



SR4301

Exercise Physiology

**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

The course provides a detailed coverage of the physiological responses to exercise, using both human and animal models. It emphasises the factors which are thought to limit exercise capacity in different situations. There will be emphasis on fatigue in high intensity exercise, with a focus on adenine nucleotide depletion, effects of pH on muscle contractility, and electrolyte changes in muscle. The potential limitations to oxygen transport will be discussed. The factors associated with fatigue in prolonged exercise will also be examined. These include: substrate depletion, thermal balance, dehydration. The aspects of biomechanics contributing to exercise performance and locomotion in general will be discussed. How the body adapts to training and the effects of excessive overload will also be considered. This will include both positive and negative effects of training which may influence health and performance. In addition, the influence of genotype on performance will be investigated.

Course Co-ordinators: Dr Arimantas Lionikas (ext 438025) a.lionikas@abdn.ac.uk; Professor Alison Jenkinson (ext 437539) a.jenkinson@abdn.ac.uk

Course Aims & Learning Outcomes

The aim of this course is to pull together material previously covered in different parts of the curriculum and to focus specifically on the following areas:

- What limits exercise performance in exercise of different intensity and duration?
- Beginning from an understanding of the factors that cause fatigue and limit performance, what physiological, biochemical and nutritional interventions can improve performance?
- How does adaptability to training overload alter health and performance?
- How does the genotype affect performance?

This provides students with a detailed understanding of the fatigue processes in exercise, positive and negative effects of training and strategies that can be used to improve performance.

To enable students to be able to:

1. Describe the physiological response to exercise of different intensities and durations.
2. Describe the causes of fatigue in different types and intensity of exercise.
3. Describe how overload, training and genetics can influence health and performance.
4. Demonstrate relevant literature search techniques.

Course Teaching Staff

Course Co-ordinator(s):

Professor A. Jenkinson (AMJ), Medical Sciences & Dr A. Lionikas (AL), Medical Sciences

Other Staff:

Dr F. Groening (FG), Medical Sciences

Dr M.E. Scholz (MES), Medical Sciences

Assessments & Examinations

Students are expected to attend all timetabled classes and to complete the class exercise by the appropriate deadline. It is imperative that any reasonable explanation for not attending the oral examination are made to the course organiser (Dr A. Lionikas or Prof A. Jenkinson) before the deadline. Otherwise there will be no continuous assessment mark and the class certificate, which is required to sit the examination, may be withheld.

Continuous assessment: (30%) of the course assessment is based on a viva voce (oral) Examination (10%), an essay assignment (10%) and the practical report (10%).

Written Examination: 70% of the course assessment is based on one two hour written paper.

Common grading scale (CGS) grade: The overall performance of the student is expressed as a grade awarded on the common spine marking scale.

The degree examination for this course will be held in the May/June examination 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 Medicine, Medical Sciences and 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)
- 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.

Course Reading List

Recommended reading will be issued by each lecturer during their teaching sessions in the course.

Lecture Synopsis

The course is divided into three different areas. Within each area, factors that are involved in the fatigue process, beneficial and harmful effects of training and strategies that could be implemented to overcome these factors or delay the fatigue process will be studied.

Module 1: Energy metabolism - Professor A Jenkinson and Dr M Scholz

Factors involved in the fatigue process:

- Causes of fatigue: depletion and accumulation theories
- ATPase activity in muscle
- Phosphagen metabolism: maintaining the ATP concentration
- Lactate thresholds: separating fact from fiction

Strategies for performance improvement:

- Designing a training programme
- Nutritional interventions that affect metabolic processes

Module 2: Cardiorespiratory function, thermoregulation and fluid/electrolyte imbalance - Dr A Lionikas and Dr M Scholz

Limitations to performance:

- Cardiac dimensions and cardiovascular function in athletes
- Relationship between cardiac function and endurance performance
- Muscle blood flow and distribution of cardiac output
- The respiratory tract
- Exercise in the heat
- Effects of dehydration and rehydration on cardiac output and blood flow
- The role of potassium

Interventions:

- Training effects on cardiorespiratory performance
- Blood volume expansion (re-infusion, EPO etc)
- Altitude training
- Fluid replacement
- Acclimation

Module 3: Training and overload, biomechanical and genetic limitations - Dr A Lionikas and Dr F Groening

Limitations to performance:

- Adaptation of skeletal muscle
- Biomechanics
- Genotype

Practical/Lab/Tutorial Work

Practical

The aim of the practical to investigate the thermoregulatory responses to acute exposure in hot and cold environments. It will take place on two separate sessions, on week 16 and week 17. At the end students will have to write a report.

Oral examination

The oral examination will last 15 minutes and will take place on Tuesday 20th November. Detailed times and venues to be confirmed. The object of this exercise is to give you experience in oral presentation and to assess your paper analysis skills. This will expand on the skills developed on BM4009 and SR4007 and help you prepare for the oral examinations,

which will be the final part of the evaluation for your degree, and job interviews. Each student will be allocated a scientific paper related to exercise science and you will be expected to answer questions on this and discuss it in detail. You may be asked to illustrate your answer with a drawing or graph which should contain details such as calibration bars and axes and explain your figure. You will also be expected to have read around the subject area prior to the examination. The assessor at the oral exam will be asked to give some constructive comments on your performance at the end of your discussion.

Essay

The purpose of the essay assignment is to assist your preparation to the format of the finals. An essay will have to be written within one hour to mimic exam conditions. Essay question will be announced in the beginning of the course. Therefore, a detailed, coherent, well-illustrated, referenced and logically organized piece of work is expected.

Analysis/Problem Solving assessment

Further details will be provided during the course.

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 SR4301: 2019-2020

Date	Time	Place	Subject	Session	Staff
Week 13					
Mon 21 Oct	12:00-13:00	1:039/040	Energy metabolism 1	Lecture	AMJ
Tue 22 Oct					
Wed 23 Oct	09:00-10:00	1:039/040	Energy metabolism 2	Lecture	AMJ
	10:00-11:00	1:039/040	Viva tutorial	Tutorial	AMJ
Thu 24 Oct					
Fri 25 Oct	10:00-11:00	1:147	Energy metabolism 3	Lecture	MES
Week 14					
Mon 28 Oct	12:00-13:00	1:039/040	Cardiorespiratory Function 1	Lecture	AL
Tue 29 Oct					
Wed 30 Oct	09:00-10:00	1:039/040	Cardiorespiratory Function 2	Lecture	AL
Thu 31 Oct					
Fri 1 Nov	10:00-11:00	1:147	Thermoregulation & fluid/electrolyte imbalance 1	Lecture	MES
Week 15					
Mon 4 Nov	12:00-13:00	1:039/040	Thermoregulation & fluid/electrolyte imbalance 2	Lecture	MES
Tue 5 Nov					
Wed 6 Nov	09:00-10:00	1:039/040	Skeletal muscle and exercise 1	Lecture	AL
Thu 7 Nov	13:00-15:00	1:154	Essay	Assess	AL
Fri 8 Nov	10:00-11:00	1:147	Skeletal muscle and exercise 2	Lecture	AL
Week 16					
Mon 11 Nov	12:00-13:00	1:039/040	Genotype and muscle properties 1	Lecture	AL
Tue 12 Nov					
Wed 13 Nov	09:00-10:00	1:039/040	Genotype and muscle properties 2	Lecture	AL
Thu 14 Nov	10:00-13:00	HSB Lab	Thermoregulation 1	Practical	AL
Fri 15 Nov	10:00-11:00	1:147	Cellular signalling and adaption to exercise 1	Lecture	MES
Week 17					
Mon 18 Nov	12:00-13:00	1:039/040	Cellular signalling and adaption to exercise 2	Lecture	MES
Tue 19 Nov	10:00-18:00	5.33 IMS	Vivas	Viva	AMJ
Wed 20 Nov	09:00-10:00	1:039/040	Sports biomechanics 1	Lecture	FG
Thu 21 Nov	10:00-13:00	HSB Lab	Thermoregulation 2	Practical	AL
	14:00-16:00	1:039/040	Problem solving assignment	Assessment	AMJ
Fri 22 Nov	10:00-11:00	1:147	Sports biomechanics 2	Lecture	FG
Week 18 - No teaching during this week REVISION WEEK					
Mon 25 Nov	12:00-13:00	1:039/040	Problem solving exam preparation	Revision Session	AMJ
Tue 26 Nov					
Wed 27 Nov					
Thu 28 Nov					
Fri 29 Nov	10:00-11:00	1:039/040	Private Revision	Study	

Staff

Prof A. Jenkinson (AMJ), Medical Sciences, Course Co-ordinator
Dr A. Lionikas (AL), Medical Sciences, Course Co-ordinator
Dr M.E. Scholz (MES), Medical Sciences
Dr F. Groening (FG), Medical Sciences