

# MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING

## TISSUE ENGINEERING

SSD ING-IND/34, 6 CFU

### Objectives

*Knowledge and understanding.* Students will be provided with the elements to understand the theoretical and practical fundamentals of tissue engineering that aims to engineer tissue analogues by combining cells and biomaterial scaffolds to regenerate tissues and organs.

*Applying knowledge and understanding.* Students will achieve skills and expertise to fabricate and characterize tissue engineering constructs.

*Making judgements.* Students will be encouraged to develop analytical and critical thinking skills in the evaluation of tissue engineering application requirements.

*Communication skills.* Students will learn the technical vocabulary for effective communication in the field of tissue engineering.

*Learning skills.* Students will learn to access specialized literature to deepen their knowledge. The course is held in English.

### Prerequisites

Fundamentals of Chemistry

### Contents

Part I (20h): Introduction to tissue engineering; mass transport within biological tissues; generalities on 2D and 3D cell cultures; cell-cell and cell-extracellular matrix interaction; cell adhesion and migration.

Part II (5h): the scaffold; biomaterials for tissue engineering; growth factors and stem cells in tissue engineering.

Part III (5h): applications: bone, cartilage, skin, blood vessels; bioreactors and microfluidic devices for tissue engineering; mechanobiology (generalities).

Part IV (18h): methods in tissue engineering.

### Teaching Methods

The course will have a large practical section and will provide basic tissue engineering skills, integrating lectures introducing the topics of the course (30h) with laboratory activities (18h). During the course, students will be assigned a lab project on a tissue engineering topic, to be developed in small working groups (max. 4 students) using the facilities of the Chemistry Teaching Lab and the Tissue Engineering Lab. An average effort of 20h is estimated to complete the project. Each group will present the outcomes of the project during the course and will deliver a report.

### Verification of learning

Project assignment, to be performed in small teams, with final report.

Written test with 3 open-ended questions.

The result (average of project assignment and written test) is converted into a mark out of 30 (and honors). In order to pass the exam, the student must score at least 18 out of 30. The mark will be recorded physically and electronically in the students' academic transcripts.

## **Texts**

Handouts and selected publications available at <http://elearning.unicampus.it>.

The following books are suggested for deepening the knowledge.

- Current protocols in molecular biology. Wiley NY
- Bruce Alberts, Molecular Biology of the cell, Garland publishing
- Kate Wilson & John Walker, Biochimica e biologia molecolare: principi e tecniche. Cortina Ed.
- Benjamin Lewin, Il gene, Zanichelli
- Robert A. Brown, Extreme Tissue Engineering: Concepts and Strategies for Tissue Fabrication, Wiley-Blackwell