Engineering Tripos Part IIA, 3G5: Biomaterials, 2020-21

Module Leader

Dr S Huang [1]

Lecturers

Dr S Huang [1]

lab Leader

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

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) + Q&A (1L)

- Drug delivery systems
- Diffusion controlled systems in drug delivery

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:

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 [2].

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Links
[1] mailto:yysh2@cam.ac.uk
[2] http://teaching.eng.cam.ac.uk/content/form-conduct-examinations