MSc in Neuroscience
Course Guide
2017-18
Welcome to the University of Sussex

The University of Sussex was founded in the 1960s and has grown to become a leading teaching and research institution in the UK. We currently have over 13,000 students, 3,000 staff and an annual turnover of £180m. Sussex is highly international, with links with every continent, over 2,300 international students from 120 countries, and teaching staff from 40 nations. We are a leading research university, as reflected in the Research Excellence Framework (2014), which placed Biological Sciences and Psychology, Psychiatry and Neuroscience at Sussex in the Top 10 universities in the UK for research quality.

Did you know that Sussex was the first University in the UK, and possibly in the world, to offer an undergraduate degree in Neuroscience? The first cohort of Neurobiology BSc students graduated in 1973, and Neuroscience is now such a large research focus at Sussex that we have over 50 research faculty working across the full range of neuroscience disciplines. In 2013 we established “Sussex Neuroscience”, a University Research Centre that brings together all neuroscience research on campus, with membership spanning four different Schools: Life Sciences, Psychology, Engineering and Informatics, and the Brighton and Sussex Medical School (BSMS). As a Masters student you will be a part of this community. The objectives of SN are both academic and social, aiming to enhance research collaboration, output, opportunity and enjoyability. You can find out more about faculty research, seminars, events and news at: www.sussex.ac.uk/sussexneuroscience.

This guide contains information specific to your MSc in Neuroscience degree course, which is run by the School of Life Sciences. Please also see the University postgraduate webpages for general information: www.sussex.ac.uk/study/pg

Key contacts
Course Organiser: Dr Ruth Staras: r.staras@sussex.ac.uk.
Postgraduate Course Co-ordinator: Nicola Davies: n.v.davies@sussex.ac.uk

Course aims and objectives
Students who successfully complete the Neuroscience MSc will gain an understanding and practical experience of contemporary neuroscience, focusing on areas of particular interest. Your objectives are to:

- Demonstrate a systematic understanding of topics relevant to neuroscience research, and be able to critically evaluate current research literature.
- Synthesise original arguments and hypotheses that can be experimentally tested, and demonstrate an ability to address theoretical problems independently, systematically and creatively.
- Use practical techniques (e.g. laboratory skills, modelling or working with human subjects) at a level needed for research in neuroscience, and be able to critically evaluate the ways in which these techniques contribute to current knowledge.
- Plan and conduct experiments in neuroscience. Write a report on research findings in the form of a dissertation, demonstrating self-direction and originality.
- Develop relevant data analysis skills.
- Present a research seminar, communicating information, ideas, problem solving and conclusions to specialist and non-specialist audiences.
- Work cooperatively with a laboratory supervisor and research team.
Course Structure

Timetable
The course runs from September 25th 2017 to the end of August 2018. Taught modules run from September to Christmas (Autumn Term, T1) and January to April (Spring Term, T2). The laboratory Research Project begins during the Spring term and runs until the end of July, with the Dissertation due in mid-August. A detailed Year Calendar for the course will be provided on arrival.

Induction
You will participate in the Life Sciences induction week at the start of the Autumn term in order to gain a general introduction to the University and to meet some of the people who will be providing central administration. Information about Induction Week will be provided in a separate document.

Taught modules
The MSc is a year-long course of 180 Credits. At least 150 Credits must be at Masters Level (Level 7), and the remaining 30 can be at level 6, allowing students to consolidate basic knowledge or learn about new subjects.

The four core modules allow you to develop academic and practical skills in Neuroscience.

• Advanced Techniques in Neuroscience (30 Credits. Term 1)
• Life Sciences Master of Science Research Proposal (15 Credits. Term 1)
• Current Topics in Neuroscience (15 Credits. Term 2)
• Research Project (60 Credits. Term 2,3)

If your undergraduate degree was not in Neuroscience we may ask you to take an additional compulsory 30 credit module to build your knowledge in core aspects of the subject:

• Foundations of Neuroscience (30 Credits. Terms 1,2)

In addition you will choose from a range of optional modules to be taken in terms 1 and 2 (often with exams in the following term). You will be able to choose your modules when you arrive in September, through discussion with the course organiser and co-ordinator. Please note that the wide range of options means that there may be unavoidable timetable clashes and some options have limited availability; this may affect your choices but should not normally preclude taking a particular combination of options. Current options are shown below (all are 15 credits at level 7 unless otherwise indicated):

Autumn (Term 1)

• Ethics, Philosophy and Methods of Research
• Intelligence in Animals and Machines
• Introduction to Genes and Biochemistry
• Linear Models in Statistics
• Maths and Computational Models for Complex Systems
• Molecular Genetics (level 6)
• Neuronal Transduction and Transmission (level 6)
• Social Neuroscience
• Topics in Cognitive Neuroscience
Spring (Term 2)

- Drug Addiction and its Treatment
- Drugs, Brain and Behaviour (level 6)
- Functional Magnetic Resonance Imaging
- Genome Stability, Gene Diseases and Cancer (level 6)
- Molecular Pharmacology (level 6)
- Neuronal Plasticity and Gene Regulation (level 6)
- Neuroscience of Consciousness
- Sensory Function and Computation (level 6)
- Structure and Function in the Brain (level 6)

Summer (Term 3; Assessment Block/ Vacation)

- Advanced Research Methods in Psychology

Some additional modules may be available in exceptional circumstances through discussion with the course organiser.

One credit corresponds to c. 10 hours of student work – which includes attending timetabled sessions, background reading and preparing for assessments and seminars. Credits should ideally be balanced across the year, i.e. 60 per term.

It may be necessary to advise students who have not previously studied in the UK that the emphasis in lectures is on describing how experimental data are obtained and used to form models, theories or hypotheses, through objective interpretation. As a result, lecture course material tends to go beyond the contents of standard textbooks, which at the level of our third year undergraduate courses are used simply as sources of fundamental information that is on the whole accepted without reasonable doubt. In addition to using conventional visual aids, lecturers usually provide students with reading lists containing references, for example, to background material or original work that is relevant to the content of their lectures. Students are expected to consult a proportion of such references to aid their understanding of the subject matter. Although in general our approach to teaching and supervision is a relatively informal one, lectures are by necessity a means of one-way information transfer. Students are strongly advised to be present at all lectures. Seminars and laboratory classes are compulsory unless otherwise indicated.

Research Plan and Project

A list of research project areas will be available from the course organiser during Induction Week. Every effort will be made to provide each student with one of their preferred projects. You are encouraged to discuss potential projects of interest with supervisors after you have received the list, but please do not make firm arrangements with individual supervisors without first checking with the course organiser. The projects will be allocated by early October, when you will commence a literature review and research proposal for the project in consultation with your supervisor (Life Sciences Master of Science Research Proposal module, Autumn term). A list of research projects undertaken by students in 2016-17 is provided on page 10 of this Guide, as an illustration of the types of projects we offer.

All supervisors have their own research laboratories in which MSc students are allocated space, and so for the duration of your project you will become part of an active research group. Supervisors who offer MSc projects belong to the Schools of Engineering and Informatics, Life Sciences, Psychology or the Brighton and Sussex Medical School.
Students are expected to organise and carry out their project work at the same time as attending lectures, seminars, tutorials and writing coursework (see below) and during both the teaching terms and vacations, requiring you to strike a proper balance amongst these commitments so that sufficient time is made available for laboratory work. Experimental work should be completed by the end of July at the latest. MSc students should have started to prepare material for their dissertation during the summer for submission in mid-August. At the end you will give a short oral presentation on your project to the rest of the MSc group.

Additional activities
Attendance at special lectures and seminars is an important part of postgraduate training. All postgraduate (including MSc) students are required to attend seminars on safety during the Autumn term. Various groups within Sussex Neuroscience run regular journal clubs in term-time on a wide range of research topics. The Sussex Neuroscience Seminar Series hosts external speakers every Monday from 13:00-14:00 in the CRPC seminar room, which postgraduates are encouraged to attend. For schedule and more information on all of Sussex Neuroscience’s activities, please visit www.sussex.ac.uk/sussexneuroscience.

Career support
The core modules on the MSc have been specifically designed to incorporate key aspects of your professional development. Formative assessments at the start of the course also help to identify any areas in your academic skills that may require particular support. Please also visit the University web pages for further help with academic skills, including advice for International students: http://www.sussex.ac.uk/skillshub/index; http://www.sussex.ac.uk/students/international/

In more general terms, it is important that you take the initiative to seek advice from the people in our research community and to build a good academic relationship with your academic adviser and project supervisor in particular, as their support can be of key importance as you progress in your early academic career. Further information about scientific careers in a wider context, as well as professional skills workshops, can be obtained through the University Careers and Employability Centre: http://sussex.ac.uk/careers/aboutus/taughtpostgrads/

Students considering further postgraduate study may also join the Study Direct site Neuro-post, which contains careers resources, advice and a student forum; please ask Ruth Staras for the current subscription key.
https://studydirect.sussex.ac.uk/course/view.php?id=17840&rel=home

Modes of assessment
Several forms of assessment are involved, including:

- **Written examinations.** Some optional modules require students to take unseen examinations. Details of the time and examination room are supplied to you on Sussex Direct and copies of previous years’ papers are usually available online, or from individual module organisers.

- **Essays.** All students are required to submit essays or other coursework on topics relating to lecture or seminar material. These essays are set by the individual module organisers and contribute towards assessment of modules. Coursework must be submitted by the date required otherwise reduced or no marks are awarded unless there are mitigating circumstances. Please check the Study Direct site for each module to see whether a particular submission must be electronic (a submission button will be shown), or as two paper copies submitted to the School Office.
• Presentations. Presentation of work in seminars is a very important skill. There are assessed presentations at least twice per term, and the nature of these presentations has been designed to allow you to build confidence and skill in this area as the course progresses.

• Dissertation. At the end of your Research Project you will write a dissertation, and your performance in the laboratory will also be taken into account for your final project mark. Note that you do not need to achieve good results to get a high project mark. A series of failed experiments can lead to a good mark if you can demonstrate an understanding of why an experiment may have failed and how to deal with this.

**Plagiarism, collusion and other forms of misconduct**

It is an offence for any student to be guilty of, or party to, attempting to commit or committing collusion, plagiarism, or any other misconduct in an examination or in the preparation of work which is submitted for assessment. Misconduct in assessment exercises, examinations or in the presentation of marks achieved elsewhere is conduct likely to be prejudicial to the integrity and fairness of the examination process. The submission of a dissertation, essay or any other assessment exercise will be considered by the examiners to be a declaration that it is the candidate's own work. Please ensure that you fully understand the University definitions of academic misconduct before commencing your studies: [http://www.sussex.ac.uk/s3/?id=33](http://www.sussex.ac.uk/s3/?id=33)

**Module Summaries**

This list includes most Masters level (Level 7) modules likely to be chosen on this degree, but it is not definitive. Up to 30 credits of final year BSc Modules (Level 6) can be taken. There may be restrictions due to space or timetabling and some modules require prerequisite skills or knowledge, or may be inappropriate because the material has been studied before. Questions should be addressed to the Course Organiser, Dr Ruth Staras: [r.staras@sussex.ac.uk](mailto:r.staras@sussex.ac.uk).

**TERM 1 - Autumn**

**COMPULSORY MODULES (Level 7)**

**Advanced Techniques in Neuroscience. 30 Credits.**

This offers a choice of practical workshops on current techniques in Neuroscience including electrophysiology, psychophysics, data analysis, and fluorescence imaging, and helps to develop your skills at writing practical reports. The practical work is complemented by seminars on the ethics of human and animal studies.

**Life Sciences Master of Science Research Proposal. 15 Credits.**

The module aims to develop an appreciation of the research field in which students will be conducting their research project, thereby enabling them to design and propose a detailed programme of research. Students will also attend seminars on science communication, careers, grant writing and science funding. Students will also have regular tutorials with their project supervisor during which they will discuss the background of the project, sources for literature review and appropriateness of experimental strategy. Students will produce a critical review of the literature in a selected area (typically their Research Project). This should identify the main objectives of the research, and key open questions, set in a wider context of the subject. In addition there is a 2000 word paper in the form of a grant proposal aimed at a non-specialist panel giving background planned experiments, the wider impact of the research and consideration of the ethical and resource implications. This document will be peer reviewed within the class, with a mark based on this evaluation.
OPTIONAL MODULES (Level 7 unless stated otherwise)

**Foundations of Neuroscience.** 30 Credits. Terms 1, 2. (M.Sc. Only)
Primarily for those who have not studied Neuroscience before, this module offers a broad introduction including, cellular physiology, synaptic transmission, developmental neuroscience and neural circuitry. The module includes a substantial lecture course and seminars based on the primary research literature.

**Ethics, Philosophy and Methods of Research.** 15 Credits.
This module considers the conceptual foundations of psychological research and is divided into three key elements. 1) Ethics and Research Governance, including the ethical issues involved in animal experiments; 2) Philosophy of Science: including classic philosophy of science, and also the foundations of statistical inference, comparing orthodox statistics with Bayesian statistics; 3) Qualitative methods: including philosophical underpinnings, through method selection, project planning, ethical considerations, data collection, data analysis, and the production, assessment, and presentation of results, though to the scientific, practical, ethical, and theoretical benefits of the end product(s).

**Intelligence in Animals and Machines.** 15 Credits.
The module develops an understanding of what it means for an animal or a machine to be intelligent, and how brain and behavioural systems are adapted to enable an animal to survive within its environment. We consider diverse aspects of intelligence including navigation and motor control, numerical, language, memory and social skills. We ask how these are related to one another, and how they are matched to the particular needs of animals and machines.

**Linear Models in Statistics.** 15 Credits.
Lectures and computer classes for postgraduate students on ANOVA, regression and related linear modelling techniques, and training in SPSS, to carry out the corresponding analyses.

**Neuronal Transduction and Transmission. Level 6.** 15 Credits.
The module follows a logical progression from sensory transduction, the point of entry of information into the brain, to an analysis of neuron-to-neuron communication through both chemical and electrical synapses. Transduction mechanisms in the visual and auditory modalities are the main focus, though other sensory modalities are also discussed. An overview of synaptic physiology is provided as an introduction to a detailed analysis of pre- and post-synaptic cell and molecular mechanisms. Non-synaptic information processing will also be introduced. Finally the module considers whether there are limits to the molecular reductionism approach to the problem of how the brain works.

**Social Neuroscience.** 15 Credits.
Social Neuroscience is concerned with how people recognise, understand and interact with each other in social settings. It aims to understand these processes in terms of fundamental cognitive and neural mechanisms that reside in the brain that have been shaped by both individual experience and evolutionary history. Topics include: the evolution of social intelligence and culture; neuroscience of emotion; recognising faces and bodies; empathy and simulation theories; ‘mentalising’ and autism; cooperation and altruism; self and identity; prejudice; anti-social behavior; neuroscience of morality; and the development of social behaviour.

**Topics in Cognitive Neuroscience.** 15 Credits.
Introduces research topics in cognitive neuroscience, and explains how neuroimaging and non-invasive brain stimulation techniques can uncover neural basis of human cognition. Students learn various methods and how they are applied. Following a discussion of the main methods, lectures cover a series of specific cognitive functions, such as vision, subliminal perception, attention and memory.
TERM 2 - Spring

COMPULSORY MODULES (Level 7)

Current Topics in Neuroscience. 15 Credits.
Current Topics in Neuroscience is designed to help you develop your ability to extract, discuss and critically evaluate the information presented in research seminars and publications. The module has two parts: one based on the Sussex Neuroscience seminar series, and one based on a series of journal clubs. You will attend at least one seminar per week and take concise notes summarising the main questions and findings, along with critical comments of your own or from others, as raised in discussion or further publications. You will produce a "News & Views"-style report on one of the seminars. In addition, you will attend four student-led journal club sessions where you will contribute to discussing and presenting important or noteworthy recent results in Neuroscience.

Life Sciences Master of Science Project. (MSc) 60 Credits. Terms 2&3
Students have the opportunity to design and perform an original piece of research in consultation with a research supervisor. The student will perform experiments that will set out to answer questions posed at the beginning of the experimental work. Can be taken in any of the participating labs across Sussex Neuroscience, subject to placement.

MRes Research Project 1 (MRes only). 45 Credits.
Students design and perform an original piece of research in consultation with a research supervisor. The experiments that will set out to answer questions posed at the beginning of the project. The Project can be taken in any of the participating labs across Sussex Neuroscience, subject to placement.

OPTIONAL MODULES (Level 7 unless stated otherwise)

Foundations of Neuroscience. 30 credits. Continued from term 1.

Drug Addiction and its Treatment. 15 Credits.
The module will taught by an expert in both pre-clinical and clinical research. It covers: 1) Recreational drugs throughout history; 2) Mechanisms of action of recreational drugs (psychostimulants, opiates/opioids, alcohol, tobacco, cannabis, hallucinogens, "club drugs", etc.); 3) Definition of drug drug reward, drug abuse, and drug addiction; 4) Neuropsychobiological underpinnings of drug reward and drug addiction (drug induced neuroplasticity; basic neuroanatomy of motivation, reward, affect, and impulsivity/compulsivity); 5) Critical understanding of the major theories of drug reward and drug addiction; 6) Therapeutic options for the treatment of drug abuse and addiction. Thus, the scope of the module ranges from basic pharmacology to clinical intervention.

Functional Magnetic Resonance Imaging. 15 Credits.
Develops an understanding of the usefulness and limitations of fMRI, how to evaluate current research in the field in terms of their methodological adequacy and soundness of their interpretations, and perform the main stages of pre-processing and statistical analysis of fMRI data.

Molecular Pharmacology. Level 6. 15 Credits
Topics include principles of drug action in terms of the Law of Mass Action, concepts of drug efficacy, (agonism, antagonism and inverse agonism), principles of Drug Discovery, mechanisms of action of a variety
of different drug classes, including clinically-used benzodiazepines and the role of GABAA receptor structure in mediating their effects.

**Neuroscience of Consciousness. 15 Credits.**

Consciousness is one of the last remaining frontiers of scientific exploration, and theories and methods in neuroscience are at the forefront of this endeavour. Topics covered include: measuring and studying consciousness; states of consciousness (including wake, dreaming, hypnosis and vegetative state); visual consciousness (including the different roles of visual cortex and fronto-parietal network; blindsight and neglect as disorders of visual awareness); implicit learning and meta-knowledge; psychiatric disturbances of consciousness (e.g. hallucinations, depersonalisation); interoceptive awareness; consciousness and cortical plasticity (examples of synaesthesia, phantom limb and sensory substitution); computational models of consciousness; biological models of consciousness; and evolutionary approaches to consciousness.

**Neuronal Plasticity and Gene Regulation. Level 6. 15 Credits**

Considers how cellular and molecular mechanisms interact in the regulation of neural functions underlying plasticity. Emphasis is placed on mechanisms that mediate the acquisition, processing and storage of information. The role of unconventional neurotransmitters such as endogenous nitric oxide and endocannabinoids in neuronal plasticity will be discussed. This will be followed by lectures on unconventional molecular mechanisms controlling gene expression in the CNS. Specifically, we will review the latest understanding of how epigenetic regulation and non-coding RNAs contribute to neural plasticity.

**Structure and Function in the Brain. Level 6. 15 Credits**

Studies the anatomical substrates on which the processing of sensory information and the generation of motor commands depend. Specific attention is paid to the relationship between structure and function. The module covers the development of the anatomical features of the nervous system, and gives a comparative interpretation of the anatomy of brain regions and their cellular components using a variety of examples including vertebrate and invertebrate models.

**Sensory Function and Computation. Level 6. 15 Credits**

Comparing the organisation of sensory modalities reveals common conceptual principles underlying how sensory information is processed and transformed, as well as mechanisms characteristic to each modality, which correspond to the distinct ways in which the nervous system extracts signals from different types of physical energy. This module will teach fundamental concepts in sensory coding: feature detection, adaptive representations, coding by spike rates and timing, and population coding. It will incorporate seminars as well as workshops where computer code will be introduced and used to analyse and simulate sensory coding by neurons.

**TERM 3 - Summer**

**COMPULSORY MODULES**

**MRes. Research Project 1 (MRes only). 45 Credits.**

Students have the opportunity to design and perform an original piece of research in consultation with a research supervisor. The student will perform experiments that will set out to answer questions posed at the beginning of the experimental work. Can be taken in any of the participating labs across Sussex Neuroscience, subject to placement.
OPTIONAL MODULES

Advanced Research Methods in Psychology. 15 Credits
Includes theoretical basis and their practical application of various advanced research methods and statistical techniques in psychology. Particular methods are considered in a set of 2-day workshops. Students study three methods (i.e. attend three workshops) from the selection that is offered. The options are likely to include the following: Discourse Analysis for Psychology; Experiment Generators: Use of Eprime; Eye Tracking; Longitudinal Data Analysis; Measurement of Affective Processing Styles; MATLAB; Meta-Analysis; Multilevel Modelling; Service User Involvement in Clinical Research; Transcranial Magnetic Stimulation (TMS); Categorical Data Analysis; Voice Analysis and Re-Synthesis; Latent Variable Analysis with Mplus, Introduction to R and Randomised Control Trials.
The project titles below are provided to illustrate the range of projects that we offer. Project areas for 2017-18 will be advertised to students at the start of the Autumn term 2017.

- Synaptically enriching glutamate reporters to improve measurements of fast excitatory synaptic activity
- Individual differences in sensory processing and subjective sensory reactivity
- Investigating retrograde axonal transport as an afferent barrage in the vinblastine model of neuropathic pain
- The genetic control of movement: a study into microRNA inhibition and protein expression
- How individual differences in interoception influence fear memories, and the potential for drug manipulation using beta blockers
- Learning and memory in an invertebrate model (Lymnaea stagnalis)
- Regional and cellular localisation of Nos1 mRNA and Mm-antiNos1 RNA transcripts within the mouse brain
- Does APOE4 over APOE3 expression cause changes in oxygen use and vascular responses during neuronal stimulation?
- Prion-like tau: Nuclear and nucleolar dysfunction
- Development of co-culture and microfluidic techniques to evaluate the axonal development of motor neurons
- The P2X4 receptor as a regulator of lysosome function in breast cancer cells
- Effects of PKA activation on memory lapses in the model organism Lymnaea stagnalis
- Understanding the altered integration of body and brain anxiety: a potential new target for treatment
- Heart modulation of fear processing and fear memories: implications for PTSD
- Establishing an objective test of what is meant by “mental image” in a study of aphantasia
- The Sigma-1 receptor as a regulator of store operated calcium entry through modulation of different isoforms of the STIM protein
- How does encoding from multiple visual perspectives influence memory?
- Does the APOE4 genotype result in vascular dysfunction in Alzheimer’s disease?
- Identifying compounds of clinical interest in modulation of the NMDAR GluN2A subunit.