



# BIOL257

## Neurophysiology

S1 Day 2014

*Dept of Biological Sciences*

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## General Information

Unit convenor and teaching staff

Other Staff

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Credit points

3

Prerequisites

6cp(P) from ((BBE101 and BIOL108 and BIOL114 and BIOL115 and (PSY104 or PSYC104) and (PSY105 or PSYC105) and HLTH108 and HLTH109))

Corequisites

Co-badged status

Unit description

This unit considers the function of nerves and hormones in the regulation of body functions. We begin with a discussion on how the selective permeability of the cell membrane gives rise to the electrical properties of cells, in particular nerve and muscle cells. The function and organisation of nerves into central and peripheral nervous systems, as well as specialised nerves and organs giving rise to the sensory system, is investigated in detail before we examine their role in homeostasis and muscle control. We then cover the neuroendocrine system, which is the link between the central nervous system and the endocrine system, before looking at the function of the main groups of hormones and their interrelationship with the immune system.

This unit is designed to serve science, medical science and chiropractic students and is also of interest to students studying psychology with an emphasis on physiology.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

Discuss how properties of biological membranes are utilised in the nervous system and explain the concept of 'excitable cells'.

Describe the function of the autonomic nervous system.

Discuss peripheral and central mechanisms of somatosensation.

Discuss peripheral and central nervous system mechanisms in motor control including muscle contraction, the stretch reflex, motor pathways as well as cortical and subcortical control of movement and posture.

Discuss peripheral and central mechanisms of special senses (hearing and balance, vision and taste and smell).

Describe how the nervous system and endocrine systems communicate in order to maintain homeostasis.

Comprehend scientific literature and express and discuss their conclusions.

Execute some of the techniques used in physiological measurement.

Collect experimental data and draw conclusions from a simple analysis

Follow an experimental protocol

Follow the requirements of Occupation, Health and Safety legislation that apply in the laboratory

## Assessment Tasks

Name	Weighting	Due
<u>Mini Test</u>	10%	Week 4
<u>Essay</u>	10%	Week 7
<u>Mid Semester Test</u>	15%	Intrl: Wk9, Extrl:S2
<u>Weekly worksheets</u>	15%	weeks 2-12
<u>Final Exam</u>	50%	Exam Period

### Mini Test

Due: **Week 4**

Weighting: **10%**

This will be given during your normal practical time in week 4 for internals and test practical material covered in the first 3 weeks of the unit. External students will do the test during the first

on campus session. For this test you will need to have an understanding of nervous system fundamentals and show how they function in transmitting nerve impulses to other cells. Questions will be based on the practical exercises done in weeks 1-3.

On successful completion you will be able to:

- Discuss how properties of biological membranes are utilised in the nervous system and explain the concept of 'excitable cells'.

## Essay

Due: **Week 7**

Weighting: **10%**

The essay will be of 1,500 words on a topic of your choice from the list below. The key to these essays, and what should make up the bulk of the essay, is a description and discussion of the physiological mechanisms that either regulate a particular body function or cause pathological development.

### Essay topics:

1. The baroreceptor circuit and baroreceptor resetting during exercise.
2. Firing properties and neurochemical characteristics of brainstem neurons that regulate breathing.
3. Multiple sclerosis: pathophysiology and mechanisms of action of current and future treatment methods.
4. Pathophysiology of diabetic neuropathy.
5. Neurotoxin types and their mechanisms of action.
6. Physiological explanation for each of the four phases of spinal shock.

On successful completion you will be able to:

- Comprehend scientific literature and express and discuss their conclusions.

## Mid Semester Test

Due: **Intrl: Wk9, Extrl:S2**

Weighting: **15%**

These will be given in your normal practical session, in **week 9** for internal students (15<sup>th</sup> & 16<sup>th</sup> May) and during **the second on campus sessions for external students** 1<sup>st</sup> June. Questions will be on lecture topics and laboratory material covered in weeks 1-8. The one-hour test will consist of multiple choice questions and short answers. Lecture material will be examined and you will need to have a level of understanding, in which you can describe cellular processes governing neuronal function, somatosensation and muscle control and contraction, describe the

functional organization of the nervous system and show how you can apply your knowledge of physiology to novel questions.

On successful completion you will be able to:

- Discuss how properties of biological membranes are utilised in the nervous system and explain the concept of 'excitable cells'.
- Describe the function of the autonomic nervous system.
- Discuss peripheral and central mechanisms of somatosensation.
- Discuss peripheral and central nervous system mechanisms in motor control including muscle contraction, the stretch reflex, motor pathways as well as cortical and subcortical control of movement and posture.

## Weekly worksheets

Due: **weeks 2-12**

Weighting: **15%**

From week 2-12 every student will need to complete the allocated worksheet for that week (see practical manual) and submit it to his or her tutors for assessment before the start of the practical/tutorial. The worksheets are based on lectures and recommended reading material and are designed to prepare you for the practical/tutorial sessions. Collectively, the worksheets are worth 15% of your final mark.

On successful completion you will be able to:

- Discuss how properties of biological membranes are utilised in the nervous system and explain the concept of 'excitable cells'.
- Describe the function of the autonomic nervous system.
- Discuss peripheral and central mechanisms of somatosensation.
- Discuss peripheral and central nervous system mechanisms in motor control including muscle contraction, the stretch reflex, motor pathways as well as cortical and subcortical control of movement and posture.
- Discuss peripheral and central mechanisms of special senses (hearing and balance, vision and taste and smell).
- Describe how the nervous system and endocrine systems communicate in order to maintain homeostasis.
- Comprehend scientific literature and express and discuss their conclusions.

## Final Exam

Due: **Exam Period**

Weighting: **50%**

The exam will comprise a 3 hour paper with multiple choice and short answer questions. All lecture and practical material is examinable.

On successful completion you will be able to:

- Discuss how properties of biological membranes are utilised in the nervous system and explain the concept of 'excitable cells'.
- Describe the function of the autonomic nervous system.
- Discuss peripheral and central mechanisms of somatosensation.
- Discuss peripheral and central nervous system mechanisms in motor control including muscle contraction, the stretch reflex, motor pathways as well as cortical and subcortical control of movement and posture.
- Discuss peripheral and central mechanisms of special senses (hearing and balance, vision and taste and smell).
- Describe how the nervous system and endocrine systems communicate in order to maintain homeostasis.

## Delivery and Resources

### DELIVERY AND RESOURCES

#### Delivery mode

This unit will be delivered through:

1. One 2 hours lecture per week, weeks 1 - 13
2. One 3 hours laboratory/tutorial class per week, weeks 2 – 6 and 7 – 12.

*Students must register for a practical/tutorial slot on e-student*

#### Class times and locations

Lectures: Monday 12:00 – 14:00 in C5C T1

Practical/tutorial: Thursday 14:00 – 17:00 *or*

Friday 10:00 – 13:00 or 14:00 – 17:00 in the F7B laboratories, rooms 102, 105 and 110.

*There are three practical classes running simultaneously during each time slot. Students must enroll into one of the practical/tutorial session of their choice.*

#### External student sessions:

Session 1: Wednesday and Thursday 16 – 17 April (during mid-semester break) and;

Session 2: Saturday and Sunday 31 May – 1 June.

Both sessions will be held in F7B rooms 105 and 110 from 9:00 – 16:00.

### **Practical classes**

Attendance to practical/tutorial classes is compulsory and must be done in your enrolled practical/tutorial class time. Students must not exchange their class time. In special circumstances, students may request a specific change. These requests are to be submitted to the scientific officer, Ms Monika King.

### **Attendance requirements**

If you miss your assigned practical in any week, you may request attendance at an alternative session through a written request with appropriate documentation (e.g., medical certificate) to the unit convener. This allowance may be used on a maximum of two occasions.

### **Unit web site**

All lecture material and other essential unit information will be posted on iLearn (<http://ilearn.mq.edu.au>).

*iLearn should be checked regularly for any updates.*

### **Student support services**

Macquarie University provides a range of academic and other student support services. Details of these services can be accessed at <http://www.student.mq.edu.au>

### **Required and recommended resources:**

#### Required text for this unit:

- Carpenter R and Reddi B. *Neurophysiology: a conceptual approach* (5<sup>th</sup> ed). Hodder Arnold; 2012
- BIOL257 Laboratory Manual – available on iLearn website

#### Other recommended resources:

- Stanfield CL. *Principles of Human Physiology* (4<sup>th</sup> ed). San Francisco: Benjamin Cummings-Pearson; 2011
- Guyton AC and Hall JE. *Textbook of Medical Physiology* (11<sup>th</sup> ed). Elsevier Saunders; 2006

### CHANGES MADE TO THE CURRENT OFFERING OF THIS UNIT

The following changes were made to this unit in 2014:

1. The objectives were revised and updated for topics 2-5 and 9.
2. Topics 6 and 7 (Muscle structure and function; and Motor pathways and reflexes, respectively) were moved to be just after “sensory receptors and pathways” to have all the neural pathway topics and neural integration taught consecutively, and their objectives were updated

3. Physiology of special senses, topic 8, is now after the motor topics
4. A new topic, topic 10 (homeostasis) was added
5. Tutorial on the autonomic nervous system was added and some of the existing tutorials were updated.
6. A new 'essay' assignment has replaced the previous 'comprehension' assignment.
7. A new 'weekly worksheet' assessment was introduced in place of the 'spot test'.

## Unit Schedule

### INTERNAL SESSION CLASS SCHEDULE

<u>Wk</u>	<u>Date</u>	<u>Lecture (2 × 1hr/week)</u>	<u>Lab session (1 × 3hr/week)</u>
1	3 Mar	Introduction to physiology and cell membrane characteristics  Membrane transport	<b>No practical</b>
2	10 Mar	Resting membrane potential and graded potentials  Action potentials	Lab induction  Resting membrane potential tutorial
3	17 Mar	Neuronal impulses and transmission  The synapse: neurotransmitters and receptors	Action potentials and nerve conduction tutorial
4	24 Mar	Gross structure and spinal cord  The brain and brainstem	PhysioEx Exercise 3: Neurophysiology of Nerve Impulses  <b>Lab-based mini test</b>
5	31 Mar	The autonomic nervous system part I & II	Lamb brain dissection



6	7 Apr	Sensory receptors and pathways part I & II	Autonomic nervous system tutorial and case study
<p><b>Mid-semester break 14-25 April</b></p> <p>First on campus session for EXTERNAL STUDENTS 16-17 April</p>			
7	28 Apr	Muscle structure & molecular basis of contraction Excitation-contraction coupling	Somatosensation practical
8	5 May	The motor unit & the neuromuscular junction Spinal and cortical control of muscles	Muscle physiology tutorial PhysioEx Chapter 12: Skeletal Muscle Physiology
9	12 May	Reflex responses The role of the cerebellum and basal ganglia in movement	<b>Mid-semester test</b>
10	19 May	Vision Hearing and balance	Motor control case studies Reflexes practical
11	26 May	Taste and smell Neuroendocrinology I	Special senses practical
12	2 June	Neuroendocrinology II Maintaining homeostasis: Role of the neuroendocrine system part I	Review/revision

13	9 June	Maintaining homeostasis: Role of the neuroendocrine system part II  Review/revision	
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## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy [http://mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy [http://mq.edu.au/policy/docs/grievance\\_management/policy.html](http://mq.edu.au/policy/docs/grievance_management/policy.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy Central.

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/support/student\\_conduct/](https://students.mq.edu.au/support/student_conduct/)

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)

- [Ask a Learning Adviser](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use Policy](#). The policy applies to all who connect to the MQ network including students.

## Graduate Capabilities

### Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

#### Assessment task

- Weekly worksheets

### Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

#### Assessment task

- Weekly worksheets

### Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them

competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

## **Learning outcomes**

- Discuss how properties of biological membranes are utilised in the nervous system and explain the concept of 'excitable cells'.
- Describe the function of the autonomic nervous system.
- Discuss peripheral and central mechanisms of somatosensation.
- Discuss peripheral and central nervous system mechanisms in motor control including muscle contraction, the stretch reflex, motor pathways as well as cortical and subcortical control of movement and posture.
- Comprehend scientific literature and express and discuss their conclusions.
- Execute some of the techniques used in physiological measurement.
- Collect experimental data and draw conclusions from a simple analysis
- Follow an experimental protocol

## **Assessment tasks**

- Mini Test
- Essay
- Mid Semester Test
- Weekly worksheets
- Final Exam

## **Critical, Analytical and Integrative Thinking**

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

## **Learning outcomes**

- Execute some of the techniques used in physiological measurement.
- Collect experimental data and draw conclusions from a simple analysis

## Assessment tasks

- Essay
- Mid Semester Test
- Weekly worksheets
- Final Exam

## Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

### Learning outcome

- Execute some of the techniques used in physiological measurement.

## Assessment tasks

- Essay
- Mid Semester Test
- Weekly worksheets
- Final Exam

## Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

### Assessment task

- Essay

## Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

## Learning outcomes

- Comprehend scientific literature and express and discuss their conclusions.
- Execute some of the techniques used in physiological measurement.
- Collect experimental data and draw conclusions from a simple analysis
- Follow the requirements of Occupation, Health and Safety legislation that apply in the laboratory

## Assessment tasks

- Essay
- Mid Semester Test
- Weekly worksheets
- Final Exam