

# Botany

The School of Botany offers an exciting and stimulating research environment for studying plants and plant processes. Programs cover a broad spectrum of basic, strategic and applied research. Active collaborations are maintained with other universities and research institutes in Australia and overseas, and with state and federal government agencies and industry.

The School of Botany offers majors in several areas of plant biology, with emphasis on modern technologies and important emerging fields of research. Some subjects offer field work and outdoor experience in diverse Australian environments. Botany is specifically responsible for majors in:

- terrestrial ecology
- plant ecology and ecophysiology
- biodiversity and evolutionary plant biology
- plant pathology
- plant cell and molecular biology
- plant biotechnology

Other Science majors in which botany has a significant teaching involvement are as follows:

- cell and molecular biology
- marine biology
- marine ecology
- conservation of Australian wildlife
- environmental science for life sciences
- reproduction and development

All these botany majors require completion of an appropriate first year package. Students are strongly encouraged to seek advice and information on their choice of majors (second and third year courses) during the course advising sessions offered in the second semester, or by appointment with course advisers arranged through the departmental secretary.

## Bachelor of Science (Honours)

For information about the Faculty and departmental entry requirements for Honours, please refer to *Bachelor of Science (Honours) and Bachelor of Information Systems (Honours) (p.883)*. These requirements should be considered when planning your course.

## Botany subject descriptions

### 606-201 The Living Plant

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr I Woodrow

**Prerequisites:** Biology 600-141 and 600-142 (Before 1996: 600-101) and one of chemistry 610-141 plus 610-142, or 610-161 plus 610-162 (Before 1998: 610-121 plus 610-122).

**Contact:** 24 lectures (two per week), 36 hours of practical work (3 hours per week) (*Semester 1*).

**Description:** Topics studied include:

- the anatomy of plant cells, tissues and organs;
- photosynthesis, growth and development;
- plant-animal and plant-microbe interactions;
- water relations and environmental stress;
- plant nutrition;
- secondary metabolism; and
- flowering.

Emphasis is given to crop and native plants. Upon completion of the subject, students should gain:

- a knowledge of plant structure and physiological function in relation to the environment; and
- skills in designing experiments and in studying the anatomy and function of plants.

**Assessment:** One 3-hour written examination at the end of the subject; up to 3000 words of practical assignments.

### 606-202 Plant Biodiversity

**Credit points:** 25

**HECS-band:** 2

**Coordinator:** Dr G T Kraft

**Prerequisites:** Biology 600-141 and 600-142 (Before 1996: 600-101). Botany 606-201 is strongly recommended.

**Contact:** 36 lectures (three per week) and 48 hours practical work (4 hours per week), and up to three days of excursions (*Semester 2*).

**Description:** Topics covered include:

- the major groups of algae, liverworts, mosses, ferns, gymnosperms and flowering plants
- evolution, classification and identification of plants

After completion of the lecture, practical and field components of this subject, students should appreciate:

- the variety and classification of algae (micro and macro) and land plants;
- skills in plant identification; and
- the concepts of modern phylogenetic analysis as bases for framing evolutionary hypotheses within and between major plant groups.

**Assessment:** Self-study exercises and projects (10%), one 3-hour written examination (45%) and two 2-hour practical tests (45%).

### 606-204 Plant Ecology

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Prof A Baker; Dr R Willis

**Prerequisites:** Biology 600-141 and 600-142. Concurrent enrolment in Botany 606-201 is strongly recommended.

**Contact:** 24 lectures (two per week), 18 hours of excursions and six tutorials (*Semester 1*).

**Description:** Topics include:

- plant community ecology
- plant population dynamics
- plants and fire
- plants and aridity
- plant-animal interactions
- environmental issues and phytoremediation

By successfully completing this subject, students should gain:

- knowledge of the ecology of Australian plants and plant communities;
- understanding of the ecosystem concept, and the structure and physiology of ecosystems;
- understanding population ecology including weeds;
- knowledge of field sampling and techniques;
- understanding of local and global environmental issues; and
- ability to synthesise, interpret and discuss current scientific literature.

**Assessment:** One 3-hour end-of-semester written examination (80%); excursion reports up to 2500 words (20%).

### 606-205 Cell Biology I - Cells and Organelles

**Note:**

- 1 Not available for students enrolled in the BBiomedSc.
- 2 This subject is a joint botany/zoology/anatomy and cell biology subject.
- 3 This subject can be taken by itself, but it is designed to be the first of a two-semester sequence with 606-206.
- 4 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:** Prof J Pickett-Heaps

**Prerequisites:** Biology 600-141 and 600-142; Chemistry 610-141 plus 610-142, or 610-161 plus 610-162 (Before 1998: 610-121 plus 610-122).

**Corequisites:** Biochemistry 521-211 is recommended.

**Contact:** 24 lectures (two per week) and 24 hours practical work (times to be arranged) and up to 12 hours computer-aided learning (*Semester 1*).

**Description:** This subject is designed to give students a thorough understanding of basic cell structure and function. It will start by covering different types of cells, their origin and their diversity across the protistan, fungal, plant and animal kingdoms. Then it will concentrate on the major components of cells and their functions, the interrelationship between organelles in plant and animal cells, and cell membranes and cell surfaces. These topics will be related to the behaviour of living cells by use of video where possible. Finally, students will be able to use computer software programs designed to teach cell biology.

The practical component is designed to show students how biologists design experiments and collect data and how data are used in the formulation of theories; it will develop skills in observation, manipulation and analysis; and finally, it will reinforce some of the phenomena discussed in the lectures.

**Assessment:** A 3-hour written examination at the end of semester (70%); up to 3000 words of practical assignments and one short computer-based assignment (30%).

### 606-206 Cell Biology II - Cellular Interactions

**Note:**

- 1 This subject is a joint botany/zoology/anatomy and cell biology subject.

2 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:** Prof J Pickett-Heaps

**Prerequisites:** Normally cell biology 606-205 (Before 1999: 606-205 or 606-215). Recommended corequisites: biochemistry 521-211 and 521-212.

**Contact:** 24 lectures (two per week), 24 hours practical work and up to 12 hours computer-aided learning (times to be arranged) (*Semester 2*).

**Description:** This subject builds on the knowledge gained from Cell Biology I: Cells and Organelles (606-205), and now treats cells as living entities that interact in complex ways to create the tissues and organs of higher animals and plants. Topics will include how cells communicate; how they divide, differentiate and interact to form tissues; and how they express genetic information during differentiation and morphogenesis. Throughout, the subject will emphasise how this information is derived from the integration of biochemical, ultrastructural and biophysical information.

The practical component of the subject will give students experience in how biologists design experiments and collect data, and how data are used in the formulation of theories. It will help develop skills in observation, manipulation and analysis.

**Assessment:** A 3-hour written examination at the end of semester (70%), up to 3000 words of practical assignments and one short computer-based assignment (30%).

### 606-207 Flora of Victoria

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Prof P Ladiges; Dr D Guest

**Prerequisites:** At least one 100-level biology subject (600-141 or 600-142 or 600-111).

**Contact:** 21 hours lectures, 33 hours practical work, including excursions full-time over two weeks in early February (*Summer semester*).

**Description:** This subject is designed for students wishing to take a summer course, who are interested in the biology of native plants and plant communities and environments in Victoria. It is suited to students studying environmental science or environmental studies.

Topics covered include:

- biogeographic regions of Victoria: climate, landforms, soils and vegetation types;
- history of the Victorian flora: fossils and evolutionary changes through the Tertiary and Quaternary;
- biology of Victorian plants: intraspecific variation and adaptation to local conditions, ecotypes and clines in eucalypts and acacias, mallee plants, coastal plants, alpine plants, marine and fungal flora; and
- threats to the Victorian flora: weeds, diseases, pests, fire, extinctions.

By taking this subject, students should:

- gain an understanding of the biogeography and biology of the Victorian flora;
- develop skills in identification of Victoria's land plants, seaweeds and macrofungi; and
- appreciate the evolutionary history of, conservation value of and threats to Victoria's ecosystems.

**Assessment:** A 2-hour written exam (60%) at the end of the subject, a written assignment (1,500 words; 20%) and a project based on excursion and practical work (six pages; 20%), submitted at the start of Semester 1.

### 606-301 Community & Ecosystem Ecology

**Note:** Credit cannot be granted for both 606-301 and 606-311.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Prof A Baker

**Prerequisites:** Botany 606-201 and 606-204 are recommended.

**Contact:** 24 lectures (two per week) and a total of 24 hours excursions and practical work (*Semester 1*).

**Description:** This subject aims to provide a sound theoretical basis of modern trends, developments and methods in plant ecology. Topics include:

- theories and models of community and ecosystem structure;
- ecosystem productivity and nutrient cycling;
- urban ecology and biodiversity;
- natural disturbance and succession;
- soils, heavy metals and restoration ecology.

By successfully completing this subject, students should gain skills in:

- preparation, writing and oral presentation of scientific reports;
- field sampling, data acquisition and analysis; and
- chemical analysis of soils and plants

**Assessment:** A 3-hour written examination at the end-of-semester (70%); practical reports of up to 3000 words on excursion and related practical work (30%)

### 606-302 Marine & Freshwater Botany

**Credit points:** 25

**HECS-band:** 2

**Coordinator:** Dr R Wetherbee; Dr G T Kraft

**Prerequisites:** Botany 606-202 or permission of the coordinator.

**Contact:** 100 hours during late November and early December, including 34 lectures, 45 hours of practical classes and 21 hours of field work (*Summer semester*).

**Description:** Topics to be covered include:

- the biology and diversity of algal protists;
- the evolution and phylogeny of protists;
- algal structure, taxonomy and classification;
- algal reproduction and life histories;
- endosymbiosis and the origin of algal chloroplasts;
- distribution and ecology of aquatic plants;
- aquatic environments and global ecology; and
- the commercial utilisation of marine algal products.

The practical component will introduce students to identifying and classifying micro- and macroalgae from marine and freshwater habitats; identifying and characterising algal pigments and use of light and electron microscopes for studying microalgae. Field work along the Victorian coast will focus on the identification and ecology of Australia's unique seaweed flora. At the completion of the subject, students should have developed an understanding of:

- the biology and diversity of algal protists;
- algal reproduction and significance of their life history strategies;
- the origin and phylogenetic significance of algal chloroplasts and pigments;
- practical skills in identifying the major groups of marine and freshwater algae;
- the biology of toxic algae and their impact;
- practical skills in light and electron microscopy of algal protists;
- the unique nature of the Australian seaweed flora; and
- current themes in algal research.

**Assessment:** A 3-hour written examination in the week following the end of the subject, three 2-hour laboratory examinations and up to three field reports of 6-10 pages each.

### 606-303 Botany Systematics & Evolution

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Prof P Y Ladiges; Dr A Drinnan

**Prerequisites:** Botany 606-202.

**Contact:** 24 lectures (two per week), 24 hours practical work (two per week) (*Semester 1*).

**Description:** Topics studied include:

- homology and form;
- numerical methods in systematics, phenetics and cladistics;
- classification of vascular plants, especially gymnosperms and angiosperms;
- fossils;
- historical biogeography; and
- Australian flora.

At the completion of the subject students should gain:

- a knowledge of modern methods of phylogenetic systematics, including the application of morphological and molecular data;
- skills in analysing systematic data, including the use of computer interactive programs; and
- a knowledge of the evolution and diversity of Australian flora, both living and fossil groups of land plants.

**Assessment:** A 1500-word essay; practical reports totalling up to 2000 words (30%); a 3-hour end-of-semester written examination (70%).

### 606-304 Environmental Plant Physiology

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr I Woodrow

**Prerequisites:** Botany 606-201.

**Corequisites:** Recommended Botany 606-314.

**Contact:** 24 lectures (two per week), 24 hours practical work (3 hours per week during the first part of semester) (*Semester 2*).

**Description:** Topics to be covered will be selected from the following:

- the physical environment;
- plant-animal interactions;
- metabolism of defensive compounds;
- energy exchange with the environment;
- transpiration and stomata;
- photosynthetic carbon assimilation and growth;
- coping with environmental extremes; and
- genetic engineering and plant performance.

The practical component of the course will introduce students to state-of-the-art methods for environmental monitoring using data acquisition systems and a range of environmental sensors. Emphasis will be placed on sampling strategies and data processing and presentation. Upon completion of this subject students should gain:

- a knowledge of plant function and performance in relation to the environment;
- an understanding of the relationship between plant growth and performance and various molecular, biochemical and physiological attributes; and
- skills in field sampling and using electronic data gathering and processing systems.

**Assessment:** A 2-hour examination at the end of semester, a laboratory test and practical reports totalling up to 2000 words.

### 606-307 Fungi & Plant Disease

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr D I Guest

**Prerequisites:** Biology 600-141 and 600-142 (Before 1996: 600-101).

**Corequisites:** Recommended Botany 606-314.

**Contact:** 24 lectures (two per week) and 24 hours laboratory classes (*Semester 2*).

**Description:** Topics to be covered in this subject include:

- the evolution and diversity of fungi;
- fungal physiology, growth and ecology;
- humans and fungi;
- fungi and other microbes that cause plant disease;
- plant-parasite relationships; and
- disease resistance in plants.

The practical component will introduce students to techniques used in handling and identifying fungi, and in studying plant disease. Emphasis is placed on the design of experiments and interpretation of experimental data.

Upon completion of this subject, students should have developed an understanding of:

- the biology and diversity of organisms that cause plant disease;
- the mechanisms by which fungi cause plant disease at the molecular, cellular, whole plant and community levels;
- the mechanisms used by plants to defend themselves against disease;
- biotechnology to plant pathology; and
- current themes in research into plant disease.

**Assessment:** A 2-hour examination at the end of semester (60%), weekly tests of 10 minutes (10%) and a practical report of 4 pages (30%).

### 606-309 Cell Biology III

**Note:** This is a joint botany/anatomy and cell biology/zoology subject

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Prof A Bacic; Dr M Dziadek

**Prerequisites:** Botany 606-205 and 606-206 or biochemistry and molecular biology 521-211 and 521-212 or 521-213. Other combinations that provide a similar background will be considered by the coordinators.

**Contact:** 36 lectures (three per week) (*Semester 1*).

**Description:** Topics to be covered include:

- the importance and applications of cell biology;
- regulation of cell phenotype, cell transformation;
- recombinant protein technology;
- plant and animal genetic manipulation; transgenesis;
- molecular basis of cell interactions; applications of plant and animal cell culture;
- cell transplantation; gene therapy;
- exploitation and commercialization of cell biology; and ethical issues.

Upon completion of this subject, students should gain:

- an advanced level of understanding of the ways in which phenotype can be manipulated to explore cell and organ function, and in biotechnology of plants and animals; and
- knowledge of the applications of cell biology in research, industry and human welfare, and policy and regulatory issues relevant to cell biology and biotechnology.

**Assessment:** A 3-hour written examination at the end of semester (60%), a review essay of no more than 3000 words (20%) and tests during the semester (20%).

All assessment components must be completed satisfactorily before credit can be granted for the subject.

### 606-310 Field Botany

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr A Drinnan

**Prerequisites:** Botany 606-202 or 606-204 or 606-207.

**Contact:** This subject is offered full-time over the first two weeks of February. Total contact is 62 hours, comprising 36 hours fieldwork (one 6-day excursion), 8 hours lectures, 18 hours practical work (*Summer semester*).

**Description:** Topics to be covered include:

- taxonomy of the Australian flora;
- field identification of major families and genera of plants;
- collection and preservation of plant specimens; mounting and cataloguing specimens; curatorial skills; nomenclature;
- using computer-based identification systems and databases;
- techniques for description and classification of vegetation; structural types, floristic associations, measures of abundance (cover, density, basal area, biomass), sampling techniques (quadrats, line transects, plotless methods), sampling scale and species-area relationships, profile diagrams, life-form spectra;
- soils; and
- vegetation mapping.

At the end of this subject, students will have the skills for:

- identification, description and quantification of plants and plant communities in the field;
- collection, cataloguing and preserving plant specimens; and
- constructing a vegetation map.

**Assessment:** A curated collection of up to 20 plants (20%); a written report of a maximum of 2000 words (40%); assessment of field activities (20%); and a 2-hour practical examination at the end of the subject (20%).

### 606-313 Molecular Evolution & The Origin of Life

**Note:** This is a joint Botany/Microbiology subject.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr G McFadden; Dr M Dyal-Smith

**Prerequisites:** Biochemistry 521-211 and 521-212 (1996: 521-201); or Genetics 652-204 and 652-205 (1996: 652-201).

**Contact:** One 3-hour lecture/tutorial per week (*Semester 1*).

**Description:** Topics include:

- spontaneous origin of life and concept of chemical evolution;
- the RNA world;
- formation of protocells;
- origin of the genetic code;
- overview of bacterial diversity (Bacteria, Archea);
- similarities between Archea and eucaryotes; and
- origins of eucaryotic specialisations (mitochondria, chloroplasts, introns, linear chromosomes, mitosis, sex).

By the end of this subject students should:

- understand theories of how life arose and have an overview of the main cellular forms it has taken during the course of evolution;
- appreciate salient features of the several key metabolic processes, especially respiration and photosynthesis;
- know the principle differences between procaryotes and eucaryotes at the structural and molecular levels and understand how these differences might have arisen; and
- appreciate the significance of the eucaryotic condition in relation to evolution.

**Assessment:** A 3-hour written examination at the end of semester and two essays of up to 1500 words each.

### 606-314 Experimental Techniques in Plant Science

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr E Newbigin; Dr I Woodrow

**Prerequisites:** Completion of, or concurrent enrolment in, at least one of: botany 606-303, 606-304, 606-307 or biochemistry 521-306.

**Contact:** 60 hours laboratory classes, including library research and seminar presentation (*Semester 2*).

**Description:** This subject involves instruction in experimental methods in plant science useful for plant biotechnologists, physiologists, plant pathologists, environmental biologists and systematists, and researchers involved in agriculture, horticulture or forestry. It will include a research project in an area of student's choice. Methods to be covered in this subject will be selected from:

- extraction, handling and manipulation of plant nucleic acids and proteins;
- gas exchange analysis;
- plant tissue culture;
- secondary metabolite analysis;
- microscopy;
- analysis of pest and disease resistance mechanisms in plants; and
- data acquisition, analysis and presentation.

By the end of the subject, students should have:

- a knowledge of basic methods and experimental design in plant science;
- experience in written and oral presentation of original research; and
- experience of working in a research team.

**Assessment:** A research report of up to 3000 words due at the end of semester, a seminar on the research project, and laboratory tests held within timetabled classes.