



Universidad de Navarra

# INGENIERÍA DE TEJIDOS Y MEDICINA REGENERATIVA

## TISSUE ENGINEERING AND REGENERATIVE MEDICINE

### Datos de la asignatura

- Titulación: **Máster Oficial en Ingeniería Biomédica**
- Departamento: **Ingeniería de Materiales**
- Periodo: **Septiembre a Diciembre**
- Número de créditos ECTS: **3**
- Numero de horas de trabajo del alumno: **75-90**
- Profesores que la imparten: **Dr. Elena de Juan Pardo y Dr. Felipe Prósper Cardoso**
- Tipo de asignatura: **optativa**
- Idioma en que se imparte: **inglés**

### Objetivos de la asignatura

Tissue Engineering is an interdisciplinary field that applies engineering, biological and medical principles in search of regeneration of tissue functions. Understanding cell function in response to environmental cues will help us to establish design criteria and engineering tools for tissue fabrication.

Lectures will be based on the reference books and recent literature. Literature research will be assigned in Discussion and Homework. Homework includes quantitative analysis, essay questions and reviews of research papers. There will be 2 midterms (written test) and an independent final project (presentation and paper). The topic will be chosen by each student and approved by the instructor. Discussion sections will include reviews of current literature and issues related to course content, homework, exams and projects.

#### **Objectives:**

- 1) To introduce the basics of tissue engineering, including cell-matrix interaction, cell migration and growth, stem cells, mechanical regulation, bioreactors, tissue preservation and immuno-modulation/isolation
- 2) To introduce the state-of-the-art in tissue engineering
- 3) To enhance the skills in analyzing and designing engineered tissue products

### Evaluación

Discussion:	5% presentation, 5% participation, 5% paper
Homework:	15%
Midterm#1:	20%
Midterm#2:	20%
Final Project:	10% presentation, 10% participation, 10% paper

## Programa de la asignatura

1. Course overview and introduction
2. Organization of Cells into Higher Ordered Structures

### I. Cell-ECM Interactions

3. Extracellular matrices (ECMs) and cell binding domains
4. Mechanical properties of ECMs
5. Cell adhesion, micropatterning and cell functions
6. Cell adhesion force
7. Cell migration: migration model
8. Cell migration: environmental cues
9. Midterm#1

### II. Key Issues in Cell and Tissue Engineering

10. Cell-cell communication and tissue maintenance
11. Cell sources for tissue engineering: stem cells
12. Mechanical regulation of cell functions
13. Bioreactors
14. Tissue preservation
15. Immuno-modulation/isolation
16. Growth factor delivery
17. Gene delivery
18. Midterm#2

### III. Case Studies

19. Artificial blood vessels
20. Angiogenesis and microvascular design
21. Artificial blood
22. Cardiac prostheses
23. Nerve regeneration
24. Bone repair
25. Artificial liver
26. Review
27. Project presentations
28. Project presentations
29. Project presentations
30. Project presentations
31. Final paper due

## Bibliografía

1. Lanza, RP, Langer, R and Vacanti, JP, "Principles of Tissue Engineering", Academic Press (2000), ISBN 0124366309
2. Bronzinno, J, "The Biomedical Engineering Handbook", CRC and IEEE Press (2000), ISBN 084930461X
3. Alberts, B et al, "Essential Cell Biology", Garland Pub (1997) ISBN 0815320450

4. Fung, YC, "Biomechanics-Mechanical Properties of Living Tissue", Springer-Verlag New York Inc (1993) ISBN 0387979476