

Introduction

The taught MSc Biotechnology programme is designed to provide training and experience in Biotechnology. It is driven by the latest commercial and research advances in the field.

Students have the opportunity to learn from experienced academic researchers. The aim of the course is to produce scientists who will be able to contribute to a range of career opportunities including academic, commercial, industrial and healthcare applications of biotechnology. The MSc qualification will also be an excellent foundation for those wishing to pursue further studies leading to a PhD.

This course starts in October and is one year, full-time.

Programme outline

The programme is based around a core of nine modules and a research project that provide experience in key areas of biotechnology. Elements of the programme include:

- > research skills and methodologies;
- > cell culture; stem cell biology; tissue engineering; bioinformatics
- > protein engineering; bioreactors and enzyme technology related to commercial applications

Introductory Molecular Biology

Students join the course with a diverse background of skills. Early in the course, this module aims to ensure that all students have knowledge of the nature and properties of nucleic acids and proteins and understand how these molecules work together in gene expression and DNA replication. The module also provides an introduction to basic techniques used in Molecular Biology, such as gene cloning and PCR. Within the module, basic level chemistry is used to explain how the structure of these biological macromolecules results in their activities. Where appropriate, experimental evidence will be

provided to demonstrate how our current knowledge was derived. Emphasis will be placed on the fact that molecular biology is still an experimental science.

Cell Culture

This module will focus on the central technique of cell culture. In particular, the basic techniques are described in detail with an introduction to animal cell culture, applications of animal cell culture and genetically engineered animal cells in culture followed by discussions of their application to both biological research and industry. The course includes cell culture experiments designed to show the importance of serum in cell maintenance and involving most aspects of the technique: aseptic methods, use of medium, passaging and cell counting.

Protein Engineering and Production

This module contains in-depth explanations of protein engineering, protein production techniques and their applications. You will learn how and why we modify native proteins to make something new. Knowledge of techniques for gene cloning, site-directed mutagenesis and generation/purification of recombinant proteins and how to engineer those proteins will be gained. You will also get an overview of genomics, proteomics, transcriptomics and bioinformatics and an insight into how these disciplines could fit together to interpret data from whole genomes.

Enzyme Technology

This module will provide an overview of the different type of enzymes and their kinetics, to reinforce and add to the students' knowledge and understanding. An in-depth description of the applications of enzymes in a variety of commercial situations will provide a full and balanced summary of the current state of the art. This will be supported by laboratory-based practicals that will demonstrate some of the key elements of enzymatic catalysis. The module will close with a discussion of possible future technologies.

Stem Cell & Tissue Engineering Technologies

Stem cell and tissue engineering technologies are in a phase of exponential growth in biological and biomedical research and industry. The potential is enormous, which was recognised in 2012 with the award of the Nobel Prize in Physiology or Medicine to Shinya Yamanaka and John Gurdon. The aim of this module is to enable students to develop a clear understanding of key concepts and knowledge within this area, including: (i) the nature of stem cells and their generation/culture; (ii) the underlying principles of tissue engineering; (iii) the ways in which stem cells and tissue engineering can be used as research tools, in drug discovery/screening and in regenerative medicine. Various examples of the application of stem cell and tissue engineering technologies will be considered in detail to explore these concepts. The challenges faced by the use of stem cells and tissue engineering in the emerging industry of Regenerative Medicine will be explored, in particular; this will include practical issues associated with their large scale production. The module is assessed by essay and examination.

Fermentation/Bioreactors

This module contains in-depth explanations of bioreactor technologies and their applications. You will learn how and why we use bioreactors to grow cells. You will also get an overview of the critical parameters in designing and monitoring cell culture experiments in modern bioreactors.

Bioinformatics

This module emphasizes a practical knowledge of bioinformatics. The lectures and computer-based assignments will develop your competence in using the public databases of the NCBI/EBI. You will execute and interpret pairwise and multiple sequence alignments. Your knowledge gained in the assignments will be consolidated in group discussions. The application of bioinformatics to common biological/biotechnological questions will be explored through primary papers and student presentations. Basic principles of eukaryotic molecular biology will be reviewed as needed.

Research Methods

This module includes the following: critical analysis of published work, reviewing papers; writing abstracts, writing research papers, preparing poster presentations and oral presentation skills.

Research Project

Here, you will undertake an individual research project involving data production, processing and analysis. The project involves experiential learning (usually in a laboratory setting), completion of a comprehensive literature review appropriate to the individual project and preparation of both a detailed final project report (mini-thesis) and a conference-type poster to illustrate the main findings from the project to an audience of fellow students and staff.

Assessment

The course is assessed by a combination of coursework, examinations, practical work, oral and written presentations. The research project is assessed on the basis of the written project and a poster presentation.

Entry requirements

The course is open to suitably qualified international and UK graduates.

Potential students must hold a least a 2nd class honours degree in biochemistry, biotechnology, biology, chemistry, chemical engineering, genetics, materials science, medicine, microbiology, or a related field, from a recognised university or an overseas degree recognized by Aston University, plus two references.

Students whose first language is not English must demonstrate a satisfactory command of written and spoken English. For International students this is demonstrated by an IELTS score of 6.5 or higher overall, but with no score below a 6.0.

Fee & financial support

Please refer to our web site for the current fee and financial support information.

Course director

Professor Roslyn Bill

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