



# BIOL257

## Neurophysiology

S1 Day 2017

*Dept of Biological Sciences*

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#### **Disclaimer**

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## General Information

### Unit convenor and teaching staff

Convenor & Lecturer

A/Prof. Nathan Hart

[biol257@mq.edu.au](mailto:biol257@mq.edu.au)

Contact via email

E8B 219

### Credit points

3

### Prerequisites

15cp at 100 level including (BIOL108 and BIOL115) or ((BIOL108 or BIOL115) and (BBE100 or BIOL114 or BIOL116 or BIOL122 or COGS100 or HLTH108 or PSYC104))

### Corequisites

### Co-badged status

### Unit description

This Unit considers the structure and function of the human nervous system. 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. We look in detail at the generation, propagation and transmission of neural signals, and examine the important principles of sensory physiology such as transduction, adaptation and stimulus coding. Students then study the anatomy and functional organization of the central and peripheral nervous systems. Having covered these basic principles, the Unit goes on to explore the somatosensory system, which is involved in proprioception and the perception of touch, pain and temperature. The nerves and organs that give rise to the special senses (vision, hearing, taste and smell) are also discussed. We next examine the structure and physiology of muscle cells, and the central control of motor functions. Lastly, we cover the autonomic nervous system and the neuroendocrine system, both of which regulate numerous physiological processes throughout the body. 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:

Relate cellular physiology and the properties of cell membranes to the generation of membrane potentials.

Explain how neural signals are generated, propagated and transmitted.

Identify and compare the major structural and functional divisions of the nervous system.

Describe the diverse sensory receptors and pathways found in the human body.

Explain how muscles work and how the nervous system coordinates motor activity.

Explain how the nervous system and endocrine system interact to regulate physiological processes.

Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.

Analyse and draw conclusions from experimental data.

Interpret the results of simple tests of neural function on human subjects.

## General Assessment Information

In order to pass this Unit, students must achieve an overall mark of 50%, submit all assessments (i.e. essay) and attend at least 6 of the 9 different practical classes (excluding the mid-semester test and the revision sessions which are also held in the practical class slots).

## Assessment Tasks

| Name                         | Weighting | Hurdle | Due        |
|------------------------------|-----------|--------|------------|
| <u>Weekly online quizzes</u> | 10%       | No     | Weeks 1-12 |
| <u>Essay</u>                 | 15%       | No     | 30/4/17    |
| <u>Mid-semester test</u>     | 25%       | No     | Week 8     |
| <u>Final exam</u>            | 50%       | No     | TBA        |

### Weekly online quizzes

Due: **Weeks 1-12**

Weighting: **10%**

Each week, students will need to complete an online quiz (iLearn) based on the topics covered in that week's lectures.

On successful completion you will be able to:

- Relate cellular physiology and the properties of cell membranes to the generation of membrane potentials.
- Explain how neural signals are generated, propagated and transmitted.

- Identify and compare the major structural and functional divisions of the nervous system.
- Describe the diverse sensory receptors and pathways found in the human body.
- Explain how muscles work and how the nervous system coordinates motor activity.
- Explain how the nervous system and endocrine system interact to regulate physiological processes.

## Essay

Due: **30/4/17**

Weighting: **15%**

Students are required to submit a 1,500 word essay on a topic selected from a list provided on iLearn. The essay should discuss the topic critically with reference to the primary scientific literature.

On successful completion you will be able to:

- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.

## Mid-semester test

Due: **Week 8**

Weighting: **25%**

Internal students will sit this test (1.5hr) in their usual practical class slot. The test will comprise a mixture of multiple choice questions, objective questions and short answer questions. The questions will be on material covered in the lectures and practical classes from Weeks 1 to 7.

On successful completion you will be able to:

- Relate cellular physiology and the properties of cell membranes to the generation of membrane potentials.
- Explain how neural signals are generated, propagated and transmitted.
- Identify and compare the major structural and functional divisions of the nervous system.
- Describe the diverse sensory receptors and pathways found in the human body.
- Explain how muscles work and how the nervous system coordinates motor activity.
- Explain how the nervous system and endocrine system interact to regulate physiological processes.
- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

## Final exam

Due: **TBA**

Weighting: **50%**

The final exam (2hr) will consist of 40 multiple choice questions and 6 short answer questions. The short answer questions will be split across two sections that relate to material covered in the first and second halves of the Unit, respectively. Students will need to select 3 out of the 4 short answer questions offered in each section. All lecture and practical/tutorial material is examinable.

On successful completion you will be able to:

- Relate cellular physiology and the properties of cell membranes to the generation of membrane potentials.
- Explain how neural signals are generated, propagated and transmitted.
- Identify and compare the major structural and functional divisions of the nervous system.
- Describe the diverse sensory receptors and pathways found in the human body.
- Explain how muscles work and how the nervous system coordinates motor activity.
- Explain how the nervous system and endocrine system interact to regulate physiological processes.
- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

## Delivery and Resources

### Delivery Mode

This Unit will be delivered through:

1. Two (consecutive) 1 hour lectures per week (Weeks 1 → 13)
2. One 3 hour laboratory-based practical/tutorial class per week (Weeks 2→6, 8→13).  
There are no practical classes in Week 7 due to the Easter Good Friday holiday on 14 April

### Practical/tutorial classes - Attendance requirements

- Practical/tutorial classes are compulsory and students must attend the class in which they have enrolled;
- To pass the unit, students must attend two thirds (i.e. 6 out of 9) of the different practical classes (excluding the mid-semester test and the revision sessions which are also held in the practical class slots). An attendance register will be held and must be signed by all

students at the start of each practical class. Please note that signing for someone else is a breach of the Academic Honesty Policy and will be treated as such;

- There are 3 practical/tutorial classes running simultaneously during each time slot. Students must enrol into one of the practical classes through eStudent;
- Students must not exchange their class slot. However, in special circumstances, students may request a specific change. These requests are to be submitted by emailing [biol257@mq.edu.au](mailto:biol257@mq.edu.au)

## **Class times and locations**

### Lectures

- Monday 14:00 - 16:00 in X5B T1 theatre (29 Wallys Walk)

### Practical/tutorial classes

- Thursday 10:00 - 13:00 in F7B science labs 102, 105 & 110
- Thursday 14:00 - 17:00 in F7B science labs 102, 105 & 110
- Friday 10:00 - 13:00 in F7B science labs 102, 105 & 110
- Friday 14:00 - 17:00 in F7B science labs 102, 105 & 110

## **Required and recommended resources**

### Required resource

- BIOL257 Laboratory/practical class manuals - available through iLearn prior to each class

### Recommended text

- Stanfield, C. L. (2016) "Principles of Human Physiology" (6th Edition). Pearson. ISBN: 9781292156484. Available through the Macquarie Co-Op Bookshop. The 5th Edition is also suitable.

### Other recommended resources

- Hall, J. E. (2015) "Guyton and Hall Textbook of Medical Physiology" (13th Edition). Philadelphia, USA; Saunders/Elsevier
- Vanderah, T. and Gould, D. (2016) "Nolte's The Human Brain: An Introduction to its Functional Anatomy" (7th Edition). London; Elsevier Health Sciences
- Details of any other relevant resources will be provided in lectures or posted on iLearn as appropriate

## **Unit website**

All lecture material, laboratory/practical class manuals and other essential Unit information will be

posted on iLearn (<http://ilearn.mq.edu.au>). iLearn should be checked regularly for any updates.

## Unit Schedule

| Week                                    | Lecture (Monday)  | Lab session (Thursday/Friday)                   |
|---|---|---|
| 1                                       | Cell physiology I<br>Cell physiology II   | <b>No lab classes</b>                           |
| 2                                       | Electrical signalling I<br>Electrical signalling II   | Lab induction<br>Resting membrane potential     |
| 3                                       | Synapses I<br>Synapses II   | Generation of action potentials                 |
| 4                                       | CNS I<br>CNS II   | Conduction and propagation of action potentials |
| 5                                       | Principles of sensory physiology<br>Special senses I - Gustation & Olfaction                    | Brain anatomy                                   |
| 6                                       | Special senses II - Vision<br>Special senses III – Hearing & Balance                            | Special senses                                  |
| 7                                       | Somatosensory I<br>Somatosensory II   | <b>No lab classes (Easter holiday)</b>          |
| <b>Mid-semester break (17-28 April)</b> |   |   |
| 8                                       | Muscle structure I<br>Muscle structure II   | <b>Mid-semester test</b>                        |
| 9                                       | Muscle physiology I<br>Muscle physiology II   | Somatosensory system                            |
| 10                                      | Muscle control I<br>Muscle control II   | Muscle physiology                               |
| 11                                      | Autonomic nervous system I - sympathetic NS<br>Autonomic nervous system II - parasympathetic NS | Reflexes  |
| 12                                      | Neuroendocrine I<br>Neuroendocrine II   | Autonomic nervous system                        |
| 13                                      | Catch-up / review lectures  | Review & revision                               |

## 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\\_2016.html](http://mq.edu.au/policy/docs/assessment/policy_2016.html)

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

Complaint Management Procedure for Students and Members of the Public [http://www.mq.edu.au/policy/docs/complaint\\_management/procedure.html](http://www.mq.edu.au/policy/docs/complaint_management/procedure.html)

Disruption to Studies Policy (in effect until Dec 4th, 2017): [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html)

Special Consideration Policy (in effect from Dec 4th, 2017): <https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration>

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/)

## Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](http://ask.mq.edu.au).

### Final Examination - Disruption to Studies Policy - Additional Information

If you apply for Disruption to Study for your final examination, you must make yourself available for the week of July 24 – 28, 2017. If you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date.

## 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://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

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

## Graduate Capabilities

### 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:

### Learning outcomes

- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

### Assessment tasks

- Essay
- Mid-semester test
- Final exam

### 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:

### **Learning outcomes**

- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

### **Assessment tasks**

- Essay
- Mid-semester test
- Final exam

## **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:

### **Learning outcomes**

- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

### **Assessment tasks**

- Essay
- Mid-semester test
- Final exam

## **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**

- Relate cellular physiology and the properties of cell membranes to the generation of membrane potentials.
- Explain how neural signals are generated, propagated and transmitted.
- Identify and compare the major structural and functional divisions of the nervous system.
- Describe the diverse sensory receptors and pathways found in the human body.
- Explain how muscles work and how the nervous system coordinates motor activity.
- Explain how the nervous system and endocrine system interact to regulate physiological processes.
- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

## **Assessment tasks**

- Weekly online quizzes
- Essay
- Mid-semester test
- 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**

- Relate cellular physiology and the properties of cell membranes to the generation of membrane potentials.
- Explain how neural signals are generated, propagated and transmitted.
- Identify and compare the major structural and functional divisions of the nervous system.
- Describe the diverse sensory receptors and pathways found in the human body.

- Explain how muscles work and how the nervous system coordinates motor activity.
- Explain how the nervous system and endocrine system interact to regulate physiological processes.
- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

## **Assessment tasks**

- Weekly online quizzes
- Essay
- Mid-semester test
- 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 outcomes**

- Relate cellular physiology and the properties of cell membranes to the generation of membrane potentials.
- Explain how neural signals are generated, propagated and transmitted.
- Identify and compare the major structural and functional divisions of the nervous system.
- Describe the diverse sensory receptors and pathways found in the human body.
- Explain how muscles work and how the nervous system coordinates motor activity.
- Explain how the nervous system and endocrine system interact to regulate physiological processes.
- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

## **Assessment tasks**

- Weekly online quizzes

- Essay
- Mid-semester test
- Final exam

## 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

- Relate cellular physiology and the properties of cell membranes to the generation of membrane potentials.
- Explain how neural signals are generated, propagated and transmitted.
- Identify and compare the major structural and functional divisions of the nervous system.
- Describe the diverse sensory receptors and pathways found in the human body.
- Explain how muscles work and how the nervous system coordinates motor activity.
- Explain how the nervous system and endocrine system interact to regulate physiological processes.
- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

### Assessment tasks

- Weekly online quizzes
- Essay
- Mid-semester test
- Final exam

## Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

## Learning outcomes

- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

## Assessment tasks

- Essay
- Mid-semester test
- Final exam

## Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

## Learning outcomes

- Critically evaluate information from the primary scientific literature and present a coherent summary or argument in a concise written format.
- Analyse and draw conclusions from experimental data.
- Interpret the results of simple tests of neural function on human subjects.

## Assessment tasks

- Essay
- Mid-semester test
- Final exam

## Changes since First Published

| Date       | Description  |
|------------|--|
| 04/08/2017 | Removal of non-teaching staff  |
| 29/01/2017 | Updated the Learning Outcomes and added additional information about the Disruption to Studies Policy for Final Exams. |