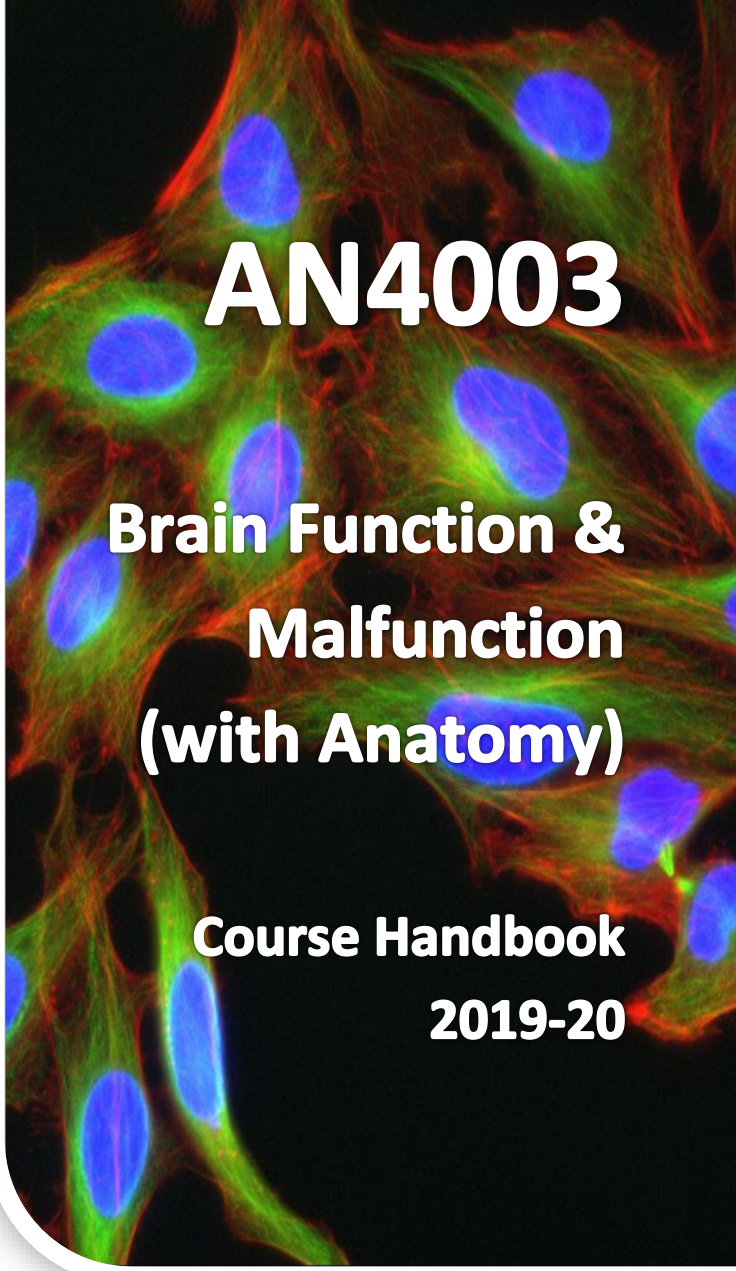
School Of Medicine, Medical Sciences & Nutrition



AN4003

Brain Function & Malfunction (with Anatomy)

Course Handbook

2019-20

UNIVERSITY OF ABERDEEN

Contents

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. In addition, we shall consider various injury states and ways of treating neurological trauma. Topics such as these are introduced in lectures, and expanded upon by tutorials and practical classes. Basic knowledge of CNS organisation and function is a prerequisite, as introduced in previous courses (2nd year anatomy and physiology courses, BM3006/SM3002).

The course consists of lectures, practical classes a tutorial and student seminars. AN4003 is examined by a dissection essay (10%), practical classes (10%), an objective practical exam (10%) and a 2-hour written exam (70%).

PLEASE NOTE: AN4003 may only be taken by students studying for the Biomedical Sciences (Anatomy) degree. All other students who are studying Neuroscience with Psychology should be registered for AN4002 and follow instructions given in that course manual.

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.
4. Obtain the skills necessary to dissect nerves and other structures in human cadaveric material
5. Allow students to demonstrate their competence in a wide range of practical and transferable skills.

Course Teaching Staff

Course Co-ordinator(s):

Course Co-ordinator: Dr Derek Scott (ext. 7566), **d.scott@abdn.ac.uk** and Professor Bettina Platt (ext. 7402) **b.platt@abdn.ac.uk**

Other Staff:

Dr Ann Rajnicek (AMR), Medical Sciences

Professor Gernot Riedel (GR), Medical Sciences

Dr Derryck Shewan (DAS), Medical Sciences

Dr Prem Ballal (PB), Anatomy

Professor Simon Parsons (SP), Anatomy

Professor Graeme Nixon (GFN), Medical Sciences

Professor Alison Jenkinson (AMJ), Medical Sciences

Professor Colin McCaig (CDM), Medical Sciences

Dr Justin Williams (JW), Psychiatry

Assessments & Examinations

In-course Assessment

- OSPE – 10%
- Essay/activities relating to dissection– 10%
- Practical class reports/answers – 10%

Dissection and Essay with Labelled Photograph(s) (10%)

You will take a digital image(s) of your dissection (using a departmental camera only) which will be loaded onto the departmental graphics computer. You will prepare the photograph(s) as if for publication/presentation in a lecture.

On no account should the photograph include any features that could be used to reveal the identity of the donor (e.g. cadaver number, tattoo, skin mole/mark/scar).

Specific instructions regarding the grading of dissections, criteria used and the write-up will be given during your dissection classes. If you do not understand anything, please ask the relevant anatomy staff for advice. Dr Ballal is responsible for the dissection activities in this

course, but other anatomy staff may be involved and are always happy to help/provide guidance. You must also follow the specific local regulations and safety guidance relating to your dissection classes that the anatomy staff will highlight for you.

The dissection essay and the dissection itself (see above) contributes 10% to the final mark. Marks will be deducted for late hand-ins out of fairness for those students who hand in on time. The OSPE will contribute 10%. The *written exam* makes up 70% of the mark. The exam consists of a two hour written examination in the May/June diet.

The other 10% of the continuous assessment grade is derived from your submissions for the EEG practical class and the brain dissection practical class. More details on these classes will be provided during the course via MyAberdeen.

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 Medicine, Medical Sciences & Nutrition 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 School 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.

NB. Departmental dissection manuals and anatomy atlases will be available in the dissecting room to support the practical dissection classes.

Lecture Synopsis

Introduction: Professor Bettina Platt, Dr Derek Scott & Dr Prem Ballal

Introduction to the course. Why is neuroanatomy 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. 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 Rajnicek

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

Apart from motor and cognitive disorders considered in previous lectures, less is clear about anatomical anomalies related to psychiatric conditions. Here, we will specifically consider mood disorders (incl. major depression and bipolar disorders), together with anxiety disorders (phobias, generalised anxiety, post-traumatic stress, obsessive compulsive disorder) and schizophrenia. Autism spectrum disorders (such as Asperger's and Rett syndrome) are also considered. A common theme in all these diseases is the graded dysfunction of the limbic system, prefrontal and orbito-frontal cortices, basal ganglia and thalamus. Regional anatomical and functional changes will be considered.

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: 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 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.

(lectures 1-8 are held jointly with AN4002)

Lecture 9: Delirium – Dr Derek Scott

What is delirium? Delirium vs dementia. What factors might be involved in inducing and maintaining delirium? Why is this such a big problem for healthcare providers? How do we assess, prevent, minimise and stop delirium from occurring?

Lecture 10: Histology, Radiology & Pathology Problem-Solving Session – Dr Derek Scott

We will review a selection of histological, radiological and pathological images and data as part of various case-based scenarios to help students understand how their knowledge and understanding of central nervous system anatomy can be applied to solve real-life problems. Students will be expected to participate fully during this session and take part in the discussions.

Lecture 11: Brain Swelling, Oedema & Intracranial Pressure – Dr Derek Scott

Traumatic brain injury can lead to damage of the hard and soft tissues of the head. Brain swelling due to inflammation or oedema can crush the delicate tissue of the brain, and a rise in intracranial pressure (ICP) can result in reduced cerebral blood flow. This lecture will review traumatic brain injury and illustrate how normal anatomy may be disrupted and what interventions can be undertaken to restore normal structure/function.

Lecture 12: The Vagus – Dr Derek Scott

Many students only remember that the vagus is cranial nerve X and that it is involved in slowing heart rate, but there is far more to this major parasympathetic nerve! Vagus is Latin for “wandering” and the cranial nerve X truly deserves this name due to its extensive distribution through the body. This lecture will review some of the evidence that illustrates the many and varied functions of the vagus throughout the body.

Practical/Lab/Tutorial Work

1. 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.

2. Objective Structured Practical Examination (OSPE) (DS)

The practical work for AN4003 will involve an Objective Structured Practical Examination (OSPE for short!), which some of you will have experienced before in subjects such as anatomy or medicine. However, this style of assessment at multiple stations during a strict time limit is also similar to the job interviewing methods used by many employers.

The practical runs over 3 weeks (see timetable). In week 1, ALL students will attend and have an opportunity to practice the skills which will be assessed. During this day, staff will be on hand to demonstrate and answer questions, and students will be directed towards what they should revise for the assessment. Given that students will have little other coursework at this time, their preparation for the assessment should not be too onerous. Many of you will be already familiar with some of the practical skills assessed. Please note – **IT IS ESSENTIAL THAT YOU ATTEND THIS LABORATORY PRACTICAL SESSION**.

In either week 2 OR 3, students will be scheduled to attend the practical laboratory for a one hour long slot, during which time they will undertake their assessment. Students cannot pick and choose when they attend, appointments will be issued by staff. Allocated groups will be available on the MyAberdeen course website. Attending at the correct time is one of the professional skills that will be assessed! During your one hour slot, you will be assessed at several stations on how well you complete the practical skills. In addition, the students' professionalism as scientists and potential employees will be graded and students will also have to submit a short written assignment.

A major benefit of this practical is that, in addition to brushing up your practical skills, it can also provide practice for future interviews for jobs or academic positions. It will also prepare you in the generic skills needed for the Honours projects you will all be undertaking in the second half-session after Christmas.

The practical coordinator for AN4003 is Dr Derek Scott (d.scott@abdn.ac.uk). The OSPE will contribute 10% towards your final course mark.

For these classes a laboratory coat should be worn at all times in the laboratory. The University and Department safety rules must be adhered to at all times. Students may find it useful to bring a calculator to the laboratories in order that the required calculations can be made.

3. EEG practical

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

4. Practical Anatomy dissection component

This part of the course provides you with an introduction to the practical skills necessary to carry out dissection of human cadaveric material. It also links with the practical anatomy component of AN4301 Developmental Neuroscience (with Anatomy) (4 x 3 hours classes) in which you will be required to prepare a dissection of an aspect of the nervous system and where many of the marks available will be for quality of the dissection prepared.

In these classes, you will be guided in stages through the preparation of a dissected human cadaveric part including superficial (cutaneous) nerves and a deep nerve branch. Each class will be of three hours duration and will be guided by a member of staff. Emphasis should be on care and precision – it is not a speed exercise. Anatomy staff will provide further details about the dissection assessment for this year.

Summary of dissection classes

Practical dissection class 1

- Introduction to activity, aims of programme.
- Removal of skin

Practical dissection class 2

- Superficial structures (veins, cutaneous nerves)

Practical dissection class 3

- Exposure of superficial muscles (photo for assessment)

Practical dissection class 4

- Deep nerve/vascular/joint exposure (photo for assessment)

University Policies

Students are asked to make themselves familiar with the information on key institutional policies which 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[1]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	• 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	• 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	• 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	• 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	• 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	• Contains major errors or misconceptions • Poor presentation
F2	4			
F3	3			
G1	2	Clear Fail/ Abysmal	-	• Token or no submission
G2	1			
G3	0			

Course Timetable AN4003: 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 / PB
Tue 10 Sep	13:00-17:00	2:054	Objective Structured Practical Examination (OSPE) Practice	Practical	DS
Wed 11 Sep					
Thu 12 Sep	12:00-14:00	1:143/144	L1: Forebrain/Alzheimer	Lecture	BP
Fri 13 Sep	09:00-12:00	Wet Room, Suttie	Dissection 1	Practical	PB
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	09:00-12:00	Wet Room, Suttie	Dissection 2	Practical	PB
	12:00-14:00	FLT	L3: Spinal cord development, trauma and repair	Lecture	AMR
Fri 20 Sep					
Week 9					
Mon 23 Sep	11:00-13:00	BMP D2 Workshop	L4: Sensory Systems	Lecture	DAS
Tue 24 Sep					
Wed 25 Sep					
Thu 26 Sep	09:00-12:00	Wet Room, Suttie	Dissection 3	Practical	PB
	12:00-14:00	1:143/144	L5: Mental Disorders	Lecture	JW
	14:00-17:00	2:054	OSPE Assessments (check your assigned slot)	Assessment	DS
Fri 27 Sep	09:00-12:00	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	DS et al.
Thu 3 Oct	09:00-11:00	Auditorium	Lecture 7: The Social Brain	Lecture	JW
Fri 4 Oct					
Week 11					
Mon 7 Oct	09:00-10:30	1:032/033	Histology, Radiology & Pathology (HRP) Problem Solving	Lecture	DS
Tue 8 Oct	09:00-12:00	Wet Room, Suttie	Dissection 4	Practical	PB
Wed 9 Oct					
Thu 10 Oct	09:00-11:00	1:032/33	Delirium	Lecture	DAS
	12:00-14:00		Private Study	Study	
	15:00-16:00	1:032/033	Brain Swelling, oedema and intracranial pressure	Lecture	DAS
	16:00-17:00	1:032/033	The Vagus	Lecture	DAS
Fri 11 Oct	10:00-12:00	FLT	Lecture 8: Recent Advances in Neuroscience	Lecture	CDM

Staff

Prof Bettina Platt (BP) (Course Co-ordinator)
Dr Derek Scott (DS) (Joint Course Co-ordinator for AN4003)
Prof Gernot Riedel (GR)
Prof Alison Jenkinson (AMJ)
Prof Colin McCaig (CDM)
Prof Simon Parsons (SP)
Prof Graeme Nixon (GFN)
Dr Derryck Shewan (DAS)
Dr Ann Rajnicek (AMR)
Dr Prem Ballal (PB) (Supervisor 'Dissections')
Dr Justin Williams (JW)