UE Biomaterials and biocompatible Surface Engineering

Niveau d'étude
Bac +5

ECTS
3 crédits

Composante
UFR Physique, Ingénierie, Terre, Environnement, Mécanique (PhITEM)

Période de l'année
Automne (sept. à dec./janv.)

Diplômes intégrant cet élément

- Master Nanosciences et nanotechnologies

Langue(s) d'enseignement: Anglais

Ouvert aux étudiants en échange: Oui

Code d'export Apogée: PAX9NAAF

Présentation

Description

Goal: The aim of this class is to discover natural materials that form our tissues in the body and to understand what are the current progresses and challenges in the field of implantable biomaterials. We will also focus on the modification of surface properties of biomaterials in terms of chemistry, topography and mechanical properties. The main steps of inflammatory reaction after implantation of a biomaterial will be reviewed. We will then discover the current products and major advances in the field of cardio-vascular implants and orthopedic biomaterials. Finally, we will present the concepts and methods used in tissue engineering.

Content:
1) Structure of natural materials : Building blocks at different length scales

- Cell / Extracellular matrix proteins / Polysaccharides
- Interaction of a cell with its environment / Adhesion

Informations non contractuelles.
Dernière mise à jour le 30 juin 2026

- Stem cells, concept of niche (gradients, position, mechanics)
- Examples of organization of some tissues (vascular wall, cartilage, bone)
- Example of peculiar properties of natural materials : superhydrophobicity, silk and super-strong adhesion

2) Overview of implantable biomaterials

- Definition, History
- Different types of biomaterials (metals, ceramics, synthetic polymers, and biopolymers)
- Concept of tissue engineering and regenerative medicine

3) Importance of surface properties : from fundamental studies to applications

- Chemistry (presence of specific receptors, growth factors)
- Micro and nano-topography
- Mechanical properties

4) Reaction against a foreign body

- Foreign body reaction
- Inflammatory cells
- Biocompatibility tests
- Development/regulatory issues

5) Design and function of cardiovascular implants

- Stents
- Vascular Grafts

6) Biomaterials for orthopaedic applications

- Different needs in orthopaedics
- Titanium
- Metallic alloys
- Ceramics as bone grafts

7) Tissue engineering / Stem cell and precursor cell-based therapies

- Different types of stem cells and their potential
- Analysis of transcription factors
- Expression of proteins to assess cell differentiation

Heures d'enseignement

CMTD	Cours magistral - Travaux dirigés	20h

Période : Semestre 9

Infos pratiques

Informations non contractuelles.
Dernière mise à jour le 30 juin 2026

Lieu(x) ville

Grenoble

Campus

Grenoble - Domaine universitaire

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