PART II Psychology, Neuroscience and Behaviour

2016 - 2017

COURSE GUIDE

This handbook contains important information on the course:
please take the time to read it and keep it for reference throughout the year.

CONTENTS

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These pages are also found on the Faculty of Biology website at:

https://www.biology.cam.ac.uk/undergrads/nst/courses/PNBFacBioltop

AIMS, OBJECTIVES & LEARNING OUTCOMES

Our Aims

- The Departments of Psychology, Physiology Development & Neuroscience (PDN) and Zoology aim to bring together experts from all over Cambridge to provide a multidisciplinary course in Psychology, Neuroscience and Behaviour.
- We aim to train students in a wide range of skills that provide the learning base for future careers in psychology, zoology and neuroscience research, medicine, veterinary medicine, related disciplines such as the pharmaceutical industry and the emerging biotechnologies.

How we expect to achieve our aims

- By offering a modular course of lectures and a laboratory-based research project, supported by supervisions where appropriate.
- By providing training in practical and conceptual tools in sub-disciplines ranging from cognitive and behavioural neuroscience, molecular, cellular and integrative neurobiology, evolution of behaviour to the clinical application of psychology, neuroscience and behaviour.
- By providing constructive feedback on your progress throughout the year on your project work and written work for supervisions.

At the end of the course you should be able to:

- Think and write critically and creatively about what you have read, learned and discovered.
- Analyse, interpret and present data collected during a research project.
- Use available resources, including computer searches, to find relevant literature and then evaluate it critically.
- Assess and implement the practical techniques necessary to solve a particular research problem.

NST Part II Psychology, Behaviour and Neuroscience (Single subject)
All single subject students must offer a Research Project, which must not exceed 8,000 words, excluding appendices, footnotes, and bibliography (see page 7). Students can also choose to offer an optional dissertation on any topic that particularly interests them (see page 7).

NST Part II BBS: Major Subject Psychology, Behaviour and Neuroscience
If you are studying PNB within the BBS Part II, you do not submit a research project. You do, however, have to submit a dissertation on a topic of your choice. Your dissertation can either be on a topic in and area of psychology, neuroscience and behaviour or a topic in your Minor subject. The arrangements for doing a dissertation on a topic in PNB are as follows: You may propose the dissertation topic, or take it from a list of possible titles that will be published at the start of the Michaelmas Term. You should approach a potential supervisor and gain their agreement to supervise you.
You must then obtain approval for the title and proposed subject of your dissertation from the NST Part II PNB course organiser (Dr Belin*), and this must be done by 4.00 pm on Monday 31st October* to enable Dr Belin to submit the titles to the Faculty of Biology by their deadline of 'not later than the Division of Michaelmas Term'. *A form is provided for this purpose,* which you can download by visiting http://www.biology.cam.ac.uk/undergrads/nst/bbs/diss-title-form. Plenty of

useful information about the dissertation is also available on the BBS website. The dissertation should not exceed 6,000 words in length.

BBS students may attend any of the PNB modules, although they should note that two modules, PNB 9 and PNB 10 are offered as BBS Minor subjects in PDN (as modules N5 and N6, respectively). BBS students therefore cannot take PNB 9 or 10 as part of their Major subject if these modules are taken as Minors. Please note there may be timetable clashes between some modules and certain Minor subjects, and students should check the timetables carefully. A list of compatible combinations of BBS Major and Minor subjects can be found here: http://www.biology.cam.ac.uk/undergrads/nst/bbs/subject-combinations.

ADAPTING TO PART II

At Part II the aim is not just to learn facts, but to understand how experiments are done and what are the limitations and uncertainties of research. You will be exploring the limits of knowledge about the brain, cognition and behaviour. Lecturers' handouts may consist largely of reference lists and much of your reading will be of original research papers. You are expected to read several references for each lecture. Some will be of general importance, others on topics that you want to concentrate on.

Note that given the need to consider environmental issues and given increasing use of electronic devices by students, it has been decided that lecture handouts will no longer be printed. Module organisers should ensure that lecturers are aware that lecture handouts will need to be posted online well in advance of the lectures.

You have to take more responsibility for your own learning than in Part I. You should organise your learning constructively. Try to integrate knowledge from different courses and modules. But also, follow up your own interests in depth – you will be told several times that there is no right way of learning.

Accessing research papers: Most recent papers are available on-line from within the cam.ac.uk domain. Others will be in departmental libraries or the Central Science Library. You should also learn to make your own literature searches on-line using databases such as Web of Science (WOS). The Psychology and Zoology librarians will help anyone needing assistance to get started.

Supervisions and essays: Because of the specialised nature of this third-year course, the lecturers themselves are often the principal providers of supervisions or will provide you with a list of suitably qualified supervisors. Lecturers are also asked to provide specimen essay titles, and supervisors should be willing to read your essays. It is your responsibility to approach individual lecturers/supervisors; preferably organise yourselves into groups for the purpose, and use e-mail to set up a meeting (supervisors should reply to requests, but with the best will in the world, an e-mail that arrives at a busy time may be forgotten - don’t be afraid to write again if you have not got a reply to your enquiry). It may not be possible for all lecturers/supervisors to meet all requests, because of the numbers taking the modules and because some are external. So, for additional assistance:

- If a supervisor has difficulty scheduling supervisions for you, either they or the module organiser should be able to suggest someone else who could do it.
- Your college Director of Studies should be willing to arrange a 'generic' supervision, to check whether you are writing essays in appropriate Part II style.

We recommend that you do a minimum of 6 essays and/or supervisions during the year; but many more will be helpful.

Course advisers: In case of problems or questions, in the first instance you should contact the relevant lecturer or organiser. In addition to this, you can feel free to approach the course organiser, David Belin, for general advice or help if you feel that you have any problems within the course.

Research seminars: Whilst not a requirement of the course, you are strongly encouraged to attend relevant research seminars within the University. Most contributing departments have their own departmental seminars, which are advertised in departments as well as on the Web (see the Cam Talks website: *http://talks.cam.ac.uk/*). In addition, seminars deemed of special interest to the course will be advertised by e-mail shots to all students and notices on our coursework website.

Safety: All departments and labs in which you work must have risk assessments and must ensure that everyone works safely. You must be aware of and observe all necessary safety precautions, especially in any workshop or lab project.

LECTURE MODULES

Eleven lecture modules are offered, 7 in Michaelmas term and 4 in Lent term. Each module has three lectures per week, giving 24 in all. **You will be examined on four modules in total.** The timetable allows you to attend all of the modules, and you are strongly encouraged to attend more than two at any one time, especially early in the term as this will give you more time to decide which modules to concentrate on. Throughout the year, sitting in on additional lectures (even if you don't do all the associated reading) will broaden your understanding of psychology, neuroscience and behaviour.

You will share these lectures with students from other Part II courses.

Michaelmas Term Modules:

PNB Module 1 Motivation, Judgement and Decision-Making (Psychology)
Mon 11am, Tues 12am, Wed 12am
Part II Lecture Theatre Department of Psychology
Module organiser: Dr David Belin (bdb26@cam.ac.uk)

This module takes different approaches to the question of behavioural control – why we take some actions, avoid taking others; do what we are supposed to do and what is best for us and do things that are clearly harmful. Some behaviours are simply elicited by the environment and others might be thought to serve regulatory needs, but most are too complex to be explained in simple terms. The module provides you with a range of approaches in current psychology, from behavioural neuroscience to purely psychological or cognitive research and demonstrates potential applications to real world issues.
The module starts with a set of 16 lectures that address the neural mechanisms of motivated behavior. These will examine what has been discovered about the neural mechanisms underlying motivation and learning using the classical techniques of physiological psychology, including lesioning, electrical and chemical stimulation, electrophysiological recording and in vivo monitoring of transmitter release. Particular emphasis will be placed on neuropharmacological advances which have implicated the monoaminergic, cholinergic and peptidergic neurotransmission in the control of behaviour. The course initially will be organised around two main topics: the re-assessment of the role of specific neurochemical systems and the hypothalamus in motivation; and the neural substrates of reward and punishment, focusing especially on obesity and drug addiction. Detailed topics will include: hypothalamic syndromes and homeostatic mechanisms underlying behaviour; the functional organization of the striatum and corticostriatal circuitries with an emphasis on understanding the neural and psychological mechanisms underlying reward and drug addiction; stress and arousal; neural mechanisms of aversive emotional learning, and cognitive enhancing drugs in neuropsychiatry.
In the second set of 8 lectures, the module will turn to the field of psychology and engage you with current debates about psychological research in the field of known as judgement and decision making (JDM). This concerns the psychological mechanisms by which people form judgements and preferences, and how they make choices and decisions in wide range of different settings. The multidisciplinary nature of JDM research is reflected in the lecture content – as well as covering many psychological theories, we will explore ideas from economics and cover applied research in areas such as law, finance, medicine, and clinical psychology. We will examine a variety of accounts of how, and how well, judgements and decisions are made, drawing on research conducted both in the laboratory and in everyday settings, and will discuss the implications of JDM research for improving judgements and decisions in the “real world”. This module therefore provides an insight into the range of psychology, from behavioural neuroscience to behavioural economics.

Recommended Reading:

Motivation:

Toates, F. (2011). Biological psychology (3rd ed.). Harlow: Prentice Hall.
Carlson, N.R. (2012). Physiology of behavior (11th ed.). Boston: Pearson.
Squire, L.R., et al. (Eds.). (2012). Fundamental neuroscience (4th ed.). San Diego: Academic Press. (Earlier versions should be consulted for more detailed chapters by Robbins & Everitt, and Koob.)
Koob, G.F., & Le Moal, M. (2006). The neurobiology of addiction. Amsterdam: Elsevier.
Feldman, R.S., Meyer, J.S., & Quenzer, L.F. (1997). Principles of neuropsychopharmacology. Sunderland, Mass.: Sinauer Associates.
Iversen, L.L., Iversen S., Bloom, F.E., & Roth R.H. (2009). Introduction to neuropsychopharmacology (1st ed.). New York: OUP.

Judgement and Decision Making:

Baron, J. (2007). Thinking and deciding (4th ed.). Cambridge: Cambridge University Press.
Hardman, D. (2009). Judgment and decision making: Psychological perspectives. Chichester, UK: Wiley (BPS Textbooks).
Hastie, R., & Dawes, R.M. (2010). Rational choice in an uncertain world: The psychology of judgment and decision making (2nd ed.). Thousand Oaks, CA: Sage.
Kahneman, D. (2011). Thinking, fast and slow. London: Allen Lane.
Newell, B.R., Lagnado, D.A., & Shanks, D.R. (2015). Straight choices: The psychology of decision making (2nd ed.). Hove: Psychology Press.

PNB Module 2 Evolution and behaviour: Genes and individuals (Zoology)

Mon, Wed, Fri 2pm
Part II Lecture Theatre, Department of Zoology
Module Organiser: Rebecca Kilner (rmk1002@cam.ac.uk)

Aims

- to illustrate the principles underlying the development of behaviour, and how developmental processes influence evolution.
- to consider techniques for analysing the genetic architecture of behaviour and to understand the significance of genes in influencing the way that traits develop and evolve.
- to emphasise the adaptive plasticity of behaviour, and other animal traits, and its role in successful adaptation to the physical and biotic environment.
- to understand how individual variation in behaviour can be attributable to variation in sensory systems, immune function and cognitive capacity.

Course structure

Individual variation is the raw material for evolution. This course examines the evolution of animal behaviour by focusing on how individual differences in behaviour arise. The first half of the course considers how behaviour develops during a lifetime by focusing particularly on the genetic foundations of behaviour, and the many ways in which genes and the environment interact in behavioural development. The aim here is to consider how these interactions influence the process of adaptive evolution. In the second half of the course, the emphasis is on cognitive, sensory and immune function. We focus particularly on natural populations with the aim of understanding the diverse selection pressures on these aspects of animal physiology, and how these systems themselves can be agents of selection.

Learning outcomes

- to develop an understanding of behavioural complexity, and the way both genes and the environment combine to affect the development of behaviour in dynamic, non-additive ways.
- to gain knowledge of how appropriate experimental design and behavioural analysis can further our understanding of all aspects of animal behaviour.

- to appreciate the current controversies and uncertainties at the forefront of research in this field.
- to emphasise how the crossing of disciplines (ecology, physiology, genetics and neuroscience) is essential to comprehending the evolution of behaviour, and how behaviour can itself play an active role in evolution.

PNB Module 3 Neuroethology: The neural basis of adaptive behaviour (Zoology)
Mon, Wed, Fri 3pm
Part II Lecture Theatre, Department of Zoology
Module Organiser: Berthold Hedwig (bh202@cam.ac.uk)

Aims:
- To foster a broad approach to neuroethology that integrates different levels of analysis.
- To understand how adaptive behaviour requires many levels of neuronal organisation, drawing examples from a wide range of animals.
- To illustrate the mechanisms by which nervous systems operate.
- To identify critical questions, gaps in current knowledge, and controversial issues.

Course structure
The course considers a central problem in animal biology: How does the nervous system gather information about the environment, integrate it and then generate appropriate behavioural responses? Emphasis is placed on the behavioural context of neural mechanisms and relating neural organisation, function and circuit design to specific behaviours, i.e. the classical approach of "Neuroethology". The lectures will cover the following topics:

- The organisation and evolution of brains
- Analysing and understanding neural circuits
- Neural mechanisms of acoustic communication
- Performance at extreme behaviours
- Colour vision
- Drosophila courtship behaviour
- Circuits and learning in Drosophila
- Neuromodulation and variability

We will use examples from invertebrates and vertebrate to identify and analyse neural circuits that process sensory signals and generate motor activity underlying simple and complex behaviour.

Learning outcomes
- An understanding of the principles of neural network function and organisation at a systems and cellular level within the context of adaptive behaviour.
- An appreciation of common organisational principles operating over a wide range of animals.
- The ability to evaluate different experimental approaches to a single problem and an appreciation of the need for a cross-disciplinary approach.
- Knowledge of the fundamental limitations and gaps in our understanding of major issues, and an understanding of the approaches that might resolve these problems.
- The development of a reasoned critical approach to the interpretation of published data, methodology and hypotheses that can be transferred to any discipline.

PNB Module 4 Developmental Neurobiology (PDN)
Mon, Thurs 9am, Fri 10am
Hodgkin Huxley Room, Department of PDN
Module organiser: Prof. Roger Keynes (rjk10@cam.ac.uk)

This module addresses how nerve cells in an embryo manage to assemble into the sophisticated information-processing system that is the brain. We now understand a considerable amount about these processes, while many fascinating questions remain. We begin the module by discussing how the nervous system has evolved, how genetically-encoded information specifies the origins of different types of nerve cells and different parts of the nervous system, and giving examples of the diverse experimental approaches that are now used. The processes of vertebrate neural induction and neural crest formation are then examined. Once nerve cells have formed they extend axons to their correct targets to wire up the nervous system, and we consider in detail the mechanisms of axon guidance, synapse formation and synapse elimination that generate functional neural networks.
Interspersed with these lectures on processes of general applicability are others that focus on specific systems of key importance. We review the development of the cerebral cortex, showing how all the mechanisms considered so far combine to generate the most advanced part of the human brain, which enables the sophistication of human thought – and which leads to developmental abnormalities if these processes go wrong. We also discuss the mechanisms of synaptic plasticity that operate in the mature cortex and underlie learning and memory. Dr Stephen Eglen gives a computational scientist's view of how topographic maps are formed and tuned, with special reference to the visual system. Finally, to illustrate how the processes of development and evolution interact, these are considered in relation to electroreception.
The course is best suited for students who have studied some neurobiology in Part IB, either in MVST or in NST, but others will be able to take it if they are prepared to do some background reading.

PNB Module 5 Molecular and Cellular Neuroscience (PDN)
Mon 10am, Wed, Fri 9am
Bryan Matthews Room, Department of PDN
Module organiser: Dr David Parker (djp27@cam.ac.uk)

While many approaches are applied to analyses of nervous systems, it is obviously important to understand the cellular and synaptic properties underlying sensory, motor, and cognitive functions. The voltage-dependent ion channels that determine the resting and active properties of neurons form a superfamily of at least 143 genes, with further functional diversity resulting from alternative splicing, posttranslational modifications, and the plasticity of varying combinations of subunits that form channels. This results in a massive range of potential cellular properties (e.g. adaptation, tonic spiking, bursting, post-inhibitory rebound, plateau potentials). At the synaptic level there is estimated to be in excess of 200 transmitter substances, each of which can differ in the mechanisms of their release and their effects. These transmitter substances can also interact to evoke effects that cannot be predicted from their individual actions.
This module provides a general basis from which you can investigate various aspects of cellular and synaptic function. The lectures will cover ion channels, glial cells, ionotropic transmitter receptors including glutamate receptors, Cys-loop receptors (e.g. nicotinic acetylcholine), G protein-coupled receptors, the role of pH, and mechanisms of transmitter release and activity-dependent and neuromodulator-evoked plasticity. Knowledge of these effects will provide a basis for understanding the cellular mechanisms underlying effects covered in other neuroscience modules.

PNB Module 6 Control of Action (PDN)
Tues 9am, 11am, Fri 11am
Hodgkin Huxley Room, Department of PDN
Module organiser: Dr Steve Edgley (sae1000@cam.ac.uk)

As captured in Sherrington's statement 'to move is all mankind can do, whether in whispering a syllable or in felling a forest', the control of movement is central to our lives. The control of movement is diverse and is as delicate and as subtle as the analysis of sensation. We use the same arm and hand to post a letter, to thread a needle, to pull our bodies up while climbing and to lift a suitcase. Furthermore, although we use different muscles to write on paper and on a blackboard, our handwriting is very similar in the two cases. A key concept in the control of movement is the organization of the system as a whole to make the outcome successful. The motor systems module looks at the key areas in motor systems control in depth to seek an understanding of the key problems and the ways forward in solving them, covering material extending from the circuits that underlay neural information processing to the performance of the movement itself. The module as a whole focuses particularly on the principles of motor control and also on the experimental evidence as to how specific supraspinal systems (Motor cortex, cerebellum and basal ganglia) contribute to the neural implementation of these control principles, but also to the more general problems of how motor patterns are generated and how sensory information relates to movement.

PNB Module 7 Sensory Transduction (PDN)
Mon 12, Wed, Thur 10am
Anatomy Lecture Theatre, Department of PDN
Module organiser: Dr Hugh Matthews (hrm1@cam.ac.uk)

The process of transduction within individual sensory receptors has consequences for, and imposes limits on, the perception of sensory events. Considerable advances have been made in recent years in elucidating the means by which primary sensory stimuli are transduced and processed. The module begins by examining the molecular mechanisms which enable vertebrate photoreceptors to respond with incredible sensitivity to individual photons of light, yet which also allow the cells to recover rapidly and to respond effectively at high light intensities. This will be followed by consideration of invertebrate phototransduction, which will include the ever-more-widespread roles of TRP channels which were originally discovered in this system. The modality then shifts to the chemical senses, to discuss transduction and coding in olfactory receptors, which share some fascinating features in common with phototransduction, as well as exhibiting some marked differences. The focus then switches to mechanotransduction, especially the encoding of auditory information in both vertebrate and invertebrate species. These special senses will be contrasted with the molecular and cellular mechanisms responsible for the transduction of pain.
You are also likely to find the module on Central Mechanisms of Reward and Emotion (N6) interesting and relevant.

Lent Term Modules:

PNB Module 8 Memory (Psychology)
Mon, Tues, Fri 10am
Plant Sciences Lecture Theatre
Module organisers: Prof Tim Bussey (tjb1000@cam.ac.uk), Dr Jon Simons (jss30@cam.ac.uk)

Understanding how information is encoded and retrieved is major research area in behavioural and cognitive neuroscience. Why does one person remember different information to another about a particular event? Why do memories come to mind suddenly and seemingly unbidden? What makes a "good" memory? In this module memory is considered at several different levels of analysis. The module begins with 12 lectures considering memory from the anatomical level to the network, cellular and molecular levels. Topics in these lectures include: amnesia in humans and animals; theories of hippocampal function; computational models of memory; emotional memory and the amygdala; cellular-level consolidation and reconsolidation. This second set of 12 lectures considers human memory specifically. These lectures will consider

evidence relating to a number of theoretical distinctions that have been proposed within human memory, covering short-term or "working" memory, and long-term episodic and semantic memory. In each case, evidence from a variety of sources will be discussed, including cognitive experiments involving healthy individuals, neuropsychological studies of patients with brain lesions, and functional neuroimaging investigations. The objective will be to achieve an understanding of the cognitive and neural mechanisms responsible for different aspects of remembering. We will also consider human memory from a clinical perspective: how well do the patterns of difficulties and strengths exhibited by patients in the memory clinic map onto the theoretical distinctions described? How do models of memory inform assessments and help make diagnoses, and can we try to help people to cope with their memory difficulties?

Recommended Reading:

Animal and computational models of memory:

Kandel, E.R. (2007). In search of memory: The emergence of a new science of mind. New York: W.W. Norton.

Ward, J. (2010). The student's guide to cognitive neuroscience (2nd ed.). Hove: Psychology Press.

Human Memory:

Baddeley, A. (1997). Human Memory: Theory & Practice. Psychology Press.

Eysenck, M. & Keane, M. (2010). Cognitive Psychology: A Student's Handbook. Psychology Press.

Hodges, J. (2007). Cognitive Assessment for Clinicians. Oxford University Press.

Simons, J. S. & Spiers, H. (2003). Prefrontal and medial temporal lobe interactions in long-term memory. Nature Reviews Neuroscience, 4, 637-648.

Ward, J. (2010). The Student's Guide to Cognitive Neuroscience. Psychology Press.

PNB Module 9 Neural Degeneration and Regeneration (PDN)

Mon, Wed, Thur 9am

Venue to be confirmed

Module organiser: Prof. Roger Keynes (rjk10@cam.ac.uk)

Diseases and injuries of the human brain and spinal cord are resistant to treatment, with major clinical consequences. This lecture module investigates the cellular causes of these diseases and injuries, the reasons why regeneration does not take place, and the research that is now under way to permit regeneration therapies in the future. As a first example we look at the physiological and clinical aspects of spinal cord injury, considering why axon regeneration fails to occur and how re-wiring can be promoted experimentally. Then we look at chronic neurodegenerative diseases, including Alzheimer's, Huntington's, and Pick's diseases, examining their origins in genetic and/or biochemical anomalies.

Progress has also been made recently in revealing the molecular genetics underlying some forms of intellectual disability, including autistic spectrum diseases, and this topic will be covered next. A subsequent course covers the rapidly developing field of neural stem cells, considering both the presence of stem cells able to generate new neurons in some parts of the adult brain, and the therapeutic potential of using stem cells from other sources. We then consider how neural damage occurs following acute ischaemic injury (stroke), a complex process that has implications for understanding other forms of neural degeneration. Returning to neurodegenerative diseases, we look at the possibility of treatment by cellular grafting or other novel approaches, particularly in Parkinson's and Huntington's diseases. Glial cells are also vital, and are the focus of demyelinating diseases such as multiple sclerosis, so finally we look at glial degeneration and repair.

The lecturers will all discuss research which could lead to new therapies, including development of molecular inhibitors, gene therapy, neural grafting, stem cells, and remyelination. This course is mostly given by researchers from the Clinical School, Vet School, Brain Repair Centre, and Stem Cell Institute.

PNB Module 10 Central Mechanisms of Reward and Emotion (PDN)
Tues 9am, 11am, Thurs 10am
Hodgekin Huxley Room, Department of PDN
Module organiser: Prof. Angela Roberts (acr4@cam.ac.uk)

The distinction between 'sensory' and 'motor' has little meaning at the higher levels of the brain. The purpose of movement is to allow interaction with the environment and to bring the organism into contact with sensory stimuli; the purpose of sensory processing is to inform action. In this module we look at these higher levels – predominantly but not entirely cortical – from the point of view of trying to understand the transformations between stimuli and responses. The specific topics covered include the central mechanisms by which both visual and auditory stimuli begin to be encoded in ways that reflect their final purpose – of recognition of possible goals, and locations, so that actions can be directed towards them. David Tolhurst discusses the first stages of object recognition by the visual cortex; Roy Patterson considers how complex sounds are represented at higher levels of the auditory system. Simone Schnall and Paul Fletcher then illustrate how our perceptions can be biased by our internal state and by our prior experiences. Finally, Wolfram Schultz, John Apergis-Schoute and Angela Roberts consider the limbic and cortical mechanisms by which sensory stimuli become rewarding or punishing and impact on our motivations and emotions to inform our decision making and ultimately drive our actions. By the end of the course you should have a better sense of one of the most exciting and active areas of brain research in this decade, that is at the heart of what the brain is all about, and whose success is largely due to taking a firmly quantitative approach to neural modelling. Those who are interested in more mathematical aspects of neuroscience will find many opportunities for applying them in this module, but the course does not require or expect a particular aptitude for maths.

PNB Module 11: Local Circuits and Neural Networks (PDN)
Mon 11am, Wed 10am, Fri 9am
Bryan Matthews Room, Department of PDN
Module organiser: Dr David Parker (djp27@cam.ac.uk)

Neural networks form the middle ground in approaches to understanding the nervous system. They assemble the molecular and cellular components needed to process sensory inputs, perform cognitive functions, and pattern motor outputs. Insight into the organisation and function of these networks is essential to understanding how cellular and synaptic properties influence nervous system function and behaviour. This is widely considered to be the major problem facing neuroscience today.
This module will examine the principles of neuronal network function using invertebrate, lower vertebrate, and mammalian model systems. It will outline the minimal requirements that need to be satisfied in order to claim understanding of a network and the extent to which these criteria have been met; highlight influences on the design of neural circuits; outline how cellular and synaptic properties could influence network outputs underlying sensory, motor, and cognitive processes; and illustrate the molecular, anatomical, electrophysiological, imaging, and computational techniques used in network (and other) analyses.
The central role of networks means that this module provides general insight that links to modules that focus on molecular and cellular mechanisms (e.g. how do these properties influence higher functions), or to higher-level aspects of sensory, motor, or cognitive functions (e.g. what cellular mechanisms and processes underlie these effects).

Lecture times are available on the University online timetable - *www.timetable.cam.ac.uk* . You will be notified by e-mail of any timetable changes. **Please address timetable queries to the relevant module organiser.**

Handouts and Slides. Wherever possible, lecturers' slides and handouts will be placed on the Part II PNB Moodle websites. You will be able to access these using your Raven password.

LECTURE TIMETABLES 2016-2017

MICHAELMAS TERM

	9-10	10-11	11-12	12-1		2-3	3-4
Monday Michaelmas	**PNB 4** Developmental Neurobiology	**PNB 5** Molecular and Cellular Neuroscience	**PNB 1** Motivation, judgement and decision-making	**PNB 7** Sensory Transduction		**PNB 2** Evolution and Behaviour: Genes & Individuals	**PNB 3** Neuroethology
Tuesday Michaelmas	**PNB 6** Control of Action		**PNB 6** Control of Action	**PNB 1** Motivation, judgement and decision-making			
Wednesday Michaelmas	**PNB 5** Molecular and Cellular Neuroscience	**PNB 7** Sensory Transduction		**PNB 1** Motivation, judgement and decision-making		**PNB 2** Evolution and Behaviour: Genes & Individuals	**PNB 3** Neuroethology
Thursday Michaelmas	**PNB 4** Developmental Neurobiology	**PNB 7** Sensory Transduction					
Friday Michaelmas	**PNB 5** Molecular and Cellular Neuroscience	**PNB 4** Developmental Neurobiology	**PNB 6** Control of Action			**PNB 2** Evolution and Behaviour: G&I ***PNB 7*** *Sensory Transduction some workshops*	**PNB 3** Neuroethology

LENT TERM

	9-10	10-11	11-12	12-1		2-3
Monday Lent	**PNB 9** Neural Degen/Regen	**PNB 8** Memory	**PNB 11** Local Circuits Neural Nets.			
Tuesday Lent	**PNB 10** Central Mechanisims	**PNB 8** Memory	**PNB 10** Central Mechanisims			
Wednesday Lent	**PNB 9** Neural Degen/Regen	**PNB 11** Local Circuits Neural Nets.				
Thursday Lent	**PNB 9** Neural Degen/Regen	**PNB 10** Central Mechanisims				
Friday Lent	**PNB 11** Local Circuits Neural Nets	**PNB 8** Memory				

RESEARCH PROJECTS

Organisation

Project will be allocated by the beginning of Michaelmas term, with every attempt being made to meet the wishes that you express.

During the project

Note: Although your day-to-day supervisor in the lab may be a PhD student or a postdoc, your actual supervisor is the academic staff member/head of the lab. All references to "supervisor" mean the lab head, not your day-to-day lab supervisor (where these are different people).

On being allocated a project, you should arrange to meet your supervisor so that you are in a position to start collecting data as soon as possible.

Your supervisor will help you formulate the plan of experiments, and arrange for you to be trained in techniques and in working safely. The research project is expected to occupy you for anywhere between 120-180 hours altogether. This is a very rough guideline and students can exceed it, but should not be put under pressure to do so.

Your supervisor will also give you advice on writing up, but of course the actual writing must be your own. The supervisor will read and comment on one full draft of the report; the final version will be your responsibility.

If you have a problem during your project that cannot be resolved with your supervisor (for instance, if you feel you are expected to spend unreasonably long hours on the project), don't hesitate to discuss it with the course coordinator.

We recommend that you read the following papers before starting your project:

Cumming, G., Fidler, F., Vaux, D.L., 2007. Error bars in experimental biology. J. Cell Biol. 177, 7-11.

Vaux, D.L., Fidler, F., Cumming, G., 2012. Replicates and repeats - what is the difference and is it significant? A brief discussion of statistics and experimental design. EMBO Rep. 13, 291-296.

Lazic, S.E., 2010. The problem of pseudoreplication in neuroscientific studies: is it affecting your analysis? BMC Neurosci. 11, 5.

Guidelines on writing up your project

Your project will be judged on the report, with the final mark for the report being awarded after a viva. You will not be penalised if, for reasons beyond your control, the project fails to produce clear (or any) results. Roughly equal weight will be given to the Introduction, Results and Discussion. The examiners may also take note of your supervisor's opinion of your performance.

Format: Your report should be no longer than 8,000 words (excluding footnotes, figure legends, tables, Bibliography, and appendices: you must give the word count on the title page). It should be written in the style of a scientific paper. The detailed format is up to you as long as it conforms to the style of a typical research paper. You are strongly advised to look at journals dealing with similar material (e.g. *Journal of Cognitive Neuroscience*, *Neuron*, etc.). There are no specific restrictions on line spacing, column format etc, however, please ensure that figure labels are clearly legible. Students in the past have had last-minute printing problems with reports

prepared in 2 columns: we strongly recommend using a single column format (as in this handbook).

Research journals typically have a similar layout, as follows:

- **Title.**
- **Summary.** This should be not more than 500 words. Give a concise summary of the main results.
- **Introduction.** Explain the significance and underlying interest of the questions you asked and relate them to the published literature.
- **Materials and Methods**. Describe the techniques you have used.
- **Results.** This section is often easier to write (and read!) if you arrange the results in a logical sequence to show how each set of experiments or observations leads to the next set. Divide the text up into sections, each with its own sub-heading. Refer to summaries of the data in the form of numbered Tables and Figures, each of which should have explanatory legends which enable readers to understand them without detailed reference to the text. When preparing your Figures, we recommend that you consult standard guidelines on image manipulation, such as those from *Nature*: http://www.nature.com/authors/policies/image.html. Ask you supervisor (lab head) for advice if you are unsure how to present your data. Statistical analysis can often be given in the legends or in the tables. Do not provide huge amounts of raw data in the tables - these should be summaries of the analysis which provide quantitative data to test your ideas. If necessary the raw data can be provided in an Appendix. Do not be afraid to include details of experiments which produced negative or inconclusive results.
- **Discussion.** This gives you the opportunity to discuss the interpretation of your results with reference to the scientific literature, and to suggest ideas for further work or "what might have been" if you'd had more time, more animals, more cells etc.
- **References**. Use a consistent style of citation. Any standard journal format is acceptable, but preferably cite references in the text in the form: Smith (1983), Bloggs et al. (1992) - rather than using numbers. Though you will not be penalised for this, it is easier for the reader (in particular the examiner!) to follow.
- **Acknowledgements**. You must acknowledge any significant contribution made by others, particularly whether materials were provided or any procedures done by others - including your supervisor and any collaborators or co-workers. In particular each figure legend should contain an acknowledgment. For most or all figures this should be "This figure was produced by [own initials]", or in some cases by 2 students jointly, or by student and supervisor. But it may be someone else in the lab, or a published work.
- **Please do not use font size smaller than 12 in your write-up.**

Below is a list of key points that an examiner may look for in a project write-up (you should not expect a model outline for this, the approach can depend on the type of project and method you have followed).
:

(i) Your Introduction should give a clear description of the background to your project, including its potential relevance: why is it interesting and important?

(ii) The methods need to be clearly and properly explained. Could someone repeat what you have done by reading your Methods section?

(iii) Consider how well the data are presented. For example, are the figures clear and informative, are they properly described (the format will depend on the specifics of the data, graphs, images, electrophysiological traces etc….), and do they properly represent the effect you are claiming. The use of quantification and statistics also needs to be appropriate, but this will again depend on the nature of your project.

(iv) The discussion needs to place the results into perspective, for example by relating them to the background in you Introduction. You also need to consider caveats to your methods, results, and conclusions. An important consideration here that shows you have understood your project is to consider how you could do things differently to address obvious caveats, as well as future work that could build on what you have done.

Supervisors will be available for you to discuss **your ideas** about the structure and content of your project report before you write it up and provide guidance where needed. The format should be roughly that of a typical research paper in Psychology. The supervisor is permitted to read and comment on only **one draft** of the project. Students are discouraged from soliciting advice on their drafts from other individuals.

Project submission:

You must submit **three bound hard copies** to the Part II Office, PDN. One will be returned to you, so that you have it for reference and to bring to the viva examination, leaving two bound copies for the examiners - and **an electronic version** via *Assignments* on the main PNB Moodle site (see below for details), by the **deadline of 2:30pm on 28th April 2017 (the first Friday of Full Easter Term). This deadline must be strictly observed. Marks may be deducted for late submission.**

Hard copies: these must be bound, each with a title page which includes the title of the project, your name, the supervisor's name, the date and a word count. If the binding cannot be done in your host department, it can be done in Zoology, for a small charge, if you bring the hard copies to reception (***ensure you leave enough time before the deadline for this, for example to allow for last minute glitches with printing etc...)*** Reports should be handed in to the Part II Office, PDN.

You must also include a signed statement in the report that it is your own work, unaided except as may be specified in the statement, and that it does not contain material that has already been used to any substantial extent for a comparable purpose; if two or more candidates have undertaken work in collaboration, they will each be required to indicate the extent of their contribution.

Electronic version: You must also submit the **final electronic version** (all tracked changes accepted; all comments deleted!), in Microsoft Word*, via *Assignments* on the main Moodle site. The electronic copy may be used to verify the word count and will be scanned with software for detection of plagiarism (the file size limit for the Word submission is 20MB as this is the Turnitin restriction. If your file size exceeds this, try removing the images).

**If you do not use Microsoft Word, your application should offer the choice of "Save As: .rtf or .txt". This will be sufficient to confirm the word count and check for plagiarism.*

Plagiarism

The following advice is relevant for students taking single-subject PNB **and** students taking BBS PNB.

As in all examinations, plagiarism is not acceptable.

Students are responsible for ensuring they have read and understood both the University's Statement on Plagiarism, and the Faculty of Biology Plagiarism Guidance, available at:

http://www.biology.cam.ac.uk/exams/plagiarism/

The Faculty of Biology uses Turnitin UK to screen student work. Screening is carried out via blanket screening of all work in Moodle. All work screened will be reviewed by the Academic Integrity Officer to determine whether further action may be necessary. Use of Turnitin UK complies with UK Copyright and Data Protection Laws. Submission to Turnitin does not affect your ownership of the work; the copyright and intellectual property of all work remains with the original owner (normally the student, with the exception of some sponsored research projects). No personal or sensitive data will be transmitted. Work screened by Turnitin UK will be retained in the Turnitin database for comparison with future submissions; if matches are identified, the

full text is not accessible to other institutions, only the matching text. You may request that your work is removed from the Turnitin UK database at the conclusion of the examination process, but this must be done separately for each piece of submitted work. Retaining your work on the database will help to ensure that your work remains protected from future attempts to plagiarise it, will help maintain the integrity of the University's qualifications, and will maximise the effectiveness of the software.

Full details about Turnitin UK and your rights and responsibilities can be found on the University's website, http://www.admin.cam.ac.uk/univ/plagiarism/.

Queries about plagiarism or the Faculty's use of Turnitin UK should be addressed in the first instance to your Director of Studies or College Tutor.

Your dissertation will automatically be submitted to Turnitin UK at the time of submission. Note that Turnitin will always find some level of similarity to text in the database; 10% similarity is common and is generally not a problem. Problems areas to look out for are unattributed whole sentences or paragraphs. Full details will be given in the General Module session on Writing your Dissertation. The Departmental Turnitin Policy is available on the Part II Moodle site.

The golden rule for avoiding plagiarism is: **NEVER COPY TEXT** (unless you actually want to give a direct quotation, in which case the copied text must be in quotation marks, as well as giving the source). Instead, make the point in your own words, as well as giving the source of your information. A good source of information on plagiarism, and how to avoid it, can be found here: https://writing.wisc.edu/Handbook/QPA_plagiarism.html

In general, plagiarism can be defined as: **The unacknowledged use of the work of others as if this were your own original work.**

In the context of an examination, this amounts to: **Passing off the work of others as your own to gain unfair advantage**.

Such use of unfair means will not be tolerated by the University; if detected, the penalty may be severe and may lead to disciplinary proceedings being taken against you.

The scope of plagiarism
Plagiarism is defined as submitting as one's own work, irrespective of intent to deceive, that which derives in part or in its entirety from the work of others without due acknowledgement. It is both poor scholarship and a breach of academic integrity.

Examples of plagiarism include **copying** (using another person's language and/or ideas as if they are a candidate's own), by:

- **quoting verbatim** another person's work without due acknowledgement of the source;
- **paraphrasing** another person's work by changing some of the words, or the order of the words, without due acknowledgement of the source;
- **using ideas** taken from someone else without reference to the originator;
- **cutting and pasting** from the Internet to make a pastiche of online sources;
- **submitting someone else's work** as part of a candidate's own without identifying clearly who did the work. For example, buying or commissioning work via professional agencies such as 'essay banks' or 'paper mills', or not attributing research contributed by others to a joint project.

Plagiarism might also arise from **colluding** with another person, including another candidate, other than as permitted for joint project work (i.e. where collaboration is concealed or has been forbidden). A candidate should include a general acknowledgement where he or she has received substantial help, for example with the language and style of a piece of written work.

Plagiarism can occur in respect to all types of sources and media:

- text, illustrations, musical quotations, mathematical derivations, computer code, etc;
- material downloaded from websites or drawn from manuscripts or other media;
- published and unpublished material, including lecture handouts and other students' work.

Acceptable means of acknowledging the work of others (by referencing, in footnotes, or otherwise) vary according to the subject matter and mode of assessment. Faculties or Departments should issue written guidance on the relevant scholarly conventions for submitted work, and also make it clear to candidates what level of acknowledgement might be expected in written examinations. Candidates are required to familiarize themselves with this guidance, to follow it in all work submitted for assessment, and may be required to sign a declaration to that effect. If a candidate has any outstanding queries, clarification should be sought from her or his Director of Studies, Course Director or Supervisor as appropriate.

Failure to conform to the expected standards of scholarship (e.g. by not referencing sources) in examinations may affect the mark given to the candidate's work. In addition, suspected cases of the use of unfair means (of which plagiarism is one form) will be investigated and may be brought to one of the University's Courts. The Courts have wide powers to discipline those found guilty of using unfair means in an examination, including depriving such persons of membership of the University, and deprivation of a degree.

EXAMINATION MATTERS

Overview

Allocation of marks:
Written Papers 64% (16% per Paper); Research project 36%

Research projects: *See previous pages for details.* The Research Project counts for 36% of the overall examination mark; the final mark will be awarded after a viva (see later section). Each student must submit a write-up on their research project, no longer than 8000 words, written in the style of a scientific paper. Reports must be handed in by 2.30 pm on **28th April 2017 (the first Friday of Full Easter Term)**. Failure to hand your report in on time may lead to deduction of marks.

Your project will be judged on the report, with the final mark awarded after a viva (see later section). Roughly equal weight will be given to the Introduction, Results and Discussion. You will not be penalised if, for reasons beyond your control, the project fails to produce clear results. The examiners also take note of your supervisor's opinion of your performance.

Written examination. Each Module provides a separate 3-hour written paper. You are required to sit 4 of the total of 11 available. Sample papers will be made available in due course on the Moodle site.

Examiners' advice on project viva*s*

The primary purpose of the viva is for examiners to clarify:
1. the depth of your understanding of the project
2. your contributions to the research described in the dissertation.

You will be marked on your dissertation, not your performance in the viva, but the viva can lead to adjustment of the provisional dissertation mark up or down. In Easter term (most likely mid-May) you will be allocated a 30-minute slot; the viva should take about 20 minutes in the middle of this. Please bring a copy of your dissertation with you.

In the viva, two examiners will ask you a number of questions about your project and dissertation. These questions will vary widely, depending on the topic of the dissertation, so it is impossible to describe specifically what you will or will not be asked. However, some possible questions might include questions about particular results, specific experiments or approaches, the main findings of your project, the references you cite in your dissertation, models to explain the data, possible future experiments, etc.

You will NOT be asked to give a presentation, although you may be asked to give a brief summary of the main findings of your project. The only thing that we advise that you do in preparation for your viva is to refresh your memory about what you have written in the dissertation, and you may also want to re-read a couple of the references you have cited that are particularly relevant to your project (we certainly do NOT expect you to have memorised every detail of every reference you have cited!).

Some advice about Part II essay questions

Students often ask for general advice about approaching essay questions in the final exams. Although we do not want you to focus on exam technique to the detriment of enjoying your modules, we hope that the following notes will be helpful.

The best answers in Part II exams present not just facts, but evidence that you understand the subject and can think about it. Many questions are not best answered by simply regurgitating a lecture course verbatim. To produce a considered, comprehensive answer, you may need to select or rearrange information from lectures, perhaps from more than one lecturer and module, make connections between lectures and modules, and include details from papers or book chapters that you have read.

"Not answering the question" is a surprisingly common mistake which will inevitably cost you marks: so read the question carefully and spend time thinking about it before you start writing. An introductory paragraph giving an overview of your answer may help to show that you have a balanced view of the subject (referring to the question, e.g. paraphrasing it, will ensure that you have read it properly and will focus on it in your answer; it is good to return to the question in the final paragraph).

Of course, you get more marks for more detail (if it is relevant and correct); but examiners want to see that you have understood a subject, not just memorised it. They are also happy to read your own thoughts, preferably with rational arguments for them! Examiners like to see evidence that you have read original research papers (and would be especially impressed if these went beyond the lecturer's list of most important ones). You can cite important ones by the principal authors' name(s), and you may be able to give your own assessments of the evidence in some of them. If you describe technical details (e.g. diagrams or equations), remember to explain enough to show that you understand them.

Finally, of course, your handwriting must be legible!

A note on the use of citations in essays

This is an issue that comes up repeatedly. Examiners **do not** count citations to decide on the mark for an exam essay. Citations *are* useful when discussing a specific scientific paper or lending support for an argument you are making or to an argument that someone else has proposed. Citations of course are also a good way of indicating that you have included material from outside of the lecture. If you include a citation, give the author(s) and year in the text (multiple authors can be dealt with using et al, or for a general overview you can say as “xx and colleagues have shown…”. If you can’t remember a name but remember the concept, then put this in anyway rather than spending a long time trying to remember names or leaving out the detail – you could still get credit for this and the name may come back to you later.

Criteria applied when marking Part II Tripos answers (Faculty of Biology)

These are the official University's Guidelines on marking answers in Part II Tripos exams,

see:
https://www.biology.cam.ac.uk/undergrads/exams/marking-tripos-essays

First:
Work, which is excellent both in the range and command of the material covered and in the argument and analysis. Work that is excellent in its understanding of the subject; that has engaged closely with the question; that has shown some originality and treated the evidence critically; that brings in relevant material from an appropriate range of sources; and that is well-planned and complete.

A first class mark may be awarded on more than one set of criteria: there may be a great deal of relevant information, displaying substantial knowledge and understanding; the arguments and presentation may be stylish; the approach may be original, critical or unorthodox. An upper first would be an outstanding performance, meeting all, or virtually all, of these criteria. A low first would meet at least some of these criteria.

Upper Second: Work that shows a good broad-based knowledge of the topic and the lecture material; that is presented in an organised way; and clearly argued and focused on the set question. Answers at the top end of this class would often include material from outside the taught material and where relevant, from different lecture courses and would include some attempt to treat the evidence critically and to synthesise arguments. Answers at the lower end of this class would be competent, accurate in reproducing lecture material and show evidence of reading of the principal sources of published work on the subject.

Lower Second: Work that overall shows a reasonable competence in the understanding and presentation of the relevant material. Answers at the top end of this class would show competent understanding of the basic lecture material or reasonable organisation and focus; an answer at the lower end would show gaps in understanding and coverage together with poor organisation and focus. Certain types of uneven work would fall into this class; detailed factually correct work that did not relate a broad knowledge of the topic to the specific question asked, or work with clear organisation and some insight but with serious omissions of factual knowledge

Third: At the upper end of the class work that just shows competent knowledge of the basic, core material. At the lower end of the class, work that shows some knowledge of the material but with serious deficiencies in understanding, coverage and organisation. This will include work that is unduly brief or largely misses the point of the question.

Fail: Work that is irrelevant, shows a considerable degree of ignorance or is short and superficial. Where the question is barely attempted.

For **Criteria applied when marking Part II Dissertations (Faculty of Biology)** *see:*

https://www.biology.cam.ac.uk/undergrads/exams/marking-part-ii-dissertations/marking-diss

ELECTRONIC RESOURCES

Part II Psychology, Neuroscience and Behaviour IT facilities are available in the Department in which you take your project and details can be found in the section “Departmental Resources”.

Email

Announcements about the course will routinely be made by e-mail. You should check your e-mail at least every morning and evening.

Moodle

All course material for Part II PNB and the Modules will be available on-line in the Moodle system. You will each be assigned membership of the main Part II PNB site plus membership of the sites for your four Modules. You will also be registered to access material for the other Modules as an Observer.

Access to Moodle
In your browser go to: https://www.vle.cam.ac.uk/
Log-in using your Raven user name and password.
(For info about Raven see: http://www.ucs.cam.ac.uk/raven/raven/n5)

Moodle functions
Moodle has a large repertoire of tools to aid the support of teaching and promote on-line access and collaboration. The most important components will be:

- *resources* to download materials from your lectures
- *assignments* tool for you to submit written materials
- *announcements* to draw your attention to changes
- *mailtool* you can send e-mails to the group directly from this page. This will be the primary route by which we will contact you, for instance for time-table changes.

Be sure to check your e-mails or the site frequently.

Inside Moodle you will see tabs for each of your worksites. These will include:

- **My Workspace**: a personal space where you can store your own files and notes. The schedule here contains the merged schedules of all your Modules as well as general course events.
- **NST Part II PNB**: the main course site. This site will contain links to the Course Handbook. There will be *announcements* from time-to-time - you can even send announcements yourself.
- **NST Part II Subject Modules**: each Module has its own site. This contains a series of resources for each lecture (the lecture handout, and/or the lecturer's Powerpoint slides – not available for every lecturer). There may be announcements specific for that Module, along with its own e-mail archive. Some Module organisers may choose to add other features such as discussions or assignments for problem sessions or journal clubs during the course.

Online Journals

Most journals are now available on-line, and many students and academics find this is the most convenient way to access papers. Most of them are on web sites run by the publishers and are only accessible from institutions which have paid subscriptions, such as the University of Cambridge. In most cases you will have access to them automatically if you are using a machine in the University (.cam domain), including your college

To get to the web site for a journal while on the University network, the simplest way is to use the University Library's 'A-Z list' of e-journals:

http://tf5lu9ym5n.search.serialssolutions.com/

Simply search for the journal title and if the journal is available online via subscription, the full text coverage for that title is given, along with any 'off campus' login information. If the journal does not appear then it is not available online and you will have to locate a print copy of it in Cambridge (see below).

To access journals from outside the University network (e.g. from home during vacations) just do your search on the A-Z list as usual and when you click on the link for the journal title you will automatically be prompted for your Raven password. You should only need to enter this once per session. N.B. it is strongly recommended to check the 'off campus' availability of the online journals you think you will need away from Cambridge BEFORE leaving for vacations etc. It will state this next to the title information for a journal on the A-Z list.

Finding printed journals in Cambridge libraries:

If you need a print copy of a journal, you can find out where it resides in Cambridge from *Library Search* at: *http://search.lib.cam.ac.uk*

Library Search allows you to look for printed books and journals held in all the libraries in the University of Cambridge. To find a journal or book, simply search for it here. If an electronic version of the book or journal is available, you will be able to click on a link that will take you directly to it. If you are searching from 'off campus', you will be prompted for your Raven password.

Electronic Databases

Science Citation Index via Web of Knowledge - *http://wok.mimas.ac.uk/*
The *Science Citation Index*, indexes the international journal literature of science, medicine, agriculture, technology and the behavioural sciences. More than 3,400 titles are indexed. It provides the titles and abstracts but not full text. Non-journal material, such as conference literature, books, reports or theses are not included. The Science Citation Index enables you to search for papers that have referenced a known paper, which is a unique and valuable feature for following up a topic. Dates of coverage: from 1981.

MEDLINE/ PUBMED –
http://www.ncbi.nlm.nih.gov/pubmed
PUBMED is the major general biomedical database produced by the US National Library of Medicine. PUBMED is searchable by index terms, synonyms and subject.

Google Scholar
http://scholar.google.co.uk/
Another good source of scientific reference material.

Other Useful Libraries:

Please see also the Cambridge Libraries Gateway at: *http://www.lib.cam.ac.uk/libraries/*
For information on all the libraries available to you.

University Library catalogues: *http://www.lib.cam.ac.uk/*

Medical Library Website: *http://library.medschl.cam.ac.uk/*

Central Science Library: *http://www.lib.cam.ac.uk/CSL/*

Online databases to use for finding and downloading scientific literature:

See the **eresources@cambridge** website at: *http://libguides.cam.ac.uk/eresources*
For access to databases such as *Scopus* and the *Web of Science*, that you can use to search for articles written on certain topics by certain authors. Many other useful databases are available via this link.

LibrarySearch+ covers all content in Library Search and allows you to search the full text of journal articles (Justor, Science Direct etc) as well as the full text of many ebooks, newspaper content, major citation databases (inc. Web of Knowledge), and more, over 200 million records. Access from the Library Search page at:

http://search.lib.cam.ac.uk/

Alternatively, here are the direct links to Scopus and WoS:

http://www.scopus.com/home.url

http://wok.mimas.ac.uk/

DEPARTMENTAL FACILITIES

Three departments contribute to the Part II Neuroscience course. You are welcome to use the facilities (e.g. library, tea room) of the Department where you undertake your project. You will also receive key/swipe cards for out of hours access to the Department where you undertake your project. BBS students will be allocated a home Department.

Department of Psychology: Downing Site.

Departmental academic representative: Dr David Belin (bdb26@cam.ac.uk)

Departmental administrative contact: Teaching Administrator, Ms Sarah Dunk (sabd3@cam.ac.uk)

Access: University Card-keys (usually only for project students), see Mr. J. Glasberg Ground floor of the main building own the Downing Site.

Library: 8.45-5.30 Mon-Fri (or 24 hours with University card key). Librarian: Judith Brown (3)33554 (jab202@cam.ac.uk). The Library offers a quiet and comfortable place to work and stocks the reading material recommended in this guide and in lecture hand-outs. Most of the Library's books are available for loan. Books should be borrowed using the self-issue machine or loans register. There is a drop-box for book return. Laptops may be used throughout the Library, which has wireless Internet access. Drinks may be consumed in the Library.

The Library website gives further information about the Library and the services it offers, and provides links to teaching resources and to electronic resources.
http://www.library.psychol.cam.ac.uk/

Photocopying: Although there is a reduced price for all copying for students (copying card from Reception), the Department of Psychology holds a Gold Green Impact award and is committed to reducing its impact on the environment by saving energy and minimizing waste. Please use electronic copies of material wherever possible and avoid the use of paper copying.

You will see throughout the Department a number of recycling bins provided for paper, cardboard, plastic, cans and tins and would encourage all students to use these and to be considerate of switching off lights, reducing waste etc.

Student Computer Room: Computers are available for your use in the Student Computer Room, which is situated next door to the Library. You will be provided with registration details from the Computer Officer (room 105) for an account, which will give you 2Gb file space, will allow you to use the printer and will give you access to a wired Internet connection.

The IBM SPSS statistics package is installed on four of the machines and the R statistics program is installed on the other four. All eight computers also have MATLAB and Microsoft Office. The computers are labelled to indicate which software package is available on each machine. Requests for other packages can be forwarded to the Computer Officer (computingrequests@psychol.cam.ac.uk).
You must not make copies of software on these machines, nor introduce copies of programs on to them.

Student Common Room: Located next door to the Library, the Student Common Room is a great place to relax. There is a microwave, kettle, fridge and cutlery and crockery for your use. The room also contains machines for hot and cold drinks and snacks. Lockers can be hired for a £5 deposit, refundable on return of the locker key.

Department of Zoology: New Museums Site.

Departmental Representative: Dr Matthias Landgraf ml10006@cam.ac.uk

Departmental administrative contact: Teaching Administrator, Becky Ramshaw, Room S6 (br316@cam.ac.uk, 01223 769017 teaching@zoo.cam.ac.uk).

Departmental Access: Your University Card will give you access to the Department of Zoology including the library and common room. If you have any issues with card access, please contact Ben Wallbanke-Taylor (bt249@cam.ac.uk)

Library: 1st floor, normal opening hours 08:30-17:00 Mon-Thurs, 08:30-16:30 Fri (and Saturdays 09:15-12:30 in full-term).
Librarian: Miss Jane Acred, Tel. 36648. Web site:
http://www.zoo.cam.ac.uk/department/library email library@zoo.cam.ac.uk. See also the guide to the Balfour Library available on Moodle, inviting you to register your University Card with the Librarian so you can borrow books, attend a tour, buy a photocopying card, and set up and credit your printing account.

Photocopying: In Library during normal opening hours. 5p per A4 single side using card purchased or borrowed from Librarians. Cards can be bought from Library Office for £5 and recharged in £1 denominations. Photocopier also available 24/7 in IT facilities room, as below.

Printing: It is possible to print PDF files of articles and results of literature searches in the Library during normal opening hours, using the University Computing Services' DS Print service. You can pre-pay for printing online using a debit or credit card, or in cash at the Computing Service Reception (located on the New Museums site). The charges for printing are:

A4 black and white sheet 5p
A4 Colour single sheet (both single and double sided): 30p

The printer is located in the Library Office.

Scanning: An A3 flatbed scanner is in the library 24/7. The photocopiers can also be used to scan from printed materials into PDF, and to print from PDF onto paper from a USB stick. This service is free. All scans are in colour. Ask librarians for more information.

Tea Room: 2nd floor (above Library) 10.00 - 11.15 am & 2.45 - 4.15 pm.

Part II Computer Suite , 2nd floor. There are **15 computers** available for the use of Part II Students (shared with Zoology) which have a range of software installed on them including: IE, Microsoft Office, Corel Draw, Photoshop, Adobe Acrobat Professional, R, Minitab, GenStat. There are **two printers**, one colour and one black & white. Printing is available via the University Computing Service's DS-Print service. A **scanner** is also available for your use. There is a black and white **photocopier** available in for your use. These run under the same system that is available in the Library.

The **University Wireless Service** is also available throughout a large part of the department, including the Computer Suite, the Library and the Tearoom.

Department of Physiology, Development & Neuroscience (PDN): Downing Site.

Departmental Representative: Dr David Parker (djp27@cam.ac.uk).

Departmental Administrative Contact: Vicky Johnson, vje20@cam.ac.uk

Access: Your university swipe card needs to be validated separately for the two buildings:
Physiology Building: for library access, and project students: see Reception (33899).
Anatomy Building: only for project students : see principal technician: Phil Garrett (33764)

Library: Physiology C floor. Open all hours. Information about the library can be found on the PDN website: http://www.pdn.cam.ac.uk/library/. The library is wireless enabled so that you can use your laptops.

Reference materials provided by lecturers

At the beginning of each year all your lecturers are encouraged to deposit, with Paul and Vicky, a paper copy of any references on their list which might be difficult to obtain in Cambridge. These copies will be kept in a filing cabinet in the Part II Computer Room. They may not be removed from the Library area as one copy is provided for all to use. In the past this facility has been abused: **At the first sign of this happening again this material will be withdrawn**.

Photocopying: In the entrance to the library. Cards can be purchased from the Physiology Reception : 8p per sheet. It is also possible to scan documents and send them to a USB key or to any University e-mail account, free of charge and without needing a photocopying card

Tea Room: Physiology Floor C.

FEEDBACK

As throughout your time in Cambridge, you will be periodically asked to provide feedback on all aspects of the course. This feedback is very important for us to continue to develop the course and is always taken seriously. We will welcome your reaction to the course as a whole, and individual lecturers will do their best to accommodate sensible criticism and suggestions.

You should feel free to approach any of the module organisers with specific concerns as and when they arise, the course organiser or the teaching administrators. We will do our best to sort out problems quickly. For any problems with lecture schedules, first contact the module organiser; for any problems with departmental access, first contact the departmental rep. In case of more general problems, feel free to approach your nominated course advisor for advice.

We collect the feedback for each module via Moodle. Obviously we are limited by the amount and quality of the feedback we receive, and opinions based on only a few returns are unlikely to be representative. So please fill out the on-line forms as soon as possible. The system is simple and fast, and the information you provide is valuable.

In addition you will elect two representatives who will attend staff-student meetings in the Michaelmas and Lent terms. You should inform them of any concerns you want raised, so that they can represent your views at these meetings