Faculty of Medicine
School of Medical Sciences

Department of Exercise Physiology

HESC3641

Advanced Exercise Physiology

Semester 1, 2018
Course Outline

CRICOS Provider Code 00098G

Please read this outline in conjunction with the following pages on the School of Medical Sciences website:

- Advice for Students
- Learning Resources

(or see "STUDENTS" tab at medicalsciences.med.unsw.edu.au)

Course Staff

Course Convener

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Course details

Credit Points: 6 UOC

Course Prerequisites / Assumed Knowledge: HESC2501

Course Description
This course gives an overview of advanced exercise physiology. It is a more advanced version of HESC2501 Exercise Physiology. Concepts in advanced exercise physiology such as bodily response to exercise as well as exercise adaptations will be covered. Literature related to acute and chronic response/adaptations to exercise as well as the mechanisms underlying the adaptations will also be discussed. In this course, students will have hands-on experience in carrying out a range of laboratory-based experiments.

Aims of the Course

The course aims to provide student with:

1. An overview of advanced exercise physiology
2. An understanding of how the human body works during exercise
3. An understanding of how the human body adapts to regular exercise
4. A variety of hands-on experience in carrying out laboratory-based experiments

Student Learning Outcomes

At the end of the course you should be able to:

- Understand advanced integrated exercise physiology
- Understand the major physiological adaptations to exercise
- Acquire conceptual understanding from laboratory experiences

Graduate Attributes

- Understand the concepts and mechanisms underlying exercise-induced cardiovascular health
- Competent in delivering/advising exercise dose-response relationship to clients with regard to preventative lifestyle strategies
- Competent in designing exercise training programs for aerobic and resistance based athletes
- Engage in independent and continual reflective learning and in line with current scientific knowledge as well as following an evidence-based approach

Teaching strategies

Lectures – Lectures are on Mondays 10am to 12pm (Wallace Wurth LG03) and Wednesdays, 9-10am (Wallace Wurth LG02). Although the lectures notes are provided (see below) it is important that you attend each lecture as it is not possible to include all information delivered in class into the PDF lecture notes. The content of lectures will be taken from core and suggested textbooks and readings (articles). Thus, it is essential that you do the readings prior to attending the lectures. Also, punctual arrival is expected for every lecture.
Lecture notes are available in PDF format on Moodle
Lectures are recorded and available from Lecture Recordings+ with Moodle.
See also: https://student.unsw.edu.au/lecture-recordings-view-and-download

Laboratories – Laboratories are on Tuesdays, 9am-12 pm and Fridays 12-3 pm (Wallace Wurth 120; weeks 3, 4, 7, 9, 11). Punctual arrival is expected in every lab as important information including the procedure of each lab is discussed prior to the lab activity. Late entry will be refused and marked as absent; allow at least 10 min arrival before each lab as you may need to change your attire for lab activity and re-read the procedure for the lab activity. The lab manual can be downloaded and printed from Moodle. During the labs all of you are expected to be involved actively as a tester or/and a subject. **Eating is not permitted** except bottles of water. You are expected to wear appropriate attire for lab activities (shorts, shirt, and trainers). **Open shoes, sandals, tongs are not permitted** and you will be refused entry and participation in the lab activities. In the case that you cannot participate in the lab as a subject/tester you are required to produce a medical certificate.

Punctuality and unit attendance

- Class and laboratory role will be taken in every lecture and laboratory. Students are expected to attend the class ***on time***.
- The attendance is compulsory for both lecture and the labs. ***Minimum of 80% of lecture attendance and 100% of lab attendance are required to pass the course.*** Failure to attend one of the labs will result in failure of the course. Students who cannot meet the attendance criteria above will not be allowed to attend the exam. Students who cannot attend lecture or labs for medical reasons will need to produce a medical certificate.

  On the SoMS website Student Advice page, see also:
  - Attendance
  - Special Consideration

Independent study – It is essential that you set aside the time for independent study. You are expected to read the core and supplement text book as well as articles provided to give you background information about the upcoming lectures/labs. You are reminded that UNSW recommends that a 6 unit-of-credit course should involve about 150-180 hours of study and learning activities.

Rationale for the inclusion of content and teaching approach

How the course relates to the Exercise Physiology profession – The content of Advanced Exercise Physiology allows students to learn and explore integrated exercise physiology. Students will have a greater understanding of concepts, underlying mechanisms, and relationships between exercise and physiological changes. Thus, a stronger background in integrated exercise physiology will make students more confident and competent in delivering exercise prescription as an exercise physiologist.

How the course relates to other courses in the Exercise Physiology program – The course is a continuation of HESC2501 Exercise Physiology. The content of Advanced Exercise Physiology (both lecture material and labs) is also related to HESC3504 Physical Activity and Health and HESC3541 Clinical Exercise Physiology. Advanced Exercise Physiology also gives a foundation for those students who are also interested in enhancing the performance of athletes.

Course evaluation and development

The course is always evaluated each year through the Course and Teaching Evaluation and Improvement (CATEI). At the end of the course students are encouraged to give feedback on both lecturers and content of the course. Based on students' feedback then necessary changes or improvement are made. The development of the course content includes some revisions on the content needed and/or current readings.

Resources

See also Learning Resources

Textbooks

- McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). Exercise Physiology: Energy, nutrition, and human performance (7th edition). Lippincot Williams & Wilkins. Baltimore, MD, USA.

Suggested Reference Books

- Tipton CM (editor) (2006). ACSMS's Advanced Exercise Physiology. Lippincot Williams & Wilkins.
- Mooren FC and Volker K (editors) (2005). Molecular and cellular exercise physiology. Eds. Human Kinetics. Champaign Illinois, USA.
- Bourke L and Deakin V (eds) (2002). Clinical Sports nutrition 2nd ed. The McGraw-Hill companies. Roseville, NSW, Australia.
- Eston R and Reilly T (eds) (2001). Kinanthropometry and Exercise Physiology Laboratory Manual: Test, procedures and data (2nd edition), Volume 2: Exercise physiology. Routledge, London & New York.

Weekly readings (textbook-article)

Week 1

Lect 1: Introduction

Lect 2: Exercise is medicine

1. Sallis RE. Exercise is medicine and physicians need to prescribe it! ***Br J Sports Med***. 2009; 43:3–4.
2. Stovitz SD, Batt ME. The epidemic has gone global: can Exercise is Medicine help quell the tide? ***Br J Sports Med*** 2010;44:693.

Lect 3: The limits of human performance

Huey RB, Eguskitza X. (2001). Limits to human performance: elevated risks on high mountains. ***J Exp Biol***. 204(Pt 18):3115-9.

Week 2

Lect 4: Cardiac daptation to exercise 1

1. McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). ***Exercise Physiology: Energy, nutrition, and human performance*** (7th edition). Chapter 16, 324-339;
2. Krieger EM, Da Silva GJ, Negrão CE. Effects of exercise training on baroreflex control of the cardiovascular system. ***Ann N Y Acad Sci***. 2001;940:338-47.

Lect 5: Cardiac adaptation to exercise 2

Goodman JM et al.. Left ventricular adaptations following short-term endurance training. ***J Appl Physiol***, 2005;98: 454-460.

Lect 6: Heart rate variability and exercise

De Meersman RE, Stein PK. Vagal modulation and aging ***Biol Psychol.*** 2007; 74(2):165-73.

Week 3

Lect 7: Acute dynamic and static exercise

McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). ***Exercise Physiology: Energy, nutrition, and human performance*** (7th edition). Chapter 25, 611-639;

Lect 8: Cardiovascular response to postural changes

1. Nishiyasu T, Nagashima K, Nadel ER, Mack GW. ***J Appl Physiol*** 1998; 85(1):160-167. Effect of posture on cardiovascular response to lower body positive pressure at rest and during dynamic exercise.
2. Patel K, Rössler A, Lackner HK, Trozic I, Laing C, Lorr D, Green DA, Hinghofer-Szalkay H, Goswami N. Effect of postural changes on cardiovascular parameters across gender. ***Medicine*** (Baltimore). 2016; 95(28):e4149. doi: 10.1097/MD.0000000000004149.

Week 4

Lect 10: Vascular adaptations to exercise 1

Tinken TM, Thijssen DHJ, Black MA, Cable NT, Green DJ. Time course of change in vasodilator function and capacity in response to exercise training in humans. ***J Physiol*** 2008*;* 586(20): 5003–5012.

Lect 11: Vascular adaptations to exercise 2

1. Edwards DG, Schofield RS, Magyari PM, Nichols WM, Braith RW. Effect of exercise training on central aortic pressure wave reflection in coronary artery disease. ***Am J Hypertens***. 2004; 17:540–543
2. Gates PE and Seals DR. Decline in large elastic artery compliance with age: a therapeutic target for habitual exercise. ***Br. J. Sports Med****.* 2006;40;897-899.

Week 5

Lect 13-14: Muscle adaptations to exercise 1 and 2

McArdle, W.D., Katch, F.I., and Katch, V.L. (2001). ***Exercise Physiology: Energy, nutrition, and human performance*** (7th edition). Chapter 22, 491-532.

Week 6

Lect 15-16: Metabolic adaptations to exercise 1 and 2

Romijn, J.A. et al. Regulation of endogenous fat and carbohydrate metabolism in relation to exercise intensity and duration. ***American Journal of Physiology,*** 1993;265: E380-E391.

Lect 17: Exercise and blood volume

Gillen CM et al. Plasma volume expansion in humans after a single intense exercise protocol***. J App Physiol***, 1991;71(5):1914-1920.

Week 7

Lect 18: Fat and exercise performance

1. Helge JF. Long-term fat diet adaptation effects on performance, training capacity, and fat utilization. ***Med. Sci. Sports Exerc.*** 2002;34(9):1499–1504
2. Hawley, J. (2002). Nutritional strategies to enhance fat oxidation during aerobic exercise. ***Clinical Sports Nutrition***. Chapter 16, 428-449.

Lect 19: Fat loss

1. Boutcher, S.H., & Dunn, S. Factors that may impede the weight loss response to exercise-based interventions. ***Obesity Reviews.*** 2009;10(6):671-680.
2. Boutcher, S.H. High-intensity intermittent exercise and fat loss. ***Journal of Obesity,*** 2011;868-305.

Lect 20: Carbohydrate and exercise performance

1. Jeukendrup AE. Carbohydrate intake during exercise and performance. ***Nutrition*** 2004;20:669–677;
2. Maughan, R. (2002). Fluid and carbohydrate intake during exercise. ***Clinical Sports Nutrition***. Chapter 14, 369-390.

Week 8

Lect 21: Exercise and environmental stress

1. Coris, EE. et al. Heat illness in athletes: The dangerous combination of heat, humidity and exercise. ***Sports Medicine***, 2004;34(1):9-16.
2. Űçok K, Şenol D, Gőkbel H, Akar S. Prevalence of exercise-induced bronchospasm in long distance runners trained in cold weather. ***Lung*** 2004;182:265–270.

Lect 22: Exercise economy and metabolic rate

1. Speakman JR, Selman C. Physical activity and resting metabolic rate. ***Proceedings of the Nutrition Society****.* 2003;62:621–634. (economy)
2. McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). ***Exercise Physiology: Energy, nutrition, and human performance*** (7th edition). Chapter 10, 206-224
3. Greiwe, JS and Kohrt, WM. Energy expenditure during walking and jogging. ***Journal Sports Medicine and Physical Fitness***, 2000;40:297-302.
4. Hopker JG, Coleman DA, Wiles JD. Differences in efficiency between trained and recreational cyclists. ***Appl Physiol Nutr Metab***. 2007;32(6):1036-42.

Week 9

Lect 23: Hemodynamic and body fluid adaptations to exercise

Jimenez C, Melin B, Koulmann N, Allevard AM, Launay JC, Savourey G. Plasma volume changes during and after acute variations of body hydration level in humans. ***Eur J Appl Physiol***.1999;80:1-8.

Week 10

Lect 24: The anaerobic power test

1. Smith JC, Hill DW. Contribution of energy systems during a Wingate power test. ***Br J Sp Med*** 1991; 25(4).
2. Souissi N, Bessot N, Chamari K, Gauthier A, Sesboüé B, Davenne D. Effect of time of day on aerobic contribution to the 30-swingate test performance. ***Chronobiology International***, 2007; 24(4):739–748.
3. Souissi N, Driss T, Chamari K, Vandewalle H, Davenne D,Gam A, Fillard JR, Jousselin E. Diurnal variation in wingate test performances: influence of active warm-up***. Chronobiology International***, 2010; 27(3):640–652.

Week 11

Lect 25: Microgravity and bed rest conbdition

1. McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). ***Exercise Physiology: Energy, nutrition, and human performance*** (7th edition). Chapter 27, 665-719
2. Convertino, VA. Cardiovascular consequences of bed rest: effect on maximal oxygen uptake. ***Medicine and Science in Sports and Exercise***, 1997;29(2):191-196
3. Edgerton, VR. et al. Human fibre size and enzymatic properties after 5 and 11 days of space flight. ***Journal of Applied Physiology***, 1995;78***:***1733-1739.

Lect 26: Hyperbaric condition and exercise

McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). ***Exercise Physiology: Energy, nutrition, and human performance*** (7th edition). Chapter 26, 640-664.

Lect 27: Exercise and cognitive function

Davenport MH[1], Hogan DB, Eskes GA, Longman RS, Poulin MJ. Cerebrovascular reserve: the link between fitness and cognitive function? **Exerc Sport Sci Rev**. 2012 Jul;40(3):153-158.

Week 12

Lect 28: Exercise and genetics

1. Roth SM. Perspective on the future use of genomics in exercise prescription. ***J Appl Physiol***. 2008;104(4):1243-1245
2. Bray MS. Genomics, genes, and environmental interaction: the role of exercise. ***J Appl Physiol.*** 2000;88(2):788-792.

Assessment and submission of tasks

Lab report	25%
Group research question report	15%
Individual oral presentation	10%
Final exam	50%

- Lab report - Students are expected to write a lab report in manuscript form (see Moodle for guidelines). The lab report has to be submitted through Moodle Turnitin. **Do not submit the report through email.** Lab reports received after the due date **will not be allocated a mark**. **Under no circumstances must you produce similar/ identical reports**. **If two or more reports are found to be similar both/all reports will be marked zero**.
- Group research question report – In a group of 3, students are expected to write 3000±10% words not including tables, graphs, and a reference list on a research question in Exercise Physiology or a related area. Students will need to choose a research question from a list provided. ***Do not submit similar topics that have been previously submitted in other courses***. The submission dates are **14th May 2018 (week 11) and 21st May 2018 (week 12).**
- Individual oral presentation – Students are expected to present their chosen research question above prior to the submission of their report. Twenty minutes for the presentation and 10 minutes for questions will be allocated for each group (3 students).

- Final exam - The final exam will consist of multiple choice and short answer questions. The multiple choice and short answer questions will be based on the material covered in the lectures, labs, and readings (articles and textbooks).

Penalties for late submission of assignment

In cases where an extension has **NOT** been granted, the following penalties will apply:

- All assignments (lab report/manuscript and research question) submitted after **9.00 am** on the due date will incur a penalty of 50% of the maximum mark available for that assignment. A further 25% of the maximum possible allocated marks (i.e., a total of 75%) will be deducted from assignments that are two days late. Assignments received two or more days after the due date **will not be allocated a mark,** however, the assignment **must** still be submitted to pass the unit.

Deferred Exams
If you miss an exam for medical reasons you must supply adequate documentation (including a medical certificate). Your request for consideration will then be assessed and a deferred exam may be granted. You cannot assume you will be granted supplementary assessment. The deferred exam may include a significant oral element.

It is intended that supplementary exams for School of Medical Sciences courses in Semester 1, 2018 will be held in the week commencing Saturday 14th July, 2018.

See Special Consideration

Marking criteria

It is recommended that you use APA style (citation) when you prepare your lab report/manuscript (see APA style: https://student.unsw.edu.au/american-psychological-association-apa-referencing-system)

Group Research Question Assignment

Criteria	High Distinction	Distinction	Credit	Pass	Pass Conceded	Fail	Mark
Introduction	Clearly written, concise, comprehensive overview of the paper's scope	Clearly written, concise, good overview of the paper's scope	Acceptable written expression, good overview of the paper's scope	Some errors in written expression, adequate overview of the paper's scope	Poorly written, cursory overview of the paper's scope	Poorly written, no overview of the paper's scope	10
Synthesis of the Literature	Clearly written, concise, comprehensive and critical analysis of relevant studies	Clearly written, concise, critical analysis of many relevant studies	Acceptable written expression, critical analysis of some relevant studies	Some errors in written expression, Adequate analysis of some relevant studies	Poorly written, Some reference to relevant studies	Poorly written, No reference to relevant studies	30
Arguments in response to the question	Clearly written, concise, original ideas well supported by evidence	Clearly written, concise, Some original ideas with supporting evidence	Acceptable written expression, Some original ideas and clear inter-pretation of sourced arguments	Some errors in written expression, Acceptable presentation of sourced arguments	Poorly written, weak presentation of sourced arguments	Poorly written, Unconvincing arguments	30
Use of figures and tables	Good use of tables and figures with excellent presentation	Good use of tables and figures and well presented	Some tables and figures and well presented	Some tables and figures but poorly presented	Either a table or figure but poorly presented	No tables, no figures	10
Conclusions	Clearly written, concise, Insightful synthesis of main points in the paper	Clearly written, concise, adequate synthesis of main points in the paper	Acceptable written expression, adequate synthesis of main points in the paper	Some errors in written expression, acceptable presentation of main points in the paper	Poorly written, weak presentation of main points in the paper	Poorly written, no synthesis of main points in the paper	10
Presentation	Neat, legible, correct referencing, correct length	Neat, legible, few errors in referencing, correct length	Neat, legible, some errors in referencing, correct length	Legible, some errors in referencing	Untidy, many errors in referencing, inappropriate length	Illegible, no referencing, inappropriate length	10

Course schedule

Week	Date	Lecture 1 Wallace Wurth LG03 Monday 10-11am	Lecture 2 Wallace Wurth LG03 Monday 11am-12pm	Lecture 3 Wallace Wurth LG02 Wednesday 9-10am	Labs WW room 120 Tuesday 9am-12pm; Friday 12-3pm
1	26/2	Introduction (YB) ***compulsory attendance***	Exercise is Medicine (YB)	The limits of human performance (YB)	
2	5/3	Cardiac adaptations to exercise 1 (YB)	Cardiac adaptations to exercise 2 (YB)	Heart rate variability and exercise (YB)	
3	12/3	Acute dynamic and static exercise (YB)	Cardiovascular response to postural changes (YB)	***Laboratory/manuscript write-up and Research question (group assignment)*** (YB)	Lab 1: Cardiovascular response to postural changes and acute exercise: 13/3 and 16/3
4	19/3	Vascular adaptations to exercise 1 (YB)	Vascular adaptations to exercise 2 (YB)	Arterial stiffness and exercise (YB)	Lab 2: Data analyses: 20/3 and 23/3
5	26/3	Muscle adaptations to exercise 1 (JT)	Muscle adaptations to exercise 2 (JT)	***Quiz***	
Mid-session recess 30/3-8/4					
6	9/4	Metabolic adaptations to exercise 1 (MM)	Metabolic adaptations to exercise 2 (MM)	Exercise and blood volume (YB)	
7	16/4	Fat and exercise performance (MM)	Fat loss and exercise (MM)	Carbohydrate and exercise performance (MM)	Lab 3: Plasma and blood volume to exercise; 17/4 and 20/4
8	23/4	Exercise and environmental stress (YB)	Exercise economy and metabolic rate (YB)	***Anzac day; No lecture***	**Lab report/manuscript due: 27/4**
9	30/4	***Research question seminar (compulsory attendance)***	***Research question seminar (compulsory attendance)***	Hemodynamic and body fluid adaptation to exercise (YB)	Lab 4: Exercise economy; 1/5 and 4/5
10	7/5	***Research question seminar (compulsory attendance)***	***Research question seminar (compulsory attendance)***	The anaerobic power test (YB)	
11	14/5	Microgravity and bed rest conditions (YB)	Hyperbaric condition and exercise (YB)	Exercise and cognitive function (YB)	Lab 5: Wingate test; 15/5 and 18/5 ***Written research question report group assignment due: 14/5 (30/4)***
12	21/5	Exercise and genetics (YB)	***Review Labs – Q and A*** (YB)	***Review*** (YB) ***compulsory attendance***	***Written research question report group assignment due: 21/5 (7/5)***

Note: YB: Yati Boutcher; JT: Jeanette Thom; MM: Maria Matuszek