

Module Code	ME5BIO3
Module Name	Tissue Engineering
ECTS Weighting	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof Daniel Kelly
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	<p>On successful completion of this module, students should have an:</p> <p>LO1. Understanding of the fundamental principles of tissue engineering</p> <p>LO2. Understanding of stem cells and animal/human cell culture processes</p> <p>LO3. Awareness of current “state of the art”, emerging technologies and advances in the field</p> <p>LO4. Ability to understand biological processes and apply this knowledge to tissue engineering and regenerative medicine</p> <p>LO5. Ability to integrate the knowledge on biomaterial fundamentals and cell and tissue biology toward the development of biomedical applications</p> <p>LO6. Ability to identify, formulate and adapt engineering solutions to unmet biological needs</p> <p>LO7. Ability to analyse biological systems as engineering systems</p> <p>LO8. Understanding and knowledge of the commercial market and the regulatory hurdles in tissue engineering</p> <p>LO9. Appreciation of ethical issues and considerations for regenerative medicine</p> <p>LO10. Ability to present a complex topic in tissue regeneration to a wide audience</p> <p>Graduate Attributes: levels of attainment</p> <p>To act responsibly - Enhanced</p> <p>To think independently - Enhanced</p> <p>To develop continuously - Enhanced</p> <p>To communicate effectively - Enhanced</p>

Module Content

This module builds upon MEU44BM6/ME5M20 Biomaterials, with the explicit objective to provide students with extensive knowledge on the fundamentals, enabling technologies and applications to generate new tissues through the combination of cells, biocompatible materials and suitable biochemical and biophysical factors to improve or replace biological functions that have been compromised through disease. An overview of contemporary approaches to tissue and cell engineering will be given, including stem cells, tissue scaffold design, use of bioreactors in tissue engineering, and molecular surface modifications for integration of engineered tissues in situ. Ethical considerations related to clinical application of tissue and cell engineering technology will also be explored. Topics covered include: Fundamental Principles of Tissue Engineering, Stem Cells for Tissue Engineering, Cell Culture for Tissue Engineering, Cell Manufacturing, Scaffolds for Tissue Based Repair, Decellularised Matrices, Bioprinting, Bioreactor Systems and Design, Diffusion & Nutrient Transport Limitations in Tissue Engineered Constructs, Mechanobiology- Response of Cells to Mechanical Forces, Cartilage Tissue Engineering & Regeneration, Bone Tissue Engineering, Cardiovascular Tissue Engineering, Corneal Tissue Engineering and Replacement, Tissue Engineering of the Intervertebral Disc (IVD), Ethical Issues and Considerations for Tissue Engineering.

Teaching and Learning Methods

The module is taught using a combination of lectures and assignment. Students are tasked with an independent or group learning assignment to research a specific area in the field of tissue engineering and regenerative medicine which introduces the student to research skills necessary for life-long learning.

Assessment Details Please include the following: <ul style="list-style-type: none"> • Assessment Component • Assessment description • Learning Outcome(s) addressed • % of total • Assessment due date 	Assessment Component	Assessment Description	LO Addressed	% of total	Week due			
	Short test	Online/In-class test on lecture material covered in the first 5 weeks	1-5	10	27			
	Independent/Group Assignment	Students are tasked with an independent or group learning assignment to research a specific area in the field of tissue engineering and regenerative medicine	1,3,10	15	29			
	Written Examination	Timetabled semester 2 examination	1-9	75	End of Semester 2			
Reassessment Requirements	There is no reassessment for MAI/MSc							
Contact Hours and Indicative Student Workload	<table border="1"> <tr> <td>Contact hours: 30 lecture hours</td> </tr> <tr> <td>Independent Study (preparation for course and review of materials): 70 hours</td> </tr> <tr> <td>Independent Study (preparation for assessment, incl. completion of assessment): 25 hours</td> </tr> </table>					Contact hours: 30 lecture hours	Independent Study (preparation for course and review of materials): 70 hours	Independent Study (preparation for assessment, incl. completion of assessment): 25 hours
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Recommended Reading List	<ul style="list-style-type: none"> ▪ Tissue Engineering, van Blitterswijk & de Boer, 2nd edition, (Elsevier) ▪ Principles of Tissue Engineering, 4th Edition, Lanza, Langer & Vacanti, 2013 (Elsevier) ▪ Tissue Engineering, Palsson & Bhatia, 2004, (Pearson Prentice Hall) 							
Module Pre-requisite	MEU44BM6							
Module Co-requisite	ME5M20 (If MEU44BM6 has not been taken previously)							
COVID contingency plan	If necessary, all lectures will be conducted online and assessments will be a mix of online examinations and continuous assessment.							
Module Website	https://www.tcd.ie/Engineering/undergraduate/maiyear5/biomedical/							

Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.

n/a

Module Approval Date

27/08/21

Approved by

Daniel Kelly

Academic Start Year

2021

Academic Year of Date

2022