The Chinese University of Hong Kong

Biomedical Engineering Programme
**Biomedical Engineering**

Biomedical engineering is an interdisciplinary study in which engineering and technology are applied innovatively to solve biological and medical problems for the benefit and welfare of mankind.

The Biomedical Engineering (BME) programme was launched by the Faculty of Engineering in close collaboration with the Faculty of Medicine as a co-owned interdisciplinary programme. The programme aims at educating next-generation biomedical engineers with an aspiration of serving society and advancing healthcare at the interface of engineering, science, and medicine. Academic contributions are provided by various departments across the two Faculties. Administrative supports are provided by the Department of Electronic Engineering for our undergraduate programme.
Mission

To be the premier source of leaders in biomedical engineering covering the broad areas of biosensors and medical devices, biomicroelectromechanical systems and bionanotechnology, functional tissue engineering, informatics in biomedicine, medical imaging, as well as medical robotics and assistive technology.

Programme Outcomes

1. Our graduates will have possessed a solid foundation in the broad areas of biomedical engineering with a strong underpinning in mathematics, science, and engineering, and will have demonstrated their specialized competence in one or more BME areas.

2. Our graduates can work in interdisciplinary teams and make contribution as biomedical engineers to develop innovative technologies to serve the healthcare needs of society. On mastering both technical and soft skills, our graduates will be able to flourish on many different career paths. They will be ready for life-long learning, including for some the pursuits of further studies in graduate school or medical school.

3. Our graduates can demonstrate an understanding of contemporary issues associated with biomedical engineering and the impact of engineering solutions in society, including the importance of ethical, safety and environmental considerations.
### BME Curriculum

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<th>Year</th>
<th>Core Courses</th>
<th>Free Electives*, General Education &amp; Languages</th>
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<tr>
<td>Year 1</td>
<td>Engineering Foundation</td>
<td>Biology / Chemistry, Engineering Design, Engineering Mathematics, Physics, Programming</td>
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<tr>
<td>Year 2</td>
<td>BME Fundamentals</td>
<td>Anatomy and Physiology, Biomechanics, Cell and Molecular Biology, Circuit and Electronics, Engineering Mathematics</td>
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<tr>
<td>Year 3</td>
<td>Advanced Major Courses</td>
<td>Business, Administration, Accounting, Law, Science, Arts, Social Science, Physical Education</td>
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<td>Year 4</td>
<td>One-year Work Study Program (optional)</td>
<td>English, Technical Communications</td>
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<td>Year 4 or 5</td>
<td>BME Specialization</td>
<td>Graduation Project, BME Electives</td>
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* Units for free electives can be used to fulfill the minor requirement.
**Streams**

**Medical Instrumentation & Biosensors**
- TeleMedicine & Mobile Healthcare
- Medical Robotics
- Bionanotechnology
- Biofluids
- Body Sensor Networks
- Cardiovascular Engineering
- Neuroengineering
- BioMEMS
- Electrophysiology
- Recommended to minor in Electronic Engineering, Mechanical & Automation Engineering, OR Physics

**Biomedical Imaging, Informatics & Modeling**
- Bioinformatics
- Biomedical Modeling
- Sound and Light Waves in Medicine
- Database & Security
- Medical Imaging Applications
- Biomedical Imaging
- Recommended to minor in Computer Science, OR Electronic Engineering

**Molecular, Cell & Tissue Engineering**
- Cell Biology
- Bionanotechnology
- Musculoskeletal Tissue Engineering
- Molecular Biotechnology
- Biomolecular Engineering
- Genetic Engineering
- BioMEMS
- Recommended to minor in Biology, OR Biochemistry

**Curriculum**
- Breadth and depth through major electives and minor options
- Coursework supplemented with practical work and hospital training
- Courses co-taught by faculty members from both engineering and medical schools
- Wide selection of free electives
- Flexible credit system

**BME + Business Administration Double-Degree Programme**

The double degree option is designed to provide students with maximum flexibility to acquire a second degree by an additional year of study after their first degree. Biomedical engineering students can pursue a second bachelor’s degree in the Faculty of Business Administration within a 5-year normative period of study if they fulfill certain requirements. For further information, please refer to the Faculty website at [http://www.erg.cuhk.edu.hk](http://www.erg.cuhk.edu.hk).

**BME Minor Programme**

The BME minor programme is a good option for students with a science background to apply engineering tools on medical science and biology. For details, see the curriculum information in our website: [http://www.bme.cuhk.edu.hk](http://www.bme.cuhk.edu.hk).
Areas of Study

Biomaterials and Regenerative Medicine

Biomaterials scaffolds and bioactive coatings, stem cell technology, microenvironmental cues in stem cell differentiation, biophysical stimulation and mechanobiology
Biomolecular Engineering and Nanomedicine

Lab-on-a-chip biosensors, point-of-care devices, microfluidic manipulation and detection of biomolecules, research into bacterial and mammalian cells, bionanotechnology and delivery of diagnostic and therapeutic molecules.
Medical Imaging and Informatics

Computer-aided diagnosis, functional magnetic resonance imaging, Terahertz, biomedical imaging and spectroscopy, bioinformatics, health informatics, telemedicine
Medical Instrumentation and Biosensors

Wearable sensors and mobile health, home healthcare technology, surgical robotics, wireless capsule endoscopy, wearable robotics for rehabilitation
Hospital Training

Students are required to participate in a two-week summer training in the Prince of Wales Hospital. During the training, students can experience the daily operation, information flow and logistics in the running of a hospital; as well as understand the fundamentals and daily operation of medical instruments. It provides a valuable chance for students to relate theory and engineering knowledge to practicing in a real-world setting.

Students’ sharing:

*Ho Lok Wai:*  
It was surely an unforgettable experience which urges me to think about the contribution of biomedical engineering to those who desperately need help.

*Mui Chi Hang:*  
This training is an inspiring tour for understanding the actual situation of the hospital and the application of biomedical engineering knowledge into the work of doctors, nurses and hospital staff.
Graduation Project

All students in their final year of study are required to complete a graduation project. The project is designed to provide students with an opportunity to carry out an independent project with research elements in biomedical engineering. Students will be under the supervision of academic staff spanning over numerous departments in the Faculty of Engineering and the Faculty of Medicine. Recent project topics include:

- Automatic scoring of sleep measures
  (Co-supervised by Department of Psychiatry and BME programme)
- Biophotonics: Improvement in image quality in laparoscopic general surgery using smaller size laparoscope
  (Co-supervised by Department of Surgery)
- Development of a therapeutic game for patients with Alzheimer’s disease
  (Co-supervised by Department of Radiology and BME programme)
- Manipulation and detection of cancer tissues on a microfluidic device
  (Co-supervised by Department of Oncology and BME programme)
- To develop a mobile app for learning cardiac anatomy
  (Supervised by Department of Computer Science)
Co-Curricular Programmes

Based on interests, students are encouraged and supported to participate in various co-curricular programmes, such as:

- Academic exchanges
- Community services
- Early research exposures
- International design competitions
- Study field trips
- Summer internships
- Work-study programmes

Recent examples of these co-curricular activities include:

- World Congress of Medical Physics and Biomedical Engineering in Beijing
- iGEM, International Genetically Engineered Machine Competition at Massachusetts Institute of Technology (MIT)
- Summer research internships at the Chinese Academy of Science Shenzhen Institute of Advanced Technology
- Overseas summer research internships at Columbia University, Northwestern University, University of Pittsburgh, University of Toronto, etc.
- Summer internships in companies such as Ample Link, etc.
- Summer internships in hospitals such as the Hong Kong Adventist Hospital and Prince of Wales Hospital
- Summer internships in organizations such as Hong Kong Government Electrical and Mechanical Services Department and Hong Kong Productivity Council

Overseas summer research internship at:

- Columbia University, USA
- Imperial College, UK
- Korea Institute of Science & Technology, Korea
- National University of Singapore, Singapore
- Northwestern University, USA
- University of California at Irvine, USA
- University of Pittsburgh, USA
- University of Toronto, Canada
Visit to the World Congress on Medical Physics and Biomedical Engineering
Hu Dawei

In the congress, we were exposed to the latest information on global health challenges, advanced technologies and innovative applications. The congress was a different learning environment to us. A lot of the ideas were new to us and they really broadened our horizons. We really appreciate the state of the art knowledge and technology in the field of biomedical engineering. We treated it as an invaluable learning opportunity. After the 6-day congress, we have a better understanding on the global health situation and related technology. In this way, we have a clearer idea on the role of a biomedical engineer.

International Genetically Engineered Machine Competition (iGEM)
Winnie So

Joining iGEM is an amazing adventure in my University life. This competition is launched by the Massachusetts Institute of Technology (MIT) and requires teams to show their knowledge in biotechnology, innovation, teamwork and public outreach. Within half of a year, students from both Life Science and Engineering cooperated with each other to finish a synthetic biology research project. It is my great pleasure to be one of the teammates of iGEM CUHK 2011. Several teammates and I also feel delighted to have further research on ChloriColight - development of a microbial desalination power plant in the Biomedical Engineering Laboratory after the competition. This iGEM experience broadens my horizons and enriches my study life in CUHK.
Global Educational Exchange Program (GLOBEX) at Peking University
Lo Po Wen

GLOBEX constitutes an initiative for international and educational exchange between the College of Engineering at Peking University and engineering schools all around the world. Studying at Peking University with foreigners gave me countless opportunities. Nanomaterial and Nanotechnology, was in some way difficult for a freshman but I really enjoyed knowing things at the nanometer length scale and their special properties and applications. Orthopedic Biomechanics was really full of fun. I learned a lot of new and in-depth knowledge about mechanics and anatomy of bone during such days. I feel really grateful to join the Global Educational Exchange Program. Not only did I learn a lot of new knowledge, but I also made a lot of foreign friends.

Summer Overseas Research Internship at the Rehabilitation Institute of Chicago
Paul Lam

I was given a 10-week internship offer at the Rehabilitation Institute of Chicago in the city of Chicago, Illinois, USA, being a research intern working at an autonomous robot lab. I was given a task to help set up the environment for the laboratory. The laboratory is researching on autonomous robots in collaboration with Northwestern University. There was a poster presentation on the Friday of Week 9 to conclude what we had done. I was satisfied with what I had. I now regard BME as the best major in my life. It connects the world of research and bright job career with students. The curriculum is well designed to prepare students to start their career in BME. It is broad and includes a bunch of BME related aspects and topics. If someone who wishes to continue a career other than BME, the curriculum also prepares the students by giving them a wide range of hardships to deal with. It is so good. On the other hand, the curriculum also prepares students for a variety of disciplines other than BME.
Summer Overseas Research Internship at Prism Lab, Holland Bloorview Kids Rehabilitation Hospital, University of Toronto

Crystal Chui

I am glad to have this opportunity to join this summer research internship. The Prism Lab is an academic health sciences centre and the largest paediatric rehabilitation hospital in Canada. My learning experience as an undergraduate student of biomedical engineering, combined with my enthusiasm on the research work, have convinced me that research is a career option that I would like to explore. This programme provided me with the ideal opportunity to expand my research skills and communicate with engineering professionals and national students from France, Canada and Beijing. Through this research experience, I appreciated the guidance of my supervisor and the support from the Prism Lab team.

Summer Overseas Research Internship at Musculoskeletal Research Center (MSRC), Department of Bioengineering, University of Pittsburgh

Bonnie Leung

I was so glad to be given an opportunity to gain research experience at the Musculoskeletal Research Center (MSRC). I did not only learn research skills, but also cooperation that a good researcher requires. During the summer internship, my project was to perform computational and in vitro test on magnesium based suture anchor. The training under MSRC as a problem solver provided me a chance to further sharpen my analytical skills. Throughout my short stay at MSRC, I experienced what research is and learned what to do when being hindered in the research process.
Work-Study Programme

In addition to the regular academic study on campus, students can choose to participate in "Work-Study Programme" upon completion of third year of their major study. The Programme aims to provide students an opportunity to apply engineering principles and methods from their studies to an authentic working environment of biomedical engineering related industries. Students will continue their final year of study on campus afterwards. Partners of the Programme include companies from the biomedical engineering industries, private hospitals, the Hospital Authority, etc. Recent examples include:

- AML Health Plus Ltd.
- Asia Satellite Telecommunications Co. Ltd
- ASM Technology Hong Kong Ltd.
- Automatic Manufacturing Ltd.
- Electrical and Mechanical Services Department, HKSAR Government
- The Hongkong and Shanghai Banking Corp. Ltd. (HSBC)
- ITE Smartcard Solutions Ltd.
- Medisen Ltd.
- Ove Arup & Partners Hong Kong Ltd.
- Paul C. Lauterbur Research Centre
Overseas Exchange

University provides overseas exchange opportunities to students to immerse in multi-cultural settings and to enrich their study life and personal experience. Many undergraduate students in Biomedical Engineering participate in overseas exchange programmes around the world. Recent examples include:

- Ewha Woman University, Korea
- Karlsruhe Institute of Technology, Germany
- KTH Royal Institute of Technology, Sweden
- Nanyang Technological University, Singapore
- Pompeu Fabra University, Spain
- San Diego State University, USA
- University College London, UK
- University of Illinois at Urbana-Champaign, USA
- University of Ottawa, Canada
- University of Tennessee, USA
- University of Western Australia, Australia

Scholarships

Students with good academic results can apply for scholarships at University-level, college-level and programme-level.
Career Opportunities

Biomedical engineering, which integrates expertise in engineering, medicine and bioscience for the enhancement of healthcare, is one of the fastest growing engineering disciplines today. It is an area of rapid expansion with promising career prospect despite economic recession. According to a long-range forecast of the U.S. Bureau of Labor, employment of biomedical engineers is expected to grow much faster than average (72% from 2008-2018) for all occupations. The aging population and the focus on health issues will increase the demand for better medical devices and equipment designed by biomedical engineers. The development of biomedical engineering is therefore a worldwide trend. The first cohort of graduates in 2013 is pursuing the following career paths.

- Research and development
- Further study pursuing a postgraduate degree in BME, medical research and other fields
- Further study pursuing a medical degree
- Consulting services for medical device industry
- Medical device manufacturing
- Medical device distribution and sale

Employers include: ArjoHuntleigh, ASM Pacific Technology, Electrical and Mechanical Services Department of HKSAR Government, Hong Kong Adventist Hospital, , Hong Kong Aircraft Engineering Company Ltd. (HAECO), Hong Kong Applied Science and Technology Research Institute (ASTRI), Hong Kong Productivity Council, Hong Kong and Shanghai Banking Corp. Ltd. (HSBC), Johnson & Johnson, Medisen (Sengital), Medtronic, Siemens (Healthcare sector), Transmedic
BME student sharing

Allan Lee

As Biomedical engineering programme (BMEG) is a new program which was launched in 2010, new friends from other departments I met in the university always wondered what I am learning in the BMEG program. When I told them that I am learning programming, engineering mathematics, circuit design, biochemistry, physiology and anatomy, etc., they were amazed by my answer. However, the major courses that I have taken exactly reflect the nature of biomedical engineering. Biomedical engineering is a multidisciplinary subject, combining life science, medicine and engineering. Say in a simple way, we are learning how to engineer our body. It is an amazing way to use engineering principles to apply to life science. Before entering the BMEG program, I never thought of treating my own body as a machine or a robot, or considering different parts of our body as electrical components. This is an innovative and interesting approach to both medicine and life science. Being a BMEG student in CUHK, we have numerous chances to get to know the biomedical engineering industry. In January 2011, we visited the Mindray Medical International Limited, an internationally renowned medical instrument manufacturing company in Shenzhen. From the trip, we were able to know more about the latest technology development of medical instruments as well as future career prospects of biomedical engineering. Moreover, we had a two-week job shadowing in Prince of Wales Hospital in summer. This fruitful experience enabled me to learn more about hospital operation and the application of different instrument in a medical setting.
Location: Room 404, Ho Sin Hang Engineering Building, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong

Phone number: 852 3943 8278
Fax number: 852 2603 5558
Webpage: http://www.bme.cuhk.edu.hk
Email: info@bme.cuhk.edu.hk