



**THE UNIVERSITY OF
NEW SOUTH WALES**

**SCHOOL OF MEDICAL SCIENCES
DEPARTMENT OF PHYSIOLOGY**

**SECOND YEAR PHYSIOLOGY
PHPH2201 PHPH2221
PHPH2502**

**SESSION 2
PRACTICAL CLASS MANUAL
2009**

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EXAMINER AND COURSE CO-ORDINATOR

Co-ordinator: **Dr. Lesley Ulman Room 210B (ph: 9385 3601)**
 L.Ulman@unsw.edu.au

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

LECTURERS IN THIS COURSE

Dr T. Lewis	T.Lewis@unsw.edu.au
Dr K. Gibson	K.Gibson@unsw.edu.au
Dr P. Bertrand	P.Bertrand@unsw.edu.au
Prof M. Morris	M.Morris@unsw.edu.au
Dr A. Boyce	A.Boyce@unsw.edu.au

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

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 2-3). Lectures will provide you with the concepts and theory essential for understanding the fundamental processes of body function. The Fri 2-3 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 weekly 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. Some of these sessions will be computer based, rather than of a practical nature and some will be self directed learning sessions based on the interactive physiology website.

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 WebCT vista. 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 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

Endocrine Physiology

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

Temperature Regulation

- normal body temperature and how it is regulated

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
- respiration and exercise

Kidney and Body Fluids

- body fluids
- 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

Gastrointestinal System

- appetite control
- overview of the gastrointestinal tract and the glands associated with digestion
- stomach – structure and digestion
- release of pancreatic enzymes and bile salts from the gallbladder and liver
- small intestine – structure and role in digestion and absorption
- regulation and control of food intake
- control of gastro-intestinal tract motility
- large intestine – structure and function

ASSESSMENT

	%Total Marks
Mid-session Theory Exam (50min duration)	
Multiple choice and short essay questions on material covered in Session 2 weeks 1-8 inclusive – Friday 18 th September 2009	25%
End of Session Exam (2 hours duration)	
Short essay questions and multiple choice questions on all lecture and tutorial material covered in Session 2 and 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.	50%
Online Feedback Quizzes	15%
There will be two 30 minute online feedback quizzes, one in week 6 and one in week 12. These will be done on-line under supervision during your normal allocated practical time. Each quiz will consist of 15 multiple choice questions. The quiz in week 6 will include material covered in all lectures on Temperature Regulation, Endocrine and Reproduction. The quiz in week 12 will include material covered in Kidney and Body Fluids lectures 3-7 and Gastrointestinal Tract lectures 1-3 inclusive. Each quiz will be worth 7.5%. These quizzes will be open book. You may bring in any material with you that you wish.	
Practical Quizzes	
Conducted immediately before some of the practical classes on that day's work.	10%

TEXTBOOK

PRINCIPLES OF HUMAN PHYSIOLOGY by Cindy L. Stanfield and William J. Germann, Benjamin Cummings, 3rd edition, 2009. This book comes with an Interactive Physiology CD which is used in the self study sessions. Books are available from the UNSW

bookshop. A few copies of the book and CD can be borrowed for short periods of time from Wallace Wurth room 210B.

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 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 Wallace Wurth Building room MG14.

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 Angela Finch (Angela.Finch@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 the Administrative Officer.

ATTENDANCE REQUIREMENTS

Attendance at practical classes/demonstrations 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 for more than 1 class per session 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 Dr. Lesley Ulman (Rm 210B) **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.**

Practical exams are 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 PPHP2201, 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.

BEHAVIOUR IN PRACTICAL CLASSES

Students must take due care with biological and hazardous material and make sure all equipment is left clean and functional. Those who don't adhere to these basic laboratory rules will be marked absent. Closed shoes must be worn to all laboratory classes. A laboratory coat must be worn to some laboratory classes as indicated on the timetable. Punctual arrival is expected and mobile phones should be turned off before entering the class.

CONSENT FORMS

Practical classes involving your participation as a subject require you to sign a witnessed, informed consent form.

NOTICEBOARDS

Noticeboards for this course can be found on the 2nd floor of the Wallace Wurth building. Current timetables and information relevant to you will be displayed here. It is your responsibility to check these regularly.

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

TEACHING RESOURCES ON THE DEPARTMENT OF PHYSIOLOGY'S WWW SITE

The Department of Physiology has chosen to use the University's central WebCT service to provide teaching material for all of its courses. You can make use of iletecture recordings taken of the lectures which are available on WebCT. Lecture notes will also be made available on WebCT either before or shortly after the lecture.

To access these materials, either point your browser to:

<http://vista.elearning.unsw.edu.au/>

or go to the School's home page at:

<http://medicalsciences.med.unsw.edu.au/>, then select "Current Students" from the menu bar and click on WebCT, under "Quicklinks" in the left column. You will need to click through the "UNSW" at the left, then click the "Log on" button and enter your Unipass credentials (zStudentNo. and password). After logging on to WebCT, look for the 2009 S2 course. You should have access to it if you are properly enrolled.

Browser Settings which are needed for WebCT:

The central WebCT service uses WebCT Vista. This makes extensive use of "pop-up" windows. Most browsers now block such pop-ups so you will need to allow pop-ups on this site for it to work properly for you.

The central WebCT service recommends the use of the "Firefox" browser when accessing WebCT. This will probably not be necessary in order to make use of the site for courses provided by the Department of Physiology. The features of WebCT Vista which don't work well in Internet Explorer are not used in our courses.

This course has a "Practice MCQ" section which holds a set of practice questions of the type which you will meet in your exam. There is a page with some fairly simple instructions for installing the software which will enable you to access these MCQ's on your own computer. Alternatively, these practice MCQs can be accessed on the student computers in G2/G4 and 106/108 Wallace Wurth Building. If you experience difficulty getting these MCQ's to operate on your computer, please contact the course convenor.

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 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 days after an examination in a course will only be considered in 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.

Students who miss an assessment must submit an application for consideration to Student Central and must also contact the course convenor immediately. 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 co-ordinator 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 attend the practical exam at the end of session.

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 co-ordinator prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or www.equity.unsw.edu.au/disabil.html). 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. Information on designing courses and course outlines that take into account the needs of students with disabilities can be found at:

www.secretariat.unsw.edu.au/acboardcom/minutes/coe/disabilityguidelines.pdf

STUDENT RIGHTS AND RESPONSIBILITIES

Refer to UNSW Student Gateway @ www.student.unsw.edu.au

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.

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

- direct duplication of the thoughts or work of another, including by copying work, or knowingly permitting it to be copied. This includes 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;
- claiming credit for a proportion of work contributed to a group assessment item that is greater than that actually contributed.†

Submitting an assessment item that has already been submitted for academic credit elsewhere may also be considered plagiarism.

Other examples of plagiarism include:

- quotation without the use of quotation marks. It is a serious breach of these rules to quote another's work without using quotation marks, even if one then refers to the quoted source. The fact that it is quoted must be acknowledged in your work.
- unacknowledged use of information or ideas, unless such information or ideas are commonplace.
- citing sources (e.g. texts) which you have not read, without acknowledging the 'secondary' source from which knowledge of them has been obtained.

Appropriate citation of sources therefore includes surrounding any directly quoted text with quotation marks, with block indentation for larger segments of directly-quoted text. The preferred format for citation of references is an author-date format with an alphabetically arranged bibliography at the end of the assignment. Note that merely citing textbooks or website URLs is unlikely to yield a bibliography of satisfactory standard. The internet should be avoided as a primary source of information. Inclusion of appropriate journal articles, both primary research publications and reviews, is usually expected.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

Students are reminded of their Rights and Responsibilities in respect of plagiarism, as set out in the University Undergraduate and Postgraduate Handbooks, and are encouraged to seek advice from academic staff whenever necessary to ensure they avoid plagiarism in all its forms.

The Learning Centre website is the central University online resource for staff and student information on plagiarism and academic honesty. It can be located at:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing 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.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle.
† Adapted with kind permission from the University of Melbourne.

APPEAL PROCEDURES

Refer to UNSW Student Gateway @ www.student.unsw.edu.au.

GRIEVANCE RESOLUTION OFFICER

In case you have any problems or grievance about the course, you should try to resolve it with the Course Co-ordinator (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

**PHYSIOLOGY 1B PPH2201, PPH2221, PPH2502
SESSION 2: 2009**

LECTURES AND TUTORIALS

Week No. Commencing	LECTURE Tuesday 9am Mathews Theatre A	LECTURE Wed 9am Law Theatre	LECTURE Friday 2pm Lecture-Mathews Theatre A Tutorials-Mathews 102 & 310, Matthews C & D, Biomed B & E
2 27-Jul	Introduction ULMAN	Temperature Regulation GIBSON	Endocrine 1 LEWIS
3 3-Aug	Endocrine 2 LEWIS	Endocrine 3 LEWIS	Endocrine 4 LEWIS
4 10-Aug	Endocrine 5 LEWIS	Reproduction 1 LEWIS	<i>Tutorial – Endocrine</i>
5 17-Aug	Reproduction 2 LEWIS	Reproduction 3 LEWIS	Respiration 1 GIBSON
6 24-Aug	Respiration 2 GIBSON	Respiration 3 GIBSON	Respiration 4 GIBSON
7 31-Aug	Respiration 5 GIBSON	Respiration 6 GIBSON	<i>Tutorial – Respiration</i>
RECESS 5 th Sep – 13 th Sep			
8 14-Sep	Kidney & Body Fluids 1 BOYCE	Kidney & Body Fluids 2 BOYCE	MID SESSION EXAM
9 21-Sep	Kidney & Body Fluids 3 BOYCE	Kidney & Body Fluids 4 BOYCE	Kidney & Body Fluids 5 BOYCE
10 28-Sep	Kidney & Body Fluids 6 BOYCE	Kidney & Body Fluids 7 BOYCE	<i>Tutorial – kidney</i>
11 5-Oct	Gastrointestinal Tract 1 – Appetite control MORRIS	Gastrointestinal Tract 2 BERTRAND	Gastrointestinal Tract 3 BERTRAND
12 12-Oct	Gastrointestinal Tract 4 BERTRAND	Gastrointestinal Tract 5 BERTRAND	<i>Tutorial –GIT</i>
13 19-Oct	Gastrointestinal Tract 6 BERTRAND	Gastrointestinal Tract 7 BERTRAND	NO CLASS

WK	DAY	DATE	GP	PRAC TIMES Tues 10-1 (gps 1,2&3), Tues 2-5 (gps 4,5&6) Wed 10-1 (gps 7,8&9)	GP	PRAC TIMES Tues 10-1 (gps 1,2&3), Tues 2-5 (gps 4,5&6) Wed 10-1 (gps 7,8&9)	GP	PRAC TIMES Tues 10-1 (gps 1,2&3), Tues 2-5 (gps 4,5&6) Wed 10-1 (gps 7,8&9)			
2		28/7 29/7	All gps	NO PRACTICALS							
3	Tues am Tues pm Wed am	4/8 4/8 5/8	1 4 7	ENDO/REPRO PHYSIOLOGY Lab M210	2 5 8	TEMPERATURE REGULATION Lab 202	3 6 9	THYROID PHYSIOLOGY Lab 204			
4	Tues am Tues pm Wed am	11/8 11/8 12/8	3 6 9		1 4 7		2 5 8				
5	Tues am Tues pm Wed am	18/8 18/8 19/8	2 5 8		3 6 9		1 4 7				
6	Tues am Tues pm Wed am	25/8 25/8 26/8	All gps		ONLINE FEEDBACK QUIZ 1						
7	Tues am Tues pm Wed am	1/9 1/9 2/9	1 4 7		RESPIRATORY GAS EXCHANGE		2 5 8		VOLUME & SOLUTE CONTROL	3 6 9	SELF-DIRECTED LEARNING – RENAL ENDOCRINE
MID-SESSION RECESS 5TH SEPTEMBER – 13TH SEPTEMBER											
8	Tues am Tues pm Wed am	15/9 15/9 16/9	3 6 9	RESPIRATORY GAS EXCHANGE Lab 202	1 4 7	VOLUME & SOLUTE CONTROL Lab M210	2 5 8	SELF-DIRECTED LEARNING – RENAL ENDOCRINE Lab 204			
9	Tues am Tues pm Wed am	22/9 22/9 23/9	2 5 8		3 6 9		1 4 7				
10	Tues am Tues pm Wed am	29/9 29/9 30/9	1 4 7	CONTROL OF RESPIRATION Lab 202	2 5 8	VOLUME & SOLUTE DISCUSSION Lab 204	3 6 9	SELF-DIRECTED LEARNING – GIT Lab M210			
11	Tues am Tues pm Wed am	6/10 6/10 7/10	3 6 9		1 4 7		2 5 8				
12	Tues am Tues pm Wed am	13/10 13/10 14/10	All gps	ONLINE FEEDBACK QUIZ 2							
13	Tues am Tues pm Wed am	20/10 20/10 21/10	2 5 8	CONTROL OF RESPIRATION Lab 202	3 6 9	VOLUME & SOLUTE DISCUSSION Lab 204	1 4 7	SELF-DIRECTED LEARNING – GIT Lab M210			

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 peptides: regulation of plasma volume. The kidneys and erythropoietin. The thymus gland.
3. **The hypothalamus and pituitary gland.** Interactions between the hypothalamus and pituitary. Control of the hypothalamus. 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 structure and histology. Synthesis of thyroid hormones. Control of thyroid secretion. Function of thyroid hormones. Hyperthyroidism and hypothyroidism. Parathyroid hormone and calcitonin.
5. **Adrenal gland.** Adrenal structure and histology; adrenal cortex and medulla. Synthesis and secretion of adrenal steroids from the cortex and catecholamines from the medulla. Function of adrenal hormones. Interaction of aldosterone with the renin-angiotensin system of the kidneys.

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 foetus in steroid hormone synthesis.

RESPIRATORY SYSTEM

1. **Introduction and Gases.** Anatomical features of the mammalian respiratory system and their physiological significance. Upper airways, bronchial tree, alveoli, pulmonary circulation. The gas laws. Gas solubility. Gas tension in a solution. Composition of air.
2. **Ventilation.** Lung volumes. 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. Oxygen capacity, saturation and content. The haemoglobin molecule. Hb-O₂ equilibrium curve. Features of the OEC - shape, CO₂ and pH effect (Bohr), temperature effect, 2,3 DPG. Comparison between haemoglobin and myoglobin. Carbon monoxide poisoning.
4. **Carbon dioxide transport and blood buffering.** Forms in which CO₂ exists in the blood. Blood CO₂ equilibrium curves. Effect of oxygenation on CO₂ transport (Haldane effect). Acids and bases - fundamental concepts. Henderson Hasselbalch Equation. Blood buffering systems. Importance of haemoglobin. Acid-base disorders (in brief).
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 - its relative importance in rest and exercise. Intrapleural and intra-alveolar pressures and gas flow during the respiratory cycle.
6. **Control of Respiration.** Neural centres in the medulla and pons. "Central controller" Pre-Botzinger complex. Respiratory related neurones. 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.

KIDNEY AND BODY FLUIDS

1. **Body fluids and introduction to the kidney.** Functions of the kidneys. Osmosis, osmolality, osmolarity, tonicity, osmotic pressure, colloid osmotic pressure. Volumes and composition of the body fluid compartments. 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. Renal blood flow. Renal sympathetic nerves. Basic steps in forming urine. Glomerular filtration and glomerular filtration rate (GFR). Filtration fraction. Equation for single nephron GFR. Effects of arteriolar tone on RBF and GFR. Autoregulation and tubuloglomerular feedback.
3. **Reabsorption and secretion; Evaluating renal function.** Comparison of filtrate and urine. Basic mechanisms of transepithelial transport. Transepithelial transport of sodium, water, glucose. T_m limited reabsorption. Calculation of filtered load, excretion rate, net reabsorption or secretion. Renal clearance. Use of clearance to measure GFR and effective renal plasma flow.
4. **Tubular structure and function along the nephron; Renal water homeostasis.** Structure and function of the proximal tubule. TF/P ratios. Glomerulotubular balance. Transport properties of the loop of Henle, distal convoluted tubule and collecting duct. Water balance. Regulation of plasma osmolality. Thirst. Antidiuretic hormone. 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. 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. The renin angiotensin aldosterone system. Potassium balance. Buffering of extracellular potassium by the tissues. Renal handling of potassium. Mechanism of potassium secretion by principal cells. Factors affecting potassium secretion.
7. **Renal acid-base balance.** Metabolic production of volatile and fixed acid. Physiological buffers. Henderson-Hasselbalch equation for HCO_3^- . Basic mechanism for secretion of H^+ . Reabsorption and manufacture of HCO_3^- . Urinary buffers and excretion of acid as titratable acid and ammonium. Net acid excretion. Renal response to acidosis and alkalosis.

GASTROINTESTINAL SYSTEM

1. **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)
2. **Overview of the gastrointestinal tract (GIT) and the glands associated with the digestion of food.** The journey begins with a meal entering the mouth and the actions of salivary enzymes. This is followed by the act of swallowing and the entry of a meal into the stomach. We will focus on the basic motility of the oesophagus and of the stomach. (PB)
3. **An overview will be presented on the structure of the stomach and the digestion of a meal.** We will focus on the mechanism of gastric enzyme secretion and the mechanism and regulation of acid production. This will be followed by a discussion of the coordinated release of a meal into the duodenum - gastric emptying. (PB)
4. **Overview of how food in the duodenum triggers release of pancreatic enzymes and bile salts from the liver (and gall bladder).** We will focus on the production of bile salts and the regulation of pancreatic and gall bladder secretions by intestinal hormones. (PB)
5. **The structure of the small intestine and its role in digestion and absorption** of carbohydrates, proteins and fats and its uptake of vitamins and minerals. An introduction to the motility patterns that move food along the intestine will be presented. (PB)
6. **Control of gastro-intestinal tract motility.** The GIT is controlled by nerves from the central nervous system as well as nerves originating from within the GIT. These nerves are known as the enteric nervous system (ENS). The role of the ENS, the types of neurons and the neurotransmitters they use and how reflexes are initiated will be covered. (PB)
7. **The structure and function of the large intestine.** The large intestine plays a role in the storage of contents and in the absorption of water and electrolytes. We will focus on how the functions of the large intestine compare to, and are coordinated by, other

parts of the GIT. The basic movements of the large intestine and the role bacterial colonies may play will be addressed. (PB)

PHYSIOLOGY PRACTICAL MANUAL

PREFACE:

Students are required to familiarise themselves with the appropriate section of the practical manual before attending each class. 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 closed shoes to **all** classes. Students are also required to wear a laboratory coat to some classes and these are indicated on the timetable.

In the interests of safety, special attention should be paid to any precautionary measures recommended in the notes. 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.

Experiments in this manual, which involves the use of human subjects, have been considered and approved by the University's Committee on Experimental Procedures Involving Human Subjects (CEPIHS 99140 and 99143, HREA 054021 and 054023). Each student must read carefully the details of each experiment before embarking on it, and is required to raise any matters of concern with the person in charge of the class before the experiment has begun.

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 07/54B expiring 30/6/10).