

MRes in Medical & Molecular Biosciences

Protein structure and function

Module code CMB8001
Module leader: Prof. Harry J. Gilbert
Semester taught: 1

Teaching staff:

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General Introduction

Proteins play a pivotal role in cellular function. They catalyse virtually all biologically significant chemical reactions, impart cellular structural integrity, mediate signal transduction, transport solutes across membranes, modulate gene expression and regulate cellular metal ion homeostasis. Our capacity to study the function of proteins has been revolutionized by major technical advances in both molecular biology and protein characterization. For example, genome sequencing programmes have revealed the complete protein repertoire of hundreds of organisms, demonstrating remarkable conservation across the complete phylogenetic landscape while revealing large numbers of proteins of unknown function. One of the key challenges facing scientists in the postgenomic era is making sense of the proteome of both prokaryotes and eukaryotes. With advances in protein expression strategies we are now able to produce large amounts of virtually all proteins which, coupled with recent developments in 3D structural determination, is resulting in a rapid expansion in crystal and solution structures of these macromolecules, which is central to dissecting their mechanism of action. There have also been major advances in analytical protein chemistry facilitating the analysis of protein complexes, protein-ligand interactions and using mass spectrometry to rapidly identify proteins in complex mixtures. As in all biologically based research centres, the Medical School, and the Institute for Cell and Molecular Biosciences in particular, is actively engaged in dissecting the mechanism of action and functional significance of an array of different proteins, providing an excellent platform on which to develop the postgraduate skill base in this important area of biology. The module is designed to provide students with a detailed understanding of the molecular structure of proteins and how such information contributes to our understanding of the function of these macromolecules. The course will also provide insight into the cellular context of proteins with respect to their macromolecular organisation and their contribution to cellular function.

The module will draw upon the specialized research expertise of academic staff within the Faculty of Medical Sciences. It will provide a strong platform for those students who wish to pursue a research career that focuses on the structure and function of proteins.

Aims:

- To inform students in the relationship between protein structure and function
- To provide insight into how the cellular function of proteins can be dissected.
- To understand the mechanism by which enzymes catalyse chemical reactions.
- To understand how proteins are able to assemble into macromolecular complexes and the functional significance of these structures.
- To understand how proteins recognise metal ions and the cellular significance of these protein-ligand interactions.

Syllabus

- Understanding the biological degradation of complex macromolecular insoluble substrates
- Providing insight into the cellular role and mechanism of action of proteins that interact with nucleic acids
- Understanding the mechanism and functional significance of metal-protein interactions
- Proteins as virulence factors
- The role of proteins in response to environmental stress

Learning outcomes

At the completion of the module the student will:

- Display an understanding of the structure and function of a range of proteins.
- Appreciate the impact recent developments in structural biology and analytical chemistry is having on our understanding of protein structure and function.
- Be able to appraise critically data on protein structure and function.
- Be able to evaluate the significance of, and key elements within, papers that dissect the structure and function of proteins.