



UNSW
AUSTRALIA

Medical Sciences
Medicine

Department of Exercise Physiology

HESC3641

Advanced Exercise Physiology

Semester 1, 2016
Course Outline

CRICOS Provider Code 00098G

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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 medicallsciences.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 Tuesdays, 3-5 pm (Wallace Wurth LG02) and Wednesdays, 12-1 pm (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 (LGO2) and available from ExhoCenter with Moodle. See also: <https://student.unsw.edu.au/lecture-recordings-view-and-download>

Laboratories – Laboratories are on Fridays, 10 am-1 pm and 2-5 pm (Wallace Wurth 116; weeks 3, 5, 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 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 units-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). *ACSM'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:

(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: 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: 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.(Met adap)

Lect 5:

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

Week 3

Lect 7: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). *Exercise Physiology: Energy, nutrition, and human performance* (7th edition). Chapter 22, 491-532.

Lect 9: Speakman JR, Selman C. Physical activity and resting metabolic rate. *Proceedings of the Nutrition Society*. 2003;62:621–634.

Week 4

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

Lect 11: 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 12:

- (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:

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

Week 6

- (1) Lect 16: De Meersman RE, Stein PK. Vagal modulation and aging **Biol Psychol**. 2007; 74(2):165-73.
- (2) Lect 17: Coris, EE. et al. Heat illness in athletes: The dangerous combination of heat, humidity and exercise. **Sports Medicine**, 2004;34(1):9-16.

Week 7

Lect 19: Üçok K, Şenol D, Gökbel H, Akar S. Prevalence of exercise-induced bronchospasm in long distance runners trained in cold weather. **Lung** 2004;182:265–270.

Lect 20: Gillen CM et al. Plasma volume expansion in humans after a single intense exercise protocol. **J App Physiol**, 1991;71(5):1914-1920.

Week 8

Lect 22: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7th edition). Chapter 21, 451-485.

Lect 23: Tanaka H and Swensen T. Impact of resistance training on endurance performance: A new form of cross-training? **Sports Med**, 1998;25(3):191-200.

Week 9

Lect 25: 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.

Lect 26:

- (1) McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7th edition). Chapter 10, 206-224;
- (2) Greiwe, JS and Kohrt, WM. Energy expenditure during walking and jogging. **Journal Sports Medicine and Physical Fitness**, 2000;40:297-302.
- (3) Hopker JG, Coleman DA, Wiles JD. Differences in efficiency between trained and recreational cyclists. **Appl Physiol Nutr Metab**. 2007;32(6):1036-42.

Week 10

Lect 28:

- (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 29: Davenport MH¹, 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.

Lect 30: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). *Exercise Physiology: Energy, nutrition, and human performance* (7th edition). Chapter 26, 640-664.

Week 11

Lect 31:

- (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.

Lect 32:

- (1) McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). *Exercise Physiology: Energy, nutrition, and human performance* (7th edition). Chapter 23, 533-585;
- (2) Maughan RJ. Nutritional ergogenic aids and exercise performance. *Nutr Res Rev* 1999;12:255-280.

Lect 33:

- (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 12

Lect 34:

- (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 35:

- (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	10%
Individual oral presentation	5%
Mid-term exam	20%
Final exam	40%

- Lab report - Students are expected to write a lab report, which is mainly answering questions and creating graphs and tables from the data obtained. **Do not submit the lab report through email. Lab report should be submitted before the next lab is started (there is no extension).** The lab report has to be submitted through Moodle Turnitin. Lab reports received after the due date **will not be allocated a mark.** It is recommended that you have a discussion group between/among you for brain storming related to the lab questions. **However, 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 not less than 15 pages (doubled spaced) not including tables, graphs, and references list on a research question in Exercise Physiology or related area. Students will choose the research question from a list provided. **Do not submit similar topics that have been previously submitted in another course.** The submission date is **13th May 2016 (week 10).**
- 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).
- Mid-term exam - The mid-term exam will consist of multiple choice questions. The questions will cover lecture material from week 1 to week 5
- 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:

- The lab report has to be handed in before the next lab is started (**there is no extension**). Lab reports received after the due date **will not be allocated a mark.**
- The last lab report has to be submitted in **week 13: 3rd June 2016 by 4pm.**
- Lab reports received after the due date **will not be allocated a mark.**
- Assignment (research question) submitted after **4.00 pm** 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 which 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, 2016 will be held in the week commencing Monday 4th July, 2016.

See [Special Consideration](#)

Marking criteria

Laboratory report – Each laboratory report is worth 5% (total of 25% for five lab reports). The content of the laboratory report should mainly answer questions related to the data that are collected during the lab activity. You are expected to answer the questions and present the findings from your lab activity concisely and clearly. You need to include graphs/figures and may also include calculations (if required) as well as some simple statistical analyses.

It is recommended that you use APA style (citation) when you prepare your lab report (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 interpretation 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 LG02 Tuesday 3-4 pm	Lecture 2 Wallace Wurth LG02 Tuesday 4-5 pm	Lecture 3 Wallace Wurth LG02 Wednesday 12-1 pm	Labs WW room 116 Friday 10am-1pm; 2-5 pm
1	1/3/16	Introduction (YB)	Exercise is Medicine (YB)	The limits of human performance (YB)	
2	8/3/16	Metabolic adaptations to exercise (SB)	Cardiovascular control and exercise (YB)	Cardiac adaptations to exercise (YB)	
3	15/3/16	Muscle adaptations to exercise (SB)	Resting metabolic rate and energy balance (SB)	<i>Laboratory write-up and Research question (YB)</i>	18/3/16 - Lab 1: Resting metabolic rate (RMR) and energy balance
4	22/3/16	Fat loss and exercise (SB)	Vascular adaptations to exercise (YB)	Arterial stiffness and exercise (YB)	
28/3/2016-3/4/2016 Mid-session recess					
5	5/4/16	Acute dynamic and static exercise (YB)	<i>Review for mid-term (YB)</i>	<i>Mid-term exam (YB)</i>	8/4/16 - Lab 2: Blood pressure and exercise <i>Lab 1 report due: 8/4/16</i>
6	12/4/16	Heart rate variability and exercise (YB)	Exercise in the heat (YB)	<i>Research question seminar (YB-SB)-compulsory attendance</i>	
7	19/4/16	Exercise in the cold (YB)	Blood volume and exercise (YB)	<i>Research question seminar (YB-SB)-compulsory attendance</i>	22/4/16 - Lab 3: Plasma and blood volume response to exercise <i>Lab 2 report due: 22/4/16</i>
8	26/4/16	Training and performance (SB)	Training issues (YB)	<i>Research question seminar (YB-SB)-compulsory attendance</i>	
9	3/5/16	Hemodynamic and body fluid adaptation to exercise (YB)	Exercise and economy (YB)	<i>Research question seminar (YB-SB)-compulsory attendance</i>	6/5/16 - Lab 4: Exercise economy <i>Lab 3 report due: 6/5/16</i>
10	10/5/16	Fat and exercise performance (SB)	Exercise, vascular function, and cognition (YB)	Hyperbaric condition and exercise (YB)	<i>Research question report due: 13/5/16</i>
11	17/5/16	Carbohydrate and exercise performance (SB)	Ergogenic aids (YB)	Wingate test (YB)	20/5/16 : Wingate test <i>Lab 4 report due: 20/5/16</i>
12	24/5/16	Microgravity and bed rest conditions (YB)	Exercise and genetics (YB)	<i>Review (YB)-compulsory attendance</i>	
13	31/5/16	NO Lecture			<i>Lab 5 report due: 3/6/16</i>

Note: YB: Yati Boutcher; SB: Steve Boutcher