

MSE-471

Biomaterials (pour MX)

Cursus	Sem.	Type
Materials Science and Engineering	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	4 weekly
Lecture	2 weekly
Practical work	2 weekly
Number of positions	32

Il n'est pas autorisé de se retirer de cette matière après le délai d'inscription.

Remark

Pas donné en 2023-24

Summary

The course introduces the main classes of biomaterials used in the biomedical field. The interactions with biological environment are discussed and challenges highlighted. State of the art examples per type of material are discussed. Students will engineer a biomaterial & study cell compatibility.

Content**BLOCK 1:**

- Lecture 1. Intro to biomaterials
- Lecture 2. Naturally derived vs Manmade biomaterials
- Lecture 3. Surfaces vs bulk
- Lecture 4. Polymers and nanoparticles
- Exercise session 1

BLOCK 2:

- Lecture 5. Materials for drug delivery
- Lecture 6. Materials for cell adhesion and tissue engineering
- Lecture 7. Materials for immune engineering
- Exercise session 2

BLOCK 3:

- Lecture 8. Characterization and performance of biomaterials
- Lecture 9. Translation to industry, patents and spin-offs
- Lecture 10. Regulatory aspects and trials

Lecture 11. Revision and conclusion

Keywords

Biomaterials, biocompatibility, biofunctionality, implants, nanotechnology, tissue engineering, drug-delivery, nanoparticles.

Learning Prerequisites

Required courses

Introduction to materials science
Biology for engineers

Recommended courses

Materials, metallurgy, polymer, ceramics, soft matter

Learning Outcomes

By the end of the course, the student must be able to:

- Estimate a biomaterial in function of the application
- Compare developments of new biomaterials
- Describe the interactions with biological environment
- Describe the translation of a biomaterial to commercial use
- Design a nanoparticle for targeting/drug delivery
- Compare biocompatibility of various materials
- Describe requirements to limit toxicity

Transversal skills

- Communicate effectively with professionals from other disciplines.
- Respect relevant legal guidelines and ethical codes for the profession.
- Collect data.
- Access and evaluate appropriate sources of information.

Teaching methods

Ex cathedra and invited speakers

Practicum at DLL laboratories: development and characterization of a soft biomaterial as scaffold for cell proliferation.

Expected student activities

Attendance at lectures.

Presence at DLL sessions.

Assessment methods

Written exam in exam period (75%)

Laboratory paper (25%, hand in at last scheduled MSE471 course day of semester)

Supervision

Office hours	Yes
Assistants	Yes
Forum	No

Resources**Ressources en bibliothèque**

- [Biological performance of materials : fundamentals of biocompatibility / Black](#)
- [Traité des matériaux 7 - Comportement des matériaux dans les milieux biologiques / Schmidt](#)
- [Biomaterials science : an introduction to materials in medicine / Ratner](#)

- [Bone Repair Biomaterials / Planell](#)
- [Human Anatomy & Physiology: Pearson New International Edition / Marieb](#)

Notes/Handbook

All necessary documentation will be made available in the Moodle of this course

Moodle Link

- <https://go.epfl.ch/MSE-471>

Videos

- <https://tube.switch.ch/channels/e9df0a00>