

CONTENTS

INTRODUCTION

Course Information
Lecture/Practical Timetables
Lecture Outlines
Physiology Practical Manual

PRACTICALS

1. Body Temperature and Cutaneous Circulation
2. Thyroid Gland Physiology
3. Reproductive & Endocrine Physiology
4. Respiratory Gas Exchange
5. Gastrointestinal System: Computer Class
6. Control of Respiration
7. Renal Endocrine Physiology: Computer Class
8. Volume and Solute Control

SELF STUDY SESSIONS

PAST EXAM PAPERS

COURSE INFORMATION

EXAMINER AND COURSE CO-ORDINATOR

Course Convenor: Dr. Lesley Ulman Room 204 West Wing Wallace Wurth
l.ulman@unsw.edu.au (ph: 9385 3601)

Co-convenor: Dr. Nicole Marden Room 204 West Wing Wallace Wurth
n.marden@unsw.edu.au (ph: 9385 3797)

If you need to consult with the course convenor or co-convenor, appointments can be set up through email.

LECTURERS IN THIS COURSE

Dr K.Gibson k.gibson@unsw.edu.au
Dr T.Lewis t.lewis@unsw.edu.au
Dr N.Marden n.marden@unsw.edu.au
A/Prof M.Klugmann m.klugmann@unsw.edu.au
Dr F.Britton f.britton@unsw.edu.au
Prof M.Morris m.morris@unsw.edu.au

If you require to consult with any of these staff, appointments can be made via email.

The teaching staff involved in the running of this course are now located on the second floor of the west wing of the Wallace Wurth building. Unfortunately students are not able to access this area and if you wish to contact one of us you will need to do so by email and we can organize to meet with you if necessary.

OBJECTIVES OF THE COURSE

This course is offered to second year students and follows on from the first session course. The major aims of this course are to provide students with a basic understanding of the fundamental processes and mechanisms that serve and control the various functions of the body. It should be noted that, although introductory, this course in Human Physiology is comprehensive in scope. Areas treated in detail include Endocrine Physiology, Reproductive Physiology, Respiration, Kidney & Body Fluids and Gastrointestinal Physiology.

It should also be noted that, where appropriate, subject areas are treated quantitatively as well as qualitatively, an approach that requires students to have at least a basic knowledge of mathematics and chemistry.

COURSE STRUCTURE

This is a 6 unit of credit course. There are 2-3, one hour lectures per week (Tue 9-10, Wed 9-10 and Fri 3-4). Lectures will provide you with the concepts and theory essential for understanding the fundamental processes of body function. The Fri 3-4 slot on some occasions will be used for a tutorial which aids in better understanding of lecture material. The practical classes are a major component of the course and comprise a fortnightly, supervised 3 hour laboratory session during which students typically work in small groups of about 5 and carry out the laboratory exercises outlined in this practical manual. These sessions will give an insight into how knowledge is obtained, and how the results of experiments depend not only on what we measure but how we measure it. Two additional sessions will be computer based, rather than of a practical nature. Although these will be unsupervised the material is still examinable.

APPROACH TO LEARNING AND TEACHING

Although the primary source of information for this course is the lecture material, effective learning can be enhanced through self directed use of other resources such as textbooks and Moodle. Your practical classes will be directly related to the lectures and it is essential to prepare for

practical classes before attendance. It is up to you to ensure you perform well in each part of the course; preparing for classes; studying for quizzes and exams and seeking assistance to clarify your understanding. Past exam questions are provided to assist you in preparing for examinations.

UNSW LEARNING OUTCOMES

UNSW aims to provide an environment that fosters students achieving the following generic graduate attributes:

1. the skills involved in scholarly enquiry
2. an in-depth engagement with the relevant disciplinary knowledge in its interdisciplinary context
3. the capacity for analytical and critical thinking and for creative problem-solving
4. the ability to engage in independent and reflective learning
5. information literacy - the skills to appropriately locate, evaluate and use relevant information
6. the capacity for enterprise, initiative and creativity
7. an appreciation of, and respect for, diversity
8. a capacity to contribute to, and work within, the international community
9. the skills required for collaborative and multidisciplinary work
10. an appreciation of, and a responsiveness to, change
11. a respect for ethical practice and social responsibility
12. the skills of effective communication.

Not every course addresses all these attributes evenly. In second year physiology, attributes 1-4 are most relevant. The following are more specific learning outcomes for this course designed to incorporate some of the generic graduate attributes listed above in a more context specific form.

SPECIFIC LEARNING OUTCOMES

By the end of this course students are expected to have gained a basic understanding of the fundamental processes and mechanisms that serve and control the various functions of the body. More specifically students should have a basic knowledge of

Temperature Regulation

- normal body temperature and how it is regulated

Endocrine Physiology

- the mechanisms of hormone action
- simple feedback-loop endocrine systems
- hypothalamus and pituitary gland
- thyroid gland
- adrenal gland

Reproduction

- male reproductive system
- female reproductive system
- pregnancy

Respiratory System

- anatomical features and their physiological significance
- ventilation
- oxygen transport
- carbon dioxide transport and blood buffering
- respiratory mechanics
- control of respiration

Gastrointestinal System

- overview of the gastrointestinal tract
- gastric secretion, motility and emptying
- digestive processes of the small intestine
- liver and biliary system
- chemical digestion and absorption of nutrients
- appetite control
- digestive processes of the large intestine

Kidney and Body Fluids

- body fluids
- renal structure, renal blood flow and glomerular filtration
- reabsorption and secretion
- evaluation of renal function
- tubular structure and function along the nephron
- renal water homeostasis
- urinary concentrating mechanisms
- renal sodium and potassium balance
- renal acid-base balance

ASSESSMENT

**%Total
Marks**

Mid-session Theory Exam (50 minutes duration)

The mid-session exam will be held on Wednesday 10th September 2014 and will consist of the following:

30%

- 15 multiple choice questions on material covered in all Temperature Regulation, Endocrine, Reproduction and Respiration lectures and tutorials.
- Two short answer questions; one on Endocrine and one on Respiration.

End of Session Exam (2 hours duration)

50%

The end of session exam will consist of the following:

- 15 multiple choice questions on all Gastrointestinal Tract and Kidney and Body Fluids lectures and tutorials.
- Three short answer questions; one on Reproduction, one on Gastrointestinal Tract and one on Kidney and Body Fluids.
- 30 multiple choice questions on material pertaining to the practical classes in Session 2. You will **not** be able to take your prac books into the exam.

Online Feedback Quizzes

10%

There will be a series of 5 online feedback quizzes throughout the session covering each topic. These quizzes will be made available online a few days after the conclusion of each lecture series. These quizzes are to be used as a study aid and you will receive immediate detailed feedback after submitting your answers. The quizzes are to be attempted in your own time and each quiz will be accessible for a period of one week. You may attempt these quizzes as many times as you wish within this period. You will receive 2% towards your overall grade for each quiz provided you achieve a minimum score of 90% for the quiz.

ALL MULTIPLE CHOICE QUESTIONS EXAMINING LECTURE AND TUTORIAL MATERIAL IN THE MIDSESSION AND END OF SESSION EXAMS WILL BE DRAWN FROM THE BANK OF QUESTIONS USED IN THE ONLINE QUIZZES THROUGHOUT THE SESSION.

PLEASE NOTE THAT THIS DOES NOT APPLY TO MULTIPLE CHOICE QUESTIONS BASED ON PRACTICAL CLASS MATERIAL – THESE QUESTIONS WILL NOT HAVE BEEN SEEN BY

YOU PRIOR TO THE END OF SESSION EXAM.

A timetable of online quiz dates and periods of accessibility will be posted up on moodle early in the session.

Please note that online feedback assessments are intended to motivate your study, provide feedback on your progress and to stimulate your learning. There is published data which demonstrates that students who participate in online feedback assessments perform significantly better than their peers in end of course examinations.

When attempting each online feedback assessment, please complete it under exam conditions (by exam conditions, we mean you should do it by yourself, don't look up the answers as you do it, and commit yourself to an answer), at least the first time you attempt it. This will provide the most realistic appraisal of your performance.

Give yourself plenty of time, and attempt the feedback assessment in a place where you won't be interrupted. If you are attempting to simulate exam conditions, you should allow up to 2 minutes per question.

Write down items that you are not sure about as you go. Even if you get the question right you should still read further about anything that is unclear to you.

If you don't agree with, or can't understand the reason for an answer, ask the appropriate member of academic staff. If you are not sure who that is, ask your colleagues or the course convenor.

Technical problems regarding access to the assessment should be directed to Fiona Wilson (f.wilson@unsw.edu.au).

Practical Quizzes

These are conducted immediately before some of the practical classes. These quizzes will contain a mixture of questions on that day's work and on the previous **supervised** practical class that you did. Please note that the self-directed learning classes on GIT and Renal Endocrine are not supervised practicals and questions on these practicals **will not** be included in the practical quizzes, however these practicals **will** be examined in the end of session exam. A minimum of three quizzes will be given throughout the session and your mark for this component will be an average of all of the quizzes you are given.

10%

TEXTBOOK

PRINCIPLES OF HUMAN PHYSIOLOGY by Cindy L. Stanfield, Benjamin Cummings,, 5th edition, 2013. Books are available from the UNSW bookshop.

This textbook comes with an Interactive Physiology CD. Several self study sessions based on this Interactive Physiology CD have been designed to allow you to revise the lecture material in your own time. There is no set time allocated for these suggested self study sessions – you are encouraged to work through these sessions in your own time as a supplement to lectures and tutorials. Please refer to the end of this practical manual for further details on the self study sessions.

GENERAL INFORMATION

The Department of Physiology is part of the School of Medical Sciences and is within the Faculty of Medicine. It is located on the 2nd and 3rd floors of the West Wing of the Wallace Wurth Building.

General inquiries can be made to the school teaching administrator Carmen Robinson (9385 2464, carmen.robinson@unsw.edu.au) who is located on the Ground Floor of the Biological Sciences Building room G27.

Professor Gary Housley is Head of Department and appointments to see him may be made through email (G.Housley@unsw.edu.au).

There is an honours program conducted by the School. The Honours program is co-ordinated by Dr Andrew Moorhouse (a.moorhouse@unsw.edu.au). Any students considering an Honours year should discuss the requirements with the co-ordinator. Outstanding students may be considered for scholarships offered by the University and School and these are offered annually.

Postgraduate research degrees

The Department of Physiology offers students the opportunity to undertake a Doctorate (*Ph.D*). For further information contact the co-ordinator, Dr Pascal Carrive (P.Carrive@unsw.edu.au).

Departmental Vacation Scholarships: The Department of Physiology supports several summer vacation scholarships each year to enable good students to undertake short research projects within the department. For further details contact Vicky Sawatt, our "Honours and Postgraduate Research Administrator" on 9385 8195 or email her at v.sawatt@unsw.edu.au. You may also like to link to the relevant page on our website:

<http://medalsciences.med.unsw.edu.au/students/undergraduate/summer-research-awards>

ATTENDANCE REQUIREMENTS

Attendance at ALL practical classes is compulsory FOR ALL STUDENTS, and must be recorded in the class roll ON THE DAY OF THE CLASS. It is your responsibility to ensure that the demonstrator records your attendance and no discussions will be entered into after the completion of the class. Satisfactory completion of the work set for each class is essential and **IS A REQUIREMENT FOR PASSING PHYSIOLOGY.** Non-attendance for other than documented medical or other serious reasons may make you ineligible to successfully complete this course. At the very least you may be required to pass an additional oral examination on the practical classes, as well as undertaking the normal practical exam and quizzes. Students who miss practical classes due to illness or for other reasons must submit a medical certificate to academic staff during lab time or leave it with a member of the technical staff located in room 118 East Wing Wallace Wurth Building **WITHIN 7 DAYS (practical classes only)** of missing a class. If received after this time, no consideration will be given and the student will be marked absent from that class. **The following details must be attached: Name, Student number, Course number, Group number, Date of the class, Name of class missed.**

The practical component of the final exam is compulsory FOR ALL STUDENTS.

PLEASE NOTE that missing any examination requires lodging a medical certificate with Student Central within **3 DAYS** (refer to UNSW Student Gateway @ www.student.unsw.edu.au for further details).

OFFICIAL COMMUNICATION BY EMAIL

All students in courses PHSL2201, 2221 and 2502 are advised that e-mail is the official means by which the School of Medical Sciences at UNSW will communicate with you. All e-mail messages will be sent to your official UNSW e-mail address (e.g., z1234567@student.unsw.edu.au) and, if you do not wish to use the University e-mail system, you **MUST** arrange for your official mail to be forwarded to your chosen address. The University recommends that you check your mail at least every other day. Facilities for checking e-mail are available in the School of Medical Sciences and in the University library. Further information and assistance is available from DIS-Connect, ph. 9385 1777. Free e-mail courses are run by the UNSW Library.

NOTICES

All current timetables, notices and information relevant to you will be available on Moodle. It is your responsibility to check Moodle regularly.

All lectures are taped by the Echo360 system and can be accessed via Moodle. Textbooks and some reference materials are available through open reserve.

TEACHING RESOURCES IN PHYSIOLOGY

The Department of Physiology has chosen to use the UNSW Moodle platform to provide teaching material for all of its courses. You can make use of Echo 360 recordings taken of the lectures which are available on Moodle. Lecture notes and various learning materials will also be made available on Moodle either before or shortly after the lecture.

For direct access to Moodle point your browser to:

<https://moodle.telt.unsw.edu.au/>

System Requirements for Moodle:

UNSW Moodle supports the following web browsers for Windows 7 and Mac OSX 10.7+:

- Google Chrome 30 or later (**recommended for optimal compatibility**)
- Safari 6 or later (please note that there are known issues with Safari and TinyMCE, the editor used in the text editor throughout Moodle)
- Mozilla Firefox 15 or later—a free download is available from the Firefox site.
- MS Internet Explorer 9.0 or later—a download is available from Internet Explorer site.
- Opera 9 or later.

For further details, visit <https://student.unsw.edu.au/moodle-system-requirements>.

HANDWRITING

Students whose writing is difficult to understand will disadvantage themselves in their written assessment. Make every effort to write clearly and legibly. Do not use your own abbreviations.

APPLICATIONS FOR SPECIAL CONSIDERATION FOR MISSED ASSESSMENTS / EXAMS

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 or for any other reason, you should ask for special consideration in the determination of your results. Such requests should be made as soon as practicable after the problem occurs. **Special consideration sought more than three days after an examination in a course WILL NOT be accepted except in TRULY exceptional circumstances.**

An application for special consideration must be made via Online Services in myUNSW. **You must obtain and attach Third Party documentation (e.g. medical certificates) before submitting the application. Failure to do so may result in the application being rejected.** Log into myUNSW and go to My Student Profile tab > My Student Services channel > Online Services > Special Consideration. Once completed, submit to UNSW Student Central. In addition to this, you should also inform the course convenor that you have applied for special consideration.

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 e.g. by

extrapolating from your percentile rank on those tasks. Where appropriate, supplementary examination may be offered, but only when warranted by the circumstances.

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 with sufficient time.

Please refer to <https://my.unsw.edu.au/student/atoz/SpecialConsideration.html> for further details regarding special consideration.

REPEATING STUDENTS

Practical class exemptions may be granted to repeat students but students **must** check with the course convenor whether they have exemption **prior** to their first practical class. All students must be familiar with the material covered in the practical classes. All students must do the practical component of the final exam.

CONTINUAL COURSE IMPROVEMENT

Periodically student evaluative feedback on the course is gathered, using among other means, UNSW's Course and Teaching Evaluation and Improvement (CATEI) Process. Student feedback is taken seriously, and continual improvements are made to the course based in part on such feedback. Significant changes to the course will be communicated to subsequent cohorts of students taking the course.

STUDENT SUPPORT SERVICES

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convenor prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or <http://www.studentequity.unsw.edu.au/>). Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

ACADEMIC HONESTY AND PLAGIARISM

The School of Medical Sciences will not tolerate plagiarism in submitted written work. The University regards this as academic misconduct and imposes severe penalties. Evidence of plagiarism in submitted assignments, etc. will be thoroughly investigated and may be penalised by the award of a score of zero for the assessable work. Flagrant plagiarism will be directly referred to the Division of the Registrar for disciplinary action under UNSW rules.

The following material has been taken from the University's "Plagiarism and Academic Integrity" website. The full document can be viewed at: <https://student.unsw.edu.au/plagiarism>

"Plagiarism at UNSW is using the words or ideas of others and passing them off as your own.

Plagiarism can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. Consequently, whenever you use the words or ideas of another person in your work, you must acknowledge where they came from".

Common forms of plagiarism include the following:

Collusion

Presenting work as your own when it has been produced in whole or part in collusion with other people. It should not be confused with academic collaboration. It includes students providing their work to another student for the purpose of them plagiarising, paying another person to perform an academic task and passing it off as your own work, stealing or acquiring another person's academic work and copying it and offering to complete another person's work or seeking payment for completing academic work.

Copying

Copying includes using the same words as the original text without acknowledging the source or without using quotation marks is plagiarism, putting someone else's ideas into your own words and not acknowledging the source of the ideas, copying materials, ideas or concepts from a book, article, report or other written document, presentation, composition, artwork, design, drawing, circuitry, computer program or software, website, internet, other electronic resource, or another person's assignment, without appropriate acknowledgement.

Inappropriate paraphrasing skills, resulting in copying the written expression of someone else without acknowledgement

Using the exact words of someone else, with proper acknowledgement, but without quotation marks, changing a few words and phrases while mostly retaining the original structure and/or progression of ideas of the original, and information without acknowledgement.

Relying too much on other people's material

Relying too much on other people's material; that is, repeated use of long quotations (even with quotation marks and with proper acknowledgement), using your own ideas, but with heavy reliance on phrases and sentences from someone else without acknowledgement, piecing together quotes and paraphrases into a new whole, without appropriate referencing.

Inappropriate citation

Citing sources which have not been read, without acknowledging the 'secondary' source from which knowledge of them has been obtained, padding' reference lists with sources that have not been read or cited within assignments.

Self-Plagiarising

Duplicating previously submitted work that you have handed in for another course, in part or in whole, re-using parts of, or all of, a body of work that has already been submitted for assessment without proper citation.

Further information on plagiarism and its management can be found at the web address given above.

"The Learning Centre serves as the central UNSW resource on academic integrity and understanding and avoiding plagiarism.

Resources are available at www.lc.unsw.edu.au/plagiarism.

The Learning Centre provides a range of programs and resources for staff and students including website materials, workshops, individual tuition and online tutorials to aid students in:

- *correct referencing and citation practices*
- *paraphrasing, summarising, essay writing, and time management*
- *appropriate use of and attribution for, a range of materials including text, images, formulae and concepts."*

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

GRIEVANCE RESOLUTION OFFICER

In case you have any problems or grievance about the course, you should try to resolve it with the Course Convenor (Dr Lesley Ulman 9385 3601). If the grievance cannot be resolved in this way, you should contact the School of Medical Sciences Grievance Officer, Dr P.Pandey (9385 2483, P.Pandey@unsw.edu.au).

TIMETABLES

SESSION 2: 2014

LECTURES AND TUTORIALS

Week No. Commencing	LECTURE Tuesday 9am CLB 7	LECTURE Wed 9am CLB 7	LECTURE Friday 3pm Lecture-CLB 7 Tutorials-Mathews C & D, Biomed E, WW LG02 & LG03, CLB 7
1 28-Jul	Introduction ULMAN	Temperature Regulation GIBSON	Endocrine 1 LEWIS
2 4-Aug	Endocrine 2 LEWIS	Endocrine 3 LEWIS	Endocrine 4 LEWIS
3 11-Aug	Endocrine 5 LEWIS	Reproduction 1 MARDEN	<i>Tutorial – Endocrine</i>
4 18-Aug	Reproduction 2 MARDEN	Reproduction 3 MARDEN	Respiration 1 KLUGMANN
5 25-Aug	Respiration 2 KLUGMANN	Respiration 3 KLUGMANN	Respiration 4 KLUGMANN
6 1-Sep	Respiration 5 KLUGMANN	Respiration 6 KLUGMANN	<i>Tutorial – Respiration</i>
7 8-Sep	Gastrointestinal Tract 1 BRITTON	MID SESSION EXAM	Gastrointestinal Tract 2 BRITTON
8 15-Sep	Gastrointestinal Tract 3 BRITTON	Gastrointestinal Tract 4 GIBSON	Gastrointestinal Tract 5 BRITTON
9 22-Sep	Gastrointestinal Tract 6 Appetite control MORRIS	Gastrointestinal Tract 7 BRITTON	<i>Tutorial – GIT</i>
MID-SEMESTER BREAK 27TH Sept – 6th Oct			
10 6-Oct	Kidney & Body Fluids 1 GIBSON	Kidney & Body Fluids 2 GIBSON	Kidney & Body Fluids 3 GIBSON
11 13-Oct	Kidney & Body Fluids 4 GIBSON	Kidney & Body Fluids 5 GIBSON	Kidney & Body Fluids 6 GIBSON
12 20-Oct	NO LECTURE	Kidney & Body Fluids 7 GIBSON	<i>Tutorial –Kidney</i>
13 27-Oct	NO LECTURE	NO LECTURE	NO LECTURE

SESSION 2: 2014

PRACTICAL TIMETABLE

week	day & time	date	group	Supervised practical Wallace Wurth East Wing LAB 115	group	Self-directed computer class Wallace Wurth East Wing LAB 120
1	Tues 10-1 Tues 2-5 Wed 10-1	29/7 29/7 30/7	All groups	NO PRACTICALS		
2	Tues 10-1 Tues 2-5 Wed 10-1	5/8 5/8 6/8	1 & 2 3 & 4 5 & 6	TEMPERATURE REGULATION		
3	Tues 10-1 Tues 2-5 Wed 10-1	12/8 12/8 13/8	7 & 8 - 9 & 10	TEMPERATURE REGULATION		
4	Tues 10-1 Tues 2-5 Wed 10-1	19/8 19/8 20/8	1 & 2 3 & 4 5 & 6	THYROID PHYSIOLOGY		
5	Tues 10-1 Tues 2-5 Wed 10-1	26/8 26/8 27/8	7 & 8 - 9 & 10	THYROID PHYSIOLOGY		
6	Tues 10-1 Tues 2-5 Wed 10-1	2/9 2/9 3/9	1 & 2 3 & 4 5 & 6	ENDO/REPRO PHYSIOLOGY		
7	Tues 10-1 Tues 2-5 Wed 10-1	9/9 9/9 10/9	7 & 8 - 9 & 10	ENDO/REPRO PHYSIOLOGY		
8	Tues 10-1 Tues 2-5 Wed 10-1	16/9 16/9 17/9	1 & 2 3 & 4 5 & 6	RESPIRATORY GAS EXCHANGE		
9	Tues 10-1 Tues 2-5 Wed 10-1	23/9 23/9 24/9	7 & 8 - 9 & 10	RESPIRATORY GAS EXCHANGE	1 & 2 3 & 4 5 & 6	SELF DIRECTED LEARNING - GIT
MID-SEMESTER BREAK 27TH Sept – 6th Oct						
10	Tues 10-1 Tues 2-5 Wed 10-1	7/10 7/10 8/10	1 & 2 3 & 4 5 & 6	CONTROL OF RESPIRATION	7 & 8 - 9 & 10	SELF DIRECTED LEARNING - GIT
11	Tues 10-1 Tues 2-5 Wed 10-1	14/10 14/10 15/10	7 & 8 - 9 & 10	CONTROL OF RESPIRATION	1 & 2 3 & 4 5 & 6	SELF DIRECTED LEARNING - RENAL ENDOCRINE
12	Tues 10-1 Tues 2-5 Wed 10-1	21/10 21/10 22/10	1 & 2 3 & 4 5 & 6	VOLUME & SOLUTE CONTROL	7 & 8 - 9 & 10	SELF DIRECTED LEARNING - RENAL ENDOCRINE
13	Tues 10-1 Tues 2-5 Wed 10-1	28/10 28/10 29/10	7 & 8 - 9 & 10	VOLUME & SOLUTE CONTROL		

COMPULSORY LAB COATS REQUIRED FOR "SHADED" CLASSES

LECTURE OUTLINES

TEMPERATURE REGULATION

1. Normal body temperature. Core and shell. Heat transfer, heat production, heat loss by conduction, convection, radiation and evaporation. Temperature regulation – concept of set point; hypothalamic centres, afferent and efferent mechanisms. CVS homeostasis in heat. Heat acclimatization. Fever.

ENDOCRINOLOGY

1. **Mechanisms of hormone action.** The endocrine glands: common characteristics of endocrine glands. Hormones are chemical signals: amines, peptides, proteins and steroids. Transport of hormones. Endocrine, paracrine and autocrine action. Control of hormone secretion; concepts of hierarchical and feedback control mechanisms. Receptor signaling cascades.
2. **Simple feedback-loop endocrine systems.** Structure and function of the pancreas. Control of insulin and glucagon secretion: regulation of plasma glucose. Type I and type II diabetes. The heart and atrial natriuretic peptide: regulation of plasma volume. The kidneys: erythropoietin, calcitriol and the renin angiotensin system. The pineal gland and the thymus gland.
3. **The hypothalamus and pituitary gland.** Interactions between the hypothalamus and pituitary. Control of the hypothalamus from neural inputs. Hypothalamic releasing hormones. Anterior and posterior pituitary hormones. Control of synthesis, secretion and actions of pituitary hormones. Hypothalamic-pituitary feedback. Pituitary hormone dysfunction.
4. **The thyroid gland.** Thyroid gland structure and histology. Synthesis of thyroid hormones. Control of thyroid hormone secretion. Action of thyroid hormones on metabolism and development. Hyperthyroidism and hypothyroidism. Actions of parathyroid hormone and calcitonin in calcium homeostasis.
5. **Adrenal gland.** Adrenal gland structure and histology; adrenal cortex and medulla. Synthesis and secretion of adrenal steroid hormones from the cortex and catecholamines from the medulla. Interaction of aldosterone with the renin-angiotensin system of the kidneys. Metabolic actions of glucocorticoids and dysfunction. Actions of catecholamines.

REPRODUCTION

1. **Male reproductive system.** A description of the function of each component of the male reproductive tract. The hormonal control of testosterone production and spermatogenesis by the hypothalamic-pituitary axis. Composition of semen. Actions of testosterone.
2. **Female reproductive system.** A description of the function of each part of the female reproductive tract. Hormonal control of the menstrual cycle: the growth of a follicle in the ovary and the hypothalamic-pituitary axis. Actions of oestrogen and progesterone.
3. **Pregnancy.** The process of fertilization of an ovum by sperm and the implantation of the developed blastocyst in the uterine lining. The production of hormones by the placenta to maintain pregnancy. The interaction between the mother, the placenta and the fetus in steroid hormone synthesis.

RESPIRATORY SYSTEM

- 1 **Introduction and gases.** Basic lung-airway anatomy; relation to function. Airway and air flow properties in respiration. Pulmonary circulation. Particle removal mechanisms. Gas laws. Gas solubility. Gas tension in a solution. Composition of air.
- 2 **Ventilation.** Lung volumes and capacities. Spirometry. Residual volume. Ventilation. Dead space and alveolar ventilation. Oxygen uptake / carbon dioxide output / respiratory exchange ratio.
- 3 **Oxygen transport.** Composition of alveolar air at rest. Venous and arterial blood gas tensions. Blood oxygen transport - need for a carrier. The haemoglobin molecule. Oxygen capacity, saturation and content. Hb-O₂ equilibrium curve (OEC) and its features (shape, CO₂ and pH (Bohr), temperature effects, 2,3 DPG). Haemoglobin compared to myoglobin. Carbon monoxide poisoning.
- 4 **Carbon dioxide transport and blood buffering.** CO₂ transport in blood. Effect of oxygenation on CO₂ transport (Haldane effect). Blood CO₂ equilibrium curves. Acids and bases - fundamental concepts. Henderson Hasselbalch Equation. Blood buffering systems. Importance of haemoglobin. Simple acid-base disorders.
- 5 **Respiratory Mechanics.** Muscles of respiration. Elastic properties of the lung. Compliance. Surface tension. Surfactant. Elastic properties of the chest wall. Compliance of lungs and chest wall. Relaxation pressure-volume curves. Airway resistance. Intrapleural and intra-alveolar pressures and gas flow during the respiratory cycle.
- 6 **Control of Respiration.** 'Central controller' (pre-Botzinger complex - critical for rhythm generation in breathing) and role of the medulla and pons. Respiratory related neurones. Sensors: Chemical control of breathing via central chemoreceptors and peripheral chemoreceptors (carotid and aortic bodies). Other receptors in lungs, upper airways etc. Interaction of O₂ and CO₂ in control of respiration. Role of pH. Control of respiration in exercise.

GASTROINTESTINAL SYSTEM

1. **Overview of gastrointestinal tract (GIT).** Structure and function of the GIT. Anatomy of the GIT wall. Patterns of GIT motility. Physiological basis of GIT motility. Enteric nervous system. Digestive reflex processes. Digestive processes occurring in the mouth, composition of saliva and control of salivation. Swallowing. (FB)
2. **Gastric secretion, motility and emptying.** Stomach anatomy. Composition and function of gastric secretions. Mechanism of gastric acid secretion. Factors regulating gastric acid secretion. Overview of gastric motility, filling and emptying. Vomiting. Gastric ulcers. (FB)
3. **Digestive processes of the small intestine.** Structure of the small intestine and its role in digestion and absorption. Composition of pancreatic juice. Regulation of pancreatic juice secretion. Pancreatic enzymes and brush border enzymes. Motility in the small intestine. Motility disorders. (FB)
4. **Liver and biliary system.** Functional anatomy of the liver. Liver blood flow. Functions of the liver. Formation and secretion of bile. Bile salts. Bilirubin metabolism and secretion. The gall bladder. Factors causing gall bladder contraction. Gallstones. (KG)
5. **Chemical digestion and absorption of nutrients.** Enzymatic hydrolysis of carbohydrate, protein and lipid. Trans-epithelial absorption and active transport of nutrients. Absorption of vitamins, electrolytes and water. Food allergies. (FB).
6. **Appetite control:** Factors that control appetite in the short and long term. Role of the brain in appetite control - brain:gut communication and the importance of adipose tissue as an endocrine organ. What goes wrong in obesity? (MJM)
7. **Digestive Processes of the Large Intestine.** Structure and function of the large intestine. Absorption of water and electrolytes. The role of bacterial flora in the colon. Motility of the large intestine. Defecation. (FB)

KIDNEY AND BODY FLUIDS

1. **Body fluids and introduction to the kidney.** Properties of solutions. Osmosis, osmolality, osmolarity, tonicity, osmotic pressure, colloid osmotic pressure. Volume and composition of the body fluid compartments. Functions of the kidneys. Basic anatomy of the urinary system.
2. **Renal structures, renal blood flow and glomerular filtration.** Structure of the nephron. Cortical and juxtamedullary nephrons. The juxtaglomerular apparatus. Basic steps in forming urine. Renal blood flow and pressure in the renal vessels. Autoregulation. The renin angiotensin system. Renal sympathetic nerves. Glomerular filtration and glomerular filtration rate (GFR). Equation for single nephron GFR. Filtration fraction. Effects of arteriolar tone on RBF and GFR.
3. **Reabsorption and secretion; Evaluating renal function.** Measurement of GFR. Measurement of renal plasma flow. Concept of effective renal plasma flow. Definition and calculation of clearance. Calculation of filtered load, excretion rate, net reabsorption or secretion. Comparison of filtrate and urine. Basic mechanisms of transepithelial transport. Transepithelial transport of sodium, water, glucose. Tm limited reabsorption.

4. **Tubular structure and function along the nephron; Renal water homeostasis.** Structure and function of the proximal tubule. Glomerulotubular balance. Transport properties of the loop of Henle, distal convoluted tubule and collecting duct. Water balance. Regulation of plasma osmolality. Thirst. Making a dilute or concentrated urine. Obligatory water loss.
5. **Urinary concentrating mechanisms; Renal sodium homeostasis.** The medullary osmotic gradient and its generation and maintenance: countercurrent multiplication, urea recycling and countercurrent exchange. Antidiuretic hormone. Aquaporins, Protecting renal medullary cells from hypertonicity. Sodium balance. Sodium and extracellular volume. Detecting changes in sodium intake. Efferent mechanisms to vary sodium output.
6. **Renal sodium and potassium balance.** Hormones involved in sodium balance. Angiotensin II. Aldosterone. Atrial natriuretic peptide. Potassium balance. Exchange of potassium between extracellular and intracellular fluid. Renal handling of potassium. Mechanism of potassium secretion by principal cells. Factors affecting potassium secretion.
7. **Renal acid-base balance.** Brief revision of fundamental concepts and body acid base balance. Role of the kidneys in acid-base balance. Equation for net acid excretion. Bicarbonate reabsorption. Secretion of H^+ and manufacture of bicarbonate. Urinary buffers and excretion of acid as titratable acid and ammonium. Renal response to acidosis and alkalosis.

LABORATORY REGULATIONS AND BEHAVIOUR

Health and Safety is a primary concern for both students and staff working in any laboratory.

The following regulations MUST be adhered to when participating in Physiology practical classes:

- Each practical class has a student risk assessment (SRA) and a student safe working procedure (SSWP) associated with it.
- The SRA identifies the hazards and risks associated with the particular practical and outlines appropriate controls that must be followed to minimize these risks. The SRA also lists the personal protective equipment (PPE) that students are required to wear for that class, emergency procedures and clean up and waste disposal instructions.
- The SSWP provides background information relating to the class and outlines the procedures to be carried out in that class.
- Students must read the practical notes and sign the SRA prior to commencing the class.
- In each laboratory there are also more comprehensive school approved risk assessments, associated safe work procedures and safety data sheets (SDS) for each particular class. You may refer to these if you require further information. First aid kits and specific spill kits are also located in the laboratories.
- If any accidents or incidents occur they should be reported immediately to the demonstrator in charge of the class who will record the incident and recommend what further action is required.
- Random tests will be given throughout the session prior to the class, to encourage adequate preparation by the students. The results of these tests will contribute 10% of your assessment for the session.
- Students are required to wear the appropriate PPE for each class. Enclosed shoes are mandatory for entering any laboratory (other than computer classes) and you will not be permitted to participate in the practical if you are not wearing appropriate footwear. Most practical classes will also require a lab coat which you must provide. You must regularly wash your lab coat. If you do not bring your lab coat to these classes you will not be able to participate.
- Many classes will require you to wear gloves (which will be provided). Gloves must be removed before writing in lab books and using computers or other electrical equipment.
- You must not wear lab coats or gloves outside the laboratory.
- You must not eat or drink in any laboratory.
- Students are expected to arrive on time. Any student arriving more than 10 minutes late may be refused entry.
- Mobile phones should be turned off before entering the class.
- Laboratory computers may only be used for work relating to the practical class.
- It is expected that students behave appropriately in laboratory classes. In the event of inappropriate behavior students may be asked to leave.
- It is of course vital that animals used in practical classes **MUST** be treated humanely and with respect. Taking photos is **ABSOLUTELY UNACCEPTABLE**, and will result in removal from the class and a referral to the Head of Department.

The procedures used in the laboratory classes involving the use of animals have been approved by the Committee on the Use of Animals in Research and Teaching (CUART registration number ACEC 13/66B expiring 10/6/16).

Experiments in this manual, which involve the use of human subjects, have been considered and approved by the School of Medical Sciences Committee on Experimental Procedures Involving Human Subjects for teaching. Practical classes involving your participation as a subject require you to sign a witnessed, informed consent form.