UNSW AUSTRALIA | Medical Sciences Medicine

DEPARTMENT OF PHYSIOLOGY

PHSL2101
PHSL2121
PHSL2501

Second Year Physiology

COURSE OUTLINE

SEMESTER 1, 2016

CONTENTS

PRACTICALS

1. Laboratory Health & Safety Induction / Safe Handling of Biological Fluids
2. Excitable Cell Physiology
3. Skeletal Muscle
4. Introduction to the Cardiovascular System
5. Microcirculation
6. Electrical and Mechanical Events in the Cardiac Cycle
7. Sensory Physiology

Please read this manual/outline in conjunction with the following pages on the School of Medical Sciences website:

- Advice for Students
- Learning Resources

(or see "STUDENTS" tab at medicalsciences.med.unsw.edu.au)

EXAMINER AND COURSE CONVENOR

Course Convenor:	**Dr. Lesley Ulman** **l.ulman@unsw.edu.au**	**Room 204 West Wing Wallace Wurth** **(ph: 9385 3601)**
Co-convenor:	**Dr. Nicole Marden** **n.marden@unsw.edu.au**	**Room 204 West Wing Wallace Wurth** **(ph: 9385 3601)**

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

LECTURERS IN THIS COURSE

A/Prof A. Moorhouse	**A.Moorhouse@unsw.edu.au**
A/Prof S. Head	**S.Head@unsw.edu.au**
Dr L. Ulman	**L.Ulman@unsw.edu.au**
Dr T. Murphy	**Tim.Murphy@unsw.edu.au**
Dr R. Vickery	**Richard.Vickery@unsw.edu.au**

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

OBJECTIVES OF THE COURSE

This course is offered to second year students and is the first physiology course that you will encounter. 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 both relatively simple cellular mechanisms (for example, the sequence of ion permeability changes in membranes that can result in the initiation and propagation of a nerve impulse along a nerve fibre) as well as more complex interactions between whole organ systems. The major areas of study include excitable tissues, muscle, blood, the cardiovascular system and neurophysiology.

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 (Mon 1-2, Wed 1-2 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 fortnightly 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 may be self-directed learning sessions.

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.

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.

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.

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:

Excitable tissues

- introduction to excitable cells and electrical signals in cells
- basic properties and structure of the cell membrane
- movement of ions across cell membranes
- generation of electrical potentials in cells and electrochemical equilibrium
- action potentials and their propagation
- neuromuscular transmission, central synaptic transmission, neurotransmitters and receptors.

Muscle

- structure of skeletal muscle, sliding filament hypothesis
- cross bridge cycle, role of calcium, excitation-contraction coupling, myofilaments,
- structure and function of cardiac and smooth muscle

Blood

- functions and composition of blood
- nutritional requirements of erythropoiesis
- blood groups, Rh Factor
- blood clotting

Autonomic Nervous System

- role of the ANS, its sensory input and levels of reflex control

Cardiovascular system

- function of the cardiovascular system
- pulmonary and systemic circulations
- blood vessels
- cardiac output
- electrical events in the heart
- mechanical events in the heart
- myocardial contractility, regulation of cardiac output
- haemodynamics, physical laws governing the CVS, Poiseuilles equation, streamline and turbulent flow
- control of the cardiovascular system
- regional blood flows
- microcirculation and lymphatics
- integration of cardiovascular physiology

Neurophysiology

- overview - the organization and connections of the peripheral and central nervous systems
- body senses
- hearing and balance
- vision
- retinal visual mechanisms
- reflexes and motor control

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).

SoMS Honours program is coordinated by Dr. Thomas Fath (t.fath@unsw.edu.au). Any students considering an Honours year should discuss the requirements with the coordinator. 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 (v.sawatt@unsw.edu.au), our "Honours and Postgraduate Research Administrator" on 9385 8195.

See
http://medicalsciences.med.unsw.edu.au/students/undergraduate/summer-research-awards

ATTENDANCE REQUIREMENTS

Attendance at ALL 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 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 via Online Services in myUNSW within **3 DAYS** (further details on how to do this are documented below under "Applications for Special Consideration").

See also: Advice for Students regarding Attendance and Special Consideration

ASSESSMENT

	%Total Marks
Mid-session Theory Exam (50 min duration) The mid-session exam will be held on Wednesday 20th April 2016 and will consist of the following: • 15 multiple choice questions on material covered in all Excitable Tissues, Muscle, Blood and ANS lectures and tutorials. • Two 10 minute short answer questions; one on Excitable Tissues and one on Muscle.	**30%**
End of Session Exam (2 hours duration) The end of session exam will consist of the following: • 15 multiple choice questions on all Cardiovascular System and Neurophysiology lectures and tutorials. • Three 10 minute short answer questions; one on Blood, one on Cardiovascular System and one on Neurophysiology lectures and tutorials. • 30 multiple choice questions on material pertaining to the practical classes in Session 1. You will **not** be able to take your prac books into the exam.	**50%**
Online Feedback Quizzes There will be a series of 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.	**10%**

ALL MULTIPLE CHOICE QUESTIONS EXAMINING LECTURE AND TUTORIAL MATERIAL IN THE MIDSESSION AND END OF SESSION EXAM MULTIPLE CHOICE QUESTIONS 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 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.

Practical Quizzes **10%**

You will be divided into small working teams of approximately 6 students within your practical group at the beginning of the session and will remain in these teams throughout the session.

Random practical quizzes will be 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 computer practical: Electrical and Mechanical Events in the Cardiac Cycle is not a supervised practical and **will not** be included in practical quizzes but **will** be examined in the end of session exam. You will be required to do each quiz individually first and then after collection of the papers, you will be required to perform each quiz as a team.

Marks will be awarded to both your individual scores and your team score. A minimum of three quizzes will be given throughout the session and your mark for this component will be an average of **all** the quizzes you are given.

LECTURE OUTLINES

EXCITABLE TISSUES

1. Introduction to excitable cells and electrical signals in cells. Brief review of electricity and chemical properties of ions. Electrical and chemical properties of the cell membrane.

2. How substances cross the cell membrane: diffusion; exocytosis and endocytosis; via membrane transporters. Facilitated diffusion and ion channels. Primary and secondary membrane transporters. The Na^+/K^+/ATPase.

3. How electrical potentials are generated. Membrane potential. Nernst equation. Action potentials. Ionic currents and channels mediating a nerve action potential.

4. Action potential propagation and myelination. Cell to cell communication. Receptors. Chemical synaptic transmission.

5. Neuromuscular transmission. Central synaptic transmission. Neurotransmitters and receptors. Inhibitory and excitatory synaptic responses. Termination of neurotransmitter action. Neurotransmitter transporters.

6. Completion of lecture content, review of practical classes, and wrap up of major course objectives.

MUSCLE

1. Macroscopic and microscopic arrangements of myofilaments and muscle proteins involved in the structure of skeletal muscle and their role in genetically inherited muscle diseases. Sliding filament hypothesis of skeletal muscle contraction.
2. Cross-bridge cycle and utilisation of ATP. Role of intramuscular calcium ions in controlling muscle contraction and relaxation. Role of the sarcolemma, t-tubules and sarcoplasmic reticulum in regulating muscle contraction. Excitation-contraction coupling. Control of force output. Properties of Fast- and Slow-twitch muscle fibre types.
3. Structure and function of smooth and cardiac muscle. Mechanisms of smooth and cardiac muscle contraction. Comparisons with skeletal muscle.

BLOOD

1. Functions and composition of blood. Leucocytes, erythrocytes, plasma proteins, erythropoiesis.

2. Nutritional requirements of erythropoiesis, folate, B_{12}, Fe. Anaemia. Blood groups: ABO and Rh and incompatibilities.

3. Blood clotting – vascular spasm, platelet plug formation, coagulation, clot retraction and clot replacement, clotting abnormalities, anticlotting agents.

AUTONOMIC NERVOUS SYSTEM

1. Role of the autonomic nervous, its sensory input, and levels of reflex control. Organization of the sympathetic and parasympathetic systems including transmitters and receptors. Differences between autonomic and somatic synapses. Overview of the diverse effects of the autonomic nervous system.

CARDIOVASCULAR SYSTEM

1. Introduction to the cardiovascular system. Role of the circulation. Circulation of blood through heart, pulmonary and systemic circuits.

2. Blood vessels. Types of vessels; arteries, veins, capillaries and their functions. Cardiac output; normal values and method of measurement. Distribution of body fluid.

3. Electrical events in the heart. Conduction through the heart. Cardiac action potentials: pacemaker and non-pacemaker. The ECG.

4. Mechanical events in the heart. Relation of mechanical events to electrical events. Relation of pressures and volumes of cardiac chambers to ECG. Points of opening and closing of valves.

5. Myocardial contractility and regulation of cardiac output.

6. Haemodynamics. The distribution of pressure, resistance and vessel surface area throughout the CVS. Physical laws governing the CVS. Poiseuilles equation, streamline and turbulent flow.

7. Control of the cardiovascular system. The autonomic nervous system and effects on CVS. Central control of CVS. Cardiovascular reflexes; arterial baroreceptors, arterial chemoreceptors, atrial and great vein baroreceptors.

8. Regional blood flows. Local control of blood flow; intrinsic mechanisms (metabolic and myogenic) and autoregulation. Extrinsic control - neural and humoral. Major factors regulating coronary, cerebral, pulmonary and muscle circulation.

9. Microcirculation and lymphatics. Capillary morphology. Exchange across the capillary wall. Starling forces and fluid balance. Role of lymphatics. Integration of cardiovascular physiology.

NEUROPHYSIOLOGY

1. Overview. The organisation and connections of the peripheral and central nervous system. The blood-brain barrier and functions of cerebro-spinal fluid.

2. Body senses. Stimulus transduction and neural coding of the environment. Receptors for touch, temperature and pain. Pathways for somatosensory information to cortex.

3. Hearing & Balance. Structure and function of the outer, middle and inner ear. Transduction of sound and the place code for pitch. Structure and function of semicircular canals, utricle and saccule.

4. Vision. Optics and image formation. Visual defects correctable with lenses. Cortical organisation. Convergence and divergence as the basis of cortical processing. Topographic organisation of sensory and motor cortices. Classification and distribution of photoreceptors. Colour vision and colour blindness.

5. Retinal visual mechanisms. Classification and distribution of photoreceptors. Colour vision and colour blindness. The motor unit, motor neuron and muscle spindle afferent.

6. Reflexes and motor control. Definition of a reflex. Postural and pain reflexes. Motor pathways. Roles of cerebellum, basal ganglia and motor cortex in planning and conducting movements.

TIMETABLES

PHYSIOLOGY 1A PHSL2101, PHSL2121, PHSL2501
SESSION 1 2016

LECTURES AND TUTORIALS

Week No. Commencing	LECTURE Monday 1-2 Clancy	LECTURE Wednesday 1-2 Clancy	LECTURE Friday 2-3 Lecture – Clancy Tutorials – Mathews C & D, Mathews 310, CLB 3 & 4, Wallace Wurth LG03.
1 29-Feb	**Introduction** ULMAN	**Excitable Tissues 1** MOORHOUSE	**Excitable Tissues 2** MOORHOUSE
2 7-Mar	**Excitable Tissues 3** MOORHOUSE	**Excitable Tissues 4** MOORHOUSE	**Excitable Tissues 5** MOORHOUSE
3 14-Mar	**Excitable Tissues 6** MOORHOUSE	**Muscle 1** HEAD	*Tutorial – excitable tissues*
4 21-Mar	**Muscle 2** HEAD	**Muscle 3** HEAD	**GOOD FRIDAY**
EASTER RECESS 25th March – 3rd April			
5 4-Apr	**Blood 1** ULMAN	**Blood 2** ULMAN	*Tutorial – excitable tissues*
6 11-Apr	**Blood 3** ULMAN	**Autonomic Nervous System** VICKERY	**Cardiovascular System 1** ULMAN
7 18-Apr	**Cardiovascular System 2** ULMAN	**MID SESSION EXAM**	**Cardiovascular System 3** ULMAN
8 25-Apr	**ANZAC DAY**	**Cardiovascular System 4** ULMAN	**Cardiovascular System 5** MURPHY
9 2-May	**Cardiovascular System 6** MURPHY	**Cardiovascular System 7** MURPHY	*Tutorial – CVS*
10 9-May	**Cardiovascular System 8** MURPHY	**Cardiovascular System 9** MURPHY	**Neurophysiology 1** VICKERY
11 16-May	**Neurophysiology 2** VICKERY	**Neurophysiology 3** VICKERY	*Tutorial – neurophysiology*
12 23-May	**Neurophysiology 4** VICKERY	**Neurophysiology 5** VICKERY	*Tutorial – neurophysiology*
13 30-May	**Neurophysiology 6** VICKERY	**NO LECTURE**	**NO LECTURE**

PHYSIOLOGY 1A PHSL2101, PHSL2121, PHSL2501
SESSION 1 2016

PRACTICAL TIMETABLE

Week	Day & Time	Date	Prac Group	Supervised practical Wallace Wurth East Wing LAB 115	Prac Group	Self-directed computer class Wallace Wurth East Wing LAB 116
1	Tues 10-1 Tues 2-5 Wed 10-1	1/3 1/3 2/3	All groups	**NO PRACTICALS**		
2	Tues 10-1 Tues 2-5 Wed 10-1	8/3 8/3 9/3	1 & 2 3 & 4 5 & 6	**H&S / SAFE HANDLING OF BIOLOGICAL FLUIDS**		
3	Tues 10-1 Tues 2-5 Wed 10-1	15/3 15/3 16/3	7 & 8 9 & 10 11 & 12	**H&S / SAFE HANDLING OF BIOLOGICAL FLUIDS**		
4	Tues 10-1 Tues 2-5 Wed 10-1	22/3 22/3 23/3	1 & 2 3 & 4 5 & 6	**EXCITABLE CELL PHYSIOLOGY**		
EASTER BREAK 25th March – 3rd April						
5	Tues 10-1 Tues 2-5 Wed 10-1	5/4 5/4 6/4	7 & 8 9 & 10 11 & 12	**EXCITABLE CELL PHYSIOLOGY**		
6	Tues 10-1 Tues 2-5 Wed 10-1	12/4 12/4 13/4	1 & 2 3 & 4 5 & 6	**SKELETAL MUSCLE**		
7	Tues 10-1 Tues 2-5 Wed 10-1	19/4 19/4 20/4	7 & 8 9 & 10 11 & 12	**SKELETAL MUSCLE**		
8	Tues 10-1 Tues 2-5 Wed 10-1	26/4 26/4 27/4	1 & 2 3 & 4 5 & 6	**INTRODUCTION TO CVS**	7 9 11	**ELECTRICAL & MECHANICAL EVENTS IN THE CARDIAC CYCLE**
9	Tues 10-1 Tues 2-5 Wed 10-1	3/5 3/5 4/5	7 & 8 9 & 10 11 & 12	**INTRODUCTION TO CVS**	1 3 5	**ELECTRICAL & MECHANICAL EVENTS IN THE CARDIAC CYCLE**
10	Tues 10-1 Tues 2-5 Wed 10-1	10/5 10/5 11/5	1 & 2 3 & 4 5 & 6	**MICROCIRCULATION**	8 10 12	**ELECTRICAL & MECHANICAL EVENTS IN THE CARDIAC CYCLE**
11	Tues 10-1 Tues 2-5 Wed 10-1	17/5 17/5 18/5	7 & 8 9 & 10 11 & 12	**MICROCIRCULATION**	2 4 6	**ELECTRICAL & MECHANICAL EVENTS IN THE CARDIAC CYCLE**
12	Tues 10-1 Tues 2-5 Wed 10-1	24/5 24/5 25/5	1 & 2 3 & 4 5 & 6	**SENSORY PHYSIOLOGY**		
13	Tues 10-1 Tues 2-5 Wed 10-1	31/5 31/5 1/6	7 & 8 9 & 10 11 & 12	**SENSORY PHYSIOLOGY**		

COMPULSORY LAB COATS REQUIRED FOR "SHADED" CLASSES

LABORATORY REGULATIONS AND BEHAVIOUR

See also https://medicalsciences.med.unsw.edu.au/students/undergraduate/advice-students#Practicals

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 revision and 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 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 UNSW Animal Ethics Committee on the Use of Animals in Research and Teaching (Approval 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 Teaching Ethics Committee on Experimental Procedures Involving Human Subjects for teaching. Practical classes involving your participation as a subject requires you to read the Participant information sheet and sign a witnessed, informed consent form.

PRACTICAL WORK IN PHYSIOLOGY

An important component of our Physiology courses is the practical work. All the classes have been carefully considered and they are included for various reasons. It is hoped that students will not only gain maximum benefit from the content of the classes but will understand why they are included.

The scope of the practical work in the different courses offered is determined by a number of factors such as the level of the course, the perceived needs of the students for whom the course is intended, and the safety of different experimental procedures. Some valuable classes have always been beyond the financial or human resources of the Department, and regrettably financial and other pressures continue to militate against the practical component of the curriculum.

The following should help students understand why the course is given and why the classes have been chosen.

Why practical work? The value of having practical work at all may be questioned. It is sometimes said that one could use the time simply in working from a book or notes, and learn more. This may be true in the short term in some instances. But even if it were true one must understand that the purpose of the course is not merely to acquire as much book learning as possible in the minimum time. In discussing Medicine, Sir William Osler once said "*To study Medicine without books is to sail an uncharted sea; to study Medicine without seeing patients is not to go to sea at all"*. Much the same could be said about studying science without experiments. The practical course in an undergraduate curriculum cannot produce a fully-fledged scientist any more than a few yacht races can produce a master mariner; but at least doing some experiments 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.

These classes show important principles or methods and it must also be realized that many graduates from the Science course will work in health-related areas.

As far as possible the classes in the practical course cover a wide range of physiological systems. We have also incorporated several different types of practical classes which provide information on how physiological systems function as well as allowing students to develop various practical and safety skills in the laboratory.

Some of the different sorts of practical classes are listed below.

1. **Training in general laboratory practice.** An example is the class on health and safety and safe handling of biological fluids, which is designed to warn students of the dangers of some laboratory procedures and to teach how to minimize these dangers.

2. **Classes on human subjects.** Much of physiology has been, and will continue to be, driven by an interest in human function. Therefore it is desirable that students perform a number of experiments on one another and learn what it is like to be a subject. They also learn the sensitivities of one another and the carrying out of these experiments is some introduction to what they may be doing later in their careers.

   These classes illustrate physiological principles but have other values. For example the class on human blood pressure introduces students to a very common clinical measurement; and the classes on respiratory gas exchange and control of respiration (session 2) give an introduction to some of the physiological testing or monitoring procedures used in operating theatres, in intensive care units, or in a sports medicine laboratory.

3. **Classes using animals.** There are several reasons for classes involving use of animals. Many of the advances in Physiology and related sciences have come from animal-based research, and in the foreseeable future many more advances will come from such work. It is vital that students are acquainted with the use of animals so that they can understand how present knowledge has been obtained and how it may change in the future. If there is no exposure to animal based experiments, it is all too easy to fall into one of two errors. It can be thought (wrongly) that animal experiments cannot be applicable to human beings; or it can be thought (also wrongly) that animal results can be transferred directly to human beings. Some examples illustrate this. Many of the cardiovascular reflexes that apply to humans can be shown well in the rabbit, or other experimental animals, and these cannot be shown in class in the intact animal or in a human being. However study of the rabbit shows that its resting heart rate is much higher than that of humans - the two species have a different resting balance in the influence of the sympathetic and parasympathetic nervous systems. Without study of rabbits or other animals, one cannot see how these vital reflexes operate; nor can one see the limitation of animals as experimental models.

   For experiments on microcirculation, nerve conduction and muscle contraction, amphibian preparations are used. They have advantages in several important respects. The red cells of the amphibian are nucleated and larger than those of mammals and so are easier to see under the microscope. Also the preparations from these cold-blooded animals last better at room temperature than preparations from a warm-blooded mammal. Much of the knowledge of the properties of nerve fibres and muscle has been gained from studies on cold-blooded animals.

   It is of course vital that animals in classes are treated humanely and with respect and it is important that students are given instruction in these aspects, both by word and example.

4. **Classes on cells**. The basis of animal function is the cell and some classes study the properties of cells on their own rather than the properties of organ systems. An example is the section on blood typing included in the class on safe handling of biological fluids.

5. **Classes based on computers**. A number of classes involve computer simulated experiments. This is partly in response to pressures on resources and partly because some aspects of the course are better taught in this way. For instance, the accurate, direct recording of membrane and action potentials in nerves requires extensive experience and specialised equipment making it impractical for a large introductory Physiology course. In this case students can be given ideal results and from there calculate the properties of the nerve.

There are other benefits of the practical course. The experiments are not designed for fast learning but they give greater depth of study in some areas. The classes also provide an opportunity for students and staff to meet and discuss the work together, in a different setting from the tutorial class. Many problems of understanding are resolved in this way.

We believe that the present practical course is a good balance between what is ideal and what is readily achievable. It includes classes with a number of different approaches and on different systems of the body. We hope that all students will find it stimulating and profitable and the Department is always open to suggestions as to how improvements can be made.

Staff of the Department of Physiology.