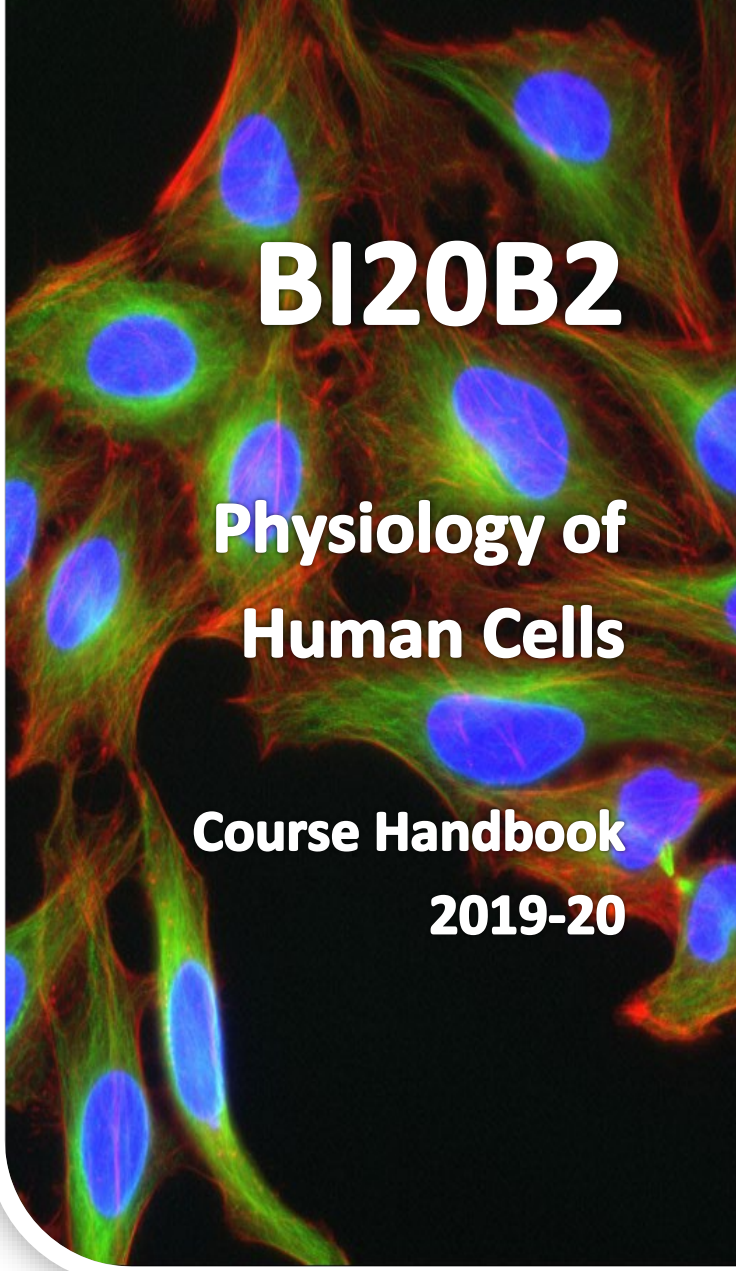
School Of Medicine, Medical Sciences & Nutrition



BI20B2

Physiology of Human Cells

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

This course introduces you to human physiology – the understanding of body function. The central concept, essential to physiology, is homeostasis – the maintenance of a relatively constant internal environment in a constantly changing external environment. This course (along with its partner BI25B2) will consider how this is achieved at cell and whole body level. The focus in this course will be on the roles of the nervous and endocrine control systems. Specifically, it deals with: the physiology of the cell with special reference to nerve and muscle; cell-cell signalling; neuro-endocrine integration and some aspects of endocrinology; membrane potentials and action potentials in nerve cells; reflexes; central nervous system control of movement; the physiology and pharmacology of the autonomic nervous system; transduction of sensory information by receptors and processing of sensory information by the CNS; The composition and function of blood including its role in immunity.

The course consists of 3 lectures per week and 1 laboratory session per fortnight. It is examined by continuous assessment of submitted practical reports, a 1-hour mid-term MCQ examination and a 2-hour MCQ examination.

Course Aims & Learning Outcomes

This course aims to develop an understanding of the main 'integrating' systems of the body, the nervous system and the endocrine system, and to enable students to become confident in practical laboratory skills and computer data-handling.

1. To understand the principles of cellular and organismal homeostasis.

2. To describe the principal components of animal cells and discuss their contributions to cell homeostasis and function.

3. To explain the mechanisms of transport across animal cell membranes and discuss their roles in the regulation of cellular homeostasis.

4. To define the processes used to achieve cell-cell signalling and discuss their role in providing variability of response and function.

5. To describe the endocrine system and evaluate its inter-relationships with the nervous system.

6. To describe the organisation of the nervous system and explain the principles of action potential conduction.

7. To explain the excitation and contraction of skeletal, cardiac and smooth muscle.

8. To describe simple spinal reflexes and their functions.

9. To explain the fine control of movement through the central nervous system.

10. To describe the organisation and functions of the autonomic nervous system and explain the role of this system in controlling the internal organs of the body.

11. To explain the transduction of sound, other mechanical stimuli, chemicals and light by various sensory receptors, and discuss how sensory information is passed to the central nervous system.

12. To introduce the principal functions of blood, to discuss its importance for nervous and endocrine function and to discuss its role in the defence against pathogenic micro-organisms.

Course Teaching Staff

Course Co-ordinator:

Prof Gordon McEwan (GTAM: tel 01224 437403; email **g.t.a.mcewan@abdn.ac.uk**)

Other Staff:

Dr Guy Bewick (GSB), Medical Sciences

Dr Derryck Shewan (DS), Medical Sciences

Dr Isabel Crane (IJC), Medical Sciences

Prof Stephen Davies (SND), Medical Sciences

Dr Alison Jack (AMJ), Medical Sciences

Dr Pietro Marini (PM), Medical Sciences

Dr Steve Tucker (SJT), Medical Sciences

Assessments & Examinations

You are expected to attend all lectures, laboratory classes and assessments and to complete all class exercises by stated deadlines. The minimum performance acceptable for the granting of a class certificate is attendance at 75% of the practical classes, and presentation of all set course work.

The course assessment consists of two components:

1. A continuous assessment component (30%). Marks within this component are derived from:

(a) Mid-term multiple choice examination paper (10%)

(b) Two completed practical reports (10% for each report)

2. A multiple choice degree examination paper (70%)

The main degree examination consists of a 2 hour paper with 100 multiple choice questions (ABCDE).

The mid-term examination will follow the same format as the degree exam but will consist of 50 multiple choice questions and will last for 1 hour.

The degree examination is set in the December diet of examinations. The re-sit degree examination is set in the June/July diet and your continuous assessment mark will be reconsidered at this and subsequent sittings. As with University regulations, class certificates are valid for two years only and extra sittings of an examination can only be considered if failure or absence from an examination is covered by a valid medical certificate (MC) or documented good cause (GC).

The overall performance of the student will be expressed as a grade awarded on the common grading scale (CGS) shown on the last page of this handbook.

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 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 (Prof 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

Recommended text for course:

Silverthorn D.U. – Human Physiology; An Integrated Approach 7th Edition 2016, Pearson. ISBN 978-0-321-98122-6

Lecture Synopsis

Lecture 1: **Introduction to the course - Prof Gordon McEwan**

Lecture 2: **What is Physiology? - Prof Gordon McEwan**

Physiology is concerned with functions of living matter. This includes a hierarchical organisation from cells to tissue to organs to systems. These principal building blocks will be introduced together with the concept of homeostasis.

Lecture 3: Membrane Transport 1. Movement across membranes - Prof Gordon McEwan

Introduction to the structural organisation of the cell, the functions of the organelles and some principles of energy metabolism. Energy is required to maintain gradients between compartments. Some principles of ion exchange across membranes will also be discussed.

Lecture 4: Membrane Transport 2. Membrane transport proteins and cellular homeostasis - Prof Gordon McEwan

This lecture discusses multiple transport functions of the plasma membrane to maintain constant cell volumes, regulate intracellular calcium, and pump ions against their gradients. The origin of membrane potentials (especially for nerve cells) is also considered along with ion channel functioning.

Lecture 5-6: Cell Signalling 1 & 2 - Prof Gordon McEwan

Communication between cells relies on specific signalling mechanisms such as paracrine, endocrine or synaptic signalling. The target cells express receptors through which information can be transduced in order to activate intracellular enzyme cascades (second messengers). This eventually leads to gene activation and expression of novel proteins.

Lecture 7: Introduction to Pharmacology – Dr Pietro Marini

A drug can be defined as any chemical (either natural or synthetic) which interacts with biological material to alter its function in some way. The discipline of Pharmacology deals with the interactions between drugs and cells, tissues and organs. Having considered the general mechanisms whereby chemical messengers mediate cell communication and signal transduction, this lecture will introduce the basic principles of pharmacology: receptors, agonists, antagonists, dose-response relationships.

Lecture 8: Hormones 1. General features of hormone actions - Dr Steve Tucker

Chemical agents travelling in the blood stream are hormones, which regulate the activity of the physiological system. Some general features of hormone actions and comparison of the 3 main chemical classes of hormones will be covered.

Lecture 9: Hormones 2. Pituitary and hypothalamus - Dr Steve Tucker

Pituitary gland and hypothalamus constitute the connection between nervous and endocrinal system. Anterior and pituitary gland function will be contrasted and details of the main hormones from each summarised. Endocrine axes, regulation and feedback loops/mechanisms will be discussed.

Lecture 10: Hormones 3. Growth hormones and thyroid - Dr Steve Tucker

Growth hormone exerts multiple direct and indirect actions and are crucial for regulating growth and metabolism. Dwarfism or indeed gigantism can result from dysfunction. The thyroid secretes T3 and T4, iodine containing hormones crucial for regulating metabolic rate and maturation of skeleton and central nervous system. Malfunctions like hypothyroidism and hyperthyroidism will also be discussed.

Lecture 11: Hormones 4. Adrenal hormones - Dr Steve Tucker

Adrenal glands secrete fast-acting catecholamines such as epinephrine and norepinephrine, which regulate rapid responses to stress/danger. They also produce corticoids, steroid hormones involved in long-term regulation of stress-response, electrolyte balance and sexual function. Aberrant production of these hormones results in characteristic syndromes, which illustrate the importance of their functions.

Lecture 12: Nerve cells & connections 1. Organization of brain & spinal cord - Prof Stephen Davies

An understanding of how the nervous system works starts with recognizing what the various parts are. This lecture therefore covers: Surface structure of the brain including meninges, cerebellar cortex, cerebral cortex and its division into four lobes, cranial nerves; Gross internal structure of the brain including ventricles, white matter, grey matter, corpus callosum, thalamus, midbrain, pons, medulla, basal ganglia and internal capsule; Gross structure of the spinal cord including dorsal horn, ventral horn, dorsal root, ventral root, dorsal column, lateral column, ventral column. Throughout, the relevant functions of these regions will be highlighted.

Lecture 13: Nerve cells & connections 2. Axonal conduction - Prof Stephen Davies

Neurones exist to send electrical signals around the body. This lecture tells you how they do it. It covers: Types of glia including astroglia, olidodendroglia, microglia, ependymal cells; Structure of neurons including soma, dendrites, axon hillock, axon, myelin, nodes of Ranvier, presynaptic terminals; Transmission of action potentials including resting membrane potential, threshold potential, voltage-gated Na+ channels and depolarization, voltage-gated K+ channels and repolarization, propagation, refractory period, factors affecting velocity of conduction, myelination and saltatory conduction, compound action potentials.

Lecture 14: Nerve cells & connections 3. Synaptic transmission - Prof Stephen Davies

Neurones usually talk to each other via synapses where the electrical signals are briefly turned into a chemical signal that is squirted onto the second cell and triggers a "new" electrical signal. This lecture describes how these chemical synapses work. It covers: Structure of a chemical synapse including presynaptic terminal, voltage-gated Ca2+ channels, synaptic vesicles, synaptic cleft, postsynaptic thickening, anatomical types of synapse, range of neurotransmitters, ligand-gated vs G-protein linked receptors, presynaptic receptors, transmitter inactivation; Postsynaptic potentials including excitatory postsynaptic potentials, inhibitory postsynaptic potentials, temporal summation, spatial summation, synaptic

integration; The neuromuscular junction as a model synapse including motoneuron, end-plate, end-plate potential, miniature end-plate potential, acetylcholinesterase, curare, eserine, myesthenia gravis.

Lecture 15: Nerve cells & connections 4. Reflexes - Prof Stephen Davies

Motor control is essential for normal bodily functions. We will discuss the hierarchical nature of control mechanisms aiding the motor system and specifically discuss the organisation of the spinal cord with respect to reflex arcs and postural control.

Lecture 16: Nerve cells & connections 5. Cortical control of movement - Prof Stephen Davies

Apart from the crude but fast reflexes, the CNS coordinates and modulates more sophisticated responses to external stimuli. Several brain structures participate in the fine control of movement. We will consider the motor cortex first and discuss its connections to the spinal cord and its physiology.

Lecture 17: Physiology & pharmacology of autonomic nervous system - Prof Stephen Davies

The Autonomic Nervous System (ANS) regulates the internal environment of the body (Homeostasis). This includes the viscera, the heart, blood vessels, all other smooth muscles of the body and exocrine glandular tissue. Anatomically and physiologically, the sympathetic nervous system associated with "Arousal" and "Fright and Flight" responses has origins in the spinal cord between thoracic level 1 and lumbar level 2, (thoracolumbar outflow). By contrast, the parasympathetic nervous system is associated with "tranquillity" and contains craniosacral outflow. The ANS has preganglionic neurones connecting the CNS to autonomic ganglia, and postganglionic neurones connecting the ganglia to effector organs. All preganglionic and parasympathetic postganglionic neurones use acetylcholine, and sympathetic postganglionic neurones use epinephrine as a neurotransmitter.

Lecture 18: Muscle 1. Cellular structure of skeletal muscle - Dr Guy Bewick

Light and electron microscopic structure. Distribution and function of the major muscle proteins (myosin, actin, tropomyosin, troponin etc.). Contraction cycle and the role of ATP. Ca ions and its role in excitation-contraction coupling.

Lecture 19: Muscle 2. Mechanical properties of skeletal muscle - Dr Guy Bewick

Isotonic and isometric contractions. Twitch and tetanus. Correlating the length-tension relationship with sarcomere length and the effect of load on the velocity of contraction. The metabolic basis of muscle activity, fatigue and recovery. The control of muscle tension; motor units; types of muscle fibres.

Lecture 20: Muscle 3. Smooth and Cardiac Muscle - Dr Guy Bewick

Smooth muscle: Cellular structure. Single unit and multi-unit types of organisation. Excitation-contraction coupling. Stimuli causing contractions. Mechanical properties. Cardiac muscle: Structure of the heart. The cardiac action potential and temporal relationship to contraction. Cellular structure of cardiac muscle cells. Excitation-contraction coupling and relaxation. The long refractory period. Length-tension relationship; rate and force of contraction. Summary/comparison of muscle types.

Lecture 21: Sensory systems 1. General features of the sensory systems - Dr Derryck Shewan

This lecture introduces some elementary features of sensory receptors, their transduction mechanisms in order to produce adequate stimuli and mechanisms for coding of stimulus intensity and duration.

Lecture 22: Sensory systems 2. The somatosensory system - Dr Derryck Shewan

Different receptor types are used to communicate information about touch, pressure, vibration and temperature to the body. The coupling of these receptors to the different afferent nerve fibres and their information processing in spinal cord and central nervous system is discussed.

Lecture 23: Sensory systems 3. Pain - Dr Derryck Shewan

Pain is a special case of somatosensory sensations. The central pain pathways in the medulla and midbrain are discussed together with different forms of pain such as referred pain, neuralgia or phantom limb.

Lecture 24: Sensory systems 4. Physiology of the eye and visual pathways - Dr Derryck Shewan

After a brief introduction into the organisation of the retina and the optic of the eye, we will discuss the physiology of blink and pupillary reflexes, highlight normal and abnormal mechanisms of focussing, describe physiology of visual acuity in the retina and establish the mechanisms of processing visual information and colour in the lateral geniculate body and the visual cortex.

Lecture 25: Sensory Systems 5. Physiology of the ear - hearing and balance - Dr Derryck Shewan

The structure of the auditory system is described with emphasis on the ear and the mechanisms of sound transduction in the cochlea. A complex network issues this information to the inferior colliculus and auditory cortex for processing and localisation. Hearing impairments include deafness or hearing loss. A second system associated with the ear is the vestibular organ, a complex membranous labyrinth aiding balance. Tilting movements lead to otolith displacements and may also signal accelerations or gravity.

Lecture 26: Sensory systems 6. The chemical senses - smell and taste - Dr Derryck Shewan

Organs of smell are located in the nose in a specific epithelial arrangement. Activation of cells uses receptors linked to second messenger cascades via G-protein activation. The limbic system is the main recipient of olfactory information in the brain. Taste is categorised into four modalities and, similar to the perception of smell, uses second messenger activation as the transduction mechanism.

Lecture 27: Blood & Defence 1. General features - Dr Alison Jack

The chemical and cellular composition of the blood will be discussed together with the process by which blood cells are formed. We will also consider how blood is typed and the importance of matching blood before transfusion.

Lecture 28: Blood & Defence 2. Homeostasis, haemoglobin and disorders - Dr Alison Jack

This lecture will centre on two main areas, blood homeostasis and the role of haemoglobin. We will discuss how blood clots after injury to prevent blood loss but how under normal conditions remains at the optimum viscosity to flow easily through vessels. We will also consider how haemoglobin carries oxygen around the body and why carbon monoxide is so dangerous. Abnormalities of these two processes, namely haemophilia and anaemia will also be covered.

Lecture 29: Blood & Defence 3. The immune system - Dr Isabel Crane

We will discuss the body's natural immune system and its response to infection or injury - namely inflammation. What triggers inflammation, how is it mediated and what good does it do? We will then compare this to the adaptive immune system - a sophisticated defence system which can remember and recognise the specific pathogens it has previously been exposed to.

Practical/Lab/Tutorial Work

You should bring a white lab coat to all laboratory-based practicals. For laboratory practicals you will be divided into two groups, A & B. Details of practical group membership will be placed on the College Teaching Facility notice boards. During laboratory practicals you will work in groups. Practical schedules will be provided at the start of the Course. Two practical reports (1 report per group) will be produced and submitted during the course and these will be assessed (see Assessment). Each of these reports contributes 10% towards the final Degree assessment.

The practical work required in this course may present difficulties to students with special educational needs. For such students, alternative arrangements will be made. Any student with special needs should make these known to the Course Co-ordinator when registering for the class and should then also discuss their needs with the Disabilities Co-ordinator, Dr Derryck Shewan, to ensure that they have the best possible outcome.

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	Fail	• Contains major errors or misconceptions • Poor presentation
F2	4			
F3	3			
G1	2	Clear Fail/ Abysmal	Fail	• Token or no submission
G2	1			
G3	0			

Course Timetable BI20B2: 2019-2020

Date	Time	Place	Subject	Session	Staff
Week 7					
Mon 9 Sep					
Tue 10 Sep	14:00-15:00	MacRob LT	Introduction	Lecture	GTAM
Wed 11 Sep					
Thu 12 Sep	14:00-15:00	NK6	What is Physiology? Homeostasis	Lecture	GTAM
Fri 13 Sep	14:00-15:00	MT4	Membrane Transport 1	Lecture	GTAM
Week 8					
Mon 16 Sep					
Tue 17 Sep	14:00-15:00	MacRob LT	Membrane Transport 2	Lecture	GTAM
Wed 18 Sep					
Thu 19 Sep	14:00-15:00	NK6	Cell Signalling 1	Lecture	GTAM
Fri 20 Sep	10:00-13:00	ZB03/ZB06	Practical 1: Microscopy; (Group A)	Practical	GTAM/GSB
	14:00-15:00	MT4	Cell Signalling 2	Lecture	GTAM
Week 9					
Mon 23 Sep	15:00-18:00	ZB03/ZB06	Practical 1: Microscopy; (Group B)	Practical	GTAM/GSB
Tue 24 Sep	14:00-15:00	MacRob LT	Hormones 1	Lecture	SJT
Wed 25 Sep					
Thu 26 Sep	14:00-15:00	NK6	Introduction to Pharmacology	Lecture	PM
Fri 27 Sep	14:00-15:00	MT4	Hormones 2	Lecture	SJT
Week 10					
Mon 30 Sep					
Tue 1 Oct	14:00-15:00	MacRob LT	Hormones 3	Lecture	SJT
Wed 2 Oct					
Thu 3 Oct	14:00-15:00	NK6	Mid-term Exam Information Session (Ombea)	Lecture	GTAM
Fri 4 Oct	10:00-13:00	ZG09/ZG11	Practical 2a: SIMNERV (Group A)	Practical	GTAM/GSB
	14:00-15:00	MT4	Hormones 4	Lecture	SJT
Week 11					
Mon 7 Oct	15:00-18:00	ZG09/ZG11	Practical 2a: SIMNERV; (Group B)	Practical	GTAM/GSB
Tue 8 Oct	14:00-15:00	MacRob LT	Nerve Cells & Connections 1	Lecture	SND
Wed 9 Oct					
Thu 10 Oct	14:00-15:00	NK6	Nerve Cells & Connections 2	Lecture	SND
Fri 11 Oct	14:00-15:00	MT4	Nerve Cells & Connections 3	Lecture	SND
Week 12					
Mon 14 Oct					
Tue 15 Oct	14:00-15:00	MacRob LT	Nerve Cells & Connections 4	Lecture	SND
Wed 16 Oct					
Thu 17 Oct	14:00-15:00	NK6	Nerve Cells & Connections 5	Lecture	SND
Fri 18 Oct	10:00-13:00	ZG09/ZG11	Practical 2b: SIMNERV Write-up (Group A)	Practical	GTAM
	14:00-15:00	MT4	Physiology & Pharmacology of Autonomic NS	Lecture	SND
Week 13					
Mon 21 Oct	15:00-18:00	ZG09/ZG11	Practical 2b: SIMNERV Write-up; (Group B)	Practical	GTAM
Tue 22 Oct	14:00-15:00	MacRob LT	Muscle 1	Lecture	GSB
Wed 23 Oct					
Thu 24 Oct	14:00-15:00	NK6	Muscle 2	Lecture	GSB
Fri 25 Oct	14:00-15:00	MT4	Muscle 3	Lecture	GSB

Week 14					
Mon 28 Oct					
Tue 29 Oct	14:00-15:00	MacRob LT	Sensory systems 1	Lecture	DS
Wed 30 Oct					
Thu 31 Oct	14:00-15:00	NK6	Sensory systems 2	Lecture	DS
Fri 1 Nov	10:00-13:00	ZG09/ZG11	Mid-term exam (Group A)	Assessment	GTAM
	14:00-15:00	MT4	Sensory systems 3	Lecture	DS
Week 15					
Mon 4 Nov	15:00-18:00	ZG09/ZG11	Mid-term exam (Group B)	Assessment	GTAM
Tue 5 Nov	14:00-15:00	MacRob LT	Sensory systems 4	Lecture	DS
Wed 6 Nov					
Thu 7 Nov	14:00-15:00	NK6	Sensory systems 5	Lecture	DS
Fri 8 Nov	10:00-13:00	ZB03/ZB06	Practical 3: Sensory Physiology (Group A)	Practical	GTAM/DS
	14:00-15:00	MT4	Sensory systems 6	Lecture	DS
Week 16					
Mon 11 Nov	15:00-18:00	ZB03/ZB06	Practical 3: Sensory Physiology (Group B)	Practical	GTAM/DS
Tue 12 Nov	14:00-15:00	MacRob LT	Sensory Systems 7	Lecture	DS
Wed 13 Nov					
Thu 14 Nov	14:00-15:00	NK6	Blood & Defence 1	Lecture	AMJ
Fri 15 Nov	14:00-15:00		Free Study/No lecture		
Week 17					
Mon 18 Nov					
Tue 19 Nov	14:00-15:00	MacRob LT	Blood & Defence 2	Lecture	AMJ
Wed 20 Nov					
Thu 21 Nov	14:00-15:00	105 St Marys	Blood & Defence 3	Lecture	IJC
Fri 22 Nov	14:00-15:00	MT4	Exam Information and FAQ	Lecture	GTAM

Staff

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Dr Alison Jack (AMJ), Medical Sciences
Dr Pietro Marini (PM), Medical Sciences
Prof Gordon McEwan (GTAM), Medical Sciences (Course Co-ordinator)
Dr Steve Tucker (SJT), Medical Sciences