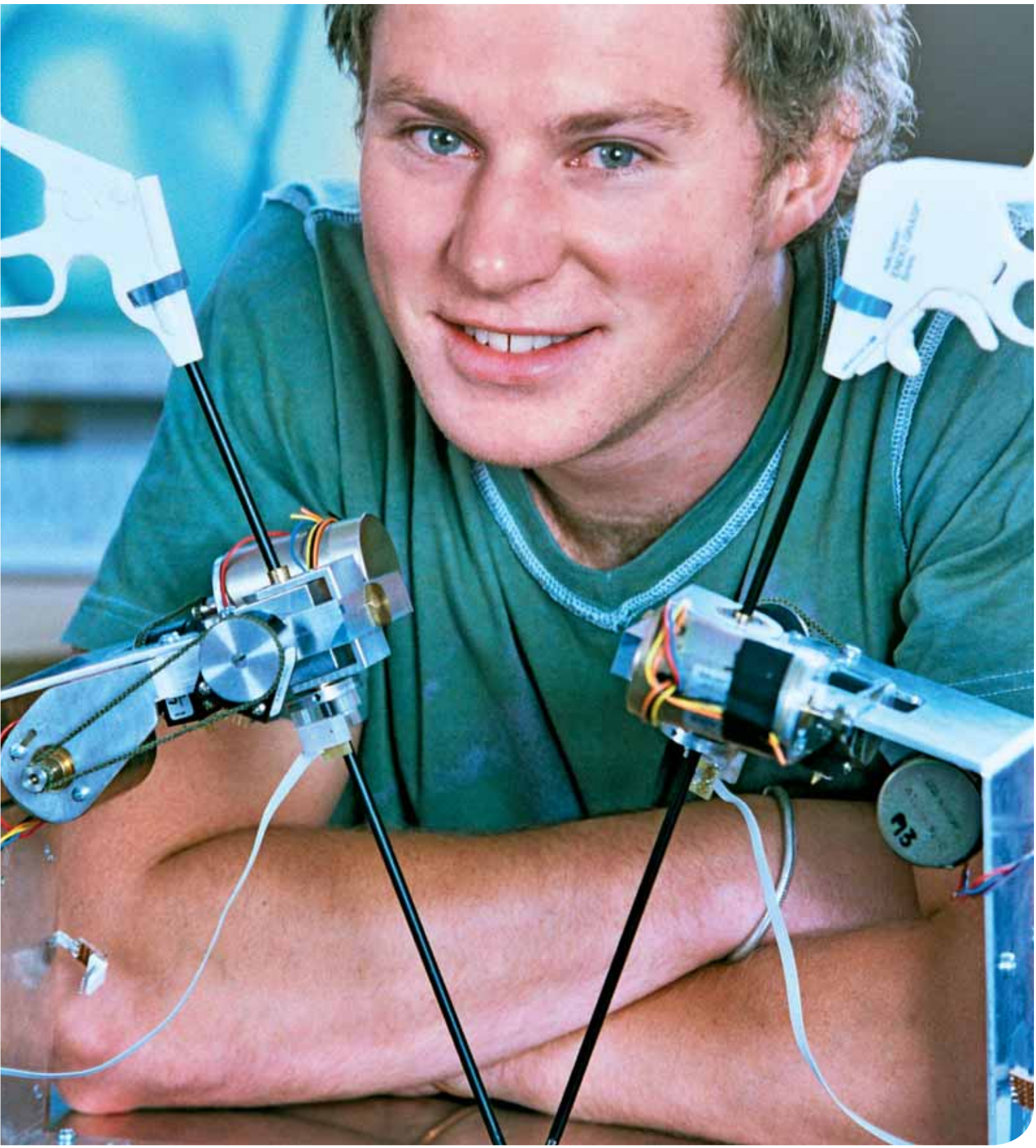
MONASH University

Bachelor of Biomedical Science/ Bachelor of Engineering

Undergraduate program



From 2006 students will be able to take this double-degree program offered by the Faculty of Medicine, Nursing and Health Sciences and the Faculty of Engineering.

Students will be able to combine a Bachelor of Biomedical Science with a Bachelor of Engineering in one of five disciplines (Chemical, Civil, Electrical and Computer Systems, Materials or Mechanical Engineering) and position themselves for careers in the Biomedical Engineering field.

What do biomedical engineers do?

Biomedical engineers have the satisfaction of helping others directly. The health care industry uses a vast array of technologies and engineers are frequently involved in the invention, design, manufacture and implementation of these technologies. In hospitals they help choose the right technology for patient care and also ensure the hospital's equipment is safe and reliable.

Some biomedical engineers design monitoring equipment, artificial organs, or schemes to deliver therapeutic drugs safely and effectively. Others develop tools to diagnose disease and to repair or replace diseased organs, including; artificial hearts, pacemakers, medical imaging techniques, lasers, prosthetic implants and life support systems. Biomedical engineers use technology and computers to help the mentally and physically impaired enjoy life. For example: diagnostic instrumentation, implantable devices, technology for the disabled, medical informatics and imaging and, more recently, intelligent prosthetics and medical robotics. They might make materials to repair and replace damaged organs, or for contact lenses, dental implants, replacement hip joints and even replacements limbs.

Biomedical engineers also work in the research laboratories of medical schools, crash test facilities, human body biomechanics research and development centres, universities, governments and consulting facilities studying the microscopic biological building blocks of life and whole-body biomechanics interactions.

Biomedical engineers with a biomechanics focus may work on forensic investigations of building failures, car crashes or accidents, analysing them in detail with the aim of identifying failure or injury mechanisms, injury criteria and designing passive safety systems that reduce injuries.

Chemical engineers with a knowledge of biotechnology and bioprocess engineering are in demand in biotechnology and pharmaceutical companies for their processing and value-adding skills.

The design of successful bioprocesses requires an intimate understanding of how the nuances of biological systems need to not only be incorporated and engineered into processing systems, but how they can be harnessed to obtain desirable outcomes.

Biomedical engineers will also work at the interface of biomedical science and public health engineering to develop improved water supply and reuse systems, and solid and liquid waste disposal systems.

The rapidly expanding biotechnology area includes the manipulation of genetic material to prevent disease, produce pure pharmaceuticals or improve plant or animal productivity. Here too, biomedical engineers are responsible for the instruments that sequence genes and other biomolecules and control the production environments and purification of products.

New cutting-edge areas include genetic, molecular and tissue engineering, ie. the development of techniques and equipment to design and construct new body parts as well as molecules to combat disease.

Career opportunities in biomedical science and engineering

Australia has an urgent need for biomedical engineers with a solid grounding in biomedical science and engineering. Career paths and opportunities include:

- medical technology design, manufacture and sales in supply industries
- medical technology selection, installation and maintenance in hospitals and other user settings
- medical technology testing, regulation and approval in both government and industry
- medical research as the technologist in a biomedical research team
- forensic engineering and accident investigative research, government and consultancy teams
- crash testing research, government and industry laboratories
- the bioprocessing industry (eg. the production of medicines, food, alcohol, fuel and plastics from renewable raw materials)
- biomechanical and ergonomic research laboratories, design centres and consultancies
- computer software companies modelling human body biomechanics
- public health engineering, design, research and implementation of biomedically safe water and land disposal systems.

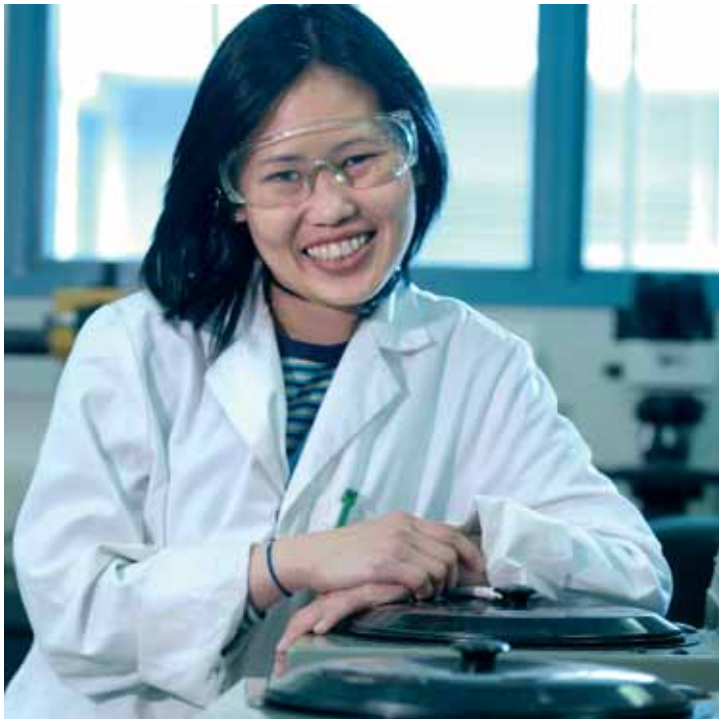
Employment prospects in the field are good and employment growth has risen steadily in recent years.

The biomedical science component of the Monash program covers the wide diversity of biomedical sciences. The engineering component is available in a broad range of engineering disciplines. Graduates will therefore be eligible to apply for a considerable array of positions drawing on their biomedical engineering training as well as positions in the broader fields of engineering and biomedical science.

Biomedical science and engineering at Monash

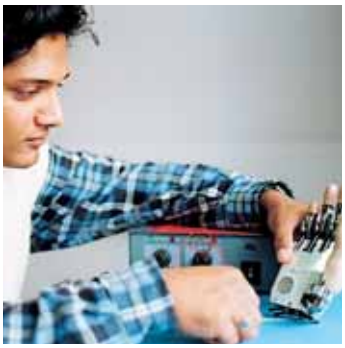
Monash is a leader in biomedical engineering research and has offered teaching programs in the discipline since 1993. This double degree is intended for students who have an interest in both biomedical science and technology. It introduces students to a range of new, interdisciplinary subjects covering areas of modern biomedical sciences, human biology and public health and develops a strong grounding in one of five branches of engineering.

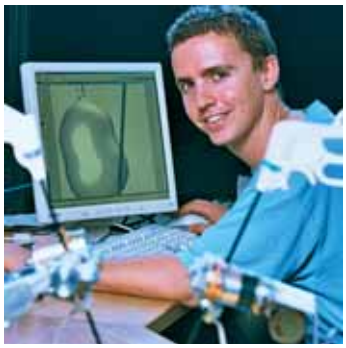
The strong research and design focus that characterises the engineering programs, combined with the inter-disciplinary approach of the biomedical science component, will produce graduates in two disciplines who are able to make a unique contribution to both biomedical science and engineering.



Engineering discipline	Biomedical engineering applications*
Chemical engineering	Pharmaceutical design and manufacture, drug delivery systems, harnessing biological systems to improve bioprocessing outcomes (eg. in the manufacturing of medicines, vaccines, food, alcohol, fuels and plastics from renewable raw materials).
Civil engineering	Quality of water supply and health implications, forensic engineering and injury biomechanics, crashworthiness and dynamics of human interaction within vehicles and road environments, biosensitive infrastructure such as 'healthy' buildings.
Electrical and computer systems engineering	Diagnostic instrumentation and monitoring equipment, electro-physiology – study of the brain and development of devices like the bionic ear, improving medical image acquisition and processing, (eg. MRI).
Materials engineering	Development of materials for implants (eg. titanium hip joints, artificial lenses), improvement of bonding materials used with implants, scaffolding: using artificial materials to induce tissue growth in the shape required for transplanting to the required area.
Mechanical engineering	Design and improvement of prosthetics, artificial valves or hearts as well as other implants and replacement organs, biomechanics and improving bioreactors.

* These applications are meant only as a guide. Biomedical engineering applications overlap and new opportunities are constantly emerging at an interdisciplinary level.





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Course details

The biomedical science component includes aspects of anatomy, biochemistry, clinical medicine, epidemiology and preventative medicine, genetics, immunology, microbiology, pharmacology, physiology, and psychology. The core subjects in this program are designed to provide the skills necessary to understand and investigate human biology and health and include aspects of traditional biomedical sciences.

The engineering component, in each of the five engineering disciplines on offer, is based on a grounding in the basic sciences combined with a focus on design, the latter being taught by a combination of lectures on design methodology culminating in a final-year project in the biomedical engineering field. In some disciplines there are additional projects at lower year levels.

BBiomedSc/BE students will learn to identify solutions to problems that include a human or biological element, and to contribute engineering solutions to medical problems confronted by a multi-disciplinary biomedical science/engineering team.

They will also understand the interface requirements, and be able to design aspects of medical systems. Experience working within a team and the acquired knowledge of a range of biomedical disciplines will provide students with the knowledge and insight to be able to communicate and collaborate with members of a multidisciplinary biomedical science/engineering research and development team.

The combined curriculum of the double degree will develop an understanding of sustainable design in the context of biomedical engineering technology where environmental aspects include both the human body and the wider ecological environment.

Ethical responsibility takes on an additional dimension in the context of biomedical science and medical technology where humans may be intimately connected to technology and dependent on technology for survival. BBiomedSc/BE students will be well placed to consider such ethical issues.

The precise manner in which the selection of units in the five engineering disciplines is organised differs between the engineering disciplines, but BBiomedSc/BE students will be taught their selected engineering discipline to the same depth as any other Bachelor of Engineering student. Course maps for Biomedical Science with each of the five engineering disciplines are available of the Faculty of Engineering website: **www.eng.monash.edu.au/courses/undergraduate**

Course recognition

This double-degree program has been designed to meet the accreditation requirements of Engineers Australia. In addition, it is anticipated that the BE/BBiomedSc degree will be recognised by Engineers Australia's College of Biomedical Engineering.

Prerequisites

VCE Units 3 and 4 – a study score of at least 25 in English (any), chemistry, mathematical methods and in one of physics or specialist mathematics.

Admissions

If you are a citizen or permanent resident of Australia, or a citizen of New Zealand, your application should be made through the Victorian Tertiary Admissions Centre.

For further information visit VTAC online at: **www.vtac.edu.au**

International students currently studying VCE or the IB in Victoria should also apply through VTAC.

All other international students should apply through Monash International: **www.monash.edu.au/international**

VTAC codes: 28811 (CSP), 28812 (Fee), 28813 (Int. Fee)

Please note: awaiting government CRICOS endorsement at the time of publication. International student visas cannot be issued without a CRICOS code. Please check on the status of the course before making an application.

Further information

For more detailed information about the Bachelor of Biomedical Science/Bachelor of Engineering contact the Faculty of Medicine, Nursing and Health Sciences:

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CRICOS provider: Monash University 00008C. July 2005

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