Engineering Tripos Part IIA, 3G1: Molecular Bioengineering I, 2022-23

Module Leader

Prof. G Micklem [1]

Lecturers

Prof. G Micklem, Dr S Bakshi

Lab Leader

Prof. G Micklem [1]

Timing and Structure

Michaelmas term. 16 lectures, 1 computational laboratory class. This is an intensive introductory level undergraduate course targeted at third year Engineering students.

Prerequisites

None

Aims

The aims of the course are to:

- provide a basic grounding in biomolecular engineering along with underpinning molecular biology.
- increase awareness for the opportunities for bioengineering within modern biology.
- have enough background knowledge and familiarity with the terminology to be able to play a productive role collaborating with biologists.

Objectives

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

- appreciate the potential of engineering living systems
- appreciate the capabilities of applying evolution in a laboratory setting
- understand the fundamental molecules and processes required for gene expression and replication
- understand gene structure and regulation in simple organisms
- understand what is feasible with genetic engineering, and the underpinning molecular techniques
- design synthetic genetic circuits: understanding basic mathematical and molecular biological frameworks
- design synthetic genetic circuits: living systems vs cell-free systems
- understand the latest technologies for genome sequencing, genome analysis, and genome-scale experimental methods
- appreciate DNA as a construction material for information storage and other applications

Content

The structure of the course will be as follows.

Lectures 1-5 (GM): Evolution; genetic information; molecular cloning, DNA amplification; example applications

Lectures 6-12 (SB): Gene expression and regulation; circuit design, construction and characterisation; noise; cell-free systems

Lectures 13-16 (GM): Genomes, genome sequencing and transcriptomics; sequence alignment; sequencing applications; DNA for construction and data storage; DNA dynamics

Further notes

Normal teaching 2022-2023

We hope that this year all teaching and activities will take place as they were before the pandemic. Please be respectful of any individuals who still need to wear masks.

Labs: the lab will be held in person in a lecture room and carried out on your own laptops - please ensure they are charged.

Recordings: the terms under which the University provides recordings means that they are strictly for your personal use only and should not be distributed further in any form.

Examples papers

See the course Moodle site

Coursework

Laboratory Practical - the lab is computational and will concern the design of a COVID-19 test and vaccine.

Learning objectives:

- To become familiar with basic tools for viewing nucleic acid sequences
- To consider the overall workflow for a PCR-based virus test and design the necessary primer sequences
- To consider the overall workflow for generation of a fusion protein and to design the necessary sequences

Practical information:

- Preliminary work (~1hour) and completing an online test in advance of the lab will be worth 1 point. The test will be available through Moodle.

Full Technical Report:

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

Booklists

Please refer to the Booklist for Part IIA Courses for references to this module, this can be found on the associated Moodle course.

Examination Guidelines

Please refer to Form & conduct of the examinations [2].

Last modified: 05/10/2022 19:52

Links
[1] mailto:gm263@cam.ac.uk
[2] https://teaching24-25.eng.cam.ac.uk/content/form-conduct-examinations