# Engineering Tripos Part IIA, 3G5: Biomaterials, 2019-20

### Module Leader

Dr AE Markaki [1]

### Lecturers

Dr R Daly, Dr AE Markaki, Dr T Savin & Dr M Birch

### lab Leader

Dr N Fox [2]

### Timing and Structure

Michaelmas term. 16 lectures.

## Aims

The aims of the course are to:

- Develop an understanding of the materials issues associated with man-made and naturally-derived materials for medical purposes. Specific case studies will be considered in addition to the general framework.

## Objectives

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

- Identify the mechanism by which medical devices and implants come to market.
- Know about the classes of materials used in medical materials and the associated reasons.
- Understand the requirements for materials used in the body and assess potential for implant-body interactions.
- Perform quantitative evaluations of drug delivery.
- Identify appropriate implants and tissue engineering approaches for tissue and body function replacements.
- Understand bioethics and safety regulations associated with medical devices and implants.

## Content

**Course overview with introduction to biomaterials and medical devices (1L)**

- Medical devices detailed definitions and classifications
- Classes of biomaterials overview
- Biocompatibility

**Bioethics and Material Sterilisation (1L)**

- Origins of bioethics and contemporary challenges
- Definitions, techniques and metrology

**Sector Analysis and Regulatory Affairs (1L)**

- Areas of growth, market values
- Market trends
- Role of standards
- Approval process

**Personalised Medicine and Future Technologies (1L)**

- Personalised medinine
- Basic introduction to tissue engineering
- Advanced and nanotechnology

**Orthopaedic Implants - Hip Replacement (1.5L)**

- Types of implant fixation
- Materials in hip implants
- Surface engineering approaches
- *In vivo* loading of hip joint

**Cardiovascular Stents (2.5L)**

- Balloon expandable & self expanding stents
- Materials in ?stents
- Stent mechanics and design

**Synthetic polymers for tissue engineering applications (2L)**

- Introduction to polymers
- Synthetic biodegradable polymers

**Host response to implants (1L)**

- Wound repair
- Innate immunity
- The biological response to biomaterials

**Using cells in tissue engineering (1L)**

- What happens when biomaterials fail
- Cell therapy
- Combining cells with scaffolds
- Working with biology - implant integration and vascularisation

**Naturally derived polymers for tissue engineering application (1L)**

**Drug delivery and diffusion (2L)**

- Drug delivery systems
- Diffusion controlled systems in drug delivery

## Further notes

## Examples papers

Example papers are available on Moodle.

## Coursework

Full Technical Report:

Students will not have the option to submit a Full Technical Report.

## Booklists

Biomedical Engineering: Bridging Medicine and Technology by W. Mark Saltzman

Biomaterial Science: An Introduction to Materials in Medicine. Edited by Ratner et al.

## Examination Guidelines

Please refer to Form & conduct of the examinations [3].

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**Links**
[1] mailto:am253@cam.ac.uk
[2] mailto:ndwf2@cam.ac.uk
[3] https://teaching24-25.eng.cam.ac.uk/content/form-conduct-examinations