

# Pharmacology

The subjects in pharmacology introduce students to the unified study of the interaction of chemical agents and living matter. The emphasis is placed on the principles of drug action and on the reactions of living processes to drugs. Toxicology, a division of pharmacology, is concerned with the adverse effects on life of therapeutic drugs and other chemicals. Pharmacology 534-201 provides an introduction to the important concepts of pharmacology and toxicology and may be taken to provide the basis for more advanced studies in pharmacology and toxicology at the 300-level or to supplement a major study in another discipline.

Generic skills that students will develop through the study of pharmacology include experimental design and technique, computer skills, organisational skills, bioinformatics, data presentation and analysis, working in teams, and communication skills.

## Suggested subjects

### Pharmacology major

Students who commenced study towards a BSc, BASc, or BSc combined course during or after 1999 are required to complete a major area of study which comprises subjects at 100, 200 and 300-levels. The requirements for a major study in pharmacology are outlined elsewhere in this Handbook, on page 15. A pharmacology major may be combined with a second major, for example, in anatomy and cell biology, biochemistry and molecular biology, chemistry, neuroscience, pathology or physiology.

### Pharmacology combined with other subjects

Students who commenced study prior to 1999 may combine pharmacology with other subjects, for example:

#### 200-level subjects

- pharmacology 534-201 with subjects selected from:
- biochemistry 521-211, 521-212 and 521-220
- physiology 536-201, 536-211 and 536-202
- chemistry 610-210 /211, 610-220 /221, 610-240/241, 610-260
- anatomy 516-201
- microbiology 526-201, 526-205 or 526-221

#### 300-level subjects

Pharmacology - all 300-level pharmacology subjects

Pharmacology and other biomedical subjects - at least 50 points in 300-level pharmacology (normally 534-301 and any other two 300-level pharmacology subjects), with selected subjects such as anatomy and cell biology, biochemistry and molecular biology, chemistry, pathology, physiology or psychology.

Refer to the relevant subject information for details of prerequisites.

#### Neuroscience

Subject 534-302 Neuropharmacology can be undertaken as part of a neuroscience sequence. Students wishing to pursue the neuroscience sequence may be allowed to undertake 534-302 without 534-301 as a prerequisite.

#### Biotechnology

Both second year 534-201 and third-year subjects 534-301 and 534-304 in pharmacology are approved subjects for inclusion in the Graduate Diploma in Biotechnology course (contact the Faculty of Medicine, Dentistry and Health Sciences for details).

## 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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## Subject descriptions

### 200-level subject

#### 534-201 Pharmacology

**Note:** Special requirements: Laboratory coat. Experiments involving the use of animals are an essential part of this subject; exemption is not possible.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr R A Hughes

**Prerequisites:** Twenty-five points of 100-level chemistry; biology 600-141 and 600-142. Exemption may be considered in special cases.

**Contact:** Thirty-six lectures (three a week); 18 hours practical work (*Semester 2*).

**Description:** The lecture course covers the basic principles of drug action and focuses on receptor sites that mediate drug action and the physiological and biochemical mechanisms associated with the response to a drug. The interaction of drugs with hormones and common therapeutic agents will be used to illustrate these principles. It investigates the ways in which drugs are handled by the body in terms of their absorption, distribution and metabolism. The course examines the development of new drugs from natural sources or new chemical syntheses and how these drugs are evaluated and regulated. Aspects of drugs of abuse and addiction and the potential strategies for dealing with this problem will be examined. The principles of selective toxicity and the toxicology of environmental contaminants will be introduced. Aspects of venoms and toxins will be examined. The practical course will reinforce the lecture material and illustrate the basic concepts of the pharmacological concentration response relationship, competitive antagonism and pharmacodynamic and pharmacokinetic modelling.

Students will gain skills in:

- critical thinking and problem solving;
- participating effectively in group work; and
- making use of information technology resources in data presentation.

**Assessment:** A 2-hour end-of-semester written examination (80%); continuous assessment throughout the practical component of the subject (20%).

### 300-level subjects

#### 534-301 Cellular and Molecular Pharmacology

**Note:**

- Formerly known as 534-301 Principles of Pharmacology
- Special requirements: Laboratory coat. Experiments involving the use of animals are an essential part of this subject; exemption is not possible.

**Credit points:** 25

**HECS-band:** 2

**Coordinator:** Dr M Lew

**Prerequisites:** Pharmacology 534-201; exemption may be given at the discretion of the Head of Department. Physiology 536-201 and 536-211 and biochemistry 521-211 and 521-212 are highly recommended.

**Contact:** Thirty-six hours lectures (three per week); 30 hours practicals (one 5-hour practical every second week); six hours workshops (one hour with each practical); three 3-hour CAL sessions (*Semester 1*).

**Description:** After completion of this subject students will have an understanding of pharmacological concepts and skills that will enhance their insight into biomedical sciences. Emphasis will be placed on the role of quantitative pharmacological analysis in the characterisation of biological systems. Topics covered include intercellular communication and signaling pathways, mechanisms of drug-receptor interactions, classification of drug receptors. The disposition of drugs in the body, drug administration, absorption and elimination, and genetically determined variability in drug action will be discussed. A major emphasis will be placed on the molecular nature and behaviour of receptors, and the exploitation of 'new biology' or biotechnology in the service of drug and receptor characterisation.

Students will gain skills in:

- critical thinking and problem solving;
- small group work;
- information gathering and report writing; and
- systematic evaluation of scientific evidence.

**Assessment:** A three-hour end-of-semester written examination (70%); continuous assessment of the practical component of the subject (24%); CAL tests (6%).

#### 534-302 Neuropharmacology

**Note:** Experiments involving the use of animals are an essential part of this subject; exemption is not possible.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr M Morris

**Corequisites:** 534-301; exemption may be given at the discretion of the Head of Department for students wishing to take 534-302 as part of the neuroscience stream.

**Contact:** Eighteen lectures and 24 hours practical (*Semester 1*).

**Description:** The teaching program will address the mechanisms of neurochemical transmission and co-transmission and the techniques used to identify transmitter substances and monitor transmitter release. Central nervous system adrenergic and cholinergic pharmacology will be discussed, in addition to peptide and amino acid neurotransmitter systems. The interaction of neuropharmacological agents such as the antidepressants at sites of chemical neurotransmission will be discussed. In the practical component of the course, students will develop skills to set up and carry out experiments using computer-based recording equipment, and learn to record and analyse the results of pharmacological experiments demonstrating the use of drugs affecting neurotransmission. Through this process, it is envisaged that students will come to appreciate the importance of good laboratory practice, including the proper handling of laboratory animals, keeping of laboratory records, and experimental design.

On completion of this subject students will be able to:

- apply scientific approaches to problem solving;
- participate effectively in group work and make clear presentations; and
- apply quantitative analysis to data and to construct a clear written report

**Assessment:** A 2-hour end-of-semester written examination covering material presented in lectures and practicals (75%); continuous assessment throughout the practical component of the subject (25%). An oral examination may also be held for students who do not pass the written examination.

### 534-304 Pharmacology of Therapeutic Substances

**Note:** Experiments involving animals are an essential part of this subject; exemption is not possible. Credit cannot be given for 534-304 and 534-305 and 534-306 prior to 1998.

**Credit points:** 25

**HECS-band:** 2

**Coordinator:** Dr M Morris

**Prerequisites:** 534-301 Cellular and Molecular Pharmacology (*p.1*)

**Contact:** Twenty-four lectures (two a week), 72 hours practical, one 6-hour session a week (*Semester 2*).

**Description:** The teaching program covers the benefits and risks associated with the use of drugs in a variety of systemic diseases. In particular, drugs affecting the cardiovascular, respiratory, gastrointestinal and renal systems, in addition to anti-inflammatory and immunomodulatory drugs. Drug action in the central nervous system; anaesthetics, sedatives and hypnotics, analgesics, drugs used in neurodegeneration and disorders of motor function will be addressed. In the practical component of the course, students will develop skills to set up and carry out experiments using computer-based recording equipment, and learn to record and analyse the results of pharmacological experiments demonstrating the use of drugs in a variety of settings. Through this process, it is envisaged that students will come to appreciate the importance of good laboratory practice, including the proper handling of laboratory animals, keeping of laboratory records, and the need for good experimental design. Thus a basis of understanding of the therapeutic benefit of drugs will be developed.

Students will gain skills in:

- participating effectively in group work;
- applying quantitative analysis to data; and
- information gathering and report writing.

**Assessment:** A 3-hour end-of-semester written examination; continuous assessment throughout the practical component of the subject. An oral examination may also be held for students who do not pass the written examination.

### 534-305 Toxicology

**Note:** Experiments involving animals are an essential part of this subject; exemption is not possible.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr G Anderson

**Prerequisites:** 534-301 Cellular and Molecular Pharmacology (*p.1*); exemption may be given at the discretion of the head of the department.

**Contact:** Twelve lectures (two a week for six weeks) and 36 hours practical, one 6-hour session a week for six weeks. First half of Semester 2 (*Semester 2*).

**Description:** The teaching program will introduce students to the mechanisms by which drugs, chemicals and toxins cause cellular toxicity and how cellular toxicity can lead to effects on specific target organs. The lectures will cover the following topics: general mechanisms of toxicity; principles of toxicity testing; clinical testing of drugs; epidemiological studies; apoptosis and necrosis; free-radicals and cell damage; organ-specific toxicity (including car-

diovascular system, lung, liver, kidney, nervous system, and reproductive system); the in-vitro and in-vivo toxic effects of commonly used and encountered drugs, chemicals and toxins. In the practical sessions, students will develop skills in a range of techniques used to examine the toxicity of drugs, chemicals and toxins, including in-vitro assays, in-vivo investigations and computer-based modelling. Throughout the teaching program, the importance of rational and critical scientific analysis of toxicological issues will be stressed.

Students will gain skills in:

- participating effectively in group work;
- applying quantitative analysis to data; and
- making use of information technology resources in data presentation.

**Assessment:** A 2-hour end-of-semester written examination covering material presented in lectures and practicals; continuous assessment throughout the practical component of the subject.

### 534-306 Drug Discovery

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr R A Hughes

**Prerequisites:** 534-301 Cellular and Molecular Pharmacology (*p.1*); exemption may be given at the discretion of the Head of Department. Some 200-level chemistry is desirable, preferably 610-210 or 610-221.

**Contact:** Twelve lectures (two a week for six weeks) and 36 hours practical workshops, one 6-hour session a week for six weeks. Second half of Semester 2 (*Semester 2*).

**Description:** The teaching program will introduce students to the means by which new drugs can be discovered. The lectures will cover the following topics: historical background; choice of therapeutic target; screening; rational drug design; molecular modelling; quantitative structure-activity relationships; the emerging role of combinatorial chemistry; peptide-based drug design; recombinant proteins as drugs; novel delivery systems; in-vitro and in-vivo assays; high throughput assays; and the impact of molecular biology on drug discovery. In the practicals, students will develop skills in the use of computer-aided molecular modelling to understand drug and receptor structure and how this knowledge can be applied to the design of new drugs, and examine case studies of modern drug discovery. Students will be encouraged to integrate knowledge from different parts of the subject, reinforcing the need for a multidisciplinary approach to the discovery and development of new drugs.

Students will gain skills in:

- making use of information technology resources in knowledge building and data presentation;
- participating effectively in group work; and
- organising information into a clear report.

**Assessment:** A 2-hour end-of-semester written examination; continuous assessment of practical reports.

### 534-307 Ocular Pharmacology

**Credit points:** 6.25

**HECS-band:** 2

**Coordinator:** Dr J Ziogas

**Prerequisites:** Enrolment in the third year of the BOptom course with successful completion of second-year physiology and biochemistry.

**Contact:** Thirty lectures, four tutorials, two 3-hour practical sessions (*Semester 2*).

**Description:** The teaching program will emphasise the importance of drug action in the eye and provide the optometry student with enough background to appreciate the special needs of optometry patients undergoing drug therapy for other conditions and be able to communicate confidently with patients and other health professionals about pharmacology and therapeutics. Topics that will be covered include principles of drug action; pharmacodynamics and pharmacokinetics; administration of drugs to the eye; absorption and penetration through the cornea; mechanisms of drug elimination and metabolism; autonomic innervation of the eye; miotics, mydriatics and cycloplegics; drugs used in systemic and central conditions and their consequence to ocular function; and drugs used in ocular conditions; local anaesthetics, anti-inflammatory drugs, antihistamines, anti-infective agents and drugs used in the treatment of glaucoma.

**Assessment:** A 3-hour written examination covering material presented in lectures, tutorials and practicals.

### 534-311 Drug Development Techniques

**Note:** Experiments involving the use of animals are an essential part of this subject; exemption is not possible.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr C E Wright

**Prerequisites:** 534-301; exemption may be given at the discretion of the Head of Department.

**Contact:** Five lectures; five tutorials and 36 hours practical (one six-hour session a week). Second half of Semester 2 (*Semester 2*).

**Description:** The teaching program will introduce students to pharmacological techniques which may be used to evaluate the mechanism of action, as well as selectivity, of potential drug candidates both in vitro and in vivo. The aims are to understand some of the theoretical and practical aspects of pre-clinical drug development from selection of candidate molecule through to Phase I clinical trial. Students will work in pairs and each week rotate through a different advanced practical technique to assess the pharmacology of a coded drug. The lectures and tutorials will cover the theory and methods involved in each advanced technique which include behavioural pharmacology; in vitro preparations of cardiovascular, airway and urogenital tissues; surgical instrumentation; and assessment of cardiovascular and autonomic responses in vivo.

Students will gain skills in:

- rational enquiry and self-directed small group learning;
- oral and written communication;
- the design of pharmacological experiments;
- identification of an unknown drug based on their practical work; and
- the strengths and weaknesses of principal pharmacological techniques.

**Assessment:** A consolidated final report (2000 words; 50%), weekly short reports (20%), oral presentation (10%) and practical skills test (20%).

