Engineering Tripos Part IIA, 3G1: Introduction to Molecular Bioengineering, 2019-20

Module Leader

Dr G Micklem [1]

Lecturers

Dr G Micklem, Dr C Gilbert, Dr D Dikicioglu

Lab Leader

Dr G Micklem [1]

Timing and Structure

Michaelmas term. 16 lectures, 1 laboratory class. This is an intensive introductory level undergraduate course targeted at third year Engineering students. This course will be delivered through lectures and a laboratory class.

Aims

The aims of the course are to:

- Provide a basic grounding in key aspects of molecular bioscience with an emphasis on biomolecular engineering.

Objectives

As specific objectives, by the end of the course students should be able to:

- To understand the potential of engineering living systems
- To understand key common features of living systems
- To have a basic understanding of cellular metabolism and examples of metabolic engineering
- To understand the basics of gene control and expression, concentrating on systems more commonly used in biotechnology
- To have basic knowledge of what is feasible with genetic engineering, the key underlying technology and case studies
- To understand the impact of the latest methods of genome sequencing, genome analysis, and genome-scale experimental methods including perturbation studies
- To have been introduced to the emerging field of synthetic biology that aims to rationally engineer biological systems
- Through the lab, to have direct experience of some basic experimental techniques

Content

This course will introduce those elements of molecular biology that are relevant to further study in bioscience and engineering applications.

- Common features of living systems
- Cellular structure and metabolism
- Metabolic engineering
- Key experimental methods
- Genetic Engineering
- Genome sequencing, genomics and key computational methods
- Synthetic Biology

The structure of the course will be as follows.

- Lectures 1-3 - Overview/introduction - why engineer living systems? Life: cells to organisms
- Lectures 4-5 - Central dogma of molecular biology, Gene regulation
- Lectures 6-7 - Genetic engineering I: basic parts, methods and terminology
- Lectures 8-9 - Genetic engineering II: further methods cases studies
- Lectures 10-12 - Cellular metabolism, catabolism/ anabolism, core molecular types, metabolic engineering, principles and case studies
- Lectures 13-15 - Genomics, genome sequencing/annotation/key computational methods, functional studies, gene expression/ regulatory networks, perturbation studies
- Lecture 16 - Synthetic biology

Coursework

Laboratory Practical

Learning objectives:

- To have had some experience of working in a biology laboratory, including consideration of safety issues.
- To have learned some basic biology laboratory techniques.
- To have gained experience in analysing and interpreting the data produced.

Practical information:

- The lab will run twice, on the Fridays following the 5th and 7th lectures, in the Department of Plant Sciences Teaching Laboratory: https://map.cam.ac.uk/Department+of+Plant+Sciences#52.202590,0.121337,18 [2]
- This activity involves preliminary work (~1hour) and completing an online test in advance of the lab. The test will be available through Moodle.

Full Technical Report:

There is no Full Technical Report (FTR) associated with this module.

Booklists

Please see the Booklist for Part IIA Courses [3] for references for this module

Examination Guidelines

Please refer to Form & conduct of the examinations [4].

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Links
[1] mailto:gm263@cam.ac.uk
[2] https://map.cam.ac.uk/Department+of+Plant+Sciences#52.202590,0.121337,18
[3] https://www.vle.cam.ac.uk/mod/book/view.php?id=364091&chapterid=48991
[4] https://teaching.eng.cam.ac.uk/content/form-conduct-examinations