# Anatomy and cell biology

The Department of Anatomy and Cell Biology is very active in both teaching and research. Our undergraduate teaching and learning specialises in three main areas: cell and developmental biology; neuroscience; and human anatomy. These disciplines represent some of the most active fields of research in the biological sciences today. Training in these areas will open up many exciting and rapidly expanding career opportunities in the biomedical sciences. Strong research groups within the department are supported by excellent external funding and departmental infrastructure. Our outstanding research performance underpins and invigorates our undergraduate teaching.

The Department of Anatomy and Cell Biology offers undergraduate majors in human anatomy, neuroscience, cell and molecular biology (with the School of Botany) and reproduction and development (with the Department of Zoology). All of these majors require students to undertake the life sciences package in first year. Subjects taught by the department complement majors in other areas.

## Majors

The Department of Anatomy and Cell Biology coordinates the anatomy and neuroscience majors and teaches several subjects in the cell and molecular biology (coordinated by the School of Botany) and reproduction and development (coordinated by the Department of Zoology) majors. Detailed course plans for these majors are listed under *Majors (p.8)*.

### Anatomy

The anatomy major enables students to undertake studies in anatomy and embryology at 200- and 300-levels. The two 200-level subjects provide an introduction to basic principles of topographic anatomy and the embryological origins of adult body structures. The 300-level subjects focus on the anatomy of the head and neck and the organisation of connective tissues and joints. These subjects can be combined with studies in neuroscience or cell and developmental biology, allowing students to undertake studies in the areas that best suit their anatomical leanings. This major is designed for students interested in a solid grounding in anatomy with an intention of a future career in research or academia, or for those students interested in a career as a health professional.

### Neuroscience

At 200-level, students wishing to do the neuroscience major take a new subject 516-209 Introductory Neuroscience *(p.2)*, taught in conjunction with the Department of Physiology. This subject provides a broad introduction to neuroscience, covering topics ranging from molecular and cellular neuroscience to higher level brain functions. It can be combined with complementary 200-level subjects in physiology, zoology, cell biology, biochemistry and molecular biology, psychology or behavioural sciences. At 300-level, students take two core subjects in neuroscience, taught by the Departments of Anatomy and Cell Biology and Physiology, together with a range of elective subjects which enable them to focus their interests in a particular area of neuroscience. This major provides ideal training for a career in basic or clinical neuroscience within university departments, research institutes and hospitals.

### Cell biology

Students who choose this major undertake a core of 200-level subjects in cell biology, tissue and organ biology and molecular biology taught by the Departments of Anatomy and Cell Biology, the School of Botany and the Department of Biochemistry and Molecular Biology. This provides a suitable background for third year studies in the areas of cell and developmental biology. A range of 300-level subjects in these areas is offered by the Departments of Anatomy and Cell Biology, the School of Botany and the Department of Zoology. This major will equip you for a career in many exciting new areas of biomedical science, including stem cell research and functional genomics.

### Reproduction and development

This major requires the student to take a core of 200-level units in cell and tissue biology (taught by the Department of Anatomy and Cell Biology and School of Botany) and animal structure and function (taught by the Department of Zoology). At the 300-level, the major comprises a core of two subjects in reproductive and developmental biology, offered by the Departments of Zoology and Anatomy and Cell Biology plus a choice of elective subjects in cell biology or marsupial biology.

## 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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## 200-level subjects

### 516-201 Cell Biology: Tissues and Organs

**Note:**

- Not available to students enrolled in BBiomedSc.
- Previously known as 516-201 Histology (prior to 2001), 516-201 Microanatomy: Cells and Tissues (2001).
- Students must register for practical classes by writing their name and preference (two alternative times will be available) on the sheets displayed outside Room E241 during Orientation Week (26 February to 2 March). A subject handbook, containing timetables, lecture outlines and practical notes, is available from the department during Orientation Week.

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Assoc Prof P Whitington

**Prerequisites:** Biology 600-141 and 600-142

**Contact:** 24 lectures (two a week) and 36 hours practical work (3 hours a week) *(Semester 1)*.

**Description:** This subject seeks to explain how the complex activities of animal tissues and organs derive from the properties of their individual cells and interactions between cells. Emphasis is given to integrating knowledge at different levels of organisation - from molecule to organism. The subject will deal with selected examples to illustrate broad principles and concepts governing the organisation of cells, tissues and organs. Laboratory work will emphasise modern experimental approaches to the study of cells and tissues and provide an opportunity for revision and reinforcement of the concepts presented in the lectures.

Upon completion of this subject students should:

- be familiar with the range of cellular activties that are especially relevant to multicellular organisation, including cell proliferation, apoptosis, cell adhesion, cell movement and cell differentiation;
- understand how the activities of organelles contribute to core cellular functions;
- understand the basic ways that cells associate to form tissues and the transition between epithelial and mesenchymal states;
- appreciate how the structural and functional properties of individual cells as well as cell-cell and cell-substrate interactions give each tissue its distinctive characteristics;
- be familiar with the major tissue types, their fundamental characteristics and roles in the body;
- understand how different tissue types are combined together to form organs;
- appreciate how the activities of different cell and tissue types within an organ and interactions between its cells contribute to the development, maintenance and function of that organ.

**Assessment:** Continuous assessment in practical classes throughout the semester (15%), a 2-hour written examination at the end of semester that will include multiple choice questions (60%), and a 30-minute practical examination, also at the end of the semester (25%).

**Prescribed texts:** B Alberts et al, *Essential Cell Biology*, 1998.

### 516-204 Anatomy 1

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Assoc Prof C A Briggs

**Prerequisites:** Biology 600-141 and 600-142

**Contact:** 32 lectures (two to three 1-hour lectures per week) and 28 hours practical work (one 2 to 3-hour practical class per week) *(Semester 1)*.

**Description:** By the end of this subject students should:

- comprehend the terminology of topographic anatomy; the principles relating to each of the following types of anatomical structure: skin, fascia and skeletal muscles, bones and joints, vessels, nerves and viscera; the organisation of the back and upper limb into regions and the trunk into cavities; the essential factual information regarding the specific anatomical structures which form the boundaries and contents of the back, thorax and upper limb; the applied anatomy of each region;

- develop observational and organisational skills to identify and interpret exposed anatomical structures and regions; communication skills (written and oral) to describe the normal structure of the back, thorax and upper limb; skills in the manipulation of anatomical structures (with dissecting instruments); and
- appreciate the common occurrence of anatomical variation; the scientific basis of knowledge of structure.

The subject provides detailed information on:

- mammalian reproduction; gametogenesis; embryogenesis; embryo formative processes; foetal maternal relationships; development of basic tissues; organogenesis; development of nervous system, skeletal system, cardiovascular system, respiratory system
- the terminology of topographic anatomy, principles related to each type of anatomical structure; skin, fascia and skeletal muscles, bones and joints, vessels, nerves and viscera; the organisation of the back, thorax and upper limb into regions, and the specific structures forming the boundaries and contents of these regions. The applied anatomy of each region is studied.

**Assessment:** Continuous assessment in practical classes throughout the semester, a 2-hour written examination, a 30-minute practical examination at the end of the semester.

**Prescribed texts:** W H Hollinshead and C Rosse, *Textbook of Anatomy*, 5th ed., Lippincott Raven, 1997.

### 516-207 Anatomy 2

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Dr I Grkovic

**Prerequisites:** Biology 600-141 and 600-142

**Contact:** 32 lectures (two to three 1-hour lectures per week) and 28 hours practical work (one 2 to 3-hour practical class per week) *(Semester 2).*

**Description:** By the end of this subject the student should be able to:

- comprehend the development of the gastrointestinal system and urogenital system; the terminology of topographic anatomy; the organisation of the trunk into cavities and the lower limb into regions; the essential factual information regarding the specific anatomical structures which form the walls and contents of the abdomen and pelvis and the boundaries and contents of the lower limb; the applied anatomy of the abdomen, pelvis and lower limb;
- develop observational and organisational skills to identify and interpret exposed anatomical structures and regions; communication skills (written and oral) to describe the normal structure of the abdomen, pelvis and lower limb; skills in the manipulation of anatomical structures (with dissecting instruments); and
- appreciate the embryonic basis of certain birth defects relating to the gastrointestinal and urogenital systems; the common occurrence of anatomical variation; the scientific basis of knowledge about development and structure; the importance of one's own observations; the need for continuing independent learning to keep pace with future advances.

The subject provides detailed information on the development of the gastrointenstinal and urogenital system; the organisation of the abdomen, pelvis and lower limb and the structures which form their walls, boundaries and contents as well as the applied anatomy of the abdomen, pelvis and lower limb.

**Assessment:** Continuous assessment in practical classes throughout the semester, a 2-hour written examination, a 30-minute practical examination at the end of the semester.

**Prescribed texts:** W H Hollinshead and C Rosse, *Textbook of Anatomy*, 5th ed., Lippincott Raven, 1997.

### 516-208 Structure & Function of the Brain

**Note:** Only available to Bachelor of Optometry students.

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Assoc Prof S Rees

**Contact:** 24 lectures (two a week) and 10 hours of practical work *(Semester 2).*

**Description:** By the end of this subject students should:

- comprehend the terminology of neuroscience, the principles and essential information regarding the macroscopic and microscopic structure of the nervous system and the functional components of the nervous system including their organisation and major connections, the correlation of structure with function including behaviour, the major effects of lesions to clinically important areas and pathways;
- develop observational and organisational skills to identify and interpret the macroscopic appearance of the brain and spinal cord including cut sections, and the microscopic appearance of the nervous system, skills to analyse the structural and functional changes which occur in disorders of the nervous system; and
- appreciate the extent and limitations of current knowledge of the organisation of the central nervous system, particularly in the context of recent profound advances in neuroscience, the implications of such limitations in our understanding of how the brain works.

The following topics are considered: the structure and function of the primate nervous system with emphasis on the main sensory systems (including vision, hearing and touch) and the motor systems, and structural and histological examination of human brains.

**Assessment:** A 2-hour end-of-semester written examination and 1-hour practical examination during the semester.

**Prescribed texts:** Kandel, Schwartz and Jessell, *Principles of Neural Science.* • J Nolte, J B Angerine, *The Human Brain in Photographs and Diagrams.*

### 516-209 Introductory Neuroscience

**Note:** This is a joint anatomy and cell biology and physiology subject.

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Prof A Goodwin, Assoc Prof J Bornstein

**Prerequisites:** Life science package OR any first year biology, chemistry, physics or mathematics subject. Prerequisites may be waived by the Head of Department.

**Contact:** 36 lectures (three 1-hour lectures per week) plus 6- two-hour tutorials *(Semester 2).*

**Description:** This subject provides a broad introduction to neuroscience. The topics covered range from the molecular and cellular mechanisms underlying neural function to an introduction to complex behaviours such as thought and language. It forms an ideal grounding for the more specialist third year neuroscience subjects and should be taken by all students looking to major in neuroscience. Because of its broad nature, it is also suitable for students who wish to learn something about neuroscience without majoring in the topic.

The subject aims to provide the student with:

- an appreciation of how human behaviour, including complex functions like thought and emotion is mediated by the brain;
- an understanding of how neurons form the building blocks of the nervous system, how they transmit information by electrical impulses, how they communicate with each other, how they are connected to form elementary circuits, how they store information;
- insight into the molecular and cellular mechanisms fundamental to neural function;
- a picture of the inter-relationships of the various parts of the nervous system; the brain, spinal cord, peripheral nervous system, automatic nervous system;
- an appreciation of the fundamentals of systems underlying sensory perception, including the transduction of sensory stimuli (for example light and sound) and the processing of sensory information by neuronal populations leading, ultimately to perception;
- an understanding, at an elementary level, of how the nervous system initiates and controls movements of the body;
- an appreciation of the plasticity of the nervous system, how it adapts to changing environments, how it ages, how nerve injuries may be repaired or may lead to irreversible damage.

**Assessment:** A 3-hour end-of-semester written examination, plus continuous assessment during the semester comprising a maximum of four ten-minute tests.

## 300-level subjects

### 516-302 Developmental Biology

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

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Dr G Hime, Prof M Renfree

**Prerequisites:** Biochemistry 521-211 plus 521-212. Zoology 654-203 is recommended.

BBiomedSc students: 521-213 and 536-250.

Prerequisites may be waived by the Head of Department.

**Contact:** 24 lectures (two a week) and 24 hours practical/tutorial (times to be arranged) *(Semester 2).*

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

- comprehend the molecular, biochemical and cellular events that regulate the development of specialised cells, tissues and organs during embryonic development, particularly cell signalling pathways that regulate embryonic induction, tissue interactions and pattern formation, and expression of regulatory genes; and
- understand the experimental strategies and techniques that are used to identify the molecular and cellular mechanisms of development.

The following topics are considered: mechanisms of cell determination and commitment; embryonic organiser; mesoderm induction; establishment of the vertebrate body plan; positional specification; tissue patterning; cell migration; epithelial-mesenchymal interactions; sex determination; developmental potency; growth control; cell and tissue transplantation; nuclear transplantation; cell ablation; cell lineage tracing; organogenesis in vitro; transgenesis; gene knockout; and developmental mutations.

**Assessment:** A 2-hour end-of-semester written examination, practical reports, and critical reviews of published journal articles.

**Prescribed texts:** L Wolpert, R Beddington, J Brockes, T Jessell, P Lawrence and E Meyerowitz, *Principles of Development*, Oxford University Press, 1998.

## 516-303 Anatomy of the Head and Neck

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Assoc Prof C A Briggs

**Prerequisites:** Anatomy 516-204 or 516-207. The prerequisite is sometimes waived for students concurrently studying neuroscience subjects.

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

**Description:** By the end of the subject students should be able to:

- comprehend the development of the head and neck; the terminology of topographic anatomy; the organisation of the head and neck; the essential factual information regarding the specific anatomical structures which form the boundaries and contents of the regions of the head and neck; the applied anatomy of the head and neck;
- develop observational and organisational skills to identify and interpret exposed anatomical structures and regions; communication skills (written and oral) to describe the normal structure of the head and neck; skills in the manipulation of anatomical structures (with dissecting instruments); and
- appreciate the embryological basis of certain birth defects relating to the head and neck; the common occurrence of anatomical variation; and the scientific basis of knowledge about development and structure; the importance of one's own observations; the need for continuing independent learning to keep pace with future advances.

The subject provides detailed information on the organisation of the head and neck; the anatomical structures which form the boundaries and contents of the head and neck; and the applied anatomy of the head and neck.

**Assessment:** Continuous assessment in practical classes throughout the semester, a 2-hour written examination, a 30-minute practical examination at the end of the semester.

**Prescribed texts:** W H Hollinshead and C Rosse, *Textbook of Anatomy*, 5th ed., Lippincott Raven, 1997.

## 516-304 Functional and Applied Anatomy

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Assoc Prof C A Briggs

**Prerequisites:** One of anatomy 516-204, 516-207, 516-303.

**Contact:** 48 hours contact time involving approximately equal weighting of lectures and practical classes. Precise subject details will be made known at the commencement of the subject *(Semester 2).*

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

- the organisation of connective tissues, including their structure and function;
- the response of connective tissues to normal and abnormal loading, the forces acting across joint complexes and how these forces may be measured;
- the functional and applied anatomy of the body's major joint complexes; including the joints of the vertebral column, the shoulder, the elbow complex, the wrist and hand, the pelvis, the hip, the knee, the ankle and the joints of the foot;
- the factors responsible for normal and abnormal gait and locomotion;
- the use of anthropometric techniques in the determination of normal and abnormal postures; and
- the use and application of anthropological techniques to determine, age, sex, stature and racial affinity.

The subject provides detailed information on connective tissues, muscle and tendon, ligament and nerve, and their response to normal and abnormal stress and strain; the forces acting across synovial joints and methods of measuring these forces; normal and abnormal movement patterns, and the principles underlying gait and locomotion; anthropometric techniques to determine posture; skeletal traits important in the identification of age, sex, stature and race; and dissection of selected joint structures.

**Assessment:** A 2-hour end-of-semester written examination; annotated bibliography of scientific papers OR dissection of a specific joint or region and poster presentation of the findings.

**Prescribed texts:** M Nordin and V H Frankel, *Basic Biomechanics of the Musculoskeletal System*, 2nd ed., Lea and Febiger, 1989.

## 516-305 Structure & Function of the Brain

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Assoc Prof S Rees

**Prerequisites:** Any 200-level subject in anatomy, cell biology, biochemistry, physiology, zoology.

BBiomedSc students: 521-213 and 536-250.

Prerequisites may be waived by the Head of Department.

**Contact:** 24 lectures (two a week) and 10 hours practical work *(Semester 2).*

**Description:** By the end of the subject the student should:

- comprehend the terminology of neuroscience, the principles and essential information regarding the macroscopic and microscopic structure of the nervous system and the functional components of the nervous system, including their organisation and major connections, the correlation of structure with function including behaviour, and the major effects of lesions to clinically important areas and pathways;
- develop observational and organisational skills to identify and interpret the macroscopic appearance of the brain and spinal cord, including cut sections, and the microscopic appearance of the nervous system; skills to analyse the structural and functional changes which may occur in disorders of the nervous system; and
- appreciate the extent and limitations of current knowledge of the organisation of the central nervous system, particularly in the context of recent profound advances in neuroscience; the implications of such limitations in our understanding of how the brain works.

The following topics will be considered: the structure and function of the nervous system with emphasis on the main sensory systems (including vision, hearing and touch) and the motor systems; structural and histological examination of human brains.

**Assessment:** A 2-hour end-of-semester written examination and a 1-hour practical examination during the semester.

**Prescribed texts:** Kandel Schwartz and Jessell, *Principles of Neural Science.* • J Nolte, J B Angerine, *The Human Brain in Photographs and Diagrams.*

## 516-306 Developmental Neurobiology

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Assoc Prof S Rees

**Prerequisites:** In 2002: anatomy 516-201; or botany 606-206; or biochemistry 521-211 plus 521-212; or physiology 536-201 plus 536-211; Zoology 654-203 is recommended.

From 2003: anatomy 516-201 plus 516-209.

BBiomedSc students: 521-213 and 536-250.

Prerequisites may be waived by the Head of Department.

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

**Description:** By the end of the subject students should:

- comprehend the terminology of developmental neuroscience; the organisation, both molecular and cellular, of developing nervous tissue; the molecular and cellular events leading to the formation and development of the vertebrate nervous system;
- develop an understanding of modern molecular and cellular approaches to questions concerning neural development; and skills to critically analyse and report on research papers in developmental neurobiology;
- appreciate the major questions currently being addressed in developmental neurobiology research; the extent and limitations of research in developmental neurobiology; and the future direction of research concerned with understanding the development of the nervous system.

This subject will deal with topics ranging from the early events leading to the induction of the neuroectoderm through to axonogenesis, pathfinding, synaptogenesis and cortical development. Factors affecting full brain development, disorders of neurodevelopment, plasticity of the neonatal and adult brain and regeneration in the central nervous system will be discussed. Emphasis will be placed on major developmental events such as phenotype commitment, cell migration, differentiation and growth cone guidance. Modern molecular and cellular approaches to understanding these events will be emphasised

**Assessment:** A 2-hour end-of-semester written examination and two critical reviews of scientific papers.

## 516-307 Project Study in Anatomy & Cell Biology

**Note:**

- Admission to the subject will depend upon the student's background and the availability of a suitable project. This subject may involve the use of animals in experiments.
- Students must contact the coordinator prior to enrolling to arrange a supervisor.

**Credit points: 12.5** **HECS-band:** 2

**Coordinator:** Dr C Anderson, Dr G Hime

**Prerequisites:** A total of 25 points at 200-level in any combination of anatomy, cell biology, physiology or biochemistry and molecular biology, or with permission of Head of Department. Approval to take this subject must be obtained from the coordinator.

**Contact:** At least 60 hours of laboratory work *(Semester 1, repeat 2, Summer).*

**Description:** By the end of the subject students should:

- comprehend the principles of research;
- develop skills to critically analyse research papers in anatomy, cell biology, developmental biology or neuroscience; and research laboratory skills;
- develop laboratory skills in a particular aspect of anatomy, cell biology, developmental biology or neuroscience;
- appreciate the extent and limitations of research in anatomy, cell biology, developmental biology or neurosciene; and
- have participated in a supervised research project focused on anatomy, cell biology, developmental biology or neuroscience

**Assessment:** Review or journal article (no more than 1500 words) (20%); written report of research project (no more than 4000 words) (60%); and oral presentation of research report (10 minutes) (20%).