



# THE UNIVERSITY OF NEW SOUTH WALES

**Health and Exercise Science  
School of Medical Sciences  
Faculty of Medicine**

## **COURSE: HESC 3641 Advanced Exercise Physiology**

**Course Title:** Advanced Exercise Physiology

**Course Number:** HESC 3641                      Session 1      2010

**Lecture Theatre:** CLB4, **Laboratory:** 202 and 204 WW building

**Time/Day:** Lectures: 9 - 10 am, Monday (CLB4); 2 - 3 pm, Tuesday (CLB4);  
Labs: 1 - 3 pm; 3 - 5 pm, Monday (204); 1 - 3 pm; 3 - 5 pm, Wednesday (202).

**Coordinator:** Dr. Yati N. Boutcher

**Office:** 252, F20 Goodsell building    **Phone:** 9385 2419    **Email:** [y.boutcher@unsw.edu.au](mailto:y.boutcher@unsw.edu.au)

**Office hours:** Monday 2 - 3 pm & Tuesday: 3 - 4 pm

**Lecturers:**    - Dr. Yati N. Boutcher  
                      - A/Prof. Steve Boutcher

### **Rationale**

This course gives an overview of advanced exercise physiology. It is a more advanced version of HESC 2501 Exercise Physiology. Concepts in advanced exercise physiology such as bodily response to exercise as well as exercise adaptations will be covered. Students will have hands on experience of carrying out a range of laboratory-based experiments.

### **Structure**

Thirty-four hours of formal contact time. This contact time comprises two 60 minute lectures, and a 120-minute laboratory class.

### **Aims**

*The major aims are to provide the 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

## Learning outcomes

*The student is expected to:*

- understand advanced integrated exercise physiology
- understand the major physiological adaptations to exercise
- acquire conceptual understanding from laboratory experiences

## Course Text

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

## Recommended Texts

- 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. (editors) (2002). Clinical Sports nutrition 2<sup>nd</sup> ed. The McGraw-Hill companies. Roseville, NSW, Australia.
- Eston, R., and Reilly (eds) (2001). Kinanthropometry and Exercise Physiology Laboratory Manual: Test, procedures and data (2<sup>nd</sup> edition), Volume 2: Exercise physiology. Routledge, London & New York.

## Assessment

1. Written exam (40% of grade). The written exam will consist of multiple choice and short answer questions.
2. Lab report (25% of grade). 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.**
3. Research question (25% of grade). Students are expected to write up to 10 pages (doubled spaced) not including tables and graphs, on a research question in Exercise Physiology or a related area. Students will choose the research question from a list provided. The submission date is **11 May 2010 (week 10) by 4.00 pm. Do not submit similar topics that have been previously submitted in another course.**
4. Research participation (10% - 15 hours).

## 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.

## 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 12: 25 May 2010 by 4 pm.** 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, a penalty of 50% of the maximum marks available for that assignment will be incurred. 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. Assignment 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.

## Academic dishonesty and plagiarism

### WHAT IS PLAGIARISM?

Plagiarism is the presentation of the thoughts or work of another as one's own (1). Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed (2).

***For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism. Knowingly permitting your work to be copied by another student may also be considered to be plagiarism. Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material. The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.***

### UNSW POLICY ON PLAGIARISM

At UNSW plagiarism is considered to be a form of academic misconduct and is viewed very seriously. UNSW is committed to helping students understand the conventions which govern academic communication to assist them avoid action which may result in academic misconduct (further information on the Student Misconduct Rules is available at:

<https://my.unsw.edu.au/student/academiclife/assessment/StudentMisconductRules.html>).

In the interests of maintaining high standards in scholarship and research, the University reminds students that when they are writing essays, theses, and assessment items of any nature, they are ethically bound to refrain from plagiarism in all its forms. Students are advised to inform themselves about University policies and practices concerning assessment and Academic Misconduct (including plagiarism). Wherever possible, students should also take up those opportunities provided to them by the University to improve their academic and/or information literacy.

(1) Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle.

(2) Adapted with kind permission from the University of Melbourne.

## Special Consideration for Illness or Misadventure affecting Assessments

Students applying for Special Consideration (SC) for an illness or misadventure that may have affected their ability to prepare or complete an assessment are required to follow the procedures outlined by the University in MyUNSW and available at the following site: <https://my.unsw.edu.au/student/atoz/SpecialConsideration.html>

Students should particularly note the additional requirements beyond a standard medical certificate to include an assessment of the severity of your illness or misadventure and opinion of the likely effect on your capacity to undertake the assessment task/s concerned. **The timeline for submission i.e. within 3 days of the assessment is also critical.**

A summary of each request for SC should also be forwarded to the Faculty Office. Students requesting SC should consider seeing the [Faculty Student Affairs Coordinator \(SAC\)](#). Any information provided by the student to the SAC is confidential and will not be disclosed without consent.

PLEASE NOTE: This process does not prevent or discourage a student from attending their own doctor, University Health Service, the Counselling Service or the Assistant Registrar in the Student Information and Systems Office.

### Assessment criteria for the lab reports

Lab reports will be assessed based on satisfactory and non satisfactory. If you obtained satisfactory for all lab reports then you will get a full mark of 25%. However, if you get non-satisfactory for one or more of the lab reports then you will get zero mark for that particular lab report. **In a case of a non-satisfactory result you cannot resubmit the lab report.** A sample of a lab report is available for you to look at (see the course coordinator).

| Satisfactory  | Non-satisfactory  |
|---|---|
| <ul style="list-style-type: none"><li>- Answers to the questions are concise; brief and clear</li><li>- Good use of tables and figures</li><li>- Appropriate citation</li><li>- APA style</li></ul> | <ul style="list-style-type: none"><li>- Answers to the questions are not concise; too long</li><li>- No tables and figures</li><li>- Inappropriate citation</li><li>- Non APA style</li></ul> |

Note: APA style: [http://www.lc.unsw.edu.au/onlib/ref\\_apa.html](http://www.lc.unsw.edu.au/onlib/ref_apa.html)

### Assessment criteria for the 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 ( e.g., re-created)    | 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   |

## LECTURE OUTLINE

| Date                              | Activities  | Content  |      |
|-----------------------------------|---|--|------|
| Week 1: 1/3/10<br>2/3/10          | Lecture<br>Lecture                                  | Introduction (YB)<br>Muscle adaptations to exercise (SB)                         |      |
| Week 2: 8/3/10<br>9/3/10          | Lecture<br>Lecture                                  | Metabolic adaptations to exercise<br>Fat and exercise performance                | } SB |
| Week 3: 15/3/10<br>16/3/10        | Lecture<br>Lecture                                  | Carbohydrate and exercise performance<br>Fat loss and exercise                   | } SB |
|                                   | <b>Lab 1</b>  | <b>Resting metabolic rate (RMR) and energy balance</b>                           |      |
|                                   | Monday: 15/3/10 - 204<br>Wednesday: 17/3/10 - 202   |  |      |
| Week 4: 22/3/10<br>23/3/10        | Lecture<br>Lecture                                  | Autonomic adaptations to exercise<br>Cardiovascular control and exercise         | } YB |
| Week 5: 29/3/10<br>30/3/10        | Lecture<br>Lecture                                  | Cardiac adaptations to exercise<br>Vascular adaptations to exercise              | } YB |
|                                   | <b>Lab 2</b>  | <b>Blood pressure and exercise</b>   |      |
|                                   | Monday: 29/3/10 - 204<br>Wednesday: 31/3/10 - 202   |  |      |
| <b>2/4/10 - 11/4/10</b>           | <b>Mid-session recess</b>                           |  |      |
| Week 6: 12/4/10<br>13/4/10        | Lecture<br>Lecture                                  | Exercise in the heat and cold<br>Hemodynamic & body fluid adaptation to exercise | } YB |
| Week 7: 19/4/10<br>20/4/10        | Lecture<br>Lecture                                  | Exercise at altitude<br>Hyperbaric condition and exercise                        | } YB |
|                                   | <b>Lab 3</b>  | <b>Plasma and blood volume response to exercise</b>                              |      |
|                                   | Monday: 19/4/10 - 204<br>Wednesday: 21/4/10 - 202   |  |      |
| <b>Week 8: 26/4/10</b><br>27/4/10 | <b>No Lecture – Anzac public holiday</b><br>Lecture | Microgravity and bed rest conditions (YB)  |      |
| Week 9: 3/5/10<br>4/5/10          | Lecture<br>Lecture                                  | Exercise economy<br>Training and gender  | } YB |
|                                   | <b>Lab 4</b>  | <b>Exercise Economy</b>  |      |
|                                   | Monday: 3/5/10 - 204<br>Wednesday: 5/5/10 - 202     |  |      |

|                  |                          |   |      |
|------------------|--------------------------|---|------|
| Week 10: 10/5/10 | Lecture                  | Ergogenic aids (SB)                       |      |
| 11/5/10          | Lecture                  | Limitations of maximal oxygen uptake (YB) |      |
| Week 11: 17/5/10 | Lecture                  | Training and performance (SB)             |      |
| 18/5/10          | Lecture                  | Training issues (YB)                      |      |
|                  | <b>Lab 5</b>             | <b>Wingate test</b>                       |      |
|                  | Monday: 17/5/10 - 204    |   |      |
|                  | Wednesday: 19/5/10 - 202 |   |      |
| Week 12: 24/5/10 | Lecture                  | Exercise and immune system                | } YB |
| 25/5/10          | Lecture                  | Exercise and genomics                     |      |

Note:

YB: Yati Boutcher; SB: Steve Boutcher

### Weekly readings (textbook-article)

Week 1

Lect 1: -

Lect 2: McArdle, W.D., Katch, F.I., and Katch, V.L. (2001). **Exercise Physiology: Energy, nutrition, and human performance** (7<sup>th</sup> edition). Chapter 22, 491-532.

Week 2

Lect 3: Romijn, J.A. et al. (1993). Regulation of endogenous fat and carbohydrate metabolism in relation to exercise intensity and duration. **American Journal of Physiology**, **265**, E380-E391.

Lect 4: Hawley, J. (2002). Nutritional strategies to enhance fat oxidation during aerobic exercise. **Clinical Sports Nutrition**. Chapter 16, 428-449.

Week 3

Lect 5: Maughan, R. (2002). Fluid and carbohydrate intake during exercise. **Clinical Sports Nutrition**. Chapter 14, 369-390.

Lect 6: Boutcher, S.H., & Dunn, S. (2009). Factors that may impede the weight loss response to exercise-based interventions. **Obesity Reviews**, **10**, 6, 671-680.

Week 4

Lect 7: De Meersman RE, Stein PK. (2007). Vagal modulation and aging **Biol Psychol**. 74(2):165-73.

Lect 8: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7<sup>th</sup> edition). Chapter 16, 324-339.

Krieger EM, Da Silva GJ, Negrão CE. (2001). Effects of exercise training on baroreflex control of the cardiovascular system. **Ann N Y Acad Sci**. 940:338-47.

Week 5

Lect 9: Goodman JM et al. (2005). Left ventricular adaptations following short-term endurance training. **J Appl Physiol**, **98**: 454-460.

Lect 10: Tinken TM, Thijssen DHJ, Black MA, Cable NT, Green DJ. (2008). Time course of change in vasodilator function and capacity in response to exercise training in humans. **J Physiol** **586**:20: 5003–5012.

Week 6

Lect 11: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7<sup>th</sup> edition). Chapter 25, 611-639.

Coris, EE. et al. (2004). Heat illness in athletes: The dangerous combination of heat, humidity and exercise. **Sports Medicine**, 34(1): 9-16.

Lect 12: Gillen CM et al. (1991). Plasma volume expansion in humans after a single intense exercise protocol. **Journal of Applied Physiology**, 71(5): 1914-1920.

#### Week 7

Lect 13: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7<sup>th</sup> edition). Chapter 24, 591-610.

Wilber RL. (2001). Current trends in altitude training. **Sports Medicine**, 31(4): 249-265.

Lect 14: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7<sup>th</sup> edition). Chapter 26, 640-664.

#### Week 8

Lect 15: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7<sup>th</sup> edition). Chapter 27, 665-719.

Convertino, VA. (1997). Cardiovascular consequences of bed rest: effect on maximal oxygen uptake. **Medicine and Science in Sports and Exercise**, 29(2): 191-196.

Edgerton, VR. Et al (1995). Human fibre size and enzymatic properties after 5 and 11 days of space flight. **Journal of Applied Physiology**, 78, 1733-1739.

#### Week 9

Lecture 16: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7<sup>th</sup> edition). Chapter 10, 206-224.

Greiwe, JS and Kohrt, WM. (2000). Energy expenditure during walking and jogging. **Journal Sports Medicine and Physical Fitness**, 40: 297-302.

Lecture 17: Wiebe CG et al (1998). Exercise cardiac function in endurance-trained males versus females. **Clin J Sports Med**, 8(4): 272-279.

#### Week 10

Lect 18: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7<sup>th</sup> edition). Chapter 23, 533-585.

Lect 19: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7<sup>th</sup> edition). Chapter 11, 225-247.

Sutton JR (1992). Limitations to maximal oxygen uptake. **Sports Medicine**, 13(2): 127-133.

#### Week 11

Lect 20: McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). **Exercise Physiology: Energy, nutrition, and human performance** (7<sup>th</sup> edition). Chapter 21, 451-485

Lect 21: Tanaka H and Swensen T. (1998). Impact of resistance training on endurance performance: A new form of cross-training? **Sports Medicine**, 25(3): 191-200.

#### Week 12

Lect 22: Nieman DC. (2000). Special feature: Exercise effects on systemic immunity. **Immunology and Cell Biology**, 78: 496-501.

Lect 23: Roth SM. (2008). Perspective on the future use of genomics in exercise prescription. **J Appl Physiol**. 104(4): 1243-1245.

Bray MS. (2000). Genomics, genes, and environmental interaction: the role of exercise. **J Appl Physiol**. 88(2): 788-792.