

# Botany

The School of Botany provides an exciting and stimulating research environment for studying plants and plant processes. Our program covers 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 the major in botany. The areas covered in this major are diverse and include plant function and ecology; phytoplankton and seaweeds; systematics and evolutionary plant biology; field botany; fungi; plant diseases and defence; plant cell and molecular biology; and plant biotechnology.

Other majors in which the School of Botany has a significant teaching and research involvement are marine biology, ecology and cell biology. The major in botany is also an excellent complementary major with biochemistry, biotechnology, environmental science, genetics, geography and zoology.

The botany major requires completion of at least 50 points of 300-level botany subjects. Accordingly, students should select as a minimum those second-year subjects that are prerequisites for the third-year courses they anticipate enrolling in. Students are strongly encouraged to seek advice and information on their choice of second- and third-year courses for any of these majors during the course advising week offered in the second semester, or by appointment with course advisors 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.1)*. These requirements should be considered when planning your course.

## Further information

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## Subject descriptions

### 200-level subjects

#### 606-201 Plant Structure and Function

**Note:** Previously known as 606-201 The Living Plant.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr I Woodrow

**Prerequisites:** Biology 650-141 and 650-142 (prior to 2004: 600-141 and 600-142); and chemistry 610-141 and 610-142 (or 610-121 and 610-122).

**Contact:** Twenty-four lectures (two per week), 36 hours of practical work (three hours per week) (*Semester 1*).

**Description:** This subject integrates plant anatomy and physiology to explain the metabolic processes involved in plant growth and development. Topics studied include:

- 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.

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 (65%); up to 3000 words of practical assignments (35%).

#### 606-202 Plant Biodiversity

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr A Drinnan; Dr R Willis

**Prerequisites:** Biology 650-141 and 650-142 (prior to 2004: 600-141 and 600-142). Botany 606-201 is recommended.

**Contact:** 24 lectures (two per week) and up to 36 hours practical work (one 3-hour practical class per week) and one day-long excursion (*Semester 2*).

**Description:** This subject introduces the major groups of land plants from liverworts to angiosperms, concentrating on their structure, biology and systematic relationships and evolution. Topics covered include:

- evolution, phylogeny and classification of land plants;
- major groups of land plants, liverworts, mosses, ferns and seed plants; their morphology, anatomy and development; and
- major families of flowering plants, including Australian flora, their characteristics and identification.

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

- the variety and classification of land plants;
- skills in plant identification; use of modern identification tools including computer-interactive keys; and
- the concepts of modern phylogenetic analysis as bases for framing evolutionary hypotheses within and between major plant groups.

**Assessment:** One 3-hour written examination at the end of semester (60%); two 1-hour practical tests during semester (20%); reports on practical work (20%).

#### 606-203 Phytoplankton and Seaweeds of Australia

**Note:** Not available for students who have completed 606-202 prior to 2002.

This subject is required for a marine biology major.

Formerly known as 606-203 Biodiversity of Protists.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr G Kraft

**Prerequisites:** Biology 650-141 and 650-142 (prior to 2004: 600-141 and 600-142).

**Contact:** 24 lectures (two per week) and 24 hours practical work (one 2-hour practical class per week) (*Semester 1*).

**Description:** This subject introduces the major groups of the kingdom Protista, concentrating on their diversity, structure, biology, systematic relationships and evolution. Emphasis is placed on Australian species. Topics covered include:

- the classification, morphology and cytology of the protistan phyla: 1) the macroscopic green, brown and red seaweeds; 2) the microalgal and phytoplankton classes: diatoms, dinoflagellates, chlorophytes, chrysophytes and other lesser-known but ecologically and phylogenetically significant groups;
- the evolutionary history of protistan organisms;
- the economic impacts, positive and negative, of algal organisms; and
- the importance of algae to biodiversity and marine ecosystems.

After completion of the subject, students will have acquired a knowledge and appreciation of:

- the variety and classification of algae and other protists;
- the extraordinary richness and biodiversity of southern Australian marine macroalgae;
- techniques for identifying macroscopic and microscopic algal organisms;
- modern cytological research and the ultrastructural, biochemical and molecular approaches to algal study;
- the pivotal roles that ancient bacterial and photosynthetic organisms have played in the evolution of mitochondria and chloroplasts,
- how to set up and use dissecting and phase-contrast compound microscopes; and
- how to interpret and draw important features of cells and organisms.

**Assessment:** 3-hour written examination at the end of semester; two 2-hour laboratory examinations during term time.

#### 606-204 Ecology: Communities and Ecosystems

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr R Willis; Dr R Day; Prof N Enright

**Prerequisites:** Biology 650-141 and 650-142 (prior to 2004: 600-141 and 600-142); or geography 121-012 and 121-013.

**Contact:** Twenty-four lectures (two per week), 27 hours of practical work plus an excursion (*Semester 2*).

**Description:** The subject provides an introduction to ecological questions that can be addressed at the levels of communities and ecosystems. Topics include:

- measurement of ecological systems at the level of food web, community, ecosystem and landscape;
- trophic interactions and resource partitioning;
- disturbance and ecological succession;

- nutrient cycling and energetics;
- palaeoecology; and
- management of human activities.

By successfully completing this subject, students should gain:

- understanding of the concept of ecological communities, ecosystems and landscapes;
- knowledge of field sampling and techniques;
- appreciation of the roles of natural and human disturbances in ecological systems;
- understanding of the approaches to management at these ecological scales;
- an appreciation of the role and usefulness of models, including mathematical models in ecology;
- an understanding of the ways in which ecological research is carried out; and
- an ability to synthesise, interpret and discuss current scientific literature.

**Assessment:** One 2-hour end-of-semester written examination; up to 15 pages of practical and excursion reports; continuous assessment of practical exercises and laboratory problems.

### 606-205 Plant Cell Biology

**Note:** Previously known as 606-205 Cell Biology.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr E Newbigin

**Prerequisites:** Biology 650-141 and 650-142 (prior to 2004: 600-141 and 600-142); and chemistry 610-141 and 610-142 (or 610-121 and 610-122).

**Contact:** 24 lectures (2 per week), 36 hours practical work and project exercises (*Semester 2*).

**Description:** This subject is designed to give students a thorough understanding of plant cell structure and function. This information will be discussed in the context of relevant elements of plant physiology and molecular biology. Topics include:

- how cells interact in a complex multicellular plant;
- the major organelles of cells, their functions and interrelationships; and
- how genetic information is expressed during these and other important processes such as cell proliferation and cell death.

At the end of this subject, students should:

- understand how organelles interact to bring about basic life processes;
- become familiar with how living cells behave during different types of cellular activity; and
- understand modern techniques used in cell and molecular biology research.

**Assessment:** 3-hour written examination at the end of semester (50%); tests during semester (25%); reports on practical work (25%).

### 606-207 Flora of Victoria

**Credit points:** 12.5

**HECS-band:** 2

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

**Prerequisites:** At least one 100-level biology subject (650-141, 650-142, 650-111 or prior to 2004: 600-141, 600-142 or 600-111).

**Contact:** 21 hours of lectures and 33 hours of 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, and 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, geology, soils and vegetation types;
- biology of Victorian plants: intraspecific variation and adaptation to local conditions, ecotypes and clines, mallee plants, coastal plants, alpine plants, 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 plants and macrofungi; and
- appreciate the evolutionary history of, conservation value of and threats to Victoria's ecosystems.

**Assessment:** 2-hour written examination at the end of the subject (60%); written assignment of 1500 words (20%); project practical work of 6 pages submitted at the start of Semester 1 (20%).

## 300-level subjects

### 606-301 Applied Ecology (Theory)

**Note:** Students cannot receive credit for this subject and geography 121-030.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Prof A Baker; Prof N Enright

**Prerequisites:** At least two of geography 121-025, botany 606-201, 606-202 606-204, 606-207 or zoology 654-204 is recommended.

**Contact:** Two 1-hour lectures and a 1-hour seminar per week. A one-day field trip (*Semester 2*).

**Description:** This subject will provide a sound theoretical background to the application of ecological concepts and their relevance to present day environmental issues.

Topics will include:

- the scientific basis of conservation and management of natural and man-made ecosystems;
- endangered species assessment and management;
- restoration ecology and contaminated land remediation;
- urban ecology and landscape management; and
- role of ecological research in global problems.

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

- ecological tools in environmental management;
- ecological approaches to the conservation and management of species and communities, and the restoration of degraded ecosystems;
- critical interpretation of ecological data;
- preparation, writing and presentation of environmental reports; and
- professionalism in ecological and environmental practice.

**Assessment:** 2-hour written examination at the end of semester (60%); research report (30%); seminar notes (10%). Students must attend 80% of seminars to be eligible to sit the final examination.

### 121-030 Applied Ecology

See full subject details on page 6.

### 606-302 Marine Botany

**Credit points:** 25

**HECS-band:** 2

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

**Prerequisites:** Botany 606-203 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 fieldwork (*Summer semester*).

**Description:** This subject will introduce students to identifying and classifying micro- and macroalgae from marine and freshwater habitats; identifying and characterising algal pigments; and the use of light and electron microscopes for studying microalgae. Fieldwork along the Victorian coast will focus on the identification and ecology of Australia's unique seaweed flora. 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.

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:** 3-hour written examination in the week following the end of the subject; two 2-hour laboratory examinations; 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:** This subject will introduce the general principles and modern methods of systematics: how to discover the phylogeny (relationships) of organisms using both morphological characters and molecular (DNA) data; how to use this information to improve the classification systems of plants, and to study aspects of evolution, coevolution and historical biogeography; and how to integrate information from living and fossil plants to discover the past and date evolutionary events. Examples of the diversity and evolution of the Australian flora - both fossil and living forms - will be used throughout this subject. Topics studied include:

- homology and form;
- numerical methods in systematics, phenetics and cladistics;
- evolution 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 plants.

**Assessment:** 1500-word essay; practical reports totalling up to 2000 words (30%); 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:** Botany 606-314 is recommended.**Contact:** 24 lectures (two per week), 24 hours practical work (3 hours per week during the first part of semester) (*Semester 2*).

**Description:** This subject deals with plant function in relation to the changing physical environment - essential study for students of basic molecular sciences with an interest in plant performance in the natural environment, and for students of ecology, forestry and environmental science with an interest in the function of plants and the detection of the physical environment. The practical component of the subject 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. 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.

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:** 2-hour examination at the end of semester; 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 650-141 and 650-142 (prior to 2004: 600-141 and 600-142).**Corequisites:** Botany 606-314 is recommended.**Contact:** 24 lectures (two per week) and 24 hours laboratory classes (*Semester 1*).

**Description:** This subject introduces the importance of fungi, and the role that they and other microbial organisms play in plant disease. 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. Topics to be covered 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.

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 and plant pathology; and
- current themes in research into plant disease.

**Assessment:** 2-hour examination at the end of semester (60%); weekly tests of 10 minutes (10%); practical report of four pages (30%).**606-309 Frontiers of Cell Biology****Note:** This is a joint botany, anatomy and cell biology and zoology subject.

Previously known as 606-309 Cell Biology III

**Credit points:** 12.5**HECS-band:** 2**Coordinator:** Prof A Bacic; Dr G Hime; Dr M Familiari**Prerequisites:** Botany 606-205 or zoology 654-203 or anatomy 516-201 or biochemistry 521-211 and 521-212.

BBiomedSc students: 521-213

Other combinations that provide a similar background will be considered by the coordinators.

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

**Description:** This subject will bring students to the forefront of modern cell biology, and provide a broad overview of plant and animal cell biology. We expect that a student who completes this subject will understand the major questions of cell biology, the tools that are being used by cell biologists, how knowledge relates to experiment, how data in cell biology is interpreted and how cell biology is being used in pure and applied research.

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;
- human cloning, stem cells, gene therapy and cell transplantation; and
- exploitation and commercialisation of cell biology, and ethical issues.

At the completion of this subject, students should have:

- 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;
- knowledge of the applications of cell biology in research, industry and human welfare, and policy and regulatory issues relevant to cell biology and biotechnology;
- enhanced presentation skills;
- developed problem-solving skills;
- the ability to think critically, and organise knowledge from consideration of the lecture material;
- learnt to adopt new ideas from participation in the lecture program;
- the ability to present a rational summary of the scientific argument presented in the lecture series; and
- the ability to present a well-organised and lucid argument.

**Assessment:** 3-hour written examination at the end of semester (60%); 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; Prof A Baker

**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 7-day excursion: 6 days fieldwork, one day travelling), 8 hours lectures, 18 hours practical work (*Summer semester*).

**Description:** This subject is structured around the fieldwork excursion in early February and covers the basic skills that are required to undertake a field-based botanical activity such as a flora survey or an environmental impact assessment, or to proceed to research in a field-based botanical discipline. 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;
- 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:** Curated collection of up to 20 plants (20%); written report of a maximum of 2000 words (40%); assessment of field activities (20%); 2-hour practical examination at the end of the subject (20%).

### 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 300-level botany subject or biochemistry 521-306. Other subjects that provide a similar background will be considered by the coordinators.

**Contact:** 60 hours practical work in total. The laboratory component of 30 hours will be completed during an intensive instruction period during the week prior to the commencement of Semester 2. A research project requiring 30 hours work will be undertaken during the semester (*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 students' 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:** Two laboratory tests (10%); reports on laboratory exercises totalling 2000 words (30%); seminar based on the research project (15%); research project report of up to 3000 words due at the end of semester (45%).

### 600-311 Research Project A

See full subject details on page 1.

### 600-312 Research Project B

See full subject details on page 1.