



AN4002

Brain Function & Malfunction

Course Handbook
2019-20

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Cover image:

Confocal micrograph of fluorescently labelled HeLa cells.

Nuclei are labelled in blue, tubulin in green and actin fibres in red.

Courtesy of:

Kevin Mackenzie

Microscopy and Histology Core Facility

Institute of Medical Sciences

University of Aberdeen

<http://www.abdn.ac.uk/ims/microscopy-histology>

Course Summary

There is currently much interest in the organisation and function of the mammalian brain. The way in which neuronal pathways interact to produce given behaviours, emotions and desires, and capabilities such as sensation and awareness represents one of the hallmarks of today's research. In addition, disorders of the central nervous systems (CNS) such as paralysis, schizophrenia and Alzheimer's disease are of increasing concern to our society. Topics such as these are introduced in lectures and expanded upon by seminar presentations and practicals. Basic knowledge of CNS organisation and function is a prerequisite. The course consists of one introductory and eight topical lectures, 3 practical classes and student seminars. AN4002 is examined via continuous assessment within the practicals (10%), the seminar presentation (20%) and a 2-hour written exam (70%).

Course Aims & Learning Outcomes

1. Describe the general organisation of the human nervous system.
2. Describe malfunctions of the nervous system and their relation to neuroanatomy.
3. Discuss current research relevant to diagnosis and treatment of nervous system disorders.

Course Teaching Staff

Course Co-ordinator(s):

Professor Bettina Platt - b.platt@abdn.ac.uk

Other Staff:

Professor Colin McCaig (CDM), Medical Sciences

Professor Simon Parson (SP), Medical Sciences

Dr Ann Rajnicek (AMR), Medical Sciences

Professor Gernot Riedel (GR), Medical Sciences

Dr Derek Scott (DS), Medical Sciences (Joint Course Co-ordinator for AN4003)

Dr Derryck Shewan (DAS), Medical Sciences

Dr Justin Williams (JW), Psychiatry

Assessments & Examinations

The *continuous assessment mark* (10%) is comprised of short assessments conducted during the practicals.

The *seminar presentation* (see later) contributes 20% to the final mark. Marks will be deducted for late hand-ins out of fairness for those students who hand in on time.

The *written exam* makes up 70% of the mark. The exam consists of a two hour written examination in the May/June diet.

Class Representatives

We value students' opinions in regard to enhancing the quality of teaching and its delivery; therefore in conjunction with the Students' Association we support the Class Representative system.

In the School of Medical Sciences we operate a system of course representatives, who are elected from within each course. Any student registered within a course that wishes to represent a given group of students can stand for election as a class representative. You will be informed when the elections for class representative will take place.

What will it involve?

It will involve speaking to your fellow students about the course you represent. This can include any comments that they may have. You will attend a Staff-Student Liaison Committee and you should represent the views and concerns of the students within this meeting. As a representative you will also be able to contribute to the agenda. You will then feedback to the students after this meeting with any actions that are being taken.

Training

Training for class representatives will be run by the Students Association. Training will take place within each half-session. For more information about the Class representative system visit www.ausa.org.uk or email the VP Education & Employability vped@abdn.ac.uk. Class representatives are also eligible to undertake the STAR (Students Taking Active Roles) Award with further information about this co-curricular award being available at: www.abdn.ac.uk/careers.

Problems with Coursework

If students have difficulties with any part of the course that they cannot cope with alone they should notify the course coordinator immediately. If the problem relates to the subject matter general advice would be to contact the member of staff who is teaching that part of the course. Students with registered disabilities should contact Mrs Jenna Reynolds (medsci@abdn.ac.uk) in the Medical Sciences Office (based in the Polwarth Building, Foresterhill), or Mrs Sheila Jones (s.jones@abdn.ac.uk) in the Old Aberdeen office associated with the teaching laboratories, to ensure that the appropriate facilities have been made available. Otherwise, you are strongly encouraged to contact any of the following as you see appropriate:

- Course student representatives
- Course co-ordinator
- Convenor of the Medical Sciences Staff/Student Liaison Committee (Professor Gordon McEwan)
- Personal Tutor
- Medical Sciences Disabilities Co-ordinator (Dr Derryck Shewan)

All staff are based at Foresterhill and we strongly encourage the use of email or telephone the Medical Sciences Office. You may have a wasted journey travelling to Foresterhill only to find staff unavailable.

If a course has been completed and students are no longer on campus (i.e. work from second semester during the summer vacation), coursework will be kept until the end of Freshers' Week, during the new academic year. After that point, unclaimed student work will be securely destroyed.

Course Reading List

- D. Richards / T. Clark / C. Clarke. The human brain and its disorders. Oxford University Press 2007.
- E. R. Kandel/ J. H. Schwartz / T. M. Jessel. Principles of neural sciences. Prentice Hall Intl.
- M.F. Bear / B.W. Connors / M.A. Paradiso. Neuroscience: Exploring the Brain. Lippincott Williams & Wilkins.
- K. Afifi / R.A. Bergmann. Functional Neuroanatomy. McGraw-Hill.
- Crossman, A.R. & Neary, D. Neuroanatomy. Churchill Livingstone, 1998.

Lecture Synopsis

Introduction: Professor Bettina Platt & Dr Derek Scott

Introduction to the course and assignment of seminar topics. Why is anatomy important? Relation to medical and biomedical research, relevance in the 21st century. Brief overview of the anatomical background required and the general organisation of the human nervous system.

Lecture 1: Forebrain/Dementia & Alzheimer's Disease - Professor Bettina Platt

General arrangement of the forebrain. Cerebral hemispheres: functional & histological organisation of the neocortex. Higher cognitive function, intellect & reasoning, language & attention. Structures within the limbic system. Special consideration of the hippocampal formation, amygdala and septal areas in emotions, learning and memory, and conscious thought. Alzheimer's disease (AD), background and research examples based on the putative role of soluble vs fibrillar protein species in AD.

Lecture 2: Motor Systems – Professor Gernot Riedel

In this lecture, we will quickly review the ancillary systems supporting and modulating the motor responses generated by the motor cortex. These include the BASAL GANGLIA as the central initiator of voluntary movements and instructing the cortical motor pathways. It will include the sub-regions within the basal ganglia, their internal connections and their intrinsic physio-pharmacological modules and neuronal units. A second system comprises the CEREBELLUM, which constitutes a more complex integration system of information from cortex, muscle and balance sensors for an integrated signal for correction, fine-tuning and smoothing of voluntary movement. The respective brain regions, their anatomical constituents, input and output pathways as well as neurotransmitters will be discussed.

Lecture 3: Spinal Cord – Dr Ann Rajnicsek

Structure and function of the intact spinal cord. What happens when it goes wrong? Developmental defects (eg. spina bifida); physical and functional consequences of traumatic spinal cord injury; acute versus chronic injury. Prospects for functional recovery, barriers to regeneration/recovery of function. Current treatments and promising future therapies.

Lecture 4: The Social Brain – Dr Justin Williams

The human cortex has undergone massive expansion in the last 100,000 years and this evolution is thought to have been driven by the brain's social function. In this lecture, we will review some of the mechanisms in the brain that serve these uniquely human social functions, including facial recognition, emotional expression, 'theory of mind', empathy and social reciprocity, at the levels of behaviour, brain and cell. We will consider what happens in autism when the social brain malfunctions.

Lecture 5: Mental disorders: classification and psychopathology – Dr Justin Williams

When you hear of diagnoses such as autism, dyslexia, depression or dementia, what does this mean? How does a diagnosis of a physical disease differ to a diagnosis of a mental disorder and how are mental disorders defined? We will consider some of the main forms of psychopathology such as hallucinations, delusions, addiction behaviour, pathological mood and phobic states. What is their character, their brain basis and how does psychopathology relate to diagnosis?

Lecture 6: Spinal Muscular Atrophy – Professor Simon Parson

SMA is a relatively (genetically) simple disease resulting from the mutation in a single gene, coding a single protein. The protein has a known function in SnRNP biogenesis, but taken together, this knowledge has not advanced our understanding of the neuromuscular pathology which characterises the disease. Further, more recent work is now showing that widespread systemic defects are also present, and that any future therapies must also target these if effective treatments are to be developed.

Lecture 7: Sensory Systems – Dr Derryck Shewan

Brief overview of the systems that regulate vision, hearing, balance, olfaction, taste, touch, pain and temperature, followed by a more in-depth discussion of the processes underlying the sensation of sight, sound and smell. Particular emphasis on the mechanisms of ‘topographical mapping’ of retinal axons to the brain and the specific projections from odorant receptors in the olfactory epithelium to the olfactory bulb, including a synopsis of leading recent research into these topics. Aspects of malfunction will involve blindness and hearing impairment.

Lecture 8: Recent Advances in Neuroscience - Professor Colin McCaig

This lecture session will concentrate on astrocytes as key players in multiple brain functions in health and disease. For a long time, astrocytes were viewed as little more than support cells which maintained the homeostasis of the extracellular environment in brain, for example K^+ ion concentrations and pH. More recently, there is growing recognition that astrocytes signal to each other and to networks of neurons and that this can influence synaptic numbers, function and strength in coordinated networks of neurons. They also respond to incoming sensory information in ways that may regulate neuronal outputs. Some of the mechanisms underpinning these events will be explored.

Practical & Lab Work

Computer-based neuroanatomy practical: This practical provides a basic introduction into CNS anatomy and offers an opportunity to engage with anatomy software packages while teaching staff are present.

EEG practical: Short introduction into EEG and its role as a diagnostic tool followed by exercises and questionnaires.

Brain dissection: This 'wet' practical offers the unique opportunity to dissect a sheep's brain and examine donated human brain material. Brain structures will be identified *in situ*. We will also discuss ethical issues related to the use of human material for teaching and research and look into brain anatomy of other animals using models. Please bring a lab coat.

Student Seminars

During the first introductory meeting, students are allocated an essay topic. The seminar has to be prepared as a PowerPoint presentation as well as a written summary and submitted by Friday 7th October (see timetable); group presentations are held during the seminar sessions in the last week of the course. Seminar presentations should be 15 minutes (plus~5-10 minutes discussion). PowerPoint files will be uploaded on MyAberdeen for the benefit of the class. Preparation efficiency and literature research skills, presentation style and delivery, slide design and illustrations, organisation of the talk, the content and handling of questions will be assessed.

Please note that the content of these seminars is examinable in the final, written examination.

All seminar presentations should include anatomical aspects, with a special focus on the link between nervous system structures and their functions, and possible malfunctions / pathology.

Do not hesitate to contact the lecturer in charge of your topic or the course organiser if in doubt.

You may prepare some notes to help you through the presentation, but please *do not* read the full text.

Copying or plagiarising another person's work, either from other students or published material in books or papers and submitted as your own is considered a form of cheating. This is a serious offence and will be penalised according to the extent involved and whether it is decided there was an attempt at deliberate deception, or whether bad practice was involved. If you do use information or ideas obtained from textbooks or other published material, you must give a precise reference to the source.

University Policies

Students are asked to make themselves familiar with the information on key institutional policies which have been made available within MyAberdeen (<https://abdn.blackboard.com/bbcswebdav/institution/Policies>). These policies are relevant to all students and will be useful to you throughout your studies. They contain important information and address issues such as what to do if you are absent, how to raise an appeal or a complaint and indicate how seriously the University takes your feedback.

These institutional policies should be read in conjunction with this programme and/or course handbook, in which School and College specific policies are detailed. Further information can be found on the [University's Infohub webpage](#) or by visiting the Infohub.

The information included in the institutional area for 2019/20 includes the following:

- Absence
- Appeals & Complaints
- Student Discipline
- Class Certificates
- MyAberdeen
- Originality Checking
- Feedback
- Communication
- Graduate Attributes
- The Co-Curriculum

Medical Sciences Common Grading Scale

Grade	Grade Point	Category	Honours Class	Description
A1	22	Excellent	First	<ul style="list-style-type: none"> Outstanding ability and critical thought Evidence of extensive reading Superior understanding The best performance that can be expected from a student at this level
A2	21			
A3	20			
A4	19			
A5	18			
B1	17	Very Good	Upper Second	<ul style="list-style-type: none"> Able to argue logically and organise answers well Shows a thorough grasp of concepts Good use of examples to illustrate points and justify arguments Evidence of reading and wide appreciation of subject
B2	16			
B3	15			
C1	14	Good	Lower Second	<ul style="list-style-type: none"> Repetition of lecture notes without evidence of further appreciation of subject Lacking illustrative examples and originality Basic level of understanding
C2	13			
C3	12			
D1	11	Pass	Third	<ul style="list-style-type: none"> Limited ability to argue logically and organise answers Failure to develop or illustrate points The minimum level of performance required for a student to be awarded a pass
D2	10			
D3	9			
E1	8	Fail	Fail	<ul style="list-style-type: none"> Weak presentation Tendency to irrelevance Some attempt at an answer but seriously lacking in content and/or ability to organise thoughts
E2	7			
E3	6			
F1	5	Clear Fail	Not used for Honours	<ul style="list-style-type: none"> Contains major errors or misconceptions Poor presentation
F2	4			
F3	3			
G1	2	Clear Fail/ Abysmal	-	<ul style="list-style-type: none"> Token or no submission
G2	1			
G3	0			

Course Timetable AN4002: 2019-2020

Date	Time	Place	Subject	Session	Staff
Week 7					
Mon 9 Sep	11:00-13:00	BMP D2 Workshop	Introduction / seminar assignment	Lecture	BP & DS
Tue 10 Sep					
Wed 11 Sep	09:00-12:00	Comp G21, G40	Practical: The Human Brain (Comp. Based)	Practical	BP
Thu 12 Sep	12:00-14:00	1:143/144	L1: Forebrain/Alzheimer	Lecture	BP
Fri 13 Sep					
Week 8					
Mon 16 Sep	11:00-13:00	BMP D2 Workshop	L2: Motor Systems	Lecture	GR
Tue 17 Sep					
Wed 18 Sep					
Thu 19 Sep	12:00-14:00	LT3	L3: Spinal cord development, trauma and repair	Lecture	AR
Fri 20 Sep					
Week 9					
Mon 23 Sep	11:00-13:00	BMP D2 Workshop	L4: The Social Brain	Lecture	JW
Tue 24 Sep					
Wed 25 Sep					
Thu 26 Sep	12:00-14:00	1:143/144	L5: Mental Disorders	Lecture	JW
Fri 27 Sep	10:00-13:00	ZB06	EEG Practical	Practical	DS
Week 10					
Mon 30 Sep	11:00-13:00	BMP D2 Workshop	L6: Spinal Muscular Atrophy	Lecture	SP
Tue 1 Oct					
Wed 2 Oct	09:00-12:00	ZB06	Sheep Brain Dissection	Practical	BP/DS
Thu 3 Oct	09:00-11:00	Aud	L7: Sensory Systems	Lecture	DAS
Fri 4 Oct	17:00		Deadline for Seminar Submission (via email)		BP
Week 11					

Mon 7 Oct	11:00-14:00	BMP D2 Workshop	Seminars 1	Seminar	BP/DS/GR
Tue 8 Oct					
Wed 9 Oct	09:00-12:00	BMP D2 Workshop	Seminars 2	Seminar	BP/AMR/SP
Thu 10 Oct	12:00-15:00	BMP D2 Workshop	Seminars 3	Seminar	BP/CDM
Fri 11 Oct	10:00-11:00 11:00-12:00	LT3	Lecture 8: Recent Advances in Neuroscience Seminars 4	Lecture	CDM BP/JW

Staff

Dr Ann Rajnicek (AMR)
Prof Simon Parson (SP)
Prof Colin McCaig (CDM)
Prof Gernot Riedel (GR)
Prof Bettina Platt (BP) (Course Co-ordinator)
Prof Derek Scott (DS)(Joint Course Co-ordinator for AN4003)
Dr Derryck Shewan (DAS)
Dr Justin Williams (JW)