

FACULTY OF MEDICINE DENTISTRY & HEALTH SCIENCES

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Majors Booklet http://bbiomed.unimelb.edu.au/majors

MDHS MAJORS (and additional major options for Biomedicine students)

A major in Biomedicine and Science* is a concerted body of study in an area of Biomedical or Biological Science. This represents a collection of four subjects (50 points at third year level) within the broad discipline area. A major will include a 'capstone' experience often embodied in a single compulsory subject, but which is also contained within the other subjects that contribute to the major. A major may also include specific second year prerequisite subjects (eg Genetics, Biotechnology) and/or alternate first year subjects (eg Bioengineering Systems).

It is important to recognize that a major may include third year subjects that are quota limited (eg Anatomy) or subjects that have quota limited second year prerequisites (eg Physiology). In these situations it is highly recommended that you seek academic course advice to explore alternate major options early on in your course planning. MDHS subjects with quota restrictions are clearly listed in the sample course plans for each major. Please also see the MDHS Student Centre quota-restricted subject webpage: http://sc.mdhs.unimelb.edu.au/quota-subjects

A major should be chosen primarily out of interest and a passion for the subject area. It will provide the knowledge foundation for further research (eg Honours/Masters and PhD studies). A major does not, however, provide direct selection advantage for students wanting to enter a professional health degree (eg Doctor of Medicine, Doctor of Physiotherapy, Doctor of Dental Science).

There are 12 majors available within the Bachelor of Biomedicine - 11 of which are also available to Bachelor of Science students (excluding Defence and Disease). This booklet provides a brief snapshot of each major available in MDHS (plus the non MDHS majors available to Biomedicine students-Genetics/Biotechnology/Bioengineering Systems). More detailed information can be obtained from the handbook and directly from MDHS majors coordinators. The full list of our coordinators is available at: http://bbiomed.unimelb.edu.au/majors

The handbook is available at: https://handbook.unimelb.edu.au/faces/ htdocs/user/search/SimpleSearch.jsp

*BSc students - this booklet lists the MDHS majors available and selected science/engineering majors relating to Biological Sciences

Key to course plans

B-BMED

Selectives	Core
Major subjects	Breadth
B-SCI	
Subjects leading to the major	Science subjects to complement the
	major

At least 50 points (four subjects) of your course must contribute to your breadth studies, the remaining 25 points (2 subjects) can be taken as breadth, or further science subjects



www.sc.mdhs.unimelb.edu.au

Biochemistry and Molecular Biology

Major Coordinator: Associate Professor Paul Gooley. Email: prg@unimelb.edu.au

Biochemists and molecular biologists study the structure and function of components of living cells, to understand the biological processes that enable all living things to survive and thrive.

The structure of complex biomolecules, particularly proteins, is closely linked to their role in the cell, so solving structures can provide valuable information about normal processes and how they can change to cause disease.

Enrich lives, including your own, through the study of Biochemistry and Molecular Biology.

Careers & graduate pathways

Plan A: Careers you can pursue with this major

You can use your knowledge of Biochemistry and Molecular Biology to pursue employment in diverse fields including basic and medical research, the pharmaceutical and biotechnology industries, agriculture, teaching, patent law, the environment and food processing industries.

You can also work on the development, production and marketing of biochemical consumables and equipment, or on policy making in government departments.

Please note: some career choices may require additional qualifications.

Plan B: Graduate/professionally-oriented courses

Master of Science (Biomedical and Health Sciences) or Master of Biotechnology; Master of Teaching to become a secondary school science teacher; Doctor of Veterinary Medicine; Doctor of Medicine, Doctor of Dental Surgery and Doctor of Physiotherapy and other health science programs. Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects. A Biomedicine or Science degree majoring in biochemistry opens pathways to a wide range of professions including biomedical sciences, health, law and business.

Plan C: Research pathways with this major

Honours year, a Master of Science (Biomedical and Health Sciences) with a research project component. Research strengths in the department include: molecular cell biology, functional genomics, bioinformatics, structural biology, protein chemistry, host-pathogen interactions, molecular immunology and signalling.

Bachelor of Biomedicine sample course plan

Yr '

Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2

Molecular & Cellular Biomedicine	Selective	Breadth
Human Structure & Function	Techniques in Molecular Science *	Breadth

Yr 3

Biomedicine: From Molecule to Malady	Functional Genomics and Bioinformatics	Advanced Techniques in Molecular Science*	Breadth
Frontiers in Biomedicine	Protein Structure and Function	Biomedical Science Research Project	Breadth
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*quota-restricted subject

Bachelor of Science sample course plan

Yr 1

Chemistry 1	Biology of Cells and Organisms	Calculus 1	Breadth
Chemistry 2	Genetics and the Evolution of Life	Calculus 2	Breadth

Yr 2

Biochemistry and Molecular Biology	Principles of Genetics	Principles of Microbiology and Immunology	Breadth
Techniques in Molecular Science*	Science subject to complement major	Science subject to complement major	Breadth

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Functional Genomics and Bioinformatics	Molecular Aspects of Cell Biology	Genes: Organisation & Function	Breadth
Advanced Techniques in Molecular Science*	Protein Structure and Function	Biomedical Science Research Project	Breadth

Bioengineering Systems

Major Coordinator: Dr David Grayden. Email: grayden@unimelb.edu.au

Biomedical engineering focuses on the design and operation of medical devices and processes, applying engineering skills to new medical treatments, instruments and machines. Biomedical engineering is based on biomedical and physical sciences, with specialist knowledge of engineering modelling, measurement, research and design. Biomedical engineers span disciplines to address healthcare specific problems from a unique perspective.

Careers & graduate pathways

Plan A: Careers you can pursue with this major

Graduates can expect to work in the biotechnology, biomedical or pharmaceutical industries, in research and innovation, in the health services or in government and consulting. Graduates may work for companies such as Cochlear, Aventis, Cell Therapies or GlaxoSmithKline, or for research organisations such as CSIRO or Bio21.

Plan B: Graduate/professionally-oriented courses

Graduates with this major are well-placed to undertake further studies within the health sciences, such as the Master of Engineering (Biomedical) degree. Other options include many other graduate degrees offered to those who graduate with the Bachelor of Biomedicine, including the Doctor of Medicine, Doctor of Dental Surgery, Doctor of Physiotherapy. Additionally, graduates can undertake the Master of Clinical Audiology or Doctor of Optometry as well as other health science programs. Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects.

Plan C: Research pathways with this major

Honours and Masters pathways to research higher degrees such as the Master of Science (Biomedical and Health Sciences).

Bachelor of Biomedicine sample course plan

Yr 1

Biomolecules & Cells	Chemistry for Biomedicine	Calculus 2	Breadth
Genes & Environment	Engineering Systems Design 2	Linear Algebra	Breadth

Yr 2

Molecular & Cellular Biomedicine	Engineering Computation	Breadth
Human Structure & Function	Engineering Mathematics	Breadth

Yr 3

Biomedicine: From Molecule to Malady	Biomechanics & Biotransport	#Fundamentals of Biosignals	Breadth
Frontiers in Biomedicine	Biocellular Systems Engineering	Biosystems Design	Breadth

#Students can alternatively take Signals and Systems if the pre-requisite for the subject has been completed.

Bachelor of Science sample course plan

Yr 1

Calculus 2	Chemistry 1	Biology of Cells and Organisms	Breadth
Engineering Systems Design 2	Linear Algebra	Science Subject	Breadth

Yr 2

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Engineering Computation	Science subject to complement major	Science subject to complement major	Breadth
Engineering Mathematics	Science subject to complement major	Science subject to complement major	Breadth

Yr 3

Biomechanics and Biotransport	Fundamentals of Biosignals	Science subject to complement major	Breadth
Biocellular Systems Engineering	Biosystems Design	Science subject to complement major	Breadth

Biotechnology

Major Coordinator: Associate Professor Ed Newbigin. Email: edwardjn@unimelb.edu.au

Our understanding of how the molecules of life actually work is increasing every day, which opens up a whole new exciting world of possibilities in biotechnology.

Biotechnology is the use of biological knowledge to develop new processes and products for use in industry, health, agribusiness and other areas of human technology.

Biotechnology advances are based on discoveries made in every area of biomedical sciences. Converting these research advances into products occurs in biotechnology companies and Melbourne is a leading location for this type of company in the Asia-Pacific region. This major will provide you with knowledge about how the products of scientific research are commercialised as well as training in a relevant discipline area.

If you would like to work at the forefront of scientific discovery and its commercialisation, study Biotechnology

Careers & graduate pathways

Plan A: Careers you can pursue with this major

Training in Biotechnology provides skills for jobs in many fields, including medical and veterinary sciences, food technology, forensic science, agriculture and waste management. There are employment opportunities in a wide range of industries within the private and public sector.

Employment growth in the Life Sciences, which includes Biotechnology, is projected to be strong leading into 2016-2017.*

*Based on data from the Department of Education, Employment & Workplace Relations accessed July 2012. See www.joboutlook.gov.au

Plan B: Graduate/professionally-oriented courses

Master of Biotechnology – provides specialised scientific learning together with executive skills training in business, communications and management; the Juris Doctor – an opportunity to combine biotechnology training with a career in law, particularly patent law. Graduates can also undertake the Doctor of Medicine, Doctor of Dental Surgery and Doctor of Physiotherapy and other health science programs. Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects.

Plan C: Research pathways with this major

Honours year. The University of Melbourne is a hub for biotechnology research, offering a wide array of research opportunities from nanotechnology and dental biotechnology to environmental and agricultural biotechnology.

Bachelor of Biomedicine sample course plan

(Biomedical, Biotechnology specialisation, Microbiology and Immunology Stream)

Y	r	1

Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2

Molecular & Cellular Biomedicine	Techniques in Molecular Science*	Breadth
Human Structure & Function	Microbes, Infections Responses	Breadth

Yr 3

Biomedicine: From Molecule to Malady	Biotechnology in Practice	Principles of Immunology	Medical Microbiology: Bacteriology
Frontiers in Biomedicine	Techniques in Microbiology and Immunology*	Breadth	Breadth

*quota-restricted subject

Bachelor of Science sample course plan

(Genetics Stream of Molecular Biotechnology)

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Biology of Cells and Organisms	Chemistry 1	Natural Environments	Breadth
Genetics and the Evolution of Life	Chemistry 2	Data Analysis	Breadth

Yr 2

Principles of Genetics	Biochemistry and Molecular Biology	Food, Chemistry, Biology & Nutrition	Breadth
Genes and Genomes	Experiments in Genetics	Biotechnology	Breadth

Yr 3

Biotechnology in Practice	Genes: Organisation & Function	Evolutionary Genetics and Genomics	Breadth
Human & Medical Genetics	Genetic Analysis	Protein Structure & Function	Breadth

www.sc.mdhs.unimelb.edu.au

Cell and Developmental Biology

Major Coordinator: Dr Robb De Iongh. Email: r.delongh@unimelb.edu.au

Cells are the building blocks of life. Diseases and disorders like cancer, diabetes, blindness or even a 'stomach bug' are caused by dysfunction at a cellular and/or molecular level.

This major will provide you with a broad understanding of how cells function and interact with each other and how these processes regulate embryonic development and tissue homeostasis. This knowledge is critical for understanding disease processes and for development of cutting edge technologies to improve the human condition. Technologies such as in-vitro fertilisation (IVF), reproductive/therapeutic cloning, stem cell therapy, the bionic ear and eye and genetically manipulated food and crops have potential for major benefits for society. The study of cell and developmental biology in heath and disease will not only contribute to further advances but will also provide an understanding of how science impacts on ethics and society.

Be part of future dramatic advances with a major in Cell and Developmental Biology.

Careers & graduate pathways

Plan A: Careers you can pursue with this major

Students majoring in Cell & Developmental Biology will be equipped with a broad knowledge base that would suit employment as a Research Assistant in the varied biomedical research institutes in the Melbourne area as well as interstate or internationally. These skills would also be applicable to careers with biotechnology companies or companies involved in clinical research, clinical trials or scientific journalism.

Plan B: Graduate/professionally-oriented courses

Some students may qualify for enrolment in vocational degrees such as Doctor of Medicine, Doctor of Dental Surgery, Doctor of Physiotherapy and other health science programs. They can also undertake the Doctor of Veterinary Medicine, Juris Doctor, Master of Nursing Science. Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects.

Plan C: Research pathways with this major

Graduates of this major will have the option of further study in Honours, Masters of Science (Biomedical and Health Sciences) and PhD programs. The Cell and Developmental Biology Major is run by the Department of Anatomy and Neuroscience but involves teaching staff from Zoology, Genetics and Botany and exposure to subjects in Biochemistry, Physiology, Pathology and Microbiology and Immunology. All of these departments have strong research programs in cell or developmental biology. In addition, the Anatomy and Neuroscience department and its affiliated research institutes have research programs in Neuroscience, Cell and Developmental Biology and Cancer Research.

Bachelor of Biomedicine sample course plan (Reproduction and Development specialisation)

Yı	1

Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2

Molecular & Cellular Biomedicine	Selective	Breadth
Human Structure & Function	Selective	Breadth

Yr 3

Biomedicine: From Molecule to Malady	Concepts in Cell and Developmental Biology	Molecular Aspects of Cell Biology	Breadth
Frontiers in Biomedicine	Stem Cells in Development and Regeneration	Developmental Biology*	Breadth

*quota-restricted subject

Bachelor of Science sample course plan (Reproduction and Development specialisation)

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Biology of Cells and Organisms	Chemistry 1	Data Analysis 1	Breadth
Genetics and the Evolution of Life	Chemistry 2	Linear Algebra	Breadth

Yr 2

Fundamentals of Cell Biology	Principles of Genetics	Biochemistry and Molecular Biology	Breadth
Human Physiology	Exploring Human Disease	Techniques in Molecular Science*	Breadth

Yr 3

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Concepts in Cell and Developmental Biology	Molecular Aspects of Cell Biology	Functional Genomics and Bioinformatics	Breadth
Developmental Biology*	Stem Cells in Development and Regeneration	Cell Signalling and Neurochemistry	Breadth

Defence and Disease

Major Coordinator: Dr Karena Waller Email: klwaller@unimelb.edu.au

The human immune system has evolved to control harmful microbes and tumours but can sometimes inflict damage on its host. This major combines two disciplines, Immunology, the study of the immune system, with Pathology, the study of processes which are associated with disease. The mechanisms of the immune defence against infection and tumours will be studied together with a range of diseases associated with inappropriate outcomes of the immune defence response. These include acute and chronic allergic reactions, autoimmune diseases including Systemic Lupus Erythematosus (SLE) and Rheumatoid arthritis and autoimmune blood diseases, and transplantation responses. The course content will also consider current and future approaches to the immunoregulation of autoimmune diseases and cancer.

You will develop the ability to acquire, analyse and apply information from multiple sources, both inside and outside the laboratory. This major will provide you with a strong basis for careers in biomedical science, further study into medicine and other paramedical disciplines and further biomedical research.

*Please note: this major is not available to B-SCI students

Careers & graduate pathways

Plan A: Careers you can pursue with this major

You can pursue careers in diagnostics, molecular biology, biotechnology and regulation as well as research into infectious agents associated with immune based pathology and the various outcomes of the immune system, especially those involved with autoimmunity and immunopathology. The pharmaceutical industry is an important employer in this area. Graduates can become research scientists, medical scientists, public service employees and sales managers.

Plan B: Graduate/professionally-oriented courses

A range of graduate professional degrees can be undertaken, including Dentistry, Medicine, Optometry, Physiotherapy and other health science programs.

Professional coursework Masters in the sciences and technology, including Biotechnology, Clinical Studies, Energy Systems, Nanotechnology, Environmental Systems, Risk Systems, Management Science and Informatics.

Plan C: Research pathways with this major

Biomedicine graduates with a major in Defence and Disease are wellplaced to apply for: Honours and research higher-degree programs: Master of Science (Biomedical and Health Sciences) and/or PhD programs in the sciences and technology within the Faculty of Arts, Engineering, Land and Food Resources, Medicine, Dentistry and Health Sciences, and Science.

Bachelor of Biomedicine sample course plan

Yr 1

Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2

Molecular & Cellular Biomedicine	Selective	Breadth
Human Structure & Function	Microbes, Infections & Responses	Breadth

Yr 3

Biomedicine: Molecule to Malady	Mechanisms of Human Disease	Principles of Immunology	Breadth
Frontiers in Biomedicine	Techniques in Microbiology & Immunology*	Consequences of Human Disease	Breadth
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*quota-restricted subject

NB: students may elect to complete PATH30002 Techniques for Investigation of Disease (Sem 1) instead of MIIM30013 Techniques in Microbiology & Immunology (Sem 1 or 2). Additionally, students may elect to complete MIIM30014 Medical Microbiology: Virology (Sem 2), PATH30004 Advanced Investigation of Human Disease (Sem 2), or MIIM30003 Medical and Applied Immunology (Sem 2) instead of PATH30003 Consequences of Human Disease (Sem 2).

Genetics

Major Coordinator: Professor Michael Hynes. Email: mjhynes@unimelb.edu.au

Genetics is the foundation for studies in biology. It is the study of variation between living things and how this variation is inherited. Genetics can include studies of gene regulation, development, neurogenetics, population genetics and evolution along with genetic disease detection, prevention and treatment in humans and other animals and plants.

A major in Genetics will include molecular genetics, human genetics, evolutionary genetics and genomics which can be applied in areas such as biology, biomedical science, biotechnology, ecology and conservation.

Careers & graduate pathways

Plan A: Careers you can pursue with this major

Students with a Genetics major can work in areas such as medical genetics, agriculture, ecology and conservation, and biotechnology. Employers include research institutes, hospitals, universities, museums, zoos, and federal and state authorities. There are careers in industries such as biotechnology and scientific supply companies.

You can also pursue a career using the knowledge and skills gained from your degree as a teacher, counsellor, policy-maker, journalist or publisher.

Employment in the Life Sciences, which includes Genetics, is expected to increase leading into 2016-2017.*

*Based on data from the Department of Education, Employment and Workplace Relations accessed July 2012. See www.joboutlook.gov.au

Plan B: Graduate/professionally-oriented courses

Graduate courses you can consider with this major include the Master of Science (Genetics) and Master of Biotechnology

Graduate courses with a professional orientation include the Master of Genetic Counselling, Master of Journalism and the Melbourne JD.

Students may also be eligible to undertake the Doctor of Medicine, Doctor of Dental Surgery, Doctor of Physiotherapy and other health science programs. Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects.

Plan C: Research pathways with this major

Master of Science (Genetics), Bachelor of Biomedicine (Honours) or Bachelor of Science (Honours) leading to PhD research.

Major research strengths of the department include gene regulation and development and evolutionary/ecological genetics.

Bachelor of Biomedicine sample course plan

Yr	1
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Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2

Molecular & Cellular Biomedicine	Principles of Genetics	Breadth
Human Structure & Function	Selective	Breadth

Yr 3

Biomedicine: From Molecule to Malady	Evolutionary Genetics and Genomics	Genes: Organisation and Function	Breadth
Frontiers in Biomedicine	Genetic Analysis	Protein Structure & Function	Breadth

Bachelor of Science sample course plan

Yr 1

Biology of Cells and Organisms	Chemistry 1	Natural Environments	Breadth
Genetics and the Evolution of Life	Chemistry 2	Data Analysis 1	Breadth

Yr 2

Principles of Genetics	Biochemistry & Molecular Biology	Animal Structure and Function	Breadth
Genes and Genomes	Experiments in Genetics	Techniques in Molecular Science*	Breadth

Yr 3

Evolutionary Genetics and Genomics	Genes: Organisation and Function	Evolution and the Human Condition	Breadth
Genetic Analysis	Human and Medical Genetics	Protein Structure and Function	Breadth

Human Structure and Function

Major Coordinator: Associate Professor Chris Briggs. Email: c.briggs@unimelb.edu.au

The Human Structure and Function major will provide you with a deep understanding of the relationship between the structure of the body and how the different parts of the body work together.

You will also have an opportunity to expand this approach by studying complementary topics in pathology, pharmacology, zoology, including the studies of diseases, drugs and animal life.

For a solid foundation to any career or research in the health sciences, study Human Structure and Function.

Careers & graduate pathways

Plan A: Careers you can pursue with this major

Graduates with a Human Structure and Function major could work as a research assistant in one of the many research institutes or university departments in Melbourne.

Graduates can also pursue careers in pharmaceutical companies, as a consultant, media liaison and scientific journalism.

With further graduate training, you could also work as a doctor, dentist, physiotherapist or medical scientist.

Employment growth in the Life Sciences, which includes human structure and function, is projected to increase leading into 2016-2017.*

*Based on data from the Department of Education, Employment and Workplace Relations accessed July 2012. See www.joboutlook.gov.au

Plan B: Graduate/professionally-oriented courses

Professionally focused graduate degrees in the sciences and technology, including the Master of Biotechnology and Master of Science (Biomedical and Health Sciences).

Graduate degrees preparing for a wide range of professions including engineering, law, medicine, optometry, dental surgery, physiotherapy and other health sciences as well as teaching. Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects.

Plan C: Research pathways with this major

Honours pathways to research higher degrees as well as the Master of Science (Biomedical and Health Sciences) leading to a PhD. This can be undertaken within the Faculty of Medicine, Dentistry and Health Sciences, Melbourne Graduate School of Science, Melbourne School of Engineering, and the Melbourne School of Land and Environment.

Bachelor of Biomedicine sample course plan

Yr 1

Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2

Molecular & Cellular Biomedicine	Selective	Breadth
Human Structure & Function	Selective	Breadth

Yr 3

Biomedicine: From Molecule to Malady	Human Locomotor Systems*	Principles of Neuroscience	Breadth
Frontiers in Biomedicine	Viscera and Visceral Systems*	Frontiers in Physiology	Breadth
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*quota-restricted subject

Bachelor of Science sample course plan

Yr 1

Biology of Cells and Organisms	Chemistry 1	Calculus 2	Breadth
Genetics and the Evolution of Life	Chemistry 2	Linear Algebra	Breadth

Yr 2

Principles of Human Structure*	Human Physiology	Principles of Microbiology and Immunology	Breadth
Research –based Physiology*	Techniques in Molecular Science*	Microbes, Infections and Responses	Breadth

Yr 3

Human Locomotor Systems*	Principles of Neuroscience	Principles of Immunology	Breadth
Viscera and Visceral Systems*	Techniques for Investigation of Disease*	Medical Microbiology: Virology	Breadth

Microbiology, Infection and Immunology

Major Coordinator: Dr Karena Waller Email: klwaller@unimelb.edu.au

Life on earth began with microorganisms and depends on their activities, most of which are beneficial. They contribute intimately to our wellbeing. However, some microorganisms can cause infections, the outcome of which can be disastrous. Indeed, these infections account for the majority of death and illness in the world today. We survive our encounters with infectious microorganisms with the help of our immune system, which has evolved to defend against not only harmful microbes, but also tumours.

Never has there been a better time to learn about microbes and their incredible ability to adapt, evolve and survive; and our defence system that controls infections and provides immunity against those microbes that cause harm. Scientists with this knowledge will have the potential to solve some of the many challenges the world is facing.

By taking this major, you will develop the ability to acquire, analyse and apply information from multiple sources, both inside and outside the laboratory. Thus the major will provide you with a strong basis for careers in biomedical science, including research in a range of biomedical sciences and further study into medicine and other paramedical disciplines.

Careers & graduate pathways

Plan A: Careers you can pursue with this major

You can pursue careers in diagnostics, forensic microbiology, vaccine development, molecular biology, biotechnology and regulation, as well as further research into a range of infectious diseases, the genetics and pathogenesis of the causative agent, and the various outcomes of the immune system in a setting of infection, autoimmunity, and cancer.

A wide range of life sciences utilise microorganisms as valuable systems that allow processes common to all life on earth to be studied. Knowing how to work with these easily manipulated organisms is important for many different areas of the life sciences.

Plan B: Graduate/professionally-oriented courses

Other Biomedicine or Science graduate pathways that students with a Microbiology major generally undertake apart from Medicine, Dentistry and Physiotherapy are: Veterinary Science, Optometry, Food Science, Agricultural Science, Education, and Teaching as well as other health sciences. Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects.

Plan C: Research pathways with this major

Honours or Master of Science (Biomedical and Health Sciences) leading to a PhD. Research areas you can pursue include various aspects of infection and immunity; the epidemiology and molecular pathogenesis of intestinal infections of humans, the mechanisms of immunity to viral infections and the immunological basis of autoimmunity.

Bachelor of Biomedicine sample course plan

Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2		
Molecular & Cellular Biomedicine	Selective	Breadth
Human Structure & Function	Microbes, Infections & Responses	Breadth

Yr 3

Yr 1

Biomedicine: Molecule to Malady	Medical Microbiology: Bacteriology	Principles of Immunology	Breadth
Frontiers in Biomedicine	Medical Microbiology: Virology	Techniques in Microbiology & Immunology*	Breadth

*quota-restricted subject

Bachelor of Science sample course plan

Yr 1

Biology of Cells and Organisms	Chemistry 1	Calculus 2	Breadth
Genetics and the Evolution of Life	Chemistry 2	Linear Algebra	Breadth

Yr 2

Principles of Microbiology and Immunology	Principles of Genetics	Biochemistry and Molecular Biology	Breadth
Microbes, Infections and Responses	Genes and Genomes	Experiments in Genetics	Breadth

Yr 3

Medical Microbiology: Bacteriology	Principles of Immunology	Evolutionary Genetics and Genomics	Breadth
Medical Microbiology: Virology	Techniques in Microbiology and Immunology*	Human and Medical Genetics	Breadth

NB: students may instead elect to complete MIIM30003 Medical and Applied Immunology in Semester 2, rather than the Genetics subject (as shown). *quota-restricted subject

Neuroscience

Major Coordinator: Dr Peter Kitchener. Email: pkitc@unimelb.edu.au

Neuroscience is one of the largest areas of study within the entire sphere of modern biology. It is also an area where Australian research has significant international impact.

The Neuroscience major will help you understand the fundamental organisation and functional principles of the nervous system from the biology of nerve cells and neural circuits through to neural systems and complex behaviours.

A multidisciplinary area, Neuroscience combines a wide range of methods and conceptual approaches united by the subject matter; understanding the nervous system. If you value breadth and depth of knowledge in your profession, study Neuroscience.

Careers & graduate pathways

Plan A: Careers you can pursue with this major

The skills acquired in the Bachelor of Biomedicine (B-BMED) or Science (BSc) can be applied to any career where the capacity to analyse, consider, and communicate complex ideas is valued. Reinforcing the value of these generic skills is the focus of the neuroscience discipline on understanding how people think, feel and behave.

A research career in neuroscience (at, for example, universities, research institutes, biotechnology and pharmaceutical companies) will see application of the knowledge of neuroscience and the generic skills acquired during the degree. The B-BMED and BSc provides the required expertise for Research Assistants, and a pathway to further study of Neuroscience in an Honours or Masters degree, which, in turn can lead to a PhD and a career as an Academic and Research Scientist.

Plan B: Graduate/professionally-oriented courses

Graduates with this Major have the ideal background to undertake a graduate degree in the health sciences, such as the Doctor of Medicine, Doctor of Dental Surgery, Master of Nursing Science or Doctor of Physiotherapy. Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects.

Plan C: Research pathways with this major

Graduates could enrol in an Honours degree and/or the Master of Science (Biomedical and Health Sciences) that could then lead to PhD training. The Neuroscience major is run by the Department of Anatomy and Neuroscience. The Department has research programs in many aspects of cellular, developmental and systems neuroscience, encompassing fundamental and applied research questions. Graduates from the major can also apply for research projects in other departments, such as Physiology and Pathology, or in affiliated research institutes, such as the Florey Neuroscience Institute within the Melbourne Brain Centre.

Bachelor of Biomedicine sample course plan

Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2			
Molecular & Cellular Biomedicine	Selective	Breadth	
Human Structure & Function	Selective	Breadth	

Yr 3

Yr 1

Biomedicine: From Molecule to Malady	Principles of Neuroscience	Neurophysiology: Neurons and Circuits	Breadth
Frontiers in Biomedicine	Sensation, Movement and Complex Functions	Developmental Neurobiology	Breadth

Bachelor of Science sample course plan

Yr 1

Biology of Cells and Organisms	Chemistry 1	Mind, Brain & Behaviour 1	Breadth
Genetics and the Evolution of Life	Chemistry 2	Mind, Brain & Behaviour 2	Breadth

Vr	0
TI	2

Fundamentals of Cell Biology	Biological Psychology	Biochemistry and Molecular Biology	Breadth
Microbes, Infections and Responses	Genes and Genomes	Experiments in Genetics	Breadth

Yr 3			
Principles of Neuroscience	Neurophysiology: Neurons and Circuits	Research Methods for Human Inquiry	Breadth
Sensation, Movement and Complex Functions	Developmental Neurobiology	Psychology Science: Theory and Practice	Breadth

Pathology

Major Coordinator: Dr Vicki Lawson. Email: v.lawson@unimelb.edu.au

Pathology is the scientific study of the nature of disease. It is the interface between science and medicine. The discipline considers the causes and consequences of disease at a cellular and molecular level and its relationship with the whole organism. Students will establish a fundamental understanding of the response of tissues and cells to injury, the process of healing and the consequence when healing is unsuccessful. These fundamental processes will be consolidated by theoretical and practical examples of human disease.

The Pathology major integrates knowledge from a range of disciplines and encourages students to apply this knowledge to problems of human health that are of significance to society.

Careers & graduate pathways

Plan A: Careers you can pursue with this major

Students with a pathology major* can follow academic, research or applied science careers in hospitals, universities, research institutions, and biotechnology laboratories. Graduates can also consider careers in scientific imaging, museums, publishing, science journalism and the public service.

Graduates with a Pathology major from the University of Melbourne have careers as research assistants, sales representatives, health consultants, occupational health and safety managers, and managers in companies supporting health and research.

*It is important to be aware that by completing a Pathology major you will learn about pathology, but you will not become a pathologist. This job title is given to those who have completed graduate studies in medicine, followed by several further years of specialist pathology studies while working in a hospital pathology department.

Bachelor of Biomedicine sample course plan

Plan B: Graduate/professionally-oriented courses

Professionally focused graduate degrees in the sciences and technology, including the Master of Biotechnology and Master of Science. Graduate degrees preparing for a wide range of professions including engineering, law, medicine, optometry, dental surgery, physiotherapy and other health sciences, and teaching. Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects.

Plan C: Research pathways with this major

Honours and Masters pathways leading to a PhD program, such as the Master of Science (Biomedical and Health Sciences), undertaken within the Faculty of Medicine, Dentistry and Health Sciences, Melbourne Graduate School of Science, Melbourne School of Engineering, Faculty of Veterinary Science, and Melbourne School of Land and Environment.

Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2

Yr 1

Molecular & Cellular Biomedicine	Selective	Breadth
Human Structure & Function	Selective	Breadth

Yr 3

Biomedicine: From Molecule to Malady	Mechanisms of Human Disease	Techniques for Investigation of Human Disease*	Breadth
Frontiers in Biomedicine	Consequences of Human Disease	Advanced Investigation of Human Disease*	Breadth

*quota-restricted subject

Bachelor of Science sample course plan

Yr 1

Biology of Cells and Organisms	Chemistry 1	Calculus 2	Breadth
Genetics and the Evolution of Life	Chemistry 2	Linear Algebra	Breadth

Yr 2

Biochemistry and Molecular Biology	Fundamentals of Cell Biology	Principles of Human Structure*	Breadth
Techniques in Molecular Science*	Exploring Human Disease	Human Physiology	Breadth

Yr 3

Mechanisms of Human Disease	Techniques for Investigation of Human Disease*	Molecular Aspects of Cell Biology	Breadth
Consequences of Human Disease	Advanced Investigation of Human Disease*	Protein Structure and Function	Breadth

Pharmacology

Major Coordinator: Dr Michael Lew Email: michaell@unimelb.edu.au

Pharmacology is responsible for major advances in the safe and effective treatment of human diseases such as cancer, diabetes, atherosclerosis, asthma and Parkinson's disease. Breakthroughs are continually being made as new drugs are developed and we gain a deeper understanding of how the body works from knowledge of drug action.

In pharmacology, you will understand the interaction between drugs or toxins and living matter. You will learn about the mechanisms of action, uses and toxicity of biologically active substances like therapeutic agents and agricultural, household and industrial chemicals.

Be part of tomorrow's breakthroughs. Start today with a major in Pharmacology.

Careers & graduate pathways

Plan A: Careers you can pursue with this major

Pharmacology is an international science. As a graduate, you can be employed in both research and non-research roles in the pharmaceutical and biotechnology industries, in universities and research institutes, in government departments responsible for the regulation and monitoring of drugs and chemicals, and in other associated industries throughout the world.

Employment for life scientists such as pharmacology graduates is expected to increase, so there will be good job prospects leading into 2016-2017*.

* Based on data from the Department of Education, Employment and Workplace Relations accessed July 2012. See www.joblook.gov.au

Bachelor of Biomedicine sample course plan

Plan B: Graduate/professionally-oriented courses

Graduate degrees in the sciences, including the Master of Biotechnology and Master of Science (Biomedical and Health Sciences). Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects.

Plan C: Research pathways with this major

Honours and Masters pathways to research higher degrees such as the Master of Science (Biomedical and Health Sciences).

Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2

Vr 1

Molecular & Cellular Biomedicine	Selective	Breadth
Human Structure & Function	Selective	Breadth

Vr 3

Biomedicine: From Molecule to Malady	Drugs: From Discovery to Market	Drugs in Biomedical Experiments	Breadth
Frontiers in Biomedicine	Drugs Affecting the Nervous System	Drug Treatment of Disease	Breadth

Bachelor of Science sample course plan

Yr 1

Biology of Cells and Organisms	Chemistry 1	Natural Environments	Breadth
Genetics and the Evolution of Life	Chemistry 2	Data Analysis 1	Breadth

Yr 2

Principles of Microbiology and Immunology	Human Physiology	Biochemistry and Molecular Biology	Breadth
Pharmacology: How Drugs Work	Genes and Genomes	Techniques in Molecular Science*	Breadth

Yr 3

Drugs: from Discovery to Market	Drugs in Biomedical Experiments	Functional Genomics and Bioinformatics	Breadth
Drugs Affecting the Nervous System	Drug Treatment of Disease	Biomedical Science Research Project	Breadth
*auota-restricted subject			

Physiology

Major Coordinator: Professor David Williams. Email: d.williams@unimelb.edu.au

Discoveries in physiology have a broad impact upon health and medicine, environmental science, industry, nutrition, exercise and reproductive biology. Many of the discoveries from the human genome rely on physiology to understand their impact on the human body.

The Physiology major will teach you how the body works. You will learn about the ways in which the cells, organs and whole body function in an integrated way. By understanding normal function, you will investigate disturbances of whole body systems such as those relating to the endocrine, cardiovascular, musculo-skeletal, developmental and nervous control systems. For a thorough understanding of the whole body in both health and disease, study Physiology.

Careers & graduate pathways

Plan A: Careers you can pursue with this major

You will have employment opportunities as a technical or research assistant in biomedical research, universities, specialist institutes, industry, teaching, government or hospitals. Employment growth in the Life Sciences (including physiology) is projected to be strong leading into 2016-2017.*

*Based on data from the Department of Education, Employment and Workplace Relations accessed July 2012. See www.joboutlook.gov.au

Plan B: Graduate/professionally-oriented courses

Physiology is a perfect undergraduate area for students wanting to enter graduate schools in medicine and allied health. Graduate degrees preparing for a wide range of professions including health sciences, engineering, law, medicine, physiotherapy, optometry, and teaching. Please note that the completion of specified prerequisites at second year level is required for entry to the Doctor of Medicine, Doctor of Dental Surgery and the Doctor of Physiotherapy graduate programs. Science students will need to select these subjects as part of their course planning. Biomedicine students will automatically meet these prerequisite requirements through the completion of the second year core Biomedicine subjects.

Bachelor of Biomedicine sample course plan

Plan C: Research pathways with this major

Honours year or a Master of Science (Physiology) with a significant research component leading to opportunities to study for a PhD. Research strengths in the Department of Physiology include: Cardiovascular Health, Neurophysiology and Muscle and Exercise Physiology, which are all supported by national and international funding agencies.

The Department has a strong record of research training with our PhD graduates securing leadership roles in universities, institutes, industry and the private sector. The winner of the 2012 Premier's Award for Health and Medical Research, Dr Stefan Gehrig, trained as an undergraduate and early postdoctoral researcher in the Department of Physiology.

Yr 1

Biomolecules & Cells	Chemistry for Biomedicine	Mathematics	Breadth
Genes & Environment	Physics for Biomedicine	Experimental Design & Data Analysis	Breadth

Yr 2

Molecular & Cellular Biomedicine	Selective	Breadth
Human Structure & Function	Selective	Breadth

Yr 3

Biomedicine: From Molecule to Malady	Muscle & Exercise Physiology	Neurophysiology: Neurons and Circuits	Breadth
Frontiers in Biomedicine	Frontiers in Physiology	Cardiovascular Health: Genes and Hormones	Breadth

Bachelor of Science sample course plan

Yr 1

Biology of Cells and Organisms	Chemistry 1	Calculus 2	Breadth
Genetics and the Evolution of Life	Chemistry 2	Linear Algebra	Breadth

Yr	2
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Human Physiology	Principles of Human Structure*	Animal Structure & Function	Breadth
Research-Based Physiology*	Techniques in Molecular Science*	Comparative Animal Physiology*	Breadth

Yr 3

Muscle and Exercise Physiology	Neurophysiology: Neurons and Circuits	Human Locomotor Systems*	Breadth
Frontiers in Physiology	Cardiovascular Health: Genes and Hormones	Biomedical Science Research Project	Breadth

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