases collectively known as Amyloidoses. These include Diabetes type 2, Parkinson's and Alzheimer's disease as well as the prion diseases. The student will be involved in discussion regarding the particular focus of the literature project and will undertake a high level literature review and opinion piece on a title of their choice.

Faculty Name: **Alison Sinclair**
Room: 3C19 Email: a.j.sinclair@sussex.ac.uk

Project Title/Area:

Cancer caused by viruses

Course or Module requirements:	No of places:	Project Type:
Genome Stability, Gene Diseases & Cancer (final year)	1-5	Data and Literature analysis

Further Information:

Explore the contribution of Epstein-Barr virus to the development of (i) Nasopharyngeal carcinoma, (ii) Hodgkin's disease, (iii) Gastric Carcinoma, (iv) EBV-lymphoma in HIV-positive people and (v) lytic reactivation of EBV as a means to treat cancer.

You will use PubMed to identify recent academic reviews on the subject then use a series of on-line sources of information to extract data about the numbers of cases, risk factors, treatment options both historical and new and current clinical trials. You may also focus on the underlying molecular mechanisms.

If you like working independently then this project will suit you. You will present and discuss your finding with the group every two weeks to gain feedback and develop your presentation skills.

Faculty Name: **Kevin Staras**
Room No: CRPC 4.06 Email: k.staras@sussex.ac.uk

Project Title/Area: Functional and ultrastructural relationships of synaptic vesicle pools in hippocampal slice/cultured neurons.

Course or Module requirements:	No of places:	Project Type:
Neuroscience courses Principles of Neuroscience / Neural Circuits modules	5	Experimental (data analysis)

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.

Recent work in my laboratory has exploited optical reporters of vesicles providing dynamic information on vesicle recycling (Nature Neurosci 9:315-321, 2006; Neuron 66:37-44, 2010; Nature Comms, 8;2:531, 2011; Neuron 76:579-589, 2012; Nature Protocols, 2014; Nature Comms, 2015). The same reporters can be photoconverted to produce an electron dense precipitate that is visible in the electron microscope; this offers a readout of which vesicles are used by a stimulus.

The projects are all DATA-ANALYSIS based. You will take fluorescence and/or EM datasets and test novel hypotheses regarding relationships between vesicle properties and synaptic function. Handling of large datasets and willingness to learn image-analysis and statistical software packages is important. Programming skills (eg. Matlab, Python) are highly recommended.

Faculty Name: **Dr Ruth Staras**
Room No: JMS 3B30 Email: r.staras@sussex.ac.uk

Project Title/Area: **Application of high-tech therapeutics to treat diseases of the retina/ Understanding the cellular mechanisms of neurosensory disorders**

Course or Module requirements:	No of places: **2**	Project Type:
Medical Neuroscience or **Principles of Neuroscience**		**Literature**

Further Information:

Retinitis pigmentosa (RP) is a currently incurable disease of the retina that leads to blindness. Some of the most advanced techniques in cellular and molecular neuroscience are being employed in the hope of finding successful treatments for RP (and other degenerative diseases of the retina) such as optogenetics, stem cell therapy and the design of artificial retinae. However, the complex aetiologies of these diseases mean that no single approach has yet emerged as a clear leader in the field.

These projects will assess the relative potentials of the different state-of-the-art treatment techniques currently under development, using a wide range of literature (e.g. neuroscience, medicine, policy) to examine what is known about the mechanisms of retinal dysfunction and how the treatments in question may be practical and effective.

Faculty Name: **Dr Alan Stewart**
Room No: JMS 5B19 Email: a.j.a.stewart@sussex.ac.uk

Project Title/Area: **Data analysis projects**

Course or Module requirements:	No of places:	Project Type:
Introduction to Ecology & Conservation (Year 1)	2-3	Experimental (including data analysis)

Further Information:
Several organisations (including the Sussex Biodiversity Records Centre and other organisations with which we have contact) hold a number of large ecological datasets, often on the occurrence of several species over several years, which could be used to inform conservation decisions. Some of these are long-term datasets which need to be analysed to establish the extent to which population changes reflect annual variation in the weather, the effects of local habitat management or long-term patterns, perhaps as a result of climate change. Various projects could be devised around particular datasets depending upon your interests, but they would all involve careful analysis of large and usually complicated datasets. Possible datasets include: (i) large-scale survey of invertebrates in Welsh peatlands, (ii) survey of bees & wasps or flies on the South Downs, (iii) changes in plant communities in coppice woodland over 30+ years, (iv) survey of insects in pine forests. No fieldwork would be involved (unless the student had a particular desire to do some and it was appropriate to the analysis). Such projects would therefore suit someone who **enjoys handling data and analysing it statistically**. Some experience with handling data would be advantageous, but it is much more important that you are prepared to learn and to get stuck into some challenging data manipulations and analyses.

Project Title/Area: **Glow worms and light pollution**

Course or Module requirements:	No of places:	Project Type:
Introduction to Ecology & Conservation (Year 1)	1	Experimental (including data analysis)

Further Information:
Glow worms are beetles that communicate at night using bioluminescence: females produce a pale green glow in order to attract a mate. The efficiency of their glowing behaviour is dependent upon the environment being really dark. There is therefore considerable concern that so-called ‘light pollution’ (i.e. artificial lighting from street lamps, lit buildings, security lights) may inhibit females from glowing or may make it harder for males to find them.
This project would examine the relationship between the position of glow worm colonies in Sussex with data on night illumination that have been collected by the South Downs National Park’s ‘Dark Night Skies’ initiative. This be an essentially data handling and statistical exercise. Some experience with handling data would be advantageous. Knowledge and some skill in GIS would be especially beneficial. However, it is much more important that you are prepared to learn and to get stuck into some challenging data manipulations and analyses.

Project Title/Area: **Own project**

Course or Module requirements:	No of places:	Project Type:
Introduction to Ecology & Conservation (Year 1)	1-2	Experimental (including data analysis)

Further Information:
I would be happy to discuss original ideas with individuals who are interested in a project involving the population or community ecology or conservation of invertebrates. Please note: you **MUST** come and discuss your ideas with me **BEFORE** opting for this project.

Faculty Name: **Steve Sweet**
Room No: G3.05 Email: s.m.sweet@sussex.ac.uk

Project Title/Area:

ChIP-MS of DNA damage repair proteins

Course or Module requirements:	No of places:	Project Type:
2nd yr Cell Regulation and Cancer (C7108) advisable; Genes and Genomes (C7110) essential 3rd yr Genome Stability, Genetic Diseases and Cancer (C7129) essential	1	Experimental

Further Information:

Repair of different types of DNA damage is a critical process for cell survival and entails large changes to the surrounding chromatin and the recruitment of large numbers of repair proteins[1].
Chromatin immunoprecipitation (ChIP) followed by mass spectrometry (MS) allows the characterisation of both chromatin context, as given by histone post-translational modifications, and protein binding partners[2-4]. We are applying this technique to investigate the composition and context of DNA double-strand break repair intermediates.
This project uses ChIP to isolate target chromatin-bound proteins after different types of DNA damage (ionizing radiation, chemical damaging agents). The techniques involved include mammalian tissue culture, immunofluorescence microscopy, western blotting and mass spectrometry.

1. Soria G, Polo Sophie E, & Almouzni G (2012) Prime, Repair, Restore: The Active Role of Chromatin in the DNA Damage Response. Molecular Cell 46(6):722-734.
2. Soldi M & Bonaldi T (2013) The Proteomic Investigation of Chromatin Functional Domains Reveals Novel Synergisms among Distinct Heterochromatin Components. Molecular & Cellular Proteomics 12(3):764-780.
3. Ji X, et al. (2015) Chromatin proteomic profiling reveals novel proteins associated with histone-marked genomic regions. Proceedings of the National Academy of Sciences.
4. Engelen E, et al. (2015) Proteins that bind regulatory regions identified by histone modification chromatin immunoprecipitations and mass spectrometry. Nat Commun 6.

Project Title/Area:

Protein post-translational modifications and binding partners of RAD51

Course or Module requirements:	No of places:	Project Type:
2nd yr Cell Regulation and Cancer (C7108) advisable; Genes and Genomes (C7110) essential 3rd yr Genome Stability, Genetic Diseases and Cancer (C7129) essential	1	Literature

Further Information:

Homologous recombination is a DNA repair pathway of critical importance to genome stability1. Rad51 plays a key role in the homology-search step of homologous recombination repair2. In this literature project the student will investigate the reported post-translational modifications and binding partners of Rad51, and their roles in DNA repair.

1. Aguilera A & Gomez-Gonzalez B (2008) Genome instability: a mechanistic view of its causes and consequences. Nat Rev Genet 9(3):204-217.
2. Renkawitz J, Lademann CA, & Jentsch S (2014) Mechanisms and principles of homology search during recombination. Nat Rev Mol Cell Biol 15(6):369-383.

Faculty Name: **Camilla Tornoe**
Room No: JMS 3B30 Email: c.tornoe@sussex.ac.uk

Project Title/Area:
White matter – it's all in the connections.

Course requirements: 2nd year: Principles of Neuroscience (or Medical Neuroscience). Useful but not essential: Neural Circuits (2nd Year)	No of places: 1	Experimental /Literature

Further Information:

This is a 'Critical Review' type projects, thus does not require direct laboratory work by the student, but involves deep-reading and critical assessment of the published literature in the area of study. These kinds of critical review projects involve students in more in-depth thinking than some experimental projects.

While it has long been known that disease like multiple sclerosis affect the myelination, White Matter has suffered a bit in the shade of Gray Matter over the decades. Things are changing however, with studies that have revealed that fast learners have more white matter, for example. Furthermore, the human connectome project.is starting to give us a better visual understanding of the interconnectedness of our brains.
The Swedish pianist and neuroscientist investigated White Matter in musicians and non-musicions. The results showed that connections between regions involved in coordinated finger movements and cognitive interpretation were more developed in pianists, than in non-musicians.
A re-evaluation of the White Matter is thus under way.

Starting references:
Bechler & ffrench-Constant (2014): “A new wrap for Neuroscience?”; Science; **344**; 480-1

Learning:
Golestani *et al* (2006): “Brain structure predicts the learning of foreign speech sounds”;Cerebral Cortex; **17**; 575-582

Bengtsson *et al* (2007): "Cortical regions involved in the generation of musical structures during improvisation in pianists"; J Cogn Neurosci; **19**; 830-42.

images and techniques:
http://www.humanconnectomeproject.org/

repair and regeneration:
Zawadzka *et al* (2010): "CNS-Resident Glial Progenitor/Stem Cells Produce Schwann Cells as well as Oligodendrocytes during Repair of CNS Demyelination"; Cell Stem Cell; **6**(6);

Project Title/Area: Spinal cord plasticity – critically assess a range of therapeutic approaches		
Course requirements: 2nd year: Principles of Neuroscience (or Medical Neuroscience). Useful but not essential: Neural Circuits (2nd Year)	No of places: 1	Experimental /Literature

Further Information:

This is a 'Critical Review' type projects, thus does not require direct laboratory work by the student, but involves deep-reading and critical assessment of the published literature in the area of study. These kinds of critical review projects involve students in more in-depth thinking than some experimental projects.
The spinal cord is not just a tube relaying information from the brain to the body. It is part of the CNS and has complex interactions within it. It is also capable of learning and changing. Some of the changes associated with spinal cord injury are detrimental, other have offered hope of therapeutic avenues. But can we really expect people with spinal cord transection to recover fully (and this means more than walking again)?

Starting references:
Dunlop SA (2008): "Activity-dependent plasticity: implications for recovery after spinal cord injury"; TINS; 31; 410-18

Nardone et al (2013): "Functional brain reorganization after spinal cord injury: Systematic review of animal and human studies"; Brain Research; e-pub ahead of print: http://dx.doi.org/10.1016/j.brainres.2012.12.034

New exciting therapeutics:
Tabakow, *et al.(*2013). Transplantation of autologous olfactory ensheathing cells in complete human spinal cord injury. Cell Transplantation, **22**, pp. 1591-1612.

and the follow up:
Tabakow et al (2014): "Functional Regeneration of Supraspinal Connections in a Patient With Transected Spinal Cord Following Transplantation of Bulbar Olfactory Ensheathing Cells With Peripheral Nerve Bridging"; Cell Transplantation; **23**; pp. 1631-1655

This made a splash in the news: Quinn, B., 2014. *Paralysed man Darek Fidyka walks again after pioneering surgery.* [Guardian Online]
Available at: http://www.theguardian.com/science/2014/oct/21/paralysed-darek-fidyka-pioneering-surgery

Project Title/Area: qualitative study of students' use of feedback		
Course requirements: none, but an interest in learning and education.	No of places: 1	Experimental /Literature

Further Information:
Feedback is an area of concern for many higher education institutions. Feedback is supposed to be part of the scaffolding to enable students to learn and progress. However, there is seemingly a gap between the intention of the tutors when providing feedback and how the students use and perceive it.
This will use structured interviews with final year students to try to get a **qualitative** assessment of how student in the School of Life Sciences at the University of Sussex utilise the feedback provided by tutors and whether this has changed during the course of their degree.

Starting references:
Crisp (2007): "Is it worth the effort? How feedback influences students' subsequent submission of assessable work"; Assessment & Evaluation in Higher Education; **32**:5; 571-581
http://dx.doi.org/10.1080/02602930601116912

The study will take a similar format to this:
Orsmond et al (2005): "Biology students' utilization of tutors' formative feedback: a qualitative interview study"; Assessment & Evaluation in Higher Education, **30**:4; 369-386
http://dx.doi.org/10.1080/02602930500099177

Faculty Name: **Felicity Watts**
Room No: G4.18 Email: f.z.watts@sussex.ac.uk

Project Title/Area:

Analysis of mutations in sumoylation factors associated with human diseases

Course or Module requirements:	No of places:	Project Type:
None	2	Literature

Further Information:
SUMO is a small ubiquitin-like modifier that can be covalently attached to target proteins. Sumoylation is required for a range of biological functions including regulation of transcription, DNA repair, cell cycle and RNA stability. At the molecular level, SUMO modification acts to alter protein-protein interactions, protein-DNA interactions, enzyme activity and protein localisation. In order to be attached to target proteins, precursor SUMO is first processed to the mature form. It is then activated by a SUMO activating enzyme and then with the aid of a SUMO conjugating enzyme and in some cases, a SUMO ligase it is attached to target proteins. Mutations is these enzymes have begun to be identified in patients with a range of different diseases

The aim of this project is to survey the published literature and databases to compile a list of diseases caused by mutations in sumoylation factors, and to identify the different mutations. . Molecular modelling will then be used to map the mutations onto the structures of the enzymes, for which crystal structures are already available.

Project Title/Area:

Analysis of mutations in translation factors in cancer patients

Course or Module requirements:	No of places:	Project Type:
None	2	Literature

Further Information:

Tumorigenesis and invasive cancer can occur through the disruption of a number of different cellular processes, which includes DNA damage repair and protein synthesis. It is hypothesised that a highly regulated translational apparatus allows a cell to couple rates of protein synthesis to their rates of proliferation. However, when protein synthesis is over-activated, "weak" mRNAs are translated relatively more efficiently, leading to an imbalance of proteins made. Such "weak" mRNAs encode numerous proteins involved in promoting cell growth and proliferation; when such protein levels increase due to the dysregulation of overall protein synthesis, cells become malignant

The aim of this project is to survey the published literature and databases of cancer-associated mutations, to identify translation initiation or elongation factors that show altered expression or which are mutated in cancer cells. Having identified such translation factors, molecular modelling will be used to map the mutations onto the structures of the proteins, where crystal structures are available.

Project Title/Area:

Investigating the role of sumoylation of *S. pombe* PCNA

Course or Module requirements:	No of places:	Project Type:
None	1	Experimental (including data analysis) /Literature

Further Information:

PCNA acts as a sliding clamp for the replicative DNA polymerases. It is modified by ubiquitin and SUMO. Ubiquitylation (modification by the covalent attachment of ubiquitin) of PCNA is required for translesion synthesis, either by recruiting a specialised DNA polymerase or for some sort of template switching process. The role of sumoylation (the covalent attachment of SUMO) is much less well defined. Our preliminary results suggest that it may be required for replication of the lagging strand – process involving DNA polymerase delta (polδ). These projects aim to investigate the interaction between sumoylated PCNA and polδ, whether this is required for response to DNA damaging agents and whether sumoylation is required for any other cellular events.

This project will take a genetic approach in order to further define the process(es) requiring sumoylation of PCNA. Specifically, the project will involve the creation and analysis of double and single mutants (involving the unsumoylatable PCNA mutant) - particularly their response to DNA damaging agents and, in the case of double mutants with ts cell cycle mutants, their response to elevated temperatures. It will also involve an analysis of whether sumoylation of PCNA is required for centromere and/or telomere function.

Faculty Name: **Prof Michelle West**
Room No: 3C20 Email:m.j.west@sussex.ac.uk

Project Title/Area:

Investigating the role of key transcription factors encoded by the cancer-associated virus Epstein-Barr virus in B cell transformation.

Course or Module requirements:	No of places:	Project Type:
Regulating the Transcriptome is essential Biochemistry and Biomedical Science students ONLY	2	Experimental

Further Information:

Epstein-Barr virus is causally linked with a number of human cancers and can infect and immortalize B-cells *in vitro*. Only a small subset of viral genes play an essential role in the immortalisation process. This project will focus on four key transcription factors that facilitate cellular transformation through the transcriptional deregulation of cellular genes. These Epstein-Barr nuclear antigens (EBNA 2, 3A, 3B and 3C) activate and repress gene transcription and promote histone modification at target genes.

We have performed chromatin immunoprecipitation coupled with deep sequencing to identify the cellular regulatory elements bound by these key EBNAs. The majority of the elements we have identified are located at long distances from gene transcription start sites and are likely to function as long-range enhancers. This project will explore the role of the binding sites we have identified in the deregulation of key cellular targets involved in the regulation of cell activation, cell-cycle control, apoptosis and cell growth. Analysis of regulatory regions will involve the use of reporter assays to study the response of these isolated elements to the EBNAs in B-cell lines. You will also use site-directed mutagenesis to mutate binding sites for cellular transcription factors that may mediate the effects of the EBNAs and test their effects in reporter assays. Techniques used will include human cell culture, PCR-based site-directed mutagenesis, DNA grow up and extraction form bacteria, B cell transfection and luciferase assays.

Project Title/Area:

Investigating the role of Epstein-Barr virus in the development of Gastric cancer and evaluating the success of current treatments.

Course or Module requirements:	No of places:	Project Type:
Cell Regulation and Cancer	1 or 2	Literature

Further Information:

Epstein-Barr virus is causally linked with a number of human cancers including Burkitt's lymphoma, Hodgkin's lymphoma, immunoblastic lymphomas in immunosuppressed patients, certain T cell and NK cell lymphomas and nasopharyngeal carcinoma. It is also associated with the development of gastric cancer, although this is less well studied.

In this project you will investigate and evaluate the factors that contribute to the development of gastric cancer with a particular emphasis on evidence for the involvement of EBV. You will also investigate and evaluate current treatments and their success and investigate potential new therapeutics under development and new possibilities for future therapy.

Project Title/Area:		
Post-transplant lymphoma: investigating incidence rates, current treatments and the role of Epstein-Barr virus		
Course or Module requirements: Cell Regulation and Cancer	No of places: 1 or 2	Project Type: Literature

Further Information:

Epstein-Barr virus is causally linked with a number of human lymphomas including Burkitt's lymphoma, Hodgkin's lymphoma, post-transplant lymphoma, certain T cell and NK cell lymphomas, nasopharyngeal carcinoma and gastric cancer.

In this project you will investigate the lymphomas that arise in patients that have had bone marrow or solid organ transplants, their rates of incidence, association with Epstein-Barr virus and the nature and success of current treatments.

Faculty Name: **Becky Wright**
Room No: 3B32 Email: R.J.Wright@sussex.ac.uk

Project Title/Area:
RTS,S malaria vaccine - A New Hope or The Malaria Strikes Back?

Course or Module requirements:	No of places: 2	Project Type:
Year 2 Combating Disease, Year 3 Immunology in Health & Disease		Literature

Further Information:
To critically analyse and review of one aspect of the new malaria vaccine RTS,S, with emphasis on the underlying immunological principles and the clinical, social or epidemiological relevance.

Example topics, or chose your own topic:

- The RTS,S vaccine itself- analysis of its efficacy, clinical use etc.
- The science behind the RTS,S vaccine (and other malaria vaccines) - how was it designed, how does it work, future malaria vaccines?
- Developing a malaria vaccine- clinical trial design, what is involved, how long does it take, what would be an acceptable clinical outcome?
- Conducting a vaccine clinical trial in a developing country- how to go about setting one up, funding, what things do you need to do, what kind of people do you need to work on it, what kind of patients and controls do you need? Power calculations and statistical tests.
- Governance, ethics and quality assurance of vaccine clinical trials, with reference to the RTS,S trial.
- After RTS,S what next? (analysis of second-generation vaccines in development)
- malaria control programs and how the RTS,S vaccine fits within these, implications for national health strategies and infrastructure