

Microbiology and immunology

Microbiology is the study of microscopic organisms. Immunology is the study of the immune response to infection and other challenges. Both disciplines are exciting and rapidly developing sciences with new information constantly displacing older theories and assumptions. Microorganisms affect all areas of human endeavour and the principles and applications of microbiology are an integral part of medicine, biochemistry, agriculture, biotechnology, genetics, ecology, environmental bioremediation and even gold mining. Immunology embraces the host response to microorganisms, vaccine development, autoimmunity, tumour immunity and transplantation medicine. The department also contributes significantly to the teaching of molecular biology. The aim of the subjects offered is to impart some of the excitement of the science, while providing a framework for students to build a career.

As a result of studying and completing subjects offered by the Department, students should have an enhanced ability to:

- seek information from textbooks, scientific literature and computer-based sources;
- identify relevant issues and think critically about information so that broad principles and relevant evidence can be applied to problem solving; and
- comprehend a question, evaluate the relevant information and communicate and answer, either orally or in writing.

Two major streams of study are offered:

- Microbiology
- Immunology

Within the microbiology major students may select subjects according to their interests, or may choose to emphasise medical microbiology, applied microbiology and biotechnology, or molecular microbiology.

Microbiology and immunology subjects may also form part of a major in biotechnology.

Students will require a basic knowledge of biology and chemistry. *All students* are expected to study the life sciences package in first year, and (except those enrolled in the immunology major) the introductory lecture and practical courses in microbiology 526-201 and 526-221 in second year.

Suggested subjects

200-level subjects

Microbiology major

For requirements see page 15.

To meet prerequisites for 300-level subjects, students should also undertake biochemistry and molecular biology 521-211 and 521-212, or genetics 652-214 and 652-215. Biochemistry and molecular biology 521-220 or genetics 652-216 may also be taken. See the prerequisites for 300-level subjects for details. Students with an interest in medical microbiology may choose to enrol in microbiology and immunology 526-205 as well.

Immunology major

For requirements see page 14.

To meet prerequisites for 300-level subjects, students should undertake 200-level subjects from microbiology and immunology, biochemistry and molecular biology, and genetics. Additional 200-level subjects may also be selected from pathology, physiology, anatomy, and cell biology.

Biotechnology major

For requirements see page 12.

300-level subjects

Microbiology major

For requirements see page 15.

Students may choose their 300-level subjects to cater for their specific interests. Some suggested combinations are:

- 526-313, 526-321, 526-314 and 526-327, for students with an interest in medical microbiology,
- 526-301, 526-321, 526-302 and 526-327, for students with an interest in applied microbiology,
- 526-301, 526-321, 526-314 and 526-327 for students with an interest in molecular microbiology.

Immunology major

For requirements see page 14.

The microbiology major with an emphasis on medical microbiology provides a complementary stream of study for students completing the immunology major.

Bachelor of Science (Degree with Honours)

For information about the faculty and departmental entry requirements for honours, please refer to *Bachelor of Science (Degree with Honours)* and *Bachelor of Information Systems (Degree with Honours)* (p.1). These requirements should be considered when planning your course.

Further information

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Subject descriptions

200-level subjects

526-201 Principles of Microbiology & Immunology

Credit points: 12.5

Coordinator: Ms C J Power

Prerequisites: Biology 650-141 and 650-142 (prior to 2004: 600-141 and 600-142). 25 points of 100-level chemistry is not essential but is highly desirable.

BBiomedSc students: 650-131 and 650-132 (prior to 2004: 600-131 and 600-132).

Contact: 36 lectures (three per week); problem-solving sessions (one per week) (*Semester 1*).

Description: Upon completion of this subject, students should:

- have acquired a foundation for future subjects in microbiology and immunology;
- appreciate the importance of microbiology and immunology in the fields of medicine, public health, genetics and biotechnology;
- be familiar with the terminology used by microbiologists and immunologists;
- have insight into the type of investigations fundamental to the development of basic microbiological concepts;
- be able to describe simple microbial life processes;
- understand how these processes are involved in infectious disease and interactions with hosts' immune systems, adaptation and survival of microorganisms and the promotion or control of microorganisms;
- be able to describe the comparative properties of Bacteria, Archaea and eukaryotic microbial cells and viruses;
- understand the significance of all these microorganisms in the environment.

Students will enhance their ability to seek and utilize information from textbooks and computer-based source, to apply that information to gaining an insight into real life situations and to extending and enhancing concepts and material introduced in lectures.

Assessment: A 1-hour written examination held mid-semester (20%); a 3-hour written examination in the examination period (80%).

Prescribed texts: L M Prescott, J P Harley and D A Klein, *Microbiology*, 6th edn, 2005.

526-205 Microbes: Infections and Responses

Credit points: 12.5

Coordinator: Ms C Power; Ms S Uren

Prerequisites: Biology 650-141 and 650-142.

BBiomedSc students: 650-131 and 650-132.

Corequisites: Microbiology 526-201 and 526-221.

BBiomedSc students: 521-213 and 536-250.

Contact: 36 lectures (three per week) and 18 hours of practical work (*Semester 2*).

Description: Upon completion of this course students should have:

- sufficient knowledge to form a foundation for future courses in microbiology and immunology;
- an understanding of microbial life processes and microbial growth and its control;
- an appreciation of the mechanisms by which microorganisms initiate infection, and the basis of the host immune response to infection;
- a knowledge of some of the ways in which infectious disease can be controlled in individuals and in communities, including the use of antimicrobials and vaccines; and

- the ability to perform basic microbiological techniques safely and effectively and recognise valid clinical applications of these techniques.

Assessment: A 10-minute oral presentation during the semester (10%); ongoing assessment of practical reports due during the semester (20%); a 3-hour written examination in the examination period (70%). Satisfactory completion of the laboratory work and written reports is necessary to pass the subject.

Prescribed texts: N C Engleberg, V DiRita and T S Dermody, *Schaechter's Mechanisms of Microbial Disease*, 4th Edn, 2006.

526-221 Practical Microbiology

Credit points: 12.5

Coordinator: Ms C J Power

Corequisites: Microbiology 526-201.

Contact: 12 lectures (one per week) and 36 hours of practical work (three hours per week) (*Semester 1, repeat 2*).

Description: Upon completion of this course students should have:

- acquired knowledge of the basic laboratory methods used in microbiology, when to use them and the ability to perform them safely and effectively;
- an understanding of how practical studies augment theoretical studies of the structure, function and activities of microorganisms;
- an experience of the laboratory as an interesting and stimulating environment in which to work;
- an appreciation of real-life applications of microbiological techniques and their relevance to industry and community health and well-being; and
- developed observational, organisational and practical skills in obtaining data and in analysing, reporting, evaluating and interpreting experimental findings.

Assessment: Ongoing assessment of practical reports due during the semester (50%); ongoing assessment of laboratory notebook during the semester (10%); a 2-hour practical examination during the semester (40%). Satisfactory completion of the laboratory work and written reports, as well as a pass in the practical examination are necessary to pass this subject.

Prescribed texts: University of Melbourne, *Department of Microbiology Techniques Manual*, 1999. • L M Prescott, J P Harley and D A Klein, *Microbiology*, 6th edn, 2005.

300-level subjects

526-301 Microbial Cells and Genomes

Note: Formerly known as 526-301 Biotechnology 1: Microbial Genes and Cells.

Credit points: 12.5

Coordinator: Dr D Tribe; Dr M Dyll-Smith

Prerequisites: Microbiology 526-201; either biochemistry 521-211 and 521-212, or genetics 652-214 and 652-215; one of microbiology 526-221, biochemistry 521-220 or genetics 652-216.

BBiomedSc students: microbiology 526-201 or 526-205; 521-213 and 536-250.

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

Description: By the end of the subject students should:

- understand fundamental concepts of cell division, cell growth, and the transfer of substrates, macromolecules and signals across cell membranes;
- be able to describe the ways in which microorganisms function and interact with their environment and each other and regulate their genetic and metabolic potential to ensure their continued existence;
- be familiar with techniques and strategies such as mutant construction, and molecular cloning that are used to dissect microbial function;
- appreciate how microbial behaviour can be modified by changes to genotype or environment to facilitate use of microbes in biotechnological processes; and
- have developed the skills necessary to read and comprehend scientific papers and interpret genomic data in electronic databases.

Students will enhance their ability to utilise information from textbooks, scientific literature and computer-based sources and logically apply broad principles to address a particular scientific question.

Assessment: A written assignment of up to 3000 words due during the semester (20%); a 3-hour written examination in the examination period (80%).

Prescribed texts: M Schaechter, J L Ingraham and F C Neidhardt, *Microbe*, 2006.

526-302 Microbial Biotechnology

Note: Formerly known as 526-302 Biotechnology 2: Processes and Innovations.

Credit points: 12.5

Coordinator: Dr D Tribe

Prerequisites: Microbiology 526-201; biochemistry 521-211 and 521-212 or genetics 652-214 and 654-215.

BBiomedSc students: microbiology 526-201 or 526-205; 521-213 and 536-250.

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

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

- comprehend many of the issues, concepts and difficulties involved in developing new biotechnology products (for instance hormones, cytokines and vaccines), and in developing biotechnology-based manufacturing processes (for instance biofuels and catalysts);
- describe the principles underlying microbial processes currently in operation in industry and for environmental management, such as those used in manufacture of amino acids, enzymes, sugars, antibiotics and related biochemical products;
- recognise the difficulties involved in transition between laboratory and larger modes of operation;
- appreciate the importance of rational, independent and critical thought in the application and commercialisation of biotechnology, such as is needed when assessing the consequences of deliberate releases of genetically modified organisms into the environment; and
- recognise the past contributions of microbial biotechnology to society (for example in the food, health care and waste-management industries, and its potential for further improvement of human welfare) as illustrated by the ongoing contribution of molecular biology to advances in medicine.

Assessment: A written assignment of up to 3000 words due during semester (20%); a 3-hour written examination in the examination period (80%).

526-304 Principles of Immunology

Credit points: 12.5

Coordinator: Prof F Carbone; Ms S Uren

Prerequisites: At least 37.5 points of theory and 12.5 points of practical 200-level subjects from microbiology and immunology, biochemistry, pathology, physiology, anatomy, cell biology or genetics.

BBiomedSc students: 521-213 and 536-250.

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

Description: By the completion of the course the students should understand and be able to describe:

- the development, function and regulation of cells of the immune system;
- the relationship between structure and function of antibodies;
- the molecular and cellular basis of T cell recognition;
- the molecular and cellular basis of innate immune responses;
- the basis of immune mechanisms underlying immunity to infection and autoimmune disease, hypersensitivity reactions, immunodeficiency diseases and transplant and tumour rejection.

The subject will include coverage of the development, function and regulation of cells of the immune system; immunoglobulins; cytokines; immunological mechanisms operating in immunity to infectious disease; autoimmunity; hypersensitivity; and transplantation and tumour immunology.

Assessment: A 1-hour written examination held mid-semester (20%); a 3-hour written examination in the examination period (80%).

Prescribed texts: A K Abbas and A H Lichtman., *Cellular and Molecular Immunology*, 5th updated edn, 2005.

526-305 Medical and Applied Immunology

Credit points: 12.5

Coordinator: Dr A Brooks; Dr S Turner

Prerequisites: 526-304 Principles of Immunology (*p.2*).

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

Description: The subject provides an in-depth study of cell interactions in the immune response: natural and acquired immunity to bacteria, viruses and parasites; design of vaccines; immunodeficiency, including HIV/AIDS; immunopathology of infection; autoimmunity, its aetiology, pathogenesis and treatment; and current practice and future perspectives in transplantation and tumour immunology.

By the end of the subject students should be able to understand and discuss:

- cell interactions in immunity as they relate to medical and applied aspects of immunology;

- the mechanisms of natural and acquired immunity to bacteria, viruses and parasites, and mechanisms of evasion of these responses, and how this knowledge relates to vaccine design;
- the problems of immunopathology and immunodeficiency in infection;
- the aetiology, pathogenesis and treatment of autoimmunity;
- the problems of transplantation and how they are overcome; and
- the potential of immunotherapy and vaccines against cancer.

Students should have developed skills in analysing experimental evidence for immunological concepts.

They should appreciate the experimental basis of our knowledge of the immune response and how this knowledge can be extrapolated to practical applications.

Assessment: A 1-hour written examination held mid-semester (20%); a 3-hour written examination in the examination period (80%).

Prescribed texts: C A Janeway et al, *Immunobiology*, 6th edn, 2004.

526-306 Microbiology and Immunology (Optometry)

Note: Only available to BOptom students.

Formerly known as 526-306 Microbiology (Optometry).

Credit points: 12.5

Coordinator: Ms S Uren

Prerequisites: Enrolment in the third year of the Bachelor of Optometry course.

Contact: 24 lectures and 12 hours of practical work/tutorials (*Semester 2*).

Description: By the end of the subject students should have an appreciation of:

- the range of infections of the eye that may be caused by bacteria, viruses, chlamydiae, fungi and protozoa;
- how infections spread from person to person and may be transmitted by optometrists;
- how infection is prevented in the optometrist's practice by appropriate aseptic technique and methods of sterilisation and disinfection;
- the principles of antimicrobial chemotherapy; and
- the principles of immunity and epidemiology.

Assessment: A 1-hour written examination held mid-semester (20%); a 2-hour written examination in the examination period (80%).

526-313 Medical Microbiology: Cellular Pathogens

Note: Credit cannot be obtained for this subject if credit has already been obtained for 526-308 (1999 Handbook) or for both 526-311 and 526-312 (2002 Handbook).

Credit points: 12.5

Coordinator: Prof R Strugnelli; Mrs H Cain

Prerequisites: Microbiology 526-201 and 526-221 and preferably one or more of the following: microbiology 526-205, biochemistry 521-211 and 521-212, or genetics 652-214 and 652-215.

BBiomedSc students: microbiology 526-201 or 526-205; 521-213 and 536-250.

Contact: 33 lectures and three hours of tutorials (*Semester 1*).

Description: Upon completion of this subject students should understand and be able to describe:

- how bacteria and parasites cause disease; and
- how infectious diseases caused by bacteria and parasites are spread, diagnosed, treated and/or prevented.

Students should be able to apply relevant knowledge of microbial pathogenesis, immunity and epidemiology to the determination of appropriate strategies for developing new diagnostic protocols, treatments or vaccines.

Assessment: A 1-hour written examination held mid-semester (20%); a 3-hour written examination in the examination period (80%).

Prescribed texts: A A Salyers and D D Whitt, *Bacterial Pathogenesis - A Molecular Approach*, 2nd edn, 2002.

526-314 Medical Microbiology: Viruses

Note: Credit cannot be obtained for this subject if credit has already been obtained for 526-303 (1999 Handbook) or for both 526-311 and 526-312 (2002 Handbook).

Credit points: 12.5

Coordinator: Dr D Purcell; A/Prof L Brown

Prerequisites: Microbiology 526-201 and 526-221 and preferably one or more of the following: microbiology 526-205, biochemistry 521-211 and 521-212, or genetics 652-214 and 652-215.

BBiomedSc students: microbiology 526-201 or 526-205; 521-213 and 536-250.

Contact: 33 lectures and three hours of tutorials (*Semester 2*).

Description: Upon completion of this subject students should understand and be able to describe:

- how medically important viruses cause disease;
- how viruses replicate, are transmitted and detected;
- how the host's immune response acts to limit viral infection and how, in some cases, this can lead to pathology.

Students should be able to apply relevant knowledge of viral replication, pathogenesis, immunity and epidemiology to the determination of appropriate strategies for developing new drugs and vaccines.

Assessment: A 1-hour written examination held mid-semester (20%); a 3-hour written examination in the examination period (80%).

Prescribed texts: S J Flint et al, *Principles of Virology*, 2nd edn, 2003.

526-321 Molecular Microbiology Techniques

Availability: This subject is likely to be quota-restricted this year, see *Quota subjects* (p.9).

Credit points: 12.5

Coordinator: Dr M Dyall-Smith

Prerequisites: Microbiology 526-201 and 526-221.

BBiomedSc students: microbiology 526-201 or 526-205; 521-213 and 536-250.

Corequisites: At least one of microbiology 526-301 or 526-313.

Contact: 54 hours of practical work and 6 hours of lectures in the first six weeks of semester only (*Semester 1*).

Description: This subject covers various aspects of practical and molecular microbiology including conventional isolation and identification methods, PCR and DNA sequencing, and antigen detection using western blots.

Upon completion of the course, students should have:

- gained some understanding of the principles and procedures involved in the culture, isolation and identification of bacteria (particularly those of medical and environmental importance) based on principles of microbial physiology;
- used molecular microbiological techniques (eg. PCR, DNA sequencing, western blot probing) to identify important characteristics of bacteria (eg. virulence factors);
- used common bioinformatics methods to analyse DNA and protein sequence data (eg. BLAST searches, translation of DNA sequences, *emm* virulence types of streptococci); and
- gained expertise in retrieving published scientific data related to the project using computer searches and library facilities (eg. Medline).

Assessment: Attendance at practical classes is compulsory. Students must attend at least 80% of the laboratory-based component to be considered for assessment.

Two written reports of laboratory work of up to 4 pages each, including answers to discussion questions given out in class, due during the semester (50%); a 2-hour written examination held mid-semester (50%). Satisfactory completion of the laboratory work and written reports is necessary to pass the subject.

526-324 Immunological Techniques

Availability: This subject is likely to be quota-restricted this year, see *Quota subjects* (p.9).

Credit points: 12.5

Coordinator: Dr S Turner; Dr A Brooks

Corequisites: 526-304 Principles of Immunology (p.2).

Contact: 54 hours of practical work and 12 hours of lectures in the last six weeks of semester only (*Semester 1*).

Description: The subject provides an overview of immunological methods, including preparation, characterisation, separation and assay of lymphocyte populations; characterisation, separation and assay of antigens and immunoglobulins; assay of the immune response to infection; and detection of normal and abnormal antigens in tissues.

By the end of the subject students should have developed:

- skills in the in-vitro manipulation and quantification of cells belonging to the immune system;
- skills in the measurement of cell function;
- skills in separation, detection and quantification of immuno-globulins and antigens; and
- an understanding of the basis of the serological diagnosis of disease.

Students should have an enhanced understanding of the experimental basis of our knowledge of the immune response. They should understand the role of controls in interpretation of experiments. They should appreciate the necessity to keep clear laboratory notes as experiments progress.

Assessment: Attendance at practical classes is compulsory. Students must attend at least 80% of the laboratory-based component to be considered for assessment.

Weekly written reports of completed laboratory work totalling up to 3000 words (50%); a 2-hour practical examination during the semester (50%). Satisfactory completion of the laboratory work, written reports and the practical examination is necessary to pass the subject.

presentation of project results during the semester (15%). Satisfactory completion of the laboratory work and written reports is necessary to pass the subject.

526-326 Projects: Immunology

Note: Students who have completed 526-322 and/or 526-323 in any year must contact the coordinator to ensure they are not repeating subject material for which they were previously awarded credit.

Formerly known as 526-326 Projects: Immunology/Biotechnology.

Availability: This subject is likely to be quota-restricted this year, see *Quota subjects (p.9)*.

Credit points: 12.5

Coordinator: Ms H Cain; Prof F Carbone

Prerequisites: 526-324.

Corequisites: 526-305.

Contact: 66 hours of practical work (*Semester 2*).

Description: Students will carry out experimental work in an area of immunology.

On completion of the subject, students should:

- appreciate the nature of scientific research, including the way in which progress is made and the realities of laboratory-based work;
- be able to work effectively as a team member in a small scientific project;
- be able to keep clear laboratory notes as experiments progress;
- have developed skills in the design, conduct and interpretation of experiments;
- have developed the expertise to critically evaluate experimental proposals and findings; and
- be able to communicate scientific ideas and findings effectively in both oral and written form.

Assessment: Attendance at practical classes is compulsory. Students must attend at least 80% of the laboratory-based component to be considered for assessment.

Ongoing assessment of laboratory work during the semester (25%); written reports of up to 3000 words due during the semester (60%); a 10-minute oral presentation of project results during the semester (15%). Satisfactory completion of the laboratory work and written reports is necessary to pass the subject.

526-327 Projects: Microbiology

Note: Students who have completed 526-322, 526-323 and/or 526-326 prior to 2004 must contact the coordinators to ensure they are not repeating subject material for which they were previously awarded credit.

Availability: This subject is likely to be quota-restricted this year, see *Quota subjects (p.9)*.

Credit points: 12.5

Coordinator: Ms H Cain; Prof R Strugnell

Prerequisites: Preference will be given to students enrolled in subjects leading to a major in microbiology.

BBiomedSc students must be enrolled in stream 7.

Corequisites: At least one of 526-301, 526-313, 526-302 or 526-314.

Contact: 66 hours of practical work (*Semester 2*).

Description: Students will carry out experimental work in an area of microbiology selected from topics in medical and general bacteriology, virology, biotechnology and environmental microbiology.

On completion of the subject, students should:

- appreciate the nature of scientific research, including the way in which progress is made and the realities of laboratory-based work;
- be able to work effectively as a team member in a small scientific project;
- be able to keep clear laboratory notes as experiments progress;
- have developed skills in the design, conduct and interpretation of experiments;
- have developed the expertise to critically evaluate experimental proposals and findings; and
- be able to communicate scientific ideas and findings effectively in both oral and written form.

Assessment: Attendance at practical classes is compulsory. Students must attend at least 80% of the laboratory-based component to be considered for assessment.

Ongoing assessment of laboratory work during the semester (25%); written reports of up to 3000 words due during the semester (60%); a 10-minute oral