



BM4009

**Staying Alive:
Adaptation in
Physiological
Systems**

**Course Handbook
2019-20**

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

The aims of the course are to provide advanced knowledge and understanding of the physiological adaptations of major body systems. Specifically we will examine how physiological systems maintain normal body function and study how these systems adapt to changing conditions under different circumstances, such as disease and exercise.

Course Aims & Learning Outcomes

The physiology of adaptation consists of complex interactions involving several major physiological systems. In order to truly understand physiological adaptation, you must first study individual systems and how they regulate normal body function.

This course considers major systems and their role in physiological adaptation. This includes:

- 1) Skeletal muscle and the way in which it responds and adapts during exercise to maintain strength and endurance.
- 2) The skeleton and bone integrity which provides structural support in normal conditions but adapts to changing environments.
- 3) Understand how normal body function is maintained by blood flow and regulation of the cardiovascular system, and how this adapts to different conditions.
- 4) Glucose metabolism and the adaptations involved, particularly in diabetes.
- 5) The inflammatory systems and the adaptations which occur during the development of sepsis.

Additionally, disease greatly affects the ability of the body to adapt. The effects of different pathological conditions will be discussed for each physiological system examined.

Course Teaching Staff

Course Co-ordinator(s):

Professor Graeme Nixon g.f.nixon@abdn.ac.uk (tel: (43)7405)

Other Staff:

Prof Alison Jenkinson (AJ), a.jenkinson@abdn.ac.uk

Dr Michael Scholz (MES), m.e.scholz@abdn.ac.uk

Dr Derek Scott (DS), d.scott@abdn.ac.uk

Prof Mirela Delibegovic (MD), m.delibegovic@abdn.ac.uk

Dr Jenny Gregory (JG), j.gregory@abdn.ac.uk

Prof Helen Galley (HG), h.f.galley@abdn.ac.uk

Assessments & Examinations

Students are expected to attend all lectures, laboratory classes, and tutorials, and to complete all class exercises by stated deadlines. The minimum performance acceptable is attendance at the practical classes, and presentation of all set course work, written and oral.

- a. Continuous assessment - will comprise 30% of the total. The practical exam which is part of the OSPE will also contribute 20% towards final course mark. The Problem Solving exercise will be marked and contribute 10%.
- b. Examination - this will take place in the summer diet, May/June. It will take the form of an essay-based examination, which will comprise 70% of the assessment for BM4009. It will be a 2-hour exam in which 2 essays are attempted from a choice of 4.

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 (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

A number of general textbooks are useful. More specific references will be given to you at the time of the lectures.

Astrand P.O. & Rodahl, K, Dahl H, Stromme S - Textbook of Work Physiology-4th Edition: Physiological Basis of Exercise, 2003, ISBN: 0736001409, Publishers: Human Kinetics

Levick J.R. – An introduction to Cardiovascular Physiology (4th Edition), 2003, ISBN 0340809213, Publishers: Hodder Arnold

Lecture Synopsis

Diabetic adaptations 1 & 2 - Professor Mirela Delibegovic

This set of lectures concentrates on causes and consequences of the development of insulin resistance and diabetes mellitus. We discuss how the body normally regulates glucose homeostasis under fed and fasting conditions, with specific emphasis on the pancreatic β -cells and insulin secretion. We also discuss the role of adipose tissue, muscle, liver and the brain and the cross-talk between the tissues under normal physiological and pathophysiological conditions. We also discuss the signalling pathways thought to play a role in the development of insulin resistance and how these converge to impact different tissues in the body.

In vivo regulation of blood flow 1 & 2 - Professor Graeme Nixon

Blood flow and blood pressure must constantly adapt to the changing demands of body function, either at rest or during exercise. This requires several physiological mechanisms to detect and produce these changes. These mechanisms will be examined and discussed in the context of different physiological situations.

Statistical analysis of data - Dr Derek Scott

How to approach statistical analyses of scientific data to prove hypotheses will be covered.

Angiogenesis - Professor Graeme Nixon

Angiogenesis is the growth of new blood vessels from existing vessels. The physiological and pathological conditions which lead to angiogenesis will be examined, particularly with respect to muscle growth. The mechanisms which lead to endothelial cell proliferation and migration to form tubules (early stage blood vessels) will also be discussed.

Satellite cells 1 & 2 - Dr Michael Scholz

Importance of satellite cells for the skeletal muscle in relation to characteristic properties of skeletal muscle cells, embryonic myogenesis and formation of satellite cells. Control of satellite cells: lineage determination by myogenic transcription factors and the underlying mechanisms, Growth factors and external control of satellite cells. Importance of satellite cells for repair and maintenance, regenerative capacity. Hypertrophy and satellite cells, Satellite cells and ageing

Free radical physiology 1 & 2 - Professor Alison Jenkinson

Skeletal muscle damage, the repeated bout effect and free radical activity. Oxidative stress, redox state, adaptations and interventions.

Skeletal physiology and adaptation 1 & 2 - Dr Jenny Gregory

The skeleton supports and facilitates movement, protects vital organs and acts as a reservoir for mineral homeostasis. Bone remodelling is a process that occurs throughout life to repair and renew bones. The balanced activities of bone-resorbing osteoclasts and bone-forming osteoblasts are critical for this process and both cell types respond to classic and newly-discovered hormones that regulate the levels of calcium and phosphate in the body. Deficiency or overproduction of these hormones results in life-threatening conditions that further highlight the critical role that the skeleton plays in maintaining mineral homeostasis. In addition, the study of diseases that affect different aspects of the bone remodelling cycle has highlighted proteins that are critical for the formation, function and activity of bone cells.

Inflammatory adaptations in sepsis 1 & 2 – Prof Helen Galley

Physiology of host immune and inflammatory responses and the process of resolution will be examined and its adaptation during disease processes. Sepsis is defined as a life threatening dysregulated inflammatory in adaptation to an infection. The pathophysiology of sepsis and highlight novel interventional approaches to attempt to restore homeostasis will be examined.

Practical/Lab/Tutorial Work

Laboratory Work

The practical work for BM4009 will take the form of 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 at the specified time slot 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 BM4009 is Dr Derek Scott (d.scott@abdn.ac.uk). The OSPE will contribute 20% 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.

Problem Solving Sessions

There will be one Problem Solving session (see timetable), in which you will be given an abstract of a published paper and a set of questions based on the information provided. Attendance at this session is mandatory. In the first part of the problem solving session you will be given instructions on how to tackle problem solving exam questions in a class tutorial. In the second part of the problem solving session, you will be given a similar exercise to do under exam-like conditions in the Polwarth Teaching Laboratory. This second assessment will

be marked by academic staff and the resulting mark will be used as part of your continuous assessment for the course (contributing 10% of your final mark for BM4009). You will be provided with important feedback at the tutorial session. Everyone must participate in this exercise which is important practice for the problem solving paper in the final exams in May.

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'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 BM4009: 2019-2020

Date	Time	Place	Subject	Session	Staff
Week 7					
Mon 9 Sep	10:00-11:00	1:143/144	Course Introduction	Lecture	GFN
Tue 10 Sep					
Wed 11 Sep	12:00-13:00	FLT	Diabetic adaptations 1	Lecture	MD
Thu 12 Sep	09:00-13:00	2:054	Practical: Introduction to the physiology OSPE	Practical	DS, AJ
	14:00-17:00	2:054			
Fri 13 Sep	10:00-11:00	1:143/144	Diabetic adaptations 2	Lecture	MD
Week 8					
Mon 16 Sep	10:00-11:00	1:143/144	In vivo adaptation of blood flow 1	Lecture	GFN
Tue 17 Sep					
Wed 18 Sep	12:00-13:00	BMP Workshop D2	In vivo adaptation of blood flow 2	Lecture	GFN
Thu 19 Sep	09:00-17:00	2:054	Practical: Physiology OSPE group I	Practical	DS, AJ, MES
Fri 20 Sep	11:00-12:00	FLT	Statistical analysis of data	Lecture	DS
Week 9					
Mon 23 Sep	10:00-11:00	1:143/144	Angiogenesis	Lecture	GFN
Tue 24 Sep					
Wed 25 Sep	12:00-13:00	FLT	Satellite cells 1	Lecture	MES
Thu 26 Sep	09:00-13:00	2:054	Practical: Physiology OSPE group II	Practical	DS, AJ, MES
	14:00-17:00	2:054			
Fri 27 Sep	10:00-11:00	1:143/144	Satellite cells 2	Lecture	MES
Week 10					
Mon 30 Sep	10:00-11:00	1:143/144	Free radical physiology 1	Lecture	AJ
Tue 1 Oct					
Wed 2 Oct	12:00-13:00	FLT	Free radical physiology 2	Lecture	AJ
Thu 3 Oct	10:00-15:00	2:054	Physiology Problem Solving	Practical	GFN
Fri 4 Oct	11:00-12:00	FLT	Skeletal physiology and adaptation 1	Lecture	JG
Week 11					
Mon 7 Oct	10:00-11:00	1:143/144	Inflammation and adaptation in sepsis 1	Lecture	HG
Tue 8 Oct					
Wed 9 Oct	12:00-13:00	FLT	Skeletal physiology and adaptation 2	Lecture	JG
Thu 10 Oct					
Fri 11 Oct	10:00-11:00	1:143/144	Inflammation and adaptation in sepsis 2	Lecture	HG

Staff

Prof Graeme Nixon (GFN), Co-ordinator
 Prof Alison Jenkinson (AJ)
 Prof Mirela Delibegovic (MD)
 Dr Michael Scholz (MS)
 Dr Derek Scott (DS)
 Dr. Jenny Gregory (JS)
 Prof Helen Galley (HG)