UNSW

THE UNIVERSITY OF NEW SOUTH WALES

Exercise Physiology Program

School of Medical Sciences

Faculty of Medicine

HESC2501

Exercise Physiology

Semester 2, 2010
Course Outline

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Staff Contact Details

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Course details

Credit Points: 6 UOC

Course Prerequisites / Assumed Knowledge

BIOC2181 Fundamentals of Biochemistry; PHSL2501 Human Physiology A

Course Description

The focus of this course in on the physiological adaptations of the respiratory, cardiovascular, endocrine and musculoskeletal systems to acute and chronic exercise, building on knowledge and skills developed in Human Physiology A and concurrently developed in Human Physiology B. Specific adaptations to the different component of exercise (intensity, duration, type) will be presented. Skills and techniques used to monitor and analyse those adaptations will be developed throughout this course, e.g. submaximal and maximal exercise tests, ECG, spirometry.

Aims of the Course

1. To encourage a comprehensive understanding of the human physiological response (energy utilisation, endocrine, cardiovascular, respiratory, musculoskeletal) to both acute and repeated bouts of exercise
2. To provide knowledge of measurement principles and techniques commonly utilised in exercise physiology
3. To provide confidence in performing basic measurements in exercise testing

Student Learning Outcomes

This course will enable students to explore and gain further understanding of the response of the human body to physical activity with an emphasis of their application to real situations in the field of Exercise Physiology. This course provides the fundamental knowledge and promotes the development of skills which will work towards the realisation of the overall Bachelor of Exercise Physiology program objectives and skills of an Exercise Physiologist.

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

- Have developed knowledge of the changes in energy utilisation, endocrine, cardiovascular, respiratory and musculoskeletal systems in response to acute or repeated bouts of exercise.
- Demonstrate basic competencies in skills associated in exercise testing (eg. heart rate and blood pressure measurement; the collection of blood by fingerprick for the analysis of lactate).
- Communicate effectively through written reports of scientific laboratory experiments.

Graduate Attributes

- Understand the relationship between physical activity and health
- Deliver lifestyle change programs that use exercise for the primary prevention of disease and the management of chronic disease
- Apply clinical skills and knowledge relevant to cardiopulmonary, metabolic, musculoskeletal and neuromuscular rehabilitation
- Communicate effectively with patients, colleagues and other health professionals

Rationale for the inclusion of content and teaching approach

How the course relates to the Exercise Physiology profession – The content allows students to develop a fundamental knowledge of the human physiological response to physical activity. This forms the basis upon which further knowledge and skills enable an Exercise Physiologist to deliver lifestyle programs that use exercise with an aim of promoting disease prevention and rehabilitation of chronic disease. This course also

enables students to develop the skills of communication and critical thinking. It reflects the position of the course convenor that their practice within the field will require these skills for ongoing development.

How the course relates to other courses in the Exercise Physiology program – The course will build upon material presented in earlier courses in the program, in particular Introductory Exercise Science (HESC1501), Exercise Programs and Behaviour (HESC1511), as well as Human Physiology A (PHSL2501). The skills and knowledge developed in this course will provide a strong base in exercise physiology essential for the clinically oriented courses offered in third stage such as Physical Activity and Health (HESC3504) and Clinical Exercise Physiology (HESC3541).

Teaching strategies

Lectures – Lecture notes are available in PDF format on Blackboard:
http://lms-blackboard.telt.unsw.edu.au/webapps/portal/frameset.jsp

Lectures are recorded and available at:
http://telt.unsw.edu.au/lectopia%5Fdiv/

Lectures are considered by the course convenor to be only a summary of the concepts and theory essential for meeting the course objectives and student learning outcomes outlined above. In order to do well in this course it is **ABSOLUTELY ESSENTIAL** that students make use of other resources such as the recommended and additional textbooks (page 8) and Web based sources. A summary of the lecture material and course schedule are on pages 11-14.

Laboratories – Students are expected to behave in an ethical, socially responsible and professional manner within the laboratory class. Punctual arrival is expected as important information including safety precautions are discussed at the beginning of each class and late students will be refused entry and marked as absent. Turn-off mobile phones before entering (mobile phones are not to be used or answered during the class). The use of computers for work not related to the current laboratory is not permitted in class. Eating is not permitted, however students may bring drinking water in a suitable unbreakable container. Students are required to bring to class, a printed copy of the laboratory which they are to download from BLACKBOARD. It is recommended that students take the time to read the laboratory before coming to the designated laboratory session. All students must come prepared for active participation wearing clothing which is suitable for exercise, such as shorts or track pants, T-shirt or light sweater, and runners or cross-trainers. Enclosed footwear is compulsory. Students who do not have suitable attire with them (eg. open footwear) or do not have a legitimate reason for not participating (eg. medical complaint or injury) will be refused entry to the class and will then be marked absent. Students must take care with biological and hazardous material and leave all equipment clean and functional. Those who don't adhere to these basic laboratory rules will be marked absent.

Assessments – These tasks have been chosen as tools to enhance and guide your learning as well as a way of measuring performance, and are therefore a central teaching strategy in this course.

Assessment

Summary of Assessments	Weight	Due Date
ASSESSMENT TASK 1 – MID SEMESTER EXAM	**30%**	Wed 1st Sept (Week 7)
ASSESSMENT TASK 2 – END OF SESSION EXAM	**45%**	End semester exam period
ASSESSMENT TASK 3 – SKILLS EXAM	**10%**	Weeks 11-13
ASSESSMENT TASK 4 – LABORATORY ASSIGNMENTS	**15%**	Wed 25th Aug (Week 6), Wed 29th Sept (Week 10)

Assessment Task 1 – EXAM 1

The MID SEMESTER EXAM is a written exam comprised of multiple choice and/or short answer questions, and analytical interpretation of typical experimental situations. It will cover lecture and laboratory material from weeks 1-6. It will be held in week 7 during the lecture timeslot on Wed 1st September, and is of 90 min duration (writing time). In the weeks prior to the mid-semester exam students will be allocated by the course convenor to either one of two rooms (Wallace Wurth GO3 or Civil Engineering 109) to allow for adequate spacing between students. Students are required to attend the exam in the room to which they have been allocated as each particular room will contain a given number of exam papers for allocated students only. No extra time will be given to a student who has arrived at the wrong room and needs to find their way to the other room to sit the exam. As each room will be supervised by one staff member only, there will be no provision made for students who wish to temporarily exit the exam room unsupervised after the exam has commenced for whatever reason (eg. visiting bathroom). Students are only permitted to leave the room after they have submitted their mid-semester exam for assessment.

Assessment Task 2 – END OF SESSION EXAM

The END OF SESSION EXAM *is a* written exam comprised of multiple choice and/or short answer questions, and analytical interpretation of typical experimental situations. It will be held during the examination period following the end of semester, and will cover ALL lectures and laboratory material from the ENTIRE semester.

Assessment Task 3 – SKILLS EXAM

The SKILLS EXAM will be held in weeks 11-13 during the laboratory timeslot and will be based on the assessment of the student's ability to perform various practical skills commonly used in exercise. Each student will be required to attend on only one of these weeks. Further information confirming the location and times of the skills exam for each individual student will be provided in the weeks prior to the exam by the course convenor.

EACH student will be required to perform ALL the skills (as listed below) on fellow students in the class under the supervision of an examiner. Broadly the assessment is based on a given student's ability to perform the skill with regard to the following three catergories:

(1) *technique* [ability to correctly perform the measurement],
(2) *safety* [ability to adhere to OHS requirements with respect to self and also to the student on whom they are performing the measurement],
(3) communication [the ability to effectively communicate verbally to the fellow student who has temporarily acquired the role of 'client'].

The exam venue will be divided into sections labelled Cardiovascular, Bicycle ergometer, Body composition and Blood collection.

More specifically the skills to be assessed at each section are:

Cardiovascular

-the manual measurement of resting heart rate
-the electronic measurement of resting heart rate using a heart rate monitor
-the measurement of resting systolic and diastolic blood pressure

Bicycle ergometer

-the correct positioning of a subject on the Monark bicycle ergometer in preparation for exercise
-the adjustment of the setting on the bicycle to allow the subject to exercise at a power output as designated by the examiner

Body composition

-height
-weight
-% body fat using the TANITA scales
-skinfolds (biceps, triceps, subscapular, abdominal, chest, midaxillary, suprailium, calf, thigh; each student will only be required to measure one skinfold chosen by the examiner)
-girths (waist, hip, forearm, upper arm, thigh, calf; each student will be required to measure only one girth chosen by the examiner)

Blood collection

-the collection of blood from a subject by fingerprick

It is the responsibility of each student to ensure that they have been examined at each of the above four (4) stations; Cardiovascular, Bicycle ergometer, Body composition, and Blood collection BEFORE they leave the examination venue. No provision will be made for a student to be assessed in part at a later date. Zero marks will be awarded for a section at which a student has not presented for assessment.

Assessment Task 4 – LABORATORY ASSIGNMENTS

Each of the six (6) laboratory assignments (with the exception of the body composition laboratory) are to be submitted for assessment. Only two (2) laboratory assignments (one from either of weeks 3, 4 and 5; and one from weeks 6, 8, 9) will be formally marked, however each student must complete and submit all six (6) laboratory assignments to pass this component of the course (ie. ALL graphs/tables and discussion questions in all six laboratories must be completed).

These six laboratory reports are due in two parts with the first three (3) reports (PART 1) due in week 6, and the following three (3) reports (PART 2) due in week 10. Therefore the due dates are as follows: Laboratory reports for the *Energy expenditure laboratory (week 3), Lactate measurement during exercise (week 4)*, and *Cardiovascular response to exercise (week 5)* are due in Week 6 on Wed 25th August **(no later than 10 am)**. Laboratory reports for *The respiratory response to exercise (week 6), the ECG (week 8)* and *VO_2max (week 9)* are due in Week 10 on Wed 29th September **(no later than 10 am)**.

The assignment coversheet is attached to the back of this unit outline (page 16), and MUST be attached to the front of each laboratory and signed by each student**. Assignments without the appropriate SIGNED coversheet will not be marked.**

Marking Criteria for Laboratory Assignments

As indicated above, though all six (6) laboratory assignments are to be submitted in two parts, only one (1) laboratory from each part will be formally marked (ie 2/6 laboratory assignments will be formally marked in this semester). However each student must complete and submit all six (6) laboratory assignments to pass this component of the course. The first laboratory assignment submission is worth 7% and the second laboratory assignment submission is worth 8%, therefore the combined laboratory assignments are worth 15% of the total marks for this course. To achieve the highest possible marks each student must do the following:

Coversheet page: Complete the coversheet (page 16) and attach to the front of the assignment and sign the declaration. **Assignments without the appropriate SIGNED coversheet will not be marked.**

Introduction and methods: must be included in the report simply for completeness, please attach the introduction and method which is made available to you on BLACKBOARD and which you have downloaded and brought to class. The reason for keeping the laboratory in its entire form is that it will serve as a useful reference on which to look back on during this semester as revision for exams and during the later years of this degree.

Results: Tables (which are provided in the original assignment handouts) need to be completed with the numerical data obtained in class. Answers to any additional numerical calculations need to be completed and entered in the appropriate space provided in the table. The required graphs (as listed in the original laboratory handouts) need to be completed, with correctly labelled headings and axis labels.

Discussion: Indicate your answer to each of the short answer questions directly below each question in the laboratory handout. Answers may range between a sentence to a small paragraph as indicated by the question. Answers need to be concise and grammatically correct.

Referencing: Particular attention and marks will also be given to correct referencing within the document (see referencing guidelines on page 9-11). You need to provide the correct reference within the answer to the question in the discussion section and also include the full reference in the reference list at the end of the assignment.

Submission of Assessment Tasks

Laboratory assignments are to be submitted by two (2) methods, an electronic version via BLACKBOARD (Turn it in); and a hardcopy which is to be given to the lecturer and course convenor Dr. Maria Matuszek at the beginning of the lecture. Assignments will not be accepted by email under any circumstances.

Penalties for late submission of assignments – In cases where an extension has NOT been granted, the following penalties will apply:

- For laboratories submitted after **10 am** on the due date, a penalty of 50% of the maximum marks available for that assignment will be incurred.
- Assignments received two (2) or more days after the due time/date **will not be allocated a mark,** however, these assignments **must** still be submitted to pass the unit.

Academic honesty and plagiarism

Plagiarism is using the words or ideas of others and presenting them as your own. Plagiarism is a type of intellectual theft and is regarded by the university as academic misconduct. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. The University has adopted an educative approach to plagiarism and has developed a range of resources to support students. The Learning Centre can provide further information via http://www.lc.unsw.edu/plagiarism.

Referencing for the laboratory assignment

Referencing is a process that identifies the sources of information used in your assignment. Some of the main purposes of referencing are: to justify/support the position you take in your assignment, to show the arguments put forward by different writers, and to allow the reader to locate the sources used. Please refer to examples cited below. Further information can be found at http://www.apastyle.org

How to cite a source in your work

In the body of text you need to provide the author(s) surname and year of publication for a direct quote or paraphrase

A study investigating the preferred mode of exercise amongst cancer sufferers found that walking is the most popular (Jones and Courneya, 2002). Winningham et al (1986) recommends a moderate intensity performed 3 to 5 days per week for approximately 30 minutes per session.

When you provide a direct quotation, place the quote within "quotation marks" and acknowledge the author's surname and year of publication

Brooks (2000) stated that "both biological and environmental factors jointly influence and individual's personality development".
Recent research shows that "children who are read to at home have a greater awareness of language and text" (Smith, 2001).

One author

Biological and environmental factors influence human development (Brooks, 2000).

Two authors

Green and Brooks (2001) noted that human development is a complex issue.

Three or more authors, use 'et al' which means 'and others'

Winningham et al (1986) recommends a moderate intensity performed 3 to 5 days per week for approximately 30 minutes per session.

Several sources

Research shows that human development is a complex and multifaceted issue (Brooks et al, 1999; Green and Brooks, 2000; Harvey et al 1998).

Two or more works from the same author
When an author has written two or more pieces of work in the same year, distinguish each piece of work by sorting the titles of each book/article alphabetically and then identifying them as:
(Clarke, 2000a) (Clarke, 2000b) (Clarke, 2000c) (Brooks et al 2001a) (Brooks et al 2001b)

Authors with the same surname
Boutcher and Boutcher (2004)

Corporate author, when an organization or a group is the same author
First citation: (National Institute of Health [NIH], 1998); Subsequent citations: (NIH, 1998)

How to format sources for your list of references

Books
One author
Reents S. (2000) Sport and exercise pharmacology. Human Kinetics, Champaign, IL.
Mottram DR (2003) Drugs in sport . Routledge, London.

Two or more authors
Antonio J, Stout JR. (2001) Sports supplements. Lippinott Williams and Wilkins, Baltimore, Maryland.
Rang HP, Dale MM, Ritter JM (1999) Pharmacology. (4th edition) Churchill Livingstone, Edinburgh.

Edition other than first edition
Rang HP, Dale MM, Ritter JM (1999) Pharmacology. (4th edition) Churchill Livingstone, Edinburgh.

Reports
Authored report
Candy P, Crebert R, O'Leary J (1994) Developing lifelong learners through undergraduate education. Canberra: AGPS

Organisational report
Australian Sports Drug Agency (2004) Anti-doping information handbook. ASDA, Curtin, Canberra.
Sports Medicine Australia (2000) Drugs in sport: A health professionals handbook. Sports Medicine Australia, Canberra.

Articles
Chapter or article in an edited book
Ward A, Kuta J, Sanborn L, Burt C (2004) Breast cancer. In: Le Mura AM, von Duvillard SP (Eds) Clinical exercise physiology, Chp 26. Lippincott Williams and Wilkins, Baltimore, Maryland.

Journal article, volume and issue number
Bessant B (1996). Higher education in Australia: The unified national system. Education Research and Perspectives, 23(1): 110-123.

Journal article, volume but no issue number
Biley F, Smith K (1998). Exploring the potential of problem-based learning in nurse education. Nurse Education Today, 18: 353-361.

Newspaper article
Murray J (2001, September 22-23). Faith built on solid pillars. The Weekend Australian, p. 24.

Electronic sources
Internet sources (eg. Articles, journals, reports) are obtained online, and these documents are cited and referenced according to the 'author-date'format. If the reference was obtained from a database or a web site, the name of the database (e.g. ProQuest) or the website's URL address (e.g www….) must be included.

Electronic journal article
Peters M (2000) Does constructivist epistemology have a place in nurse education? Journal of Nursing Education 39 (4) 166-170. Retrieved May 10, 2001, from CINAHL database.

Electronic report
Department of Education, Training and Youth Affairs (2000). Higher education report for the 2000 to 2002 triennium. Retrieved October 20, 2000, from DETYA Web site: www.detya.gov.au/highered/he_report/2000_2002/html_1/htm

How to construct a reference list
Start your reference list on a new page, and list all citation entries alphabetically, according to author.
You may use the hanging indent format for a professional appearance.
Use single spaces within each citation entry in the list, double spaces between citation entries in the list.

Course schedule

Week	Date	Lecture 1 Wallace Wurth LGO3	Lecture 2 Wallace Wurth LGO3	Laboratory See below for day/location	Clinical or Suggested Readings
2	26th July	Introduction to HESC2501 Exercise Physiology (MM) Measurement of force, work and power (MM) The energy systems in aerobic and anaerobic exercise, ATP and the metabolic mill (MM)	ECG -1) Overview of the applications in exercise testing (TBA)		*WED:* Measurements of work, powe and energy expenditure (worksheet, electronic course notes) Powers and Howley (2009) Ch 6 (1) Metabolism of carbohydrate (2) Macronutrient metabolism (fats/protein) (both on electronic course notes) McArdle et al (2010) Ch 1, 5, 6 *FRI:* McArdle et al (2010) On the Horizon
3	2nd Aug	Endocrinological management of nutrient use in exercise (MM) Measurement of energy expenditure by calorimetry, RER, RQ (MM)	ECG-2) Normal rhythm and arrhythmias (TBA)	Energy expenditure assessment (using Douglas Bags). Manual calculation of oxygen uptake (MM, NvD, MH)	*WED:* McArdle et al (2010) Ch 8, 9, 11, 20 Borer (2003) *FRI:* McArdle et al (2010) Ch 18 Jones and Round (1990)
4	9th Aug	Lactate production and measurement during exercise (MM) Assessment of aerobic power (MM)	ECG-3 Myopathies, ischemia, coronary blood flow (TBA)	The lactate threshold and OBLA in exercise (MM, NvD, MH, AK)	*WED:* McArdle et al (2010) Ch 7, 11, 21 Australian Sports Commission (2000) Ch 4, 6 *FRI:* Brooks et al (2005)
5	16th Aug	Cardiovascular response to exercise (MM)	ECG-4 Electrolyte imbalances (TBA)	Cardiovascular response to exercise (MM, NvD, MH, AK)	*WED:* McArdle et al (2010) Ch 15, 16, 17 *FRI:* Brooks et al (2005)
6	23rd Aug	Respiratory response to exercise (MM)	Biochemical and Cardiovascular Adaptations to exercise training (TBA)	Respiratory response to exercise (MM, NvD, MH, EG) **LAB REPORT (PART 1) DUE by 10 AM**	*WED:* McArdle et al (2010) Ch 12, 13, 14
7	30th Aug	**Mid-semester exam (MM, NvD, MH)** **Room WWLGO3 or Civil Engineering 109**	Review of weeks 1-6 Attendance is compulsory (TBA)		*FRI:* Hampton (2008)

	6th Sept	**No formal classes this week**			
8	13th Sept	Exam Review (MM) Nutrient intake recommendations for rest and exercise (MM)	Exercise and thermal stress (TBA)	The ECG during rest and exercise (TBA, NvD, MH, AK)	WED: McArdle et al (2010) Ch 1, 3 FRI: Hampton (2008)
9	20th Sept	Nutrient intake recommendations for rest and exercise *continued* (MM)	Physiological response to exercise at altitude (TBA)	The VO_2max (MM, NvD, MH, AK, EG)	WED: Burke and Deakin (2010) McArdle et al (2010) Ch 1, 3 FRI: Hampton (2008)
10	27th Sept	Pharmacological aids in exercise (MM) The interaction between medications and exercise (MM)	Gender differences in exercise physiology (FN)	Assessment of body composition (MM, NvD, MH, AK, EG) **LAB REPORT (PART 2) DUE by 10 AM**	*WED:* Reents (2000), Mottram (2003), Kenakin (2009) *FRI:* Hampton (2008)
11	4th Oct	Gender differences in exercise physiology *continued* (FN) Molecular biology and exercise physiology (RB)	Muscle fibre type and changes as a result of exercise (RB)	Skills exam (NvD, MH, AK, EG)	*WED:* McArdle et al (2010) Brooks et al (2005) *FRI:* McArdle et al (2010) Ch 21
12	11th Oct	Muscle damage (BB) Muscle fatigue (BB)	Muscle strength training/detraining (TBA)	Skills exam (NvD, MH, AK, EG)	*WED:* McArdle et al (2010) Ch 24, 25 *FRI:* Baechle and Earle (2000), Batman and van Capelle (1995) McArdle et al (2010) Ch 22
13	18th Oct	Muscle strength training/detraining (TBA)	Review of weeks 7 – 13 Attendance is compulsory (TBA)	Skills exam (NvD, MH, AK, EG)	*WED:* Baechle and Earle (2000), Batman and van Capelle (1995) McArdle et al (2007) Ch 22

Please note that there may be some slight alterations to the above schedule.
Lecturers: Dr. Maria Matuszek, (MM), Dr. Fiona Naumann (FN), Dr. Ben Barry (BB), Dr. Romain Barres (RB)
Demonstrators: Ms Nancy van Doorn (NvD), Mr Mehrdad Heydari (MH), Mr Andrew Keech (AK), Mr Ehsan Ghahramanloo (EG)
All lectures on Wednesdays (2 hr) are at 10am-12pm, in room Wallace Wurth LGO3
All lectures on Fridays (1 hr) are at 10-11am, in room Wallace Wurth LGO3
Laboratory sessions (weeks 3, 4, 5, 6, 8, 10) are on Wednesdays 2-4pm and 4-6pm in Wallace Wurth 204 with the exception of the VO_2max lab and the skills exam.
The VO_2max lab (week 9) and the skills exam (weeks 11, 12, 13) will be held at 2-4 and 4-6pm on Wednesdays and 10am-12pm on Thursdays, at 24 Arthur St, more information regarding these laboratories and the session time for each individual student will be provided during semester by the course convenor prior to the laboratories.**The mid-semester exam is held between 10am-12pm, consists of 90 min reading/writing time, and will be held in rooms Wallace Wurth LGO3 and Civil Engineering 109.**

Summary of lecture content

Measurement of work, force and power during exercise (SI units, traditional units) (includes examples on bicycle ergometer, treadmill and bench stepping); *Review of energy systems* and ATP production during aerobic and anaerobic metabolism, metabolic mill; *Endocrine management* of nutrient use during exercise (catecholamines, cortisol, growth hormone, glucagon, insulin, triiodothyonine, thyroxine, prolactin); *Energy expenditure* (basal, resting, exercise), units (calorie, Calorie, kilojoule, megajoule, MET), calorimetry (direct and indirect), manual calculation of O_2 use, CO_2 expenditure and RER, RQ, Haldane transformation; *Lactate* production in rest and exercise, removal (Cori cycle, lactate shuttle [intracellular, extracellular]), terminology (lactate threshold, OBLA, misuse of term anaerobic threshold), measurement, training adaptations; *Aerobic Power* VO_2max test, prediction of VO_2max (non-exercise, submaximal exercise tests (walking, running, cycling [YMCA, Astrand]); *Cardiovascular response* to acute and chronic exercise (submaximal, maximal, endurance, resistance, upper body, lower body, postural changes), heart rate (including anticipatory), cardiac output, stroke volume (influence of preload, afterload, contractility, heart rate), rate pressure product or double product, cardiovascular drift, blood flow/redistribution, blood pressure, total peripheral resistance, regulation (neural, hormonal, baroreceptors, chemoreceptors, muscle afferents, local); *Electrocardiography (ECG)*: overview of the applications in exercise testing, normal rhythm and arrhythmias, myopathies, ischemia, coronary blood flow, electrolyte imbalances; *Respiratory response* to acute, chronic, steady state, incremental exercise, regulation, minute, alveolar and maximum voluntary ventilation, frequency, tidal volume, ventilation-perfusion relationship, FVC, FEV1, oxyhaemoglobin and myoglobin dissociation curves, acid-base regulation; *Nutrition and exercise* fuelling pre-event, during and post event, glycemic index and applications, carbohydrate and protein requirements, strategies to enhance fat oxidation, fad diets; *Pharmacological* aids in exercise, interaction between medications and exercise; *Exercise and the environment*, thermal stress, physiological adjustment to temperature regulation during exercise, maintenance of fluid balance, factors which modify heat tolerance, complications from excessive heat stress; exercise at altitude, (sea-level, medium and high altitude), acclimatization, metabolic, physiologic and exercise capacities at altitude, aerobic capacity upon return to sea level, at-home acclimatization; *Gender* differences in physical performance, growth and maturation, body composition, oxygen transport and endurance, muscle metabolism, strength; *Molecular biology* and relevance to exercise physiology; *Muscle* characteristic differences in fibre type, plasticity of muscle fibre type, fibre typing, muscle damage in eccentric muscle action (delayed onset muscle soreness, structural and biochemical changes, recovery, adaptation); muscle fatigue (central and peripheral contribution); muscle strength, strength measurement and resistance training, structural and functional adaptations to resistance training, detraining.

Summary of laboratory content

Energy expenditure (week 3) during rest and three increasing levels of submaximal power outputs on a cycle ergometer, requires manual collection and measurement of O_2 and CO_2 content of expiratory gases, manual calculation of O_2 used and CO_2 expired, RER, RQ, and percentage of macronutrients (carbohydrate and fat) used during each given power output. Students work as a team to collect the gases from an exercising voluntary peer, each student then measures the gas content of at least one sample in class and performs the metabolic calculations.

Blood lactate (week 4) is sampled by fingerprick during rest and submaximal exercise at small increasing increments of power output. Students work in groups of small teams (approximately 5-8 students) with each team consisting of one volunteer subject on a cycle ergometer. All students have the opportunity to collect blood samples, adhering to OHS principles (gloves, safe disposal of blood stained products and sharps). Provision is made for students who performed the exercise to also practice taking a fingerprick blood sample(s) from fellow peers in class.

Cardiovascular response (week 5) to exercise is examined with students working in small groups (2-4 students per group). Each student has the opportunity to measure heart rate and blood pressure at different postures at rest (supine, sitting, standing) and also during various exercises (aerobic exercise on a cycle ergometer and arm ergometer, during upper body (arm) and lower body (leg) isometric contraction).

Respiratory response (week 6) to rest and exercise requires each student in the class to measure their resting FVC and FEV1, whereas during exercise students work as a team to

measure respiratory frequency, ventilation, tidal volume and maximum voluntary ventilation of a volunteer subject exercising at various power outputs on a cycle ergometer.

The ECG (week 8) is measured on a resting volunteer subject after students are divided into small groups of approximately 4 students per group. The ECG is re-examined during exercise when each volunteer subject engages in a bout of aerobic activity on a cycle ergometer.

VO_2max test (week 9) of a volunteer subject using a metabolic cart is performed in class where students are asked to examine the changes in ventilation, O_2 use, expired CO_2, RER, heart rate, and identify the ventilatory threshold.

Body composition analysis (week 10) allows each student to work in pairs with another student to measure height, weight, skinfolds and girths, calculate body mass index and percent body fat.

Resources for students

Blackboard

Information about the course and a number of electronic study resources can be accessed via the UNSW Blackboard system. Blackboard is an internet-based set of Course Tools designed to enable online learning. You can access the system from the following site:
http://lms-blackboard.telt.unsw.edu.au/webapps/portal/frameset.jsp

You can use Blackboard to download lecture notes, access your grades, find reference material in the course (such as this document), and communicate with the lecturer and your peers. Please see the lecturer if you would like more information to help you to make the most of this resource.

Lectopia

The Lectopia system (iLecture) provides digital audio recordings of lectures that can be accessed via streaming media over the web or as a podcast (if permitted by the lecturer). Lecture slides may be embedded in these presentations. http://telt.unsw.edu.au/lectopia/content/default.cfm?ss=1

UNSW Library

The University Library provides a range of services to assist students in understanding how to identify what information is required for assignments and projects; how to find the right information to support academic activities; and how to use the right information most effectively.
http://www.library.unsw.edu.au

Reserve (MyCourse)

Many items (books and journal articles) set as recommended reading for courses will be located in Reserve, which is on Level 2 of the Main Library. Some of the journal articles will be available in electronic format via MyCourse. To search for these items, go to the library website catalogue and search for the course code.

Textbooks

McArdle WD, Katch FI, Katch VL (2010) Exercise physiology. Energy, nutrition and human performance. (7th edition) Lippincott, Williams and Wilkins. Philadelphia, USA.

Suggested Reference Books

- **American College of Sport Medicine (2005)** ACSM's health-related physical fitness assessment manual. Lippincott, Williams and Wilkins, Philadelphia, USA.
- **American College of Sport Medicine (2010)** ACSM guidelines for exercise testing and prescription. (8th edition) Lippincott, Williams and Wilkins, Philadelphia, USA.
- **Australian Sports Commission (2000)** Physiological tests for elite athletes. (Gore CJ. Editor) Human Kinetics, Champaign.IL., USA.
- **Baechle TR, Earle RW (2000)** Essentials of strength training and conditioning. Human Kinetics, Champaign IL., USA.

- **Batman P, van Capelle M (1994)** Exercise analysis made simple. FIT4U Publications, Sydney, Australia.
- **Batman P, van Capelle M (1995)** The exercise guide to resistance training. FIT4U Publications, Sydney, Australia.
- **Borer KT (2003)** Exercise endocrinology. Human Kinetics, Champaign, IL., USA.
- **Bourke L, Deakin V (2010)** Clinical sports nutrition. (4th edition) WCB/McGraw-Hill, Boston, USA.
- **Brooks GA, Fahey TD, White TP, Baldwin KM (2005).** Exercise physiology: human bioenergetics and its applications (4th edition). Mayfield Publishing Company, Mountain View, CA., USA.
- **Gore C, Edwards D (1992)** Australian fitness norms: a manual for fitness assessors. Health Development Foundation, North Adelaide, Australia.
- **Hampton JR (2008)** The ECG made easy. (7th edition) Churchill Livingstone, Edinburgh, UK.
- **Houston ME (2001)** Biochemistry primer for exercise science. (2nd edition) Human Kinetics, Champaign IL, USA.
- **Jones DA, Round JM (1990)** Skeletal muscle in health and disease. Manchester University Press, Manchester, UK.
- **Kenakin TP (2009)** A pharmacology primer – theory, applications and methods. Elsevier Academic Press, London, UK. **is available online:** http://info.library.unsw.edu.au/cgi-bin/local/access/access.cgi?url=http://www.sciencedirect.com/science/book/9780123745859
- **Mottram DR (2003)** Drugs in Sport. Routledge, London, UK.
- **Powers SK, Howley ET (2009)** Exercise physiology. (7th edition) WCB/McGraw-Hill, Boston, USA.
- **Reents S (2000)** Sport and exercise pharmacology. Human Kinetics, Champaign, IL., USA.
- **Robergs RA, Keteyian SJ (2003)** Fundamentals of Exercise Physiology. WCB/McGraw-Hill, Boston, USA.
- **Schell J, Leelarthaepin B (1994)** Physical fitness assessment in exercise and sport science (2nd edition) Leelar Biomediscience services, Sydney, Australia.
- **Wilmore JH, Costill DL (1999)** Physiology of sport and exercise. (2nd edition) Human Kinetics, Champaign.IL., USA.

Course evaluation and development

Each year feedback is sought from students about the courses offered in Exercise Physiology and continual improvements are made based on this feedback. The Course and Teaching Evaluation and Improvement (CATEI) Process of UNSW is the method used for the collection of feedback. At the end of the semester students will be asked by UNSW to provide feedback on HESC2501. Significant changes are then communicated to the following cohort of students. This year additional lecture timeslots have been introduced to provide more class student-teacher interaction time. The musculoskeletal section has been expanded. Extra opportunity for revision has been provided within the timetable. The applied topics of exercise and temperature regulation, and exercise at altitude have been reintroduced. A brand new lecture on molecular biology and exercise has been included as this is a newly emerging dynamic area of exercise science. The submission of laboratory reports for assessment have been reintroduced to provide additional feedback on student progress during semester.

Occupational Health and Safety

Class activities must comply with the NSW Occupational Health & Safety Act 2000 and the Occupational Health & Safety (OHS) Regulations 2001. It is expected that students will conduct themselves in an appropriate and responsible manner in order not to breach OHS regulations. Further information on relevant OHS policies and expectations is outlined at: http://www.hr.unsw.edu.au/ohswc/ohs/ohs_policies.html
All students must come prepared for active participation in laboratories. No open footwear is permitted. No consumption of food is permitted in class.

Examination procedures and attendance requirements

Attendance is expected at all lectures, practicals and tutorials for this course. Attendance at all practicals, tutorials and clinicals will be recorded. Students who do not participate in these sessions for any reason other than medical or misadventure, will be marked absent and will be awarded a grade of FAIL for the entire

course. If absent for medical reasons, a medical certificate must be lodged with the lecturer within 7 days of the time period of the certificate's expiry. No consideration will be given after this time. Although lectures will be available on ilecture, student participation is encouraged in both the lectures and the tutorials and these are important to attend.

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, 2010 will be held in the week commencing Monday 19th July, 2010.***

Special consideration in the event of illness or misadventure

Please note the following Statement regarding Special Consideration.
If you believe that your performance in a course, either during session or in an examination, has been adversely affected by sickness, misadventure, or other circumstances beyond your control, you should notify the Registrar and ask for special consideration in the determination of your results. Such requests should be made as soon as practicable after the problem occurs. **Applications made more than three working days after the relevant assessment will not be accepted except in TRULY exceptional circumstances.**

When submitting a request for special consideration you should provide all possible supporting evidence (eg medical certificates) together with your student number and enrolment details. Consideration request forms are available from Student Central in the Chancellery or can be downloaded from the web page linked below.

Note that normally, if you miss an exam (without medical reasons) you will be given an absent fail. If you arrive late for an exam no time extension will be granted. It is your responsibility to check timetables and ensure that you arrive on time.

Students who apply for consideration to Student Central must also contact the Course Convenor immediately.

All applications for Special Consideration will be processed in accordance with UNSW policy (see: http://my.unsw.edu.au/student/atoz/SpecialConsideration.html). If you miss an assessment and have applied for Special Consideration, this will be taken into account when your final grade is determined. You should note that marks derived from completed assessment tasks may be used as the primary basis for determining an overall mark. Where appropriate, supplementary examination may be offered, but only when warranted by the circumstances.

Student equity and diversity issues
Students requiring assistance are encouraged to discuss their needs with the course convenor prior to, or at the commencement of the course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (EADU) (9385 4734). Further information for students with disabilities is available at http://www.studentequity.unsw.edu.au/disabil.html

THE UNIVERSITY OF NEW SOUTH WALES

Exercise Physiology

School of Medical Science

Faculty of Medicine

Laboratory assignment
Exercise Physiology HESC2501

Lecturer: Dr. Maria Matuszek (m.matuszek@unsw.edu.au))

Laboratory title: _____

Student Number: _____

Student Name: _____

Date Submitted: _____

I, the undersigned, declare that I am the author of this work, and that any other content from other sources has been acknowledged and fully cited.

Student signature _____