

# Zoology

How animals live and why they live that way are questions addressed by zoologists. Most of the Australian fauna are poorly understood or not even formally named, yet informed management and resource use of Australia's flora, fauna and habitats depend upon zoological knowledge. We need to catalogue what species exist and how they survive in their natural environments. This requires knowledge of their physiology, breeding and reproductive systems, ecology, evolution and behaviour. Students enrolled in zoology subjects can learn a diversity of topics, ranging from the structure and function of the cells that make up animals, through anatomy and physiology, reproduction and development, evolution, ecology and behaviour. This knowledge is important for biomedical research, agricultural and fisheries practices, the management of natural resources, environmental planning and for understanding the natural world. Graduates with majors in zoological subjects are employed in the public and private sector in a wide range of biomedical, environmental, fisheries and wildlife fields. Their degree provides them with specialised knowledge about animals and their environment. The skills learnt in the study of zoology will allow students in the workforce to make informed decisions, and/or to accumulate more knowledge by further research. These skills include the ability to:

- evaluate critically zoological evidence;
- use a variety of technical analytical equipment;
- develop research projects;
- organise and analyse data; and
- gain oral and written communication experience.

Zoology graduates have gained employment in secondary and tertiary education; museums; federal and state instrumentalities, such as CSIRO, National Parks and Wildlife Service and state Departments of Natural Resources; organisations specialising in medical (e.g. Department of Health, hospitals), biomedical, veterinary, agricultural, fisheries, aquaculture and industrial research; companies dealing with environmental, conservation and wildlife management; and the media (e.g. ABC Natural History Unit, national newspapers). Additionally, you may wish to gain further research experience by undertaking a higher degree in zoology, which will provide you with opportunities to pursue independent research interests. The specific majors offered by the Department of Zoology cover the broad spectrum of zoological subjects and include:

- animal behaviour and evolution
- animal physiology
- conservation and Australian wildlife
- ecology, including marine ecology and terrestrial ecology
- marine biology
- reproduction and development

Zoology students can add further breadth to their degree by taking a co-major in environmental science, or other subjects offered by the Department of Zoology or other departments (e.g. anatomy and cell biology, biochemistry and molecular biology, botany, Earth sciences, genetics, geography, physiology, and psychology). You may also pursue your own research interests in zoology more extensively by enrolling in a 'Research Project' subject.

## Zoology subject descriptions

### 654-201 Animal Diversity

**Note:** Previously known as: 654-201 Invertebrate Biology - Lectures and Prac.

Credit cannot be granted for both 654-201 and 654-212. 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 D L Macmillan

**Prerequisites:** Biology 600-141 plus 600-142; or biology 600-131 plus 600-132

**Contact:** 24 lectures (two a week) and 27 hours practical work; and up to 6 hours of excursions, tutorials and demonstrations (*Semester 1*).

**Description:** Upon completion of this subject students should have:

- an appreciation of the range and diversity of the main groups of invertebrate animals; and
- an understanding of current views about the phylogenetic relationships between the groups.

In the practical component students should develop the ability to recognise and classify the main groups of invertebrate organisms and an understanding of their morphological, physiological and behavioural characteristics.

The subject provides an introduction to the characteristics of the major invertebrate groups. Structural, physiological, behavioural and evolutionary

aspects of their biology are covered. The practical component will cover the taxonomy and morphology of the major invertebrate groups.

**Assessment:** A 2-hour end-of-semester written examination and a 2-hour end-of-semester practical examination; essay work, progress tests and excursion reports of up to 1000 words in total. Practical notebooks may be assessed.

### 654-202 Animal Structure and Function

**Note:** Previously known as: 654-202 Vertebrate Biology - Form and Function. Credit cannot be granted for both 654-202 and 654-212. 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 D Young

**Prerequisites:** Biology 600-141 plus 600-142; or Biology 600-131 plus 600-132

**Contact:** 24 lectures (two a week) and 30 hours practical work; 10 hours demonstrations/excursions (*Semester 2*).

**Description:** Upon completion of this subject students should have:

- an appreciation of the range and diversity of vertebrate animals;
- an insight into the evolutionary history and relationships of the vertebrate groups; and
- an understanding of the anatomy and functional organisation of the vertebrate body.

In the laboratory component students should:

- gain a practical knowledge of the structural diversity and relationships of the vertebrates; and
- acquire skills in the anatomical and microscopical methods relevant to the study of vertebrate animals.

The subject provides an introduction to basic vertebrate anatomy and functional organisation; the diversity and relationships of living vertebrates; aspects of vertebrate phylogeny; and principal organ systems of the vertebrate body. The practical component will cover the microscopic anatomy of vertebrates; comparative studies of the vertebrate skeleton; and the gross anatomy of selected vertebrates.

**Assessment:** A 2-hour end-of-semester written examination and a 2-hour end-of-semester practical examination; laboratory notebooks and excursion reports of up to 1200 words in total.

### 654-204 Animal Ecology

**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 R W Day; Dr G Coulson

**Prerequisites:** Biology 600-141 plus 600-142 or biology 600-131 and 132; Zoology 654-201 (or concurrent enrolment in 654-202); mathematics and statistics 620-160 or 620-152.

**Contact:** 24 lectures (two a week) and 27 hours practical work plus an excursion (*Semester 2*).

**Description:** By the completion of this subject, students should have an appreciation of:

- the way in which components of the environment affect individual organisms' ability to survive and reproduce;
- the way in which populations grow;
- the consequences of environmental effects on individuals and on the distribution and abundance of populations;
- the nature of interactions between species in communities, and how these interactions affect individuals and populations; and
- the effect of natural selection on individuals and on the dynamics of populations and communities.

In the practical component students should:

- develop an understanding of the ways in which ecological research is carried out; and
- gain an appreciation of the importance of field experiments and the role and usefulness of models, including mathematical models, in ecology.

The subject provides an introduction to ecological questions that can be addressed at the levels of individuals, populations, communities and ecosystems. Topics covered include aquatic and terrestrial examples; organisms and the physical environment; life histories, population growth and regulation; managing populations; theoretical model; and species interactions, especially competition and predation. The practical component will emphasise experimental approaches to ecology and experimental design and biometry and how to write scientific papers.

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

**Prescribed texts:** M Begon et al., *Ecology: Individuals, Populations and Communities*, 3rd ed., Blackwell, 1996.

### 654-207 Australian Wildlife Biology

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr K Handasyde

**Prerequisites:** Biology 600-111; and either biology 600-141 plus 600-142 or 600-131 plus 600-132. (Students who do not have all three prerequisites must seek permission to enrol from the subject coordinator).

**Contact:** 36 lectures (three a week); 20 hours practical (including excursions) (*Semester 1*).

**Description:** This subject will introduce students to the biology of Australia's vertebrate fauna (including fish, amphibians, reptiles, birds and mammals) with an emphasis on frogs, reptiles, birds and eutherian mammals. There will be particular focus on the adaptations of the fauna to the unique and uncertain nature of the Australian environment. A variety of topics will be discussed including diversity of Australian vertebrate groups in comparison to other parts of the world; the impact of human activities and introduced animals on native fauna; wildlife diseases; venomous fauna; and the ethics associated with research and experimentation on animals.

Upon completion of this subject students would have an appreciation of the natural history and uniqueness of a broad range of Australian wildlife; and a sound knowledge of the interactions between wildlife and natural and human-modified environments.

**Assessment:** A 2-hour, end-of-semester written examination; reports on practical work and excursions of up to 1200 words in total.

### 654-212 Animal Diversity, Structure & Function

**Note:** Credit cannot be granted for both 654-212 and 654-201 or 654-202. Credit cannot be granted for both 654-212 and 654-211 (Before 1999) or 654-212 (Before 1999).

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr D Young

**Prerequisites:** Biology 600-141 plus 600-142 or Biology 600-131 plus 600-132.

**Contact:** 48 lectures (two a week) (*Year long*).

**Description:** Upon completion of this subject students should have:

- an appreciation of the range and diversity of animals;
- an insight into the evolutionary history and relationships of the main groups of animals; and
- an understanding of the anatomy and functional organisation of the main groups of animals.

The subject provides an introduction to the characteristics and relationships of the main animal groups. Morphological, physiological, behavioural and evolutionary aspects of their biology are covered.

**Assessment:** A 2-hour examination at the end of each semester, which may include essay and short answer sections. Progress tests may be included in the assessment.

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

See full subject details on page 795.

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

See full subject details on page 795.

### 654-301 Animal Physiology: Comparative Approach

**Note:** 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 B Dumsday

**Prerequisites:** Zoology 654-202 and cell biology 606-205 or physiology 536-201, 536-202, 536-203 and 536-211; or biochemistry 521-211, 521-212, 521-221 and 521-222.

**Contact:** 36 lectures (three a week) and 50 hours practical work (*Semester 1*).

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

- physiological adaptations of animals to diverse and changing environments;
- basic physiological processes in animals, such as gas exchange; thermoregulation; circulation; water and salt balance, including excretion; and
- endocrine and neural control of physiological processes, including synaptic transmission.

Through study of this material students should develop an understanding of:

- the means by which different animals cope with environmental changes;
- the nature of physiological regulation; and
- the key roles of nerves and hormones in such regulation.

At the completion of the practical component, students should understand the design of experiments and have further developed (by first-hand experience) an insight into the collection of data that precedes the formulation of theories such as those discussed in lectures. This element will include surgical experience.

**Assessment:** A 3-hour end-of-semester written examination; essay work of up to 3000 words in total or up to four practical assignments (not exceeding 6 pages each). An 8-hour practical examination may be prescribed if performance in practical classes is unsatisfactory.

### 654-302 Experimental Marine Ecology

**Note:**

- Experiments involving the use of animals are an essential part of this subject; exemption is not possible.
- Students may not gain credit for 654-302 and 654-315 Marine Ecological Methods.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr M J Keough

**Prerequisites:** Zoology 654-312 (or enrolment in 654-312 in current year)

**Contact:** 10 lectures and 50 hours practical work. Practical work will be undertaken at the Queenscliff Marine Station, operated by the Faculty of Science, over eight days in February. No more than 30 students may enrol in any year (*Summer semester*).

**Description:** This subject covers current ecological principles and concepts, particularly as they apply to the marine biota. The major focus is on experimental approaches to ecological questions, emphasising the design and analysis of ecological experiments. An important emphasis of the course is developing the ability to read and assimilate current papers in the ecological literature, and evaluating critically the arguments and data presented in those papers.

**Assessment:** Up to 5000 words of essay work and/or reports on practical work and excursions.

### 654-303 Experimental Animal Behaviour

**Note:**

- Students may not gain credit for 654-303 and 654-305 Animal Behaviour.

**Credit points:** 25

**HECS-band:** 2

**Coordinator:** Dr M A Elgar; Dr R Mulder

**Prerequisites:** Zoology 654-204; mathematics and statistics 620-160 or 620-152.

**Contact:** 36 lectures (three a week) and 50 hours practical work (*Semester 1*).

**Description:** This subject describes and evaluates contemporary issues in evolutionary and behavioural biology. In particular, it highlights the relevance of evolutionary theory to ultimate explanations of animal behaviour and other life-history characteristics. Topics include natural and sexual selection; the evolution of sex and of sex allocation; the underlying neural mechanisms of animal behaviour (including motor, sensory and central nervous systems); foraging, competitive, mating and parental behaviour; learning; communication; and comparative social behaviour. The subject provides an opportunity to assimilate and evaluate critically the relevant, contemporary literature, thereby ensuring a familiarity and understanding of current and controversial issues in behavioural and evolutionary biology. Group projects will allow students to design, execute, analyse and interpret simple observational and experimental studies of animal behaviour.

**Assessment:** A 3-hour end-of-semester written examination; up to 3000 words of essay work and/or practical assignments.

### 654-304 Reproduction

**Note:**

- Experiments involving the use of animals are an essential part of this subject; exemption is not possible.
- Students may not gain credit for 654-304 and 654-314 Reproduction (Lectures).

**Credit points:** 25

**HECS-band:** 2

**Coordinator:** Prof M B Renfree; Dr G Shaw

**Prerequisites:** Mathematics and statistics 620-160 or 620-152 or equivalent, and at least one of biomedical science 521-213; biomedical science 536-250; cell biology 606-205 or 606-206; physiology 536-211 and 536-202 or zoology 654-202, 654-301. Students with other backgrounds should seek permission to enrol from the subject coordinator.

**Contact:** 30 lectures, six 1-hour tutorials and 50 hours practical work (*Semester 2*).

**Description:** This subject aims to give students of science and biomedical science a solid foundation in reproductive biology and its applications. By the completion of this subject students should:

- understand the structure and function of male and female reproductive systems;
- understand neuroendocrine and endocrine control systems and their role in the regulation of reproductive processes;
- understand and be able to apply selected methods used in reproductive physiology, including surgery; and
- understand the modern experimental approaches of reproductive physiology and assisted reproductive techniques.

Topics will include structure, function, and development of the reproductive organs; endocrine and neuroendocrine and environmental control of reproduction, mating, fertilisation, pregnancy, parturition and lactation in vertebrates; and human intervention in the reproductive process.

**Assessment:** A 3-hour end-of-semester written examination of both theory and practical aspects; laboratory participation in problem-based learning tutorials; three practical reports or reviews of up to eight pages each.

**Prescribed texts:** B J Everitt and M H Johnson, *Essential Reproduction*, 5th ed., Blackwells.

### 654-305 Animal Behaviour

**Note:** Students may not gain credit for 654-305 and 654-303 Experimental Animal Behaviour.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr M A Elgar; Dr R Mulder

**Prerequisites:** Zoology 654-201, 654-202 or 654-204

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

**Description:** This subject describes and evaluates contemporary issues in evolutionary and behavioural biology. In particular, it highlights the relevance of evolutionary theory to ultimate explanations of animal behaviour and other life-history characteristics. Topics include natural and sexual selection; the evolution of sex and sex allocation; the underlying neural mechanisms of animal behaviour (including motor, sensory and central nervous systems); foraging, competitive, mating and parental behaviour; learning; communication; and comparative social behaviour. The subject provides an opportunity to assimilate and critically evaluate the relevant, contemporary literature, thereby ensuring a familiarity and understanding of current and controversial areas of behavioural and evolutionary biology.

**Assessment:** A 3-hour end-of-semester written examination; up to 2000 words of essay work.

### 654-307 Evolution and Human Origins

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr D Young

**Prerequisites:** Some 200-level subjects in a biological discipline (including psychology) or history and philosophy of science. Zoology 654-202 and 654-204 are recommended.

**Contact:** 36 lectures (three a week) and 6 hours excursion, tutorial or practical work (*Semester 1*).

**Description:** This subject aims to provide students with an appreciation of the modern theory of evolution, as a basis for understanding biological diversity and adaptation, including a general understanding of the pattern and process of human evolution.

Specific topics to be addressed will usually include the contribution of Darwin and Wallace; natural selection and adaptation; the roles of chance and constraint in evolution; the origin and extinction of species; adaptive radiation, with particular reference to the primates; the fossil record and major evolutionary transitions; the fossil evidence of human origins; and the origin and expansion of human populations and their consequences.

**Assessment:** A 3-hour end-of-semester written examination; up to 3000 words of essay work and/or a report may be included in the assessment.

### 654-308 Conservation Biology

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr G Coulson

**Prerequisites:** Zoology 654-204, mathematics and statistics 620-160 (Before 1998: 619-100). Genetics 652-214 (Prior to 1997: 652-201) are strongly recommended.

**Contact:** 24 lectures (two a week) and 20 hours tutorials/workshops (including excursions) (*Semester 2*).

**Description:** The subject describes and evaluates the theoretical principles and practical applications of conservation biology, and the scientific study of biological diversity. In particular, it identifies the implications of global and

local changes for ecological communities and habitats, especially within the Australian environment. It also examines the role of population genetics for the fitness and viability of natural and captive populations; the patterns and explanations of diversity and rarity; the effects of habitat fragmentation and the role of corridors as a management practice; the methods of rangeland and marine management; the control of introduced species; and the impact of genetic engineering. Finally, the subject highlights the importance of statistical design for the analysis of monitoring programs and preparation of environmental impact statements.

**Assessment:** Up to three written assignments (totalling not more than 6000 words).

### 654-309 Field Biology of Marsupials & Monotremes

**Note:**

- Experiments involving the use of animals are an essential part of this subject; exemption is not possible.
- Students may not gain credit for 654-309 and 654-319 Biology of Marsupials and Monotremes (Before 1998: 654-314).
- Students cannot take this subject and zoology 654-315 in the same year because the respective field trips overlap.

**Credit points:** 25

**HECS-band:** 2

**Coordinator:** Dr S J Ward; Prof M B Renfree

**Prerequisites:** Zoology 654-202, 606-205 and 654-204 or equivalent and at least 25 points of third year zoology subjects. Students who do not have a pass in all prerequisites must seek permission from the coordinators.

**Contact:** 36 lectures (three per week) and 60 hours practical work including a week-long field trip during the mid-semester break (*Semester 2*).

**Description:** This subject provides a combined lecture and field course to give an overall perspective on the biology of marsupials and monotremes. By the completion of the course, students should have developed an appreciation of the physiology, reproduction, behaviour, ecology and genetics of these mammals and understand how these characteristics have developed in the evolutionary and biogeographical histories of Australia and South America. Students will also learn to identify the major marsupial and monotreme families, and some of the techniques for studying these animals in captivity and in the wild. This subject also covers the basic taxonomic features of modern marsupials and monotremes, the separate radiations of marsupials in Australia and South America, and the relationships between the three groups of extant mammals. The reproductive and developmental biology of marsupials and monotremes separates them markedly from each other and from eutherian mammals, and this subject puts particular emphasis on their study. We also show how studies of marsupials provide unique opportunities for understanding mammalian biology generally.

**Assessment:** A 3-hour end-of-semester written examination. Up to 6000 words of practical and excursion/field reports. Continuous assessment of practical exercises and laboratory problems.

### 654-312 Marine Ecology

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr M J Keough; Dr R W Day

**Prerequisites:** Zoology 654-201, 654-204; mathematics and statistics 620-160 (Before 1998: 619-100).

**Contact:** 36 lectures (3 each week) (*Semester 2*).

**Description:** The subject covers current ecological principles and concepts, particularly as they apply to the marine biota. The subject focuses on population dynamics and community ecology of marine organisms, covering life history patterns, recruitment processes, interaction between species, and the role of natural disturbance in marine communities. The use of ecological principles for managing exploited marine organisms is also covered. An important emphasis of the course is developing the ability to read and assimilate current papers in the ecological literature.

**Assessment:** A 3-hour end-of-semester written examination; up to 3000 words of essay work and/or reports.

### 654-313 Marine Invertebrate Zoology

**Note:**

- Experiments involving the use of animals are an essential part of this subject; exemption is not possible.
- Places in this subject will be offered before the Christmas recess.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Prof D L Macmillan

**Prerequisites:** Zoology 654-201 or equivalent.

**Contact:** 12 lectures (2 a day) and 40 hours of practical work; 6 hours excursions (the subject is held in the summer break before Semester 1) (*Summer semester*).

**Description:** Upon completion of this subject students should have:

- an appreciation of the range and diversity of the main groups of marine invertebrate animals particularly those of south-eastern Australia;
- an understanding of the morphological, physiological, behavioural and developmental characteristics of selected groups; and
- an understanding of some current research issues involving marine invertebrates.

In the practical component students should develop the ability to recognise and classify the main groups of marine invertebrate organisms and develop an understanding of their morphological, physiological, behavioural and developmental characteristics.

The subject provides for advanced study of invertebrate groups that are important in the marine environment. Structural, physiological, behavioural and developmental aspects of their biology are covered with particular emphasis on areas in which there is current research activity.

**Assessment:** Essay work and/or reports of up to 3000 words will be assessed. A record of practical work undertaken that includes details of observations and experiments and oral presentations may also be assessed.

### 654-314 Reproduction (Lectures)

**Note:** Students may not gain credit for 654-314 and 654-304 Reproduction.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Prof M B Renfree & Dr G Shaw

**Prerequisites:** Mathematics and statistics 620-160 or 620-152 or equivalent, and at least one of biomedical science 521-213; biomedical science 536-250; cell biology 606-205 or 606-206; physiology 536-211; zoology 654-202, 654-301. Students with other backgrounds should seek permission to enrol from the subject coordinator.

**Contact:** 30 lectures, six 1-hour tutorials (*Semester 2*).

**Description:** This subject aims to give students of science and biomedical science a solid foundation in reproductive biology and its applications. By the completion of this subject students should:

- understand the structure and function of male and female reproductive systems;
- understand neuroendocrine and endocrine control systems and their role in the regulation of reproductive processes; and
- understand and be able to apply selected methods used in reproductive physiology, including surgery.

Topics will include structure, function, and development of the reproductive organs; endocrine and neuroendocrine and environmental control of reproduction, mating, fertilisation, pregnancy, parturition and lactation in vertebrates; and human intervention in the reproductive process.

**Assessment:** A 2-hour end-of-semester written examination, a review of up to 3000 words and participation in problem-based learning tutorials.

**Prescribed texts:** B J Everitt and M H Johnson, *Essential Reproduction*, 5th ed., Blackwells.

### 654-319 Biology of Marsupials and Monotremes

**Note:**

- Students may not gain credit for 654-319 and 654-309 Field Biology of Marsupials and Monotremes.

**Credit points:** 12.5

**HECS-band:** 2

**Coordinator:** Dr S J Ward; Prof M B Renfree

**Prerequisites:** Zoology 654-202, 606-205 and 654-204 or equivalent and at least 25 points of third year zoology subjects. Students who do not have a pass in all prerequisites must seek permission from the coordinators.

**Contact:** 36 lectures (three per week) (*Semester 2*).

**Description:** This subject covers a wide range of biological disciplines, and shows how they are interconnected in the marsupials and monotremes. By the completion of the course, students should have developed an appreciation of the physiology, reproduction, behaviour, ecology and genetics of these mammals and understand how these characteristics have developed in the evolutionary and biogeographical histories of Australia and South America. This subject also covers the basic taxonomic features of modern marsupials and monotremes, the separate radiations of marsupials in Australia and South America, and the relationships between the three groups of extant mammals. The reproductive and developmental biology of marsupials and monotremes separates them markedly from each other and from eutherian mammals, and this subject puts particular emphasis on their study. We also show how studies of marsupials provide unique opportunities for understanding mammalian biology generally.

**Assessment:** A 2-hour end-of-semester written examination. Up to 3000 words of assignment.

### 516-302 Developmental Biology

See full subject details on page 782.

### 606-309 Cell Biology III

See full subject details on page 797.