

LF910-10 Regenerative Medicine

23/24

Department

Life Sciences

Level

Taught Postgraduate Level

Module leader

Andrew Nelson

Credit value

10

Module duration

2 weeks

Assessment

100% coursework

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This module introduces the students to the scientific principles underpinning the application of biotechnology to the medical sector.

[Module web page](#)

Module aims

The focus is on design and development of stem cell-based approaches, translation of fundamental developmental biology to therapeutic endpoints, use of functional biomaterials, and tissue engineering. The aim is to give the students a clear understanding of regenerative medicine and the role of biotechnology in this context.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Regenerative medicine is a branch of translational research aimed at restoring or establishing normal tissue function through artificially stimulating cell regeneration, or direct replacement with

engineered cells and tissues. This module will cover the pivotal concepts underpinning the discipline. It will be taught through presentation and discussion of fundamental concepts and illustrative case studies, allowing the student to apply the knowledge gained across other areas of regenerative medicine.

Specific areas covered include:

1. Introduction of stem cell biology
 - a. Embryonic stem cell derivation and maintenance
 - b. Adult stem cells including mesenchymal stem cells
 - c. Reprogramming of induced pluripotent stem cells
2. Reprogramming and differentiation of cells for therapeutic application
 - a. Design and implementation of directed differentiation
 - b. Transdifferentiation through transcription factor-based cell reprogramming
3. Patient-specific disease modelling and therapy
 - a. Use of patient-specific stem cells for drug screening for regenerative outcomes
 - b. Correction of genetic mutations followed by tissue replacement
4. Natural tissue regeneration in animals
 - a. Analysis of tissue regeneration in other vertebrates
 - b. Pre-clinical application of knowledge gained from study of animal tissue regeneration
5. Tissue organisation and maintenance
 - a. Cell interactions with other cells and their environment
 - b. Properties and epithelia and other tissue components
 - c. Consequences of loss of tissue organisation
6. Tissue Engineering
 - a. 3D bioprinting
 - b. Tissue assembly
 - c. Selection and application of biomaterials
7. Bioethics and regulation
 - a. Regulation of Human Subject Research
 - b. Informed consent, use of human material and data

Learning outcomes

By the end of the module, students should be able to:

- Identify the advantages and disadvantages, issues and potential of the use of biomaterials, stem cells and engineered tissue in regenerative medicine.
- Demonstrate an understanding of the scientific principles and attendant biotechnological techniques being exploited in the use of biomaterials, stem cells and engineered tissues in regenerative medicine.
- Discuss the issues and problems in the clinical application of stem cells and engineered tissues.
- Interact effectively with peers and academics on the validation/implementation of stem cells

and engineered tissues via written and visual means.

- Discuss the application of patient-specific stem cells to regenerative medicine via drug development, and/or correction of genetic mutation based on a critical assessment of the known data.

Indicative reading list

Regenerative Biology and Medicine 2nd Edition. D.L. Stocum. Elsevier (2012) ISBN 9780123848604

Comprehensive Biotechnology 2nd edition Editor: Murray Moo-Young; Volume 5 Editor Zhanfeng Cui. Elsevier (2011) ISBN 978-0-44-453352-4

Biotechnology: Applying the Genetic Revolution. D.P. Clark and N.J. Pazdernik. Elsevier (2009) ISBN 13: 978-0-12-175552-2

Biology and Biotechnology: Science, applications and issues. H. Kreuzer and A. Massey. ASM Press (2005) ISBN 1-55581-304-6

Specific articles in the scientific literature.

[View reading list on Talis Aspire](#)

Subject specific skills

Identify the advantages and disadvantages, issues and potential of the use of biomaterials, stem cells and engineered tissue in regenerative medicine.

Demonstrate an understanding of the scientific principles and attendant biotechnological techniques being exploited in the use of biomaterials, stem cells and engineered tissues in regenerative medicine.

Discuss the issues and problems in the clinical application of stem cells and engineered tissues.

Interact effectively with peers and academics on the validation/implementation of stem cells and engineered tissues via oral, written and visual means.

Discuss the application of patient-specific stem cells to regenerative medicine via drug development, and/or correction of genetic mutation based on a critical assessment of the known data.

Transferable skills

Interact effectively with peers and academics on

Study

Study time

Type	Required
Lectures	15 sessions of 1 hour (15%)
Seminars	(0%)
Practical classes	(0%)
Other activity	6 hours (6%)
Private study	49 hours (49%)
Assessment	30 hours (30%)
Total	100 hours

Private study description

Independent and group research

Other activity description

Workshops on:

1. Ethics and Responsible Innovation
2. Approach to assessment - alternative approaches to the same regenerative medicine problem

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group AF

	Weighting	Study time	Eligible for self-certification
Critical analysis of alternative approaches to tackle the same regenerative medicine challenge	100%	30 hours	Yes (extension)

Individual written assignment where the students will critically analyse two different approaches to addressing the same regenerative medicine problem of their choice, and provide a reasoned

Weighting

Study time

**Eligible for self-
certification**

justification for the approach they would choose to pursue through a hypothetical biotechnology startup.

Feedback on assessment

Written individual feedback to each student. Face-to-face feedback on request from the student.

Availability

Courses

This module is Core for:

- Year 1 of TLFS-J7N2 Postgraduate Medical Biotechnology and Business Management