A close-up of a logo

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*SM3003- Frontiers of Applied Medical Sciences*

*Course Handbook 2023-2024*



*Undergraduate Medical Sciences*

*School of Medicine, Medical Sciences & Nutrition*

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Course Summary

This course provides core material regarding the physiological responses to acute exercise and the adaptations that occur in response to repeated bouts of exercise. It deals with the measurement of energy, work and power, the structure and function of skeletal muscle, respiration and control of acid-base status, cardiovascular function, and temperature regulation during exercise, the adaptation to training, and mechanisms of fatigue.

Course Co-ordinators: Dr Michael Scholz (ext 8022) m.e.scholz@abdn.ac.uk

Course Aims & Learning Outcomes

To provide students with core knowledge appropriate to the study of the physiological responses and adaptations to physical exercise. Specifically, to:

1. Provide a basic understanding of the concepts of energy, work and power as applied to the exercising human.
2. Give an overview of the factors that determine muscle strength in man, the adaptations of skeletal muscle to strength training, and the contractile and metabolic properties of different muscle fibre types.
3. Explain the control of ventilation and the ventilatory response to exercise: considering both gas transport and acid-base roles of the lungs.
4. Present the function of the cardiovascular system at rest and during exercise, and discuss possible sites of limitation to the transport of oxygen and the adaptations that occur with training.
5. Explain thermal balance of man during exercise in different environments.
6. Introduce the theory of training and the adaptations that occur in response to different types of training.

Course Teaching Staff

Course Co-ordinator(s):

Dr Michael Scholz (MES), Medical Sciences & Prof Alison Jenkinson (AMJ), Medical Sciences

Other Staff:

Dr Guy Bewick (GB), Medical Sciences

Dr Derek Ball (DB), Medical Science

Prof Stephen Davies (SND), Medical Sciences

Dr Arimantas Lionikas (AL), Medical Sciences

Susan McCourt (SM), Library & Information Services

Assessments & Examinations

Students are expected to access and study **ALL** lectures, online test materials, tutorials and workshops and to complete all exercises by the given deadlines. The minimum performance acceptable for the granting of a class certificate is evidence of engagement with, at least, 50% of the lectures and tutorials/workshops, and completion of all set course work, written and oral, Failure to achieve this may result in your class certificate being withheld

The course assessment consists of 50% continuous assessment (CA) and 50% course tests (essay question/case study). Further information will be provided during the course. The continuous assessment is based on the course essay (22.5%), the oral presentation (12.5%) and the data analysis and blood pressure workshops (7.5% each). Resit assessment will be based on a resit examination constituting 50% of the resit grade; the remaining 50% will come from previous continuous assessment.

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

# 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](http://www.ausa.org.uk) or email the VP Education & Employability [vped@abdn.ac.uk](mailto: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](http://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 the medical sciences office, ([medsci@abdn.ac.uk](mailto:medsci@abdn.ac.uk)) (based in the Polwarth Building, Foresterhill) 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 half session during the summer vacation), coursework will be kept until the end of Fresher’s Week, during the new academic year. After that point, unclaimed student work will be securely destroyed.

Course Reading List

Astrand, P.O., Rodahl, K, Dahl, M.A & Stromme, S.B. Textbook of Work Physiology (Physiological Bases of Exercise), 2004, ISBN 0-7360-0140-9, Human Kinetics.

McArdle W.D., Katch F.I., Katch V.L.. Exercise Physiology:, Nutrition, Energy & Human Performance 9th edition. Publishers: Wolters Kluwer. 2023

Powers, S.K, Howley E.T Exercise Physiology - Theory and Application to Fitness and Performance, Ninths edition, 2015 ISBM 978-1-259-09500-9, McGraw-Hill

Lecture Synopsis

Lecture 1: Applied Medical Sciences: an overview - Dr Michael Scholz & Prof Alison Jenkinson

Description of the content of Course SM3003 and introduction to the physiology of exercise. Expectations with regard to continuous assessment (essay & presentation).

Lecture 2-3: Energy, work and power - Dr Michael Scholz

Lecture 2: Units of measurement. Energy, work and power defined. Laboratory measurement of work and power. Measurement of energy expenditure.

Lecture 3: Laboratory measures of aerobic and anaerobic power and capacity. Absolute and relative power output: maximum oxygen uptake. Limitations to predictive methods. Calculation of mechanical efficiency. Laboratory tests of performance.

Lecture 4-6: Respiration and acid-base balance - Dr Derek Ball

Lecture 4: Mechanics & control of breathing. Lung structure and function. Physics of breathing. Transport of oxygen and carbon dioxide. Controls of breathing: central and peripheral chemoreception. Other control mechanisms.

Lecture 5: Ventilation during exercise. Energy for respiration. Effects of exercise intensity and duration. The lungs as a limiting factor in exercise.

Lecture 6: Acid-base balance in exercise. Metabolic acidosis. Respiratory compensation. Renal and non-renal mechanisms.

Lecture 7-11: Skeletal muscle structure and function. - Dr Alison Jenkinson

Lecture 8: Skeletal Muscle - an overview: muscle structure and mechanisms of contraction. Isometric, isotonic and isokinetic contraction. Neural control of movement.

Lecture 9: Determinants of muscle strength. Muscle size; anatomical and physiological cross section. Experimental models in man. Voluntary and evoked contractions.

Lecture 10: Muscle fibre types. Contractile and metabolic characteristics of different fibre types. Recruitment patterns in different activities. Implications for muscle strength.

Lecture 11: Effects of training on muscle strength. Hypertrophy vs hyperplasia. Limits to adaptation. Effects of disuse on muscle mass and function. Effects of ageing on strength.

Lecture 12-15: Cardiovascular function - Prof Stephen Davies

Lecture 12: The heart. Heart rate, stroke volume and cardiac output. Control of heart rate at rest and during exercise of varying intensities. Cardiac drift. Control of blood pressure. Cardiac output as a limitation to oxygen uptake. Adaptations to training. (SND)

Lecture 13: The peripheral circulation. Muscle capillarity. Fibre types and capillary density. Adaptations to endurance exercise. Implications of altered capillary density. (SND)

Lecture 14: Oxygen utilisation in the periphery. Muscle metabolic capacity as a limitation to maximum oxygen uptake. Integration of the metabolic and cardio-respiratory response to exercise. Adaptations to training. (SND)

Lecture 15-17: Training and Adaptation – Dr Arimantas Lionikas

Lecture 15: Principles of training. Classical and contemporary views of mechanisms that control adaptation to training.

Lecture 16: Strength training; training forms to increase muscle size and neural activations. Muscle protein synthesis response to resistance training. Neural adaptations.

Lecture 17: Endurance training; ACSM guidelines, programmes for athletes, introduction to mechanisms that regulate fibre phenotype, mitochondrial biogenesis and cardiac hypertrophy.

Lecture 18-20: Endocrinology – Dr Derek Ball

Lecture 18: Introduction and overview

Lecture 19/20: Endocrinology and Exercise

Lecture 21-24: The body in extreme environments –Dr Michael Scholz

Lecture 21: Principles of heat production and heat loss during exercise. Exercise in the heat: physiological impact and effect on performance.

Lecture 22: Exercise in the cold: heat conservation mechanisms, risks and tolerance.

Lecture 23: Exercise at altitude: atmospheric changes at altitude, physiological adjustments, impact on performances, acclimatization.

Lecture 24: Diving - water as surrounding media: buoyancy, density, viscosity, gasses under high pressure, nitrogen narcosis, oxygen toxicity, tissue saturation, decompression, SCUBA-diving, apnoea diving

Lecture 25-27: Fatigue and limitations to exercise performance. - Dr Derek Ball

Lecture 25: Performance measures and assessment of fatigue. Causes of fatigue in high intensity exercise. Depletion and accumulation hypotheses. Anaerobic capacity and oxygen deficit. Oxygen supply. Acid-base and manipulation of performance.

Lecture 26: Causes of fatigue in prolonged exercise. Substrate depletion. Cardiovascular function: maintenance of muscle perfusion and skin blood flow. Maintenance of central venous pressure.

Lecture 27: The central fatigue hypothesis. Serotonin and fatigue. Circumstantial evidence. Experimental interventions: pharmacological studies. Animal models. Training and serotonergic function.

Practical/Lab/Tutorial Work

**Course Work**

All students will complete a 1,500-word essay on a set subject. Your essay should include a list of cited references and these should be cited at appropriate places in the text. The essay must be submitted in word-processed format. The deadline for essay submission is Monday 7th November at 13.00 and should be submitted using Turnitin. A link will be made available on MyAberdeen. The essay content and titles will be discussed during the Essay Topics tutorial.

In addition, you will have to complete a seminar based on the content of your course essay to the class. Each seminar will consist of a 10-minute PowerPoint presentation followed by a 5-minute discussion and a further 5 minutes to allow peer assessment. The criteria for assessing each presentation is given on a separate sheet. Presentations will be delivered via Blackboard Collaborate.

**Data analysis and blood pressure workshops**

Details to follow.

**Health and Safety**

Before you start your laboratory work, you will have to attend a short course on Health and Safety. This is a legal requirement and you will have to complete and submit a short test to show that you have attended. You will not be allowed to continue with the rest of the course unless you have satisfactorily completed this test.

University Policies

Students are asked to make themselves familiar with the information on key education policies, available [here](https://www.abdn.ac.uk/staffnet/teaching/key-education-policies-for-students-11809.php). 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 how the University will calculate your degree outcome.

These University wide education policies should be read in conjunction with this programme and/or course handbook, in which School specific policies are detailed. These policies are effective immediately, for the 2023/24 academic year. Further information can be found on the [University’s Infohub webpage](https://www.abdn.ac.uk/students/) or by visiting the Infohub.

The information included in the institutional area for 2023-24 includes the following:

* Absence
* Appeals & Complaints
* Assessment
* Avoiding Plagiarism
* Communication
* Graduate Attributes
* MyAberdeen
* Student Learning Service (SLS)
* Student Monitoring/Class Certificates
* Student Discipline
* The Co-curriculum

Where to Find the Following Information:

C6/C7- University of Aberdeen Homepage > Students > Academic Life > Monitoring and Progress > Student Monitoriung (C6 & C7)

https://www.abdn.ac.uk/students/academic-life/student-monitoring.php#panel5179

Absences- To report absences you should use the absence reporting system tool on Student Hub. Once you have successfully completed and sent the absence form you will get an email that your absence request has been accepted. The link below can be used to log onto the Student Hub Website and from there you can record any absences you may have.

[Log In - Student Hub (ahttps://www.abdn.ac.uk/studenthub/loginbdn.ac.uk)](https://www.abdn.ac.uk/studenthub/login)

Submitting an Appeal- University of Aberdeen Homepage > Students > Academic Life > Appeals and Complaints

https://www.abdn.ac.uk/students/academic-life/appeals-complaints-3380.php#panel2109

Academic Language & Skills support

For students whose first language is not English, the Language Centre offers support with Academic Writing and Communication Skills.

Academic Writing

* Responding to a writing task: Focusing on the question
* Organising your writing: within & between paragraphs
* Using sources to support your writing (including writing in your own words, and

citing & referencing conventions)

* Using academic language
* Critical Thinking
* Proofreading & Editing

Academic Communication Skills

* Developing skills for effective communication in an academic context
* Promoting critical thinking and evaluation
* Giving opportunities to develop confidence in communicating in English
* Developing interactive competence: contributing and responding to seminar discussions
* Useful vocabulary and expressions for taking part in discussions

More information and how to book a place can be found here

Medical Sciences Common Grading Scale

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Grade | Grade Point | % Mark | Category | Honours Class | Description |
| A1 | 22 | 90-100 | 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 | 85-89 |  |
|  |
| A3 | 20 | 80-84 |  |
|  |
| A4 | 19 | 75-79 |  |
|  |
| A5 | 18 | 70-74 |  |
|  |
| B1 | 17 | 67-69 | 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 | 64-66 |  |
|  |
| B3 | 15 | 60-63 |  |
|  |
| C1 | 14 | 57-59 | 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 | 54-56 |  |
|  |
| C3 | 12 | 50-53 |  |
|  |
| D1 | 11 | 47-49 | 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 | 44-46 |  |
|  |
| D3 | 9 | 40-43 |  |
|  |
| E1 | 8 | 37-39 | 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 | 34-36 |  |
|  |
| E3 | 6 | 30-33 |  |
|  |
| F1 | 5 | 26-29 | Clear Fail | Not used for Honours | • Contains major errors or misconceptions • Poor presentation |  |
|  |
| F2 | 4 | 21-25 |  |
|  |
| F3 | 3 | 16-20 |  |
|  |
| G1 | 2 | 11-15 | Clear Fail/Abysmal |  | • Token or no submission |  |
|  |
| G2 | 1 | 1-10 |  |
|  |
| G3 | 0 | 0 |  |
|  |

Course Timetable SM3003: 2023-2024

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date | Time | Place | Subject | Session | Staff |
| Week 8 | | | | | |
| Mon 18 Sep | 12:00-13:00 | MT2 | Course introduction | Lecture |  |
| Tue 19 Sep |  |  |  |  |  |
| Wed 20 Sep | 10:00-11:00 | MR051 | Applied Medical Sciences: an overview | Lecture | MES/AMJ |
| Thu 21 Sep | 14:00-15:00 | \* | Private study time | N/A |  |
| Fri 22 Sep | 12:00-13:00 | MT6 | Energy, work & power 1 | Lecture | MES |
| Week 9 | | | | | |
| Mon 25 Sep | 10:00-11:00 | NK6 | Safety course - part 1 (with SM3002) | Lecture | GSB |
| 12:00-13:00 | MT2 | Mechanics & control of breathing | Lecture | DB |
| Tue 26 Sep |  |  |  |  |  |
| Wed 27 Sep | 10:00-11:00 | MR051 | Ventilation during exercise | Lecture | DB |
|  | 11:00-12:00 | ZG18 | Safety course - part 2 (with SM3002) | Lecture | GSB |
| Thu 28 Sep | 15:00-18:00 | Comp S81 | Essay & Presentation Preparation - Introduction | Tutorial | MES |
| Fri 29 Sep | 12:00-13:00 | MT6 | Energy, work & power 2 | Lecture | MES |
| Week 10 | | | | | |
| Mon 2 Oct | 12:00-13:00 | MT2 | Acid-base balance in exercise | Lecture | DB |
| Tue 3 Oct |  |  |  |  |  |
| Wed 4 Oct | 12:00-13:00 | FN2 | Using Library Resources Lecture | Lecture | EB |
| Thu 5 Oct | 13:00-14:30 | LCR3 | Using Library Resources Group 1 | Practical | EB |
| 14:30-16:00 | LCR3 | Using Library Resources Group 2 | Practical | EB |
|  |  |  |  |  |  |
| Fri 6 Oct | 12:00-13:00 | MT6 | Private study time | N/A |  |
| Week 11 | | | | | |
| Mon 9 Oct | 12:00-13:00 | MT2 | Skeletal muscle - 1 | Lecture | AMJ |
| Tue 10 Oct |  |  |  |  |  |
| Wed 11 Oct | 10:00-11:00 | MR051 | Skeletal muscle - 2 | Lecture | AMJ |
| Thu 12 Oct |  |  |  |  |  |
| Fri 13 Oct | 12:00-13:00 | MT6 | Practical skills: Blood pressure | Tutorial | MES |
| Week 12 | | | | | |
| Mon 16 Oct | 12:00-13:00 | MT2 | Cardiovascular response to exercise 1 | Lecture | DB |
| Tue 17 Oct |  |  |  |  |  |
| Wed 18 Oct | 10:00-11:00 | MR051 | Skeletal muscle - 3 | Lecture | AMJ |
| Thu 19 Oct | 9:00-12:00 |  |  |  |  |
| Fri 20 Oct | 12:00-13:00 | MT6 | Skeletal muscle - 4 | Lecture | AMJ |
| Week 13 | | | | | |
| Mon 23 Oct | 12:00-13:00 | MT2 | Cardiovascular response to exercise 2 | Lecture | DB |
| Tue 24 Oct |  |  |  |  |  |
| Wed 25 Oct | 10:00-11:00 | MR051 | Training mechanisms | Lecture | AL |
| Thu 26 Oct | 10:00-12:00 | Comp G21/ Comp G40 | Case study assessment | Assessment | MES/JG |
|  | 14:00-16:00 | STH 0.001 | Practical skills: Blood pressure | Practical | MES |
| Fri 27 Oct | 12:00-13:00 | MT6 | Limitations to cardiac performance | Lecture | DB |
| Week 14 | | | | | |
| Mon 30 Oct | 12:00-13:00 | MT2 | Strength training | Lecture | AL |
| Tue 31 Oct |  |  |  |  |  |
| Wed 1 Nov | 10:00-11:00 | MR051 | Endurance training | Lecture | AL |
| Thu 2 Nov | 13:00-17:00 | Comp F81 | Data handling/analysis practical | Practical | AL |
| Fri 3 Nov | 12:00-13:00 | MT6 | Endocrinology I: Introduction and Overview | Lecture | DB |
| Week 15 | | | | | |
| Mon 6 Nov | 12:00-13:00 | MT2 | Endocrinology II: Endocrinology & Exercise | Lecture | DB |
|  | by 12:00 |  | Deadline for essay submission |  |  |
| Tue 7 Nov |  |  |  |  |  |
| Wed 8 Nov | 10:00-11:00 | MR051 | Endocrinology III: Endocrinology & Exercise | Lecture | DB |
| Thu 9 Nov | 10:00-12:00 | Comp G21/ Comp G40 | Data handling/analysis practical | Practical | AL |
|  | 14:00-16:00 | Comp F81 | How to make an effective presentation | Tutorial | MES |
| Fri 10 Nov | 12:00-13:00 | MT6 | Exercise in extreme environments I: Temperature regulation in the heat | Lecture | MES |
| Week 16 | | | | | |
| Mon 13 Nov | 12:00-13:00 | MT2 | Exercise in extreme environments II: Temperature regulation in the cold | Lecture | MES |
| Tue 14 Nov |  |  |  |  |  |
| Wed 15 Nov | 10:00-11:00 | MR051 | Exercise in extreme environments III: High altitude | Lecture | MES |
| Thu 16 Nov | 9:00-13:00 | MT3 | Presentations to all staff & students’ group 1 | Seminar | MES/AMJ |
|  | 13:00-14:00 | MT4 | Presentations to all staff & students’ group 1 (optional) | Seminar |  |
| Fri 17 Nov | 12:00-13:00 | MT6 | Exercise in extreme environments IV: Diving (Hyperbaric conditions) | Lecture | MES |
| Week 17 | | | | | |
| Mon 20 Nov | 12:00-13:00 | MT2 | Fatigue & exercise performance 1 | Lecture | DB |
| Tue 21 Nov |  |  |  |  |  |
| Wed 22 Nov | 10:00-11:00 | MR051 | Fatigue & exercise performance 2 | Lecture | DB |
| Thu 23 Nov | 09:00-13:00 | MT3 | Presentations to all staff & students group 2 | Seminar | MES/AMJ |
|  | 13:00-14:00 | MT4 | Presentations to all staff & students group 2 (optional) | Seminar |  |
| Fri 24 Nov | 12:00-13:00 | MT6 | Fatigue & exercise performance 3 | Lecture | DB |
| Week 18 – NO TEACHING (CONSOLIDATE INTO 10 WEEKS) | | | | | |
| Mon 27 Nov | 10:00-12:00 | Comp G21 | Essay Exam | Assessment |  |
|  |  | Comp G40 |  |  |  |
| Tue 28 Nov |  |  |  |  |  |
| Wed 29 Nov |  |  |  |  |  |
| Thu 30 Nov |  |  |  |  |  |
| Fri 1 Dec |  |  |  |  |  |

Staff

|  |
| --- |
| Dr Guy Bewick (GB) Biomedical Sciences |
| Dr Derek Ball (DB), Biomedical Sciences |
| Dr Stephen Davies (SND), Biomedical Sciences |
| Dr Alison Jenkinson (AMJ), Biomedical Science |
| Dr Arimantas Lionikas (AL) Biomedical Sciences |
| Eleni Borompoka (EB), Library & Information Services |
| Dr Michael Scholz (MES), Biomedical Sciences (Course Co-ordinator) |

|  |  |
| --- | --- |
| Venues: | |
| Comp G21 | Zoology G21 |
| Comp G40 | Zoology G40 |
| Comp F81 | Edward Wright F81 |
| FN2 | Frazer Nobel 2 |
| MT2 | Meston 2 |
| MT3 | Meston 3 |
| MT4 | Meston 4 |
| MT6 | Meston 6 |
| ZG18 | Zoology LT ZG18 |
| STH 0.001 | Science Teaching Hub 0.001 |
| MR051 | MacRobert 051 |
| NK6 | New King’s 6 |
| LCR3 | Library Computer Room 3 |

Campus Maps - Foresterhill



Polwarth Floor Plans

Diagram, schematic

Description automatically generated

Diagram

Description automatically generated

Diagram

Description automatically generated