Tissue Engineering: Cells, Biomaterials and Bioreactors

Course at a Glance

Basic concepts for generating engineered bone/cartilage grafts for clinical and/or research applications

Instructors

Silvia Scaglione silvia.scaglione@ieiit.cnr.it
Tel: 010 647 5206
Istituto di Elettronica e di Ingegneria dell'Informazione e delle Telecomunicazioni (IEIIT), Consiglio Nazionale delle Ricerche (CNR) - Via De Marini, 6, 16° floor

Credits: 5

Synopsis

Tissue Engineering is an multidisciplinary field involving biology, medicine, material science and bioengineering aimed to improve the health and quality of life for millions of people worldwide by restoring, maintaining, or enhancing tissue and organ function. Tissue engineering research includes the following areas: (i) Biomaterials: including novel biomaterials designed to direct the organization, growth, and differentiation of cells in the process of forming functional tissue by providing both chemical and physical (macro-micro-nano scale) cues. (ii) Cells: including enabling methodologies for the proliferation and differentiation of cells, acquiring the appropriate source of cells such as autologous cells, allogeneic cells, xenogeneic cells, stem cells, genetically engineered cells, and immunological manipulation. (iii) Biomolecules: including growth factors, differentiation factors, angiogenic factors, their synthesis and their release. (iv) Engineering Design Aspects: including 3D tissue growth, modeling of scaffold internal architecture, bioreactors to offer specific stimulation to living tissues. (v) Biomechanical Aspects of Design: including properties of native tissues, identification of minimum properties required of engineered tissues, mechanical signals regulating engineered tissues, and efficacy and safety of engineered tissues. (vi) Informatics to support tissue engineering: gene and protein sequencing, gene expression analysis, protein expression and interaction analysis, quantitative tissue analysis, in silico tissue and cell modeling

Syllabus

The course develops in about 15/20 hours in the classroom.

- Cell-Based Therapies for TE: methodologies for isolation, differentiation, selection of adult progenitors/stem cells.
- Biomaterials for TE: design of intelligent biomaterials; study or the proper macro-micro-nano-structures, chemical compositions, biomechanical properties; cell-biomaterials interfaces, bioactivation of surfaces.
- Bioreactor systems for TE: perfusing bioreactor systems, biomechanical stimulating bioreactors, fluido-dynamic stimulating bioreactors.
- Pre-clical/Clinical models: in vivo case studies, implant of cell-biomaterials constructs, animal models.

The examination consists in a journal club or a brief research project proposal.

Reading list

[1] Jeffrey A. Hubbell 1995 “Biomaterials in Tissue Engineering” Nature Biotechnology **13**, 565 - 576
[2] Ivan Martin, David Wendt and Michael Heberer 2004 “The role of bioreactors in tissue engineering” Trends in Biotechnology 22(2): 80-86
[3] Paolo Bianco & Pamela Gehron Robey 2001 “Stem cells in tissue engineering”Nature 414, 118-121

Venue

(CNR) - Via De Marini, 6, 16° floor

Course date

7, 14, 21 – 28 April and 5 May 2015 - from 14.00 to 17.00