Healthcare is changing rapidly, moving away from traditional practices towards more technological approaches in terms of diagnosis (such as body scanners), treatment (including radiation therapy, minimal access surgery and implantable devices), and the extensive use of information technology. As a result, there is an increasing demand both for doctors who are technically competent and for engineers and scientists who are properly trained in basic medical science. Biomedical engineering is steadily becoming the world's largest industrial sector and is expected to grow over a long period of time.

The Department of Bioengineering was established to coordinate the world-ranking, multidisciplinary research in biomedical engineering which has been a long-standing feature of Imperial College, as well as to promote collaboration between the Faculty of Engineering and the Faculties of Medicine, Life and Physical Sciences in the College.

Requirement:
A strong desire to become a competent engineer and to apply your training to biological or medical problems or in any career which requires a multidisciplinary approach.

Essential entry requirements:
- High competence in Mathematics
- Scientific ability: good grounding in Physics
- Strong motivation

Desirable entry requirements:
- Interest in Biology, Biochemistry or Medicine
- Interest in design
- Interest in problem solving
- Interest in working with others

Skills developed on the course:
- Multidisciplinary thinking
- Analysis and modelling
- Design and design assessment
- Problem solving
- Information technology
- Team-work and communication
- Independent study

Total expected intake: 50
Typical GCE A/AS level points required for entry: 340 (28)
What does this course offer me?

Biomedical engineering is a rapidly changing, interdisciplinary field that applies engineering principles and technology to medical and biological problems. The undergraduate curriculum provides integrated training in science, engineering, and mathematics as preparation for a variety of careers in broad range of areas of engineering, science, health care, and business. The course focuses on providing students with the skills necessary to solve problems that impact a wide range of economic, environmental, ethical, legal, and social issues.

The course provides a broad foundation in physics, mathematics, engineering and medical science and then progresses to more advanced engineering studies that apply the quantitative aspects of engineering analysis and design to a broad range of biomedical problems.

In a rapidly changing technological landscape, one of the most important aspects of engineering is the creation of new approaches and solutions. It should be stressed that the Bioengineering course at Imperial emphasises education in the fundamentals of engineering sciences that form the common basis of all engineering subspecialties. Education with this emphasis is intended to provide students with a solid engineering foundation for a career in which engineering practice may change rapidly.

Our overriding desire is to nurture our students’ innate curiosity, to provide them with a firm scientific and technical foundation and to instil in them the need to continuously upgrade their knowledge and skills throughout life. We want to train and encourage individuals who will be well-positioned to assume a leadership role in a rapidly changing world. The course provides students with the skills necessary to solve problems arising in a wide range of economic, environmental, ethical, legal and social areas.

The course has been designed in close consultation with the Imperial College Medical School. Medical practice is becoming increasingly technological and it is hoped that a number of those who have taken this degree will become graduate entrants to Medical Schools and eventually qualify with the degrees BEng MB BS. Because part of the course is taught conjointly with medical students it is expected that students will be able to take an accelerated route through medical curricula.

Essential Entry Requirements

Mathematical Competence

All engineers must use physical principles in understanding the problems which they are addressing. One major approach is to use mathematical models to describe the processes and systems which they are investigating and to predict their performance. A thorough understanding of mathematics is essential to facilitate this approach. Within the first two years of the course you will develop your mathematical skills, but you must demonstrate a high potential in this area before entering the course.

Scientific Ability

In biomedical engineering you will need to apply an unusually broad range of scientific principles, but, as in all other engineering disciplines an understanding of the basic physical principles is an essential requirement of a successful engineer. As the course progresses, you will acquire expertise in other areas of science including some chemistry, and particularly the biomedical sciences. It is recognised that it is unlikely that you will have studied all sciences to a high level, but it is essential that you have demonstrated proficiency in Physics before embarking on the course.

Strong Motivation

Because of its breadth, the course is designed for the highly motivated individual who wishes to use an engineering education to solve much broader problems than in the more traditional disciplines. In your UCAS form we would like to see evidence of this motivation. You will need to demonstrate success in a wide range of enterprises as well as showing that you are aware of what Biomedical Engineering entails. You are advised to find out about the subject through your own research and preferably by talking to those working in healthcare or engineering or by attending our Open day. The effort involved will be invaluable in deciding whether the course is appropriate for you.

Desirable Entry Requirements

Interest in Biology, Biochemistry or Medicine

This course is unique at Imperial in offering the opportunity to study both engineering science and biomedical science in considerable depth. While the essential entry requirements will demonstrate potential and skills in mathematics and physics you must show that you are keen to learn new areas of science and apply very fundamental principles in them.

Interest in design

The course is highly structured in the first two years, with study of a range of technical subjects which form the scientific background to engineering and medical science. Increasingly though you will need to apply this basic material in the creation of devices and machines which will be useful to
people. The designs must work, be safe and economic to manufacture and operate. An enjoyment of design technology will be a great advantage during the course.

Interest in problem solving
During the course, you will be applying mathematics, science and engineering to solve problems at the interface between engineering and biology. To do this you will be acquiring, analysing and interpreting data from living systems. You will quickly learn that this presents extremely complex problems, much more so than in the traditional engineering disciplines. To be effective you will need to be able to identify clearly the main components of the problem, and then to propose and implement strategies for solving or resolving them. This is the primary skill in project management.

Interest in working with others
Being such a broad field, biomedical engineering invariably needs teamwork. Not only will you find that you are unlikely to develop all the engineering skills to solve the complex problems that medicine presents but you will also have to work with doctors in implementing systems in medical practice. You will also need to understand problems presented by the medical community, and translate them into solvable engineering solutions. Success in these endeavours not only requires good interpersonal skills but you will also need to address ethical, professional and sociological problems associated with the interaction between biological and non-biological systems.

Skills developed on the course

Multidisciplinary thinking
You will be acquiring knowledge and skills across an unusually large range of topics. The ability to integrate these will develop as you progress through the course. On graduation you will be highly qualified to tackle the most complex issues in whatever field you wish to develop your career.

Analysis and modelling
Using the basic mathematical and engineering training given in the early part of the course, you will progress in the later years to model and analyse the behaviour of body systems in health and disease. Such analysis requires an understanding of the human body but also interactions of individuals with the environment, including the population of which he or she is a part. You will also need to apply these techniques to the increasing range of technologies that are being exploited in diagnosis and treatment.

Design and design assessment
If the engineer is to make an effective contribution to the biomedical sciences he or she will need to find effective solutions to very complex problems, involving many diverse and often conflicting requirements. A scientific approach to design specification and optimisation, with the powers of lateral thinking to imagine what could go wrong and hence minimise the possible effects are very useful attributes in a bioengineer. Many design constraints may conflict with each other and these may turn out to be very surprising. For example, a design which works effectively in the laboratory during development may prove to have poor patient compliance. These specific problems for the bioengineer may be additional to the more obvious ones of safety, economy and efficiency.

Problem solving
During the course you will increasingly be presented with assignments either individually or in groups, which will develop your problem solving skills. Initially these will be fairly direct applications of analytical methods to predict performance of the body or biomedical equipment under given sets of conditions, but later the constraints will be less structured, and various solutions could be considered. The final year project will give you a chance to manage a long-term assignment with guidance from a supervisor.

Information technology
Computing is becoming increasingly important in the field of healthcare. Modern medical equipment uses very sophisticated hardware and software in a wide range of applications from the acquisition and processing of medical images for optimal clinical diagnosis to expert systems for interrogating and interpreting the data obtained during clinical monitoring. Additionally software is being applied to manage information with which the medical sector is in danger of being overloaded. During the course you will acquire knowledge about how these systems are being implemented and the skills to incorporate them in your own designs.

Team work and communication
Because of the need for the bioengineer to interact with others including other engineers, doctors, manufacturers, sales and maintenance representatives and customers you will need to develop the skills to optimise these interactions. You will be working in small teams on various projects, enabling you to experience group dynamics and inter-personal relationships while solving problems. It will also give you practice at planning and controlling small group activity will also develop your inter-personal skills. During the course, you will be expected to write and speak effectively to address both technical and non-technical audiences.

Independent study
In a world of change you will not obtain all the knowledge which you may possibly require for your whole career during your time at University. However you will learn how to study with minimum
help, and to find out for yourself, by reading, searching publications and papers, and by research. These skills will enable you to add to your knowledge and skills whenever you need to in the future.

**Entry Routes**

A levels and AS

Full A-level Mathematics is a pre-requisite. In addition, A-Level Physics is customarily required for entry. In the absence of Physics, we would require very strong grades in two complimentary subjects, such as Further Maths, Mechanics, Chemistry, Biology or Computing. We would accept 2 AS in place of the third full A-level with Chemistry and Biology being particularly useful. Overall you must have achieved very high grades, normally AAB at A-level or the equivalent.

Scottish Qualifications

We require CSYS in Maths and Physics at Grade A, together with a third subject at grade B.

International Baccalaureate

We require at least 36 points overall, with 7, 6, 6 at Higher Level, including Maths and Physics.

European Baccalaureate

We require Maths and Physics at >80%, with an overall mark of 70%

International Applications

We accept French Baccalaureate, German Abitur, Italian Maturitá, and equivalent degrees with good grades in Maths and Physics. Other qualifications will be considered on an individual basis. Please contact the Admissions tutor to discuss your case.

Irish Leaving Certificate

We require Maths and Applied Maths at Grade A, Physics at Grade A, all at higher level.

Mature applicants

We will consider mature applicants on an individual basis. However, you will still have to pass our exams and hence be able to demonstrate a high level of ability in both Maths and Physics.

**Course Options**

Three years of the course are identical for all students, providing the background engineering science and design skills as a foundation for the advanced studies in bioengineering. Those working towards the MEng (BH9C) will take an additional year gaining additional proficiency in one of the traditional engineering disciplines. This will be essential for those who wish to proceed to Chartered Engineer status.

All students are required to take a module in Management studies or the Humanities. The range of options is considerable.

**Student Activities**

Life at University is not all study, and Imperial College Student Union has a very large number of clubs and societies. In addition you will be a member of London University Student Union. There are several clubs which relate to engineering which runs a series of events for students during the year.

**Careers**

Graduates of this course will be very well equipped for employment in the growing industrial sector devoted to health care, which includes pharmaceuticals, medical devices, artificial organs, prosthetics and sensory aids, diagnostics, medical instrumentation, and medical imaging. Employment will also be available in hospitals and clinics, research institutes and in government or other public organisations concerned with regulation of medical materials and equipment.

Because of the breadth and the multidisciplinary nature of the course graduates will be welcomed in many commercial areas, where analytical and problem solving skills may be useful for a very wide range of applications.