

69705 - Scaffolds and tissue engineering

Syllabus Information

Academic year: 2023/24

Subject: 69705 - Scaffolds and tissue engineering

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 633 - Master's Degree in Biomedical Engineering

ECTS: 3.0

Year:

Semester: Second semester

Subject type: Optional

Module:

1. General information

The objective of the *Tissue Engineering and Scaffolding* subject is to provide the student with the necessary skills to analyse and design different strategies for tissue regeneration based on tissue engineering. The subject focuses on providing the student with a set of basic knowledge that will allow them to understand how tissues regenerate. The study and analysis of the function and properties of scaffolds, as well as their manufacturing processes, will be studied in depth. The mechanisms of interaction between cells and scaffolds will be analysed. Finally, some situations of clinical interest will be presented.

These approaches and objectives are aligned with some of the SDGs of the 2030 Agenda: SDG 3 (Objective 3.6) and Goal 9 (Objective 9.5).

2. Learning results

- To know the different cell types that can be used in tissue engineering.
- To know different cell culture strategies.
- To be familiar with the different types of biomaterials used for the fabrication of scaffolds in different applications.
- To understand the different scaffolding bio-manufacturing processes.
- To know the different families of growth factors commonly used in tissue engineering.
- To estimate and quantify the mechanical properties of scaffolds as a function of their microstructure and the base biomaterial.
- To understand the regulatory role of microenvironmental factors in cell behaviour.
- To know what a bioreactor is, what elements compose it and what they are used for.
- To know what an organoid is and what it is used for.

3. Syllabus

Lesson 1. Introduction to tissue engineering

Lesson 2. Tissue mechanobiology

Lesson 3. Cellular mechanobiology

Lesson 4. Fabric engineering scaffolding

Lesson 5. Cellular processes and interaction with synthetic materials

Lesson 6. Mass transport (nutrients and metabolites: vascularization).

Lesson 7. Use of cells and other regulators in tissue engineering

Lesson 8. Bioreactors

Lesson 9. Organoids

Lesson 10. Computational modelling of the mechanobiological behaviour of scaffolds and their interaction with tissues.

Lesson 11. 3D printing and bioprinting

4. Academic activities

A01 Participative master class (22 hours). Presentation by the teacher of the main contents of the subject.

A03 Laboratory practices (4 hours). For the development of the practices there will be some scripts that the student will have to read before the practice, proposing a series of activities to be carried out during the same.

A05 Performance of practical application or research work. In groups, students must carry out a study of the state of the art of tissue engineering in a specific field of application that will be previously indicated. This work must be presented in public in front of the whole class and the teachers of the subject. The work will be supervised by the teachers on a case-by-case basis.

5. Assessment system

- E1: Final exam (60%).

Written exam, with a grade from 0 to 10 points. The test will consist of several theoretical and practical questions. There will be a global test in each of the calls established throughout the term, on the dates and times determined by the School.

- E2: Tutored practical work (40%).

Graded from 0 to 10 points. In the evaluation of the tutored work proposed during the four-month period, both the quality of the work presented and the scope and bibliographic study of the proposed solution, as well as the oral presentation, will be taken into account.

The student must obtain a minimum total score of 4 points out of 10 in each activity in order to average it with the rest of the evaluation activities.

- E3: Laboratory and computer practices (0%).

The completion of the internship is mandatory, but does not entail a specific evaluation.

Students who do not opt for the evaluation procedure described above, will have the right to take a global test in each of the calls established throughout the term, on the dates and times determined by EINA.