

MSE-471

**Biomaterials (pour MX)**

Bastings Maartje

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

Language of teaching	English
Credits	4
Withdrawal Session	Unauthorized Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Courses	2 weekly
TP	2 weekly
<b>Number of positions</b>	<b>32</b>

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

**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](#)
- [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-471>

### **Videos**

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