

MSE-489

Biomaterials (for SV)

Cursus	Sem.	Type
Life Sciences Engineering	MA1, MA3	Opt.

Language of teaching	English
Credits	2
Withdrawal Session	Unauthorized Winter
Semester	Fall
Exam	Written
Workload	60h
Weeks	14
Hours	2 weekly
Lecture	2 weekly
Number of positions	25

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.

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.
- Access and evaluate appropriate sources of information.

Teaching methods

Ex cathedra and invited speakers

The course is structured in 3 blocks, with exercise sessions after block 1 and 2, and a general course conclusion after block 3.

Expected student activities

Attendance at lectures.

Assessment methods

Written exam in exam period.

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](#)
- [Human Anatomy & Physiology: Pearson New International Edition / Marieb](#)
- [Bone Repair Biomaterials / Planell](#)
- [Biomaterials science : an introduction to materials in medicine / Ratner](#)

Notes/Handbook

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

Moodle Link

- <https://go.epfl.ch/MSE-489>