

Physiology

Physiology is the study of how the body works: the ways in which cells, organs and the whole body functions, and how these functions are maintained in a changing environment.

Physiology offers two major streams. Mammalian cellular physiology is the study of the cellular components that primarily determines organ function. Systems physiology is the study of the coordinated and networked processes that determine whole body function and adaptation to change.

Physiology is very suitable to be taken as a double major with anatomy, biochemistry, cell biology (botany), genetics, microbiology, pathology, pharmacology, and zoology.

Students may take a double major or take the balance of their subjects from the specialist areas listed above.

Suggested subjects

100-level subjects

Two semesters of three of the following:

- chemistry: 610-141 and 610-142; or 610-121 and 610-122)
- physics: 640-141 and 640-142; or 640-121 and 640-122; or 640-161 and 640-162;
- biology: 600-141 and 600-142;
- mathematics and statistics: 620-141 and 620-143; or 620-121 and 620-123; or 620-161 and 620-160; or 620-151 and 620-152.
- psychology 512-120 and 512-121.

Note: Combined course students who take a full year's course load and only two of the science subjects listed above will be eligible for selection into 200-level physiology.

200-level subjects

Some combination of:

- physiology 536-201, 536-211, 536-202, 536-203;
- biochemistry 521-211, 521-212; 521-220, 521-221
- anatomy 516-201, if possible;
- a selection of: microbiology 526-201 or 526-205, 526-202; pharmacology 534-201; chemistry 610-221 or 610-220; genetics 652-214, 652-215; zoology 654-202, 654-203 or 654-212.

Physiology 536-201, 536-211, 536-202 and 536-203 are recommended for students considering taking physiology in third year.

Physiology 536-201, 536-211 and 536-202 are the minimum requirements for acceptance into third year. However, students taking only 536-201 and 536-211 who wish to take third year physiology are encouraged to seek exemption from the Head of Department. Students must have taken at least 72 hours practical work in second year.

The aim of physiology subjects 536-201, 536-211, 536-202 and 536-203 is to introduce the student to the investigation of body systems and their control at the cellular and systemic levels, with emphasis on quantitative aspects of physiology studied as an experimental science. They are intended to provide an adequate background for all third year physiology units, and to stand alone as the physiological components for students with majors in other disciplines.

On completion of these subjects a student should have an understanding of cellular physiology, concerned with both those properties that characterise all living cells, and those that are unique to special cell types such as neurones and muscle fibres; systemic physiology, in which the activity of different tissues and organs subserving the various coordinated functions of the human body (e.g. the cardiovascular, respiratory and nervous systems) are considered. The emphasis is on the functions of the human body, although the foundations of this knowledge commonly depend on observations and experiment in other animals; the skills required to observe physiological responses; and the skills to record and analyse data accurately.

300-level subjects

- For students undertaking a major in physiology a minimum of 50 points of 300-level physiology subjects is required. However, less than 50 points of 300-level physiology subjects may be appropriate for students undertaking other majors such as neuroscience.
- Selections from the following: anatomy and cell biology, biochemistry and molecular biology, pathology, pharmacology, and zoology.

Third year physiology is offered as a group of eight subjects. Subjects (536-301, 536-311, 536-302, 536-303, 536-308) encompass basic physiology teaching and the other two subjects (536-304, 536-310) cannot be taken without the necessary corequisite or prerequisite subjects. Physiology 536-304 and 536-310 offer practical research experience in physiology. The depart-

ment strongly recommends that physiology students taking these subjects do so in combination with other subjects.

On completion of 300-level physiology subjects, a student should have attained specialised knowledge in the areas of physiology of interest to the student; a precise and detailed knowledge of specialist areas in physiology; an appreciation of how areas of physiology integrate to give overall control of body function; the ability to generate and test hypotheses in an area of interest to the student; and a strong background in current approaches and technology to test concepts in physiology.

Students who have completed anatomy, biochemistry, physics, psychology or zoology without physiology at the 200-level may be admitted to individual 300-level subjects. Students should consult with subject advisers in the department during the second semester of their second year.

Bachelor of Science (Honours)

For information about faculty and departmental entry requirements for honours, please refer to *Bachelor of Science (Honours) and Bachelor of Information Systems (Honours) (p.1)*. These requirements should be considered when planning your course.

Further Information

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Physiology 200-level

536-201 Principles of Physiology

Note:

- Not available for students enrolled in BBiomedSc.
- Students seeking a thorough understanding of physiology at second year level, and seeking entry into third year physiology, will take this subject in combination with 536-211 Physiology:Control of Body Function (p.2) in Semester 2. This lecture combination, together with the practical subject 536-202 Physiology (General Practical) (p.1), forms the basic requirements for selection into third year physiology (see *300-level subjects (p.1)*)
- This subject contains computer-aided learning sessions. Students must attend the department to enrol in the available sessions between 9.00am-4.00pm during the week **prior** to the start of Semester 1. The enrolment location is in the Physiology Teaching Laboratory, Room N306 (Level 3, North Wing) Medical Faculty Building.

Credit points: 12.5

HECS-band: 2

Coordinator: Dr R Di Nicolantonio

Prerequisites: Two pairs of subjects from: biology (600-141 and 600-142); chemistry (610-141 and 610-142; or 610-161 and 610-162); physics (640-121 and 640-122; 640-141 and 640-142; or 640-161 and 640-162); psychology (512-120 and 512-121); mathematics (two of: 620-112, 620-113, 620-121, 620-122, 620-123, 620-141, 620-142, 620-143, 620-160).

Contact: 36 lectures, 24 hours computer aided instruction (*Semester 1*).

Description: Physiology is an integrative study of the control of normal body function. This subject:

- illustrates how body systems act and interact to maintain homeostasis (a constant internal environment);
- provides an understanding of cellular, subcellular and membrane structures and their importance in fluid distribution, functions of excitable cells (nerve and muscle), information transfer (electrical and hormonal) and metabolism. This provides an introduction to cellular physiology covering the properties and characteristics of specialised cells such as neurones and muscle cells;
- shows how cellular specialisation results in hormonal, neural and organ systems subserving specialised body functions by studying organ function including the cardiovascular system, respiration, kidney function and the gastrointestinal physiology;
- provides an understanding of physiology as an experimental science with many key concepts arising from the qualitative and quantitative observation and analysis of living organisms.

Assessment: A 2.5-hour end-of-semester written examination plus tasks related to computer-aided learning activities.

536-202 Physiology (General Practical)

Note:

- Not available for students enrolled in BBiomedSc.
 - This is a practical subject. Students enrol separately for the lecture subject 536-201 Principles of Physiology (*p.1*)
 - Students must attend the department to enrol. Web-generated personal timetables are a guide only, and do not enrol students in a practical session.
- Students must enrol between 9.00am and 4.00pm during the week prior to the start of semester. The enrolment location is in the Physiology Teaching Laboratory, Room N306 (Level 3, North Wing) Medical Faculty Building. The size of each session group is restricted. Early enrolment with a full preference list from the available practical class sessions is advisable. Students unable to attend in person must communicate their full preference list by letter or email.
- Experiments involving the use of animals are essential to this subject; exemption is not possible.
 - Students must have a white laboratory coat and close-topped footwear to comply with safety regulations. Also required: dissecting instruments, record book (No. 536 from the University Bookroom); free laboratory manual obtained from the Physiology Teaching Laboratory, Room N306 (Level 3, North Wing) Medical Faculty Building.

Credit points: 6.25**HECS-band:** 2**Coordinator:** Dr R Kemm**Prerequisites:** Chemistry 610-141 and 610-142 (or 610-121 and 610-122; or 610-161 and 610-162); biology 600-141 and 600-142.**Corequisites:** 536-201 Principles of Physiology (*p.1*)**Contact:** 36 hours practical work and workshops (*Semester 1*).**Description:** Experiments will be undertaken that lead to an understanding of experimental design, report writing and the acquisition of data for testing physiological concepts. Teaching will be computer-based for recording and analysis.

Emphasis is given to comprehending:

- the way experimental methods can be used to answer physiological questions;
- the methods needed to study physiological mechanisms at the level of an individual organ; and
- the design of experiments to analyse the mechanisms that maintain normal physiological behaviour in humans.

Students will develop:

- skills to accurately record physiological observations, and the ability to draw appropriate conclusions from the results of physiological experiments; and
- the ability to write clear and concise descriptions of experimental data and the conclusions that can be drawn from them.

Discussions in workshops will:

- place experimental data into the context of theoretical knowledge;
- explore the difference between experimentally and theoretically derived knowledge;
- cover ethical issues;
- cover reasons why some experiments are carried out on isolated tissues and why other experiments are performed on living subjects; and
- explore the importance of relating results obtained in living subjects to those obtained from isolated tissues and vice versa.

Assessment: Continuous assessment of report writing, and a 1-hour open-book examination at the end of semester.

536-203 Physiology (Integrative Physiology)

Note:

- This is a practical subject. Students enrol separately for the lecture subject 536-211 Physiology:Control of Body Function (*p.2*).
- Students must attend the Department to enrol. Web-generated personal timetables are a guide only, and do not enrol students in a practical session. Students must enrol between 9.00am and 4.00pm during the week prior to the start of semester. The enrolment location is in the Physiology Teaching Laboratory, Room N306 (Level 3, North Wing) Medical Faculty Building. The size of each session group is restricted. Early enrolment with a full preference list from the available practical class sessions is advisable. Students unable to attend in person must communicate their full preference list by letter or email.
- Experiments involving the use of animals are essential to this subject; exemption is not possible.
- Students must have a white laboratory coat and close-topped footwear to comply with safety regulations. Also required: dissecting instruments, record book (No. 536 from the University Bookroom); free laboratory manual obtained from the Physiology Teaching Laboratory, Room N306 (Level 3, North Wing) Medical Faculty Building.

Credit points: 6.25**HECS-band:** 2**Coordinator:** Dr R Kemm**Prerequisites:** Physiology 536-201, 536-202.**Corequisites:** 536-211 Physiology:Control of Body Function (*p.2*)**Contact:** 36 hours of practical work and laboratory workshops (*Semester 2*).**Description:** Experiments will be performed that build on concepts taught in Physiology 536-202. Emphasis will be given to the study of areas of physiology that relate to coordinated function (including brain, endocrinology and exercise physiology).

Students completing this subject should:

- understand experimental design including the use of appropriate statistical methods in both the design and the analysis of physiological experiments;
- understand the reasons for careful selection of appropriate controls in physiological experimentation;
- comprehend the relationship between psychophysical experiments and experiments on isolated nervous tissues in the analysis of the behaviour of the nervous system;
- appreciate the way in which experiments on human subjects should be carried out to derive useful physiological information; and
- understand the principles of physiological experimentation on anaesthetised animals.

Skills to be covered will include:

- experimental design taking into account different experimental approaches and the ways in which such approaches can be integrated;
- accurate recording of physiological observations;
- statistical analysis of physiological data;
- developing the ability to draw appropriate conclusions from the results, and place those conclusions into the context of theoretical knowledge; and
- concise and unambiguous writing.

Assessment: Continuous assessment of report writing, assignment and a 1-hour open-book examination at the end of semester.

536-206 Physiology (Optometry)

Note:

- This subject is only available to students enrolled in the Bachelor of Optometry course.
- Experiments involving the use of animals are essential to this subject; exemption is not possible.

Credit points: 12.5**HECS-band:** 2**Coordinator:** Dr R Di Nicolantonio**Prerequisites:** Enrolment into the second year of the BOptom course.**Contact:** 36 lectures, 15 hours practical work, 12 hours computer-aided instruction (*Semester 1*).**Description:** This subject:

- illustrates how body systems act and interact to maintain homeostasis, i.e. a constant internal environment;
- provides an understanding of cellular, subcellular and membrane structures and their importance in fluid distribution, functions of excitable cells (nerve and muscle), information transfer (electrical and hormonal) and metabolism; and
- demonstrates how organs and tissues interact leading to coordinated body function.

In particular, the subject matter covers:

- an introduction to cellular physiology covering the properties and characteristics of specialised cells such as neurones and muscle cells;
- how cellular specialisation results in hormonal, neural and organ systems subserving specialised body functions by studying organ function including the cardiovascular system, respiration, kidney function and gastrointestinal physiology;
- control mechanisms, the endocrine, paracrine, autocrine and neuronal processes, including an introduction to study of the brain and its regulatory processes; and
- a series of lectures focusing on how different processes integrate to sustain and modulate body function including control of the central nervous, respiratory, renal, reproductive, digestive, muscular, cardiovascular and haematological systems. Practical experiments will illustrate selected lecture material.

Assessment: A 2.5-hour written examination at the end of semester and a component of ongoing assessment related to practical classes and computer-aided learning activities.

536-211 Physiology:Control of Body Function

Note:

- Not available for students enrolled in BBiomedSc.

- This subject builds upon the physiological principles and systems introduced in 536-201 Principles of Physiology (*p.1*). The combination of 536-211, 536-201 Principles of Physiology (*p.1*), and the practical subject 536-202 Physiology (General Practical) (*p.1*) forms the basic requirement for selection into third year physiology (see *300-level subjects (p.1)*)
- This subject contains computer-aided learning sessions. Students must attend the department to enrol in the available sessions between 9.00am and 4.00pm during the week prior to the start of Semester 2. The enrolment location is in the Physiology Teaching Laboratory, Room N306 (Level 3, North Wing) Medical Faculty Building.

Credit points: 12.5

HECS-band: 2

Coordinator: Dr R Di Nicolantonio

Prerequisites: Physiology 536-201.

Contact: 36 lectures, 24 hours workshops including computer-aided learning (*Semester 2*).

Description: Physiology is an integrative study of the control of normal body function. This subject covers:

- the integrated endocrine, paracrine and autocrine and neuronal processes controlling body function;
- an introduction to the study of the brain and its regulatory processes;
- an introduction to the physiology of vision, hearing and taste;
- consideration of the processes that control balance, posture and movement; and
- the various processes that together sustain and modulate body function including control of the central nervous, respiratory, renal, reproductive, digestive, muscular, cardiovascular and haematological systems.

Assessment: A 2.5-hour end-of-semester written examination plus tasks related to computer-assisted learning activities. The written examination may draw upon materials taught in 536-201.

516-209 Introductory Neuroscience

See full subject details on page 2.

Physiology 300-level

536-301 Integrative Physiology: Heart & Kidney

Note: Formerly known as 536-301 Systems Physiology Part A.

Credit points: 12.5

HECS-band: 2

Coordinator: Dr L M D Delbridge

Prerequisites: Physiology 536-201, 536-211, and 536-202.

BBiomedSc students: 521-213 and 536-250.

The Head of Department will consider exemptions for students who passed 536-201 and 536-211.

Contact: 30 hours of lectures, 12 hours of collaborative learning, multimedia workshops and assignments (*Semester 1*).

Description: This subject focuses on physiological control systems with an emphasis on cardiovascular, renal and endocrine homeostasis. Your studies will follow the programmed development of the cardiovascular system from gene to cell and organ. You will develop an understanding of how hearts, kidneys and hormones interact in a coordinated and integrated way to control blood pressure and fluid balance.

Cardiovascular and renal themes of study include principles of endocrine action; factors controlling heart and kidney growth and function; interaction of genetic and environmental influences; adaptations in pregnancy and human pathophysiology. You will also be introduced to experimental approaches and models in physiology and current controversies in heart, kidney and hormone research. Disturbances in physiological function will be studied to gain insight into the molecular and cellular bases of disease processes. These disturbances include hypertension, cardiac hypertrophy and arrhythmia, renal failure and pre-eclampsia.

In this subject, the lectures are supplemented with an integrated program of multimedia workshops and mentored sessions to accommodate a variety of learning styles. You will work together in small, interactive groups with an academic mentor to examine topical research issues and to evaluate experimental approaches and design. Assessment comprises both group contribution and individual work components by combining examination and assignment tasks.

Assessment: A 1.5-hour end-of-semester examination, two written assignments (not more than 3000 words combined in total) and three multimedia tutorial reports.

536-302 Molecular Neurophysiology

Note: This subject is recommended for both BSc and BBiomedSc students specialising in neuroscience, molecular and cell biology, integrated systems biology or reproductive and developmental biology.

Formerly known as 536-302 Molecular Physiology of Neurons and Muscle and 536-302 Mammalian Cellular Physiology

Credit points: 12.5

HECS-band: 2

Coordinator: Dr G Barrett

Prerequisites: Physiology 536-201 and 536-211.

BBiomedSc students: 521-213 and 536-250.

Either biochemistry 521-211, 521-212, and 521-221, or cell biology 606-205 and 606-206 are recommended. The Head of Department will consider other students on application.

Contact: 24 hours lectures, 18 hours interactive workshops (*Semester 1*).

Description: Much of the course is based on the discipline of molecular neuroscience, but it also encompasses the physiology involved in interactions between neurons. Molecular neuroscience examines the molecular and cellular mechanisms that underlie the functioning of the nervous system. Neurons and glial cells are unique and highly specialised cells that use sophisticated molecular mechanisms to interact in a network manner. The main objective of the course is that students master a core program of molecular neuroscience and neurophysiology. Specifically, students will be expected to demonstrate a high degree of knowledge and understanding of the following core topics: the cellular biology of neurons and glial cells, synaptic structure and function at the molecular level, channel activity of neurons and muscle cells at the neuromuscular junction, long-term potentiation, axonal transport, neuronal plasticity and neurodegeneration. Additionally, the role of neurons in networks will be considered. Some of the lectures will be given by research scientists from the fields of neural control and circuitry.

One of the objectives of the course is to equip students with the knowledge and ability to assess scientific reports insightfully and critically. These skills are required to keep abreast of new developments, as reported in the lay press and in the scientific literature. The scope and growth of molecular neuroscience is such that this is something that will be important for all, not only those who choose to do research in the field.

Assessment: A 2-hour end-of-semester examination (65%), a 1-hour mid-semester quiz (10%), and continuous assessment of interactive workshops during semester (25%).

536-303 The Brain: Neurophysiology of Behaviour

Credit points: 12.5

HECS-band: 2

Coordinator: Dr J Bornstein

Prerequisites: Physiology 536-201, 536-211 and 536-202.

BBiomedSc students: 521-213 and 536-250.

Students who do not have a background in physiology, but who have strong background in psychology or zoology, may seek exemption by writing to the Head of Physiology.

Contact: 36 lectures (*Semester 1*).

Description: The course initially details the theoretical and functional mechanisms involved in the formation and recall of memory. It includes the theoretical basis of memory, Hebbian synapses, the use of brain imaging methods, types of memory and their relationships to cognition, the role of membrane events in memory and other behaviours, arousal and attention, role of the thalamus, general sensory pathways and higher processing, e.g. language. Students will be expected to complete a short library-based project, building on the lecture material, to extend their understanding to other forms of behaviour. Each project will be distinct and students will work in small groups to answer one component of the assigned problem. Potential project topics include neurophysiology of music, neurophysiology of exercise, neurophysiology of addiction, neurophysiology of appetite, colour vision, sex hormones in the brain, genetics of neurological diseases.

Assessment: A 3000-word project report, and four 200-word journal article summaries submitted throughout the semester.

536-304 Seminars & Experimental Physiology

Credit points: 12.5

HECS-band: 2

Coordinator: Assoc Prof D Williams

Pre or Corequisites: Physiology 536-301 or 536-302 or 536-303.

Contact: 8 lectures, 15 hours of assignment and literature work, 42 hours of practical work and seminars (*Semester 2*).

Description: This subject provides practical experience in experimental physiology within a 'work-experience' research environment. Emphasis is given to communication (oral and written) and to interactive small group research. The lecture material will be given by the staff of the department, using their own research to practically illustrate how the principles and processes of experimental design, critical thinking and data analysis translate into fundable research programs. The assignments will concentrate on scientific writing and critical appreciation of the literature. In the research component, students will learn to work cooperatively in small groups with a member of staff actively investigating a specific physiological problem. Students will be expected to use their training undertaken in physiology 536-301, 536-302, or 536-303 as

a basis for writing their reports. The range of topics offered varies from year to year, and include cardiac physiology, brain function, vascular function, exercise and skeletal muscle physiology.

Assessment: One scientific writing assignment (800 words), one critical literature review (1500 words), and laboratory work (a report of up to 2500 words written in manuscript format, laboratory performance and seminar presentation).

536-308 Physiology of Muscle & Exercise

Note:

- This subject is recommended for BSc students taking a physiology major or BBiomedSci students undertaking a specialisation in molecular and cell biology or integrated systems biology
- The experimental approaches taught in this course are further implemented in 536-304 Seminars & Experimental Physiology (*p.3*)
- Credit is not available for this subject and 536-311 Systems Physiology Part B.

Credit points: 12.5

HECS-band: 2

Coordinator: Dr G Lynch

Prerequisites: Physiology 536-201, 536-211 and 536-202.

BBiomedSci students: 521-213 and 536-250.

A waiver of the prerequisite 536-202 may be considered for students who passed 536-201 and 536-211. Written requests should be made to science coordinator, Department of Physiology.

Contact: 30 hours of lectures, 15 hours of practical work and computer-aided learning (*Semester 1*).

Description: This subject will enable students to comprehend aspects of normal muscle development and growth, neuromuscular transmission, the control of human movement as well as the adaptation of skeletal muscle to interventions such as acute and long-term endurance and resistance training. Students will look at how aging affects muscle structure and function, the underlying cellular mechanisms involved in disuse atrophy, muscle damage and repair, as well as how muscle responds to different pharmacological interventions, including anabolic steroids. Students undertake two practical experiments designed to provide some understanding of all aspects of experimentation in this area, from experimental design to manuscript writing.

Assessment: A 2.5-hour end-of-semester examination and two practical classes each with a report of not more than 6 pages written in manuscript form.

536-310 Research Project in Physiology

Credit points: 12.5

HECS-band: 2

Coordinator: Dr N Williams

Prerequisites: Physiology 536-201, 536-211, 536-202. Approval to take this subjects must be obtained by the course coordinator or Head of Department.

Contact: 60 hrs (*Summer semester*).

Description: Students will undertake in-depth research in a single area in contemporary physiology. Study will be undertaken with a researcher in the department by mutual consent. Students should see the coordinator during the exam period to initially discuss potential research areas. Emphasis is placed on developing a strong background in hypothesis formulation and testing, data analysis and manuscript writing.

Assessment: A written report of up to 5000 words on supervised research including experimental plan, experimental work, data analysis and interpretation.

536-311 Molecular/Cellular Basis of Physiology

Note:

- This subject is recommended for BSc students taking a physiology major or BBiomedSci students undertaking a specialisation in molecular and cell biology, integrated systems biology or reproductive and developmental biology
- The subject matter taught in this subject is supported by the experimental investigations presented in 536-304 Seminars & Experimental Physiology (*p.3*). It is a recommended companion subject.
- Formerly known as 536-311 Systems Physiology Part B.

Credit points: 12.5

HECS-band: 2

Coordinator: Assoc Prof D Williams

Prerequisites: At least one of Physiology 536-301, 536-302, 536-303, 536-308.

Contact: 31 lectures and 24 hours of assignments (*Semester 2*).

Description: The subject will provide a detailed understanding of how molecular and cellular mechanisms control the functional interactions of whole body systems, the integration and coordinated control of physiological systems, homeostasis and adaptations to change. Students will explore the most

recent advances in select areas of physiology. Student select among a number of areas of study that reflect the dynamic nature of physiology and research focuses of the department. These include ion and channels and disease; the specialised role of calcium in cell control; genesis and treatment of muscle and injury/disease; gastrointestinal physiology and computational biology; signalling in neuronal cells; perinatal physiology; and stress proteins and skeletal muscle function.

Students develop theoretical and communication skills in using molecular, biological, biochemical and physiological approaches to investigate physiological processes. Students will be introduced to new technologies that enable the understanding of selected areas of study to be advanced. The assignment is designed to extend experience and the ability to read critically and to evaluate and to communicate physiological information. Several of the units offered will be supported with a small group practical investigation in 536-304 Seminars & Experimental Physiology (*p.3*).

Assessment: A 2-hour end-of-semester examination, a group poster presentation, and an individual assignment of not more than 1500 words.