

## **Engineering Tripos Part IIA, 3G5: Biomaterials, 2022-23**

### **Module Leader**

[Prof S Huang](#) [1]

### **Lecturers**

Prof S Huang, Prof A Markaki, Prof R Daly

### **lab Leader**

Prof A Markaki

### **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 medicine
- Basic introduction to tissue engineering
- Advanced nanotechnology

### **Synthetic polymers for biomedical applications (2L)**

- Introduction to polymers
- Synthetic biodegradable polymers

### **Naturally derived polymers and hydrogels (1L)**

- Naturally derived polymers
- Hydrogels

### **Tissue engineering (1L)**

- General concepts of tissue engineering
- Combining cells with scaffolds
- Implant integration and vascularisation

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

- Drug delivery systems
- Diffusion controlled systems in drug delivery
- General strategies for drug delivery

### **Biological response to implants (2L+Q&A)**

- Wound healing
- Biological response to biomaterials

### **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

### **Further notes**

### **Examples papers**

Example papers are available on Moodle.

### Coursework

#### Full Technical Report:

There is no FTR for this lab

### 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](#) [2].

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### Links

[1] <mailto:yysh2@cam.ac.uk>

[2] <https://teaching22-23.eng.cam.ac.uk/content/form-conduct-examinations>