

MSE-471

Biomaterials (pour MX)

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

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

It is not allowed to withdraw from this subject after the registration deadline.

Remark

pas donné en 2021-22

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 generate a biomaterial and study cell compatibility.

Content

- Lecture 1. Intro to biomaterials
- Lecture 2. Naturally derived biomaterials
- Lecture 3. Manmade biomaterials
- Lecture 4. Polymers and nanoparticles
- Lecture 5. Surfaces
- Lecture 6. Materials for drug delivery
- Lecture 7. Materials for cell adhesion
- Lecture 8. Materials for immune engineering
- Lecture 9. Materials for tissue engineering
- Lecture 10. Characterization and performance
- Lecture 11. Sensors and diagnostic devices
- Lecture 12. Translation to industry, patents and spin-offs
- Lecture 13. Regulatory aspects and trials
- Lecture 14. 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: developement and characterization of a soft biomaterial as scaffold for cell proliferation.

Expected student activities

Attendance at lectures.

Presence at practicum (also at hours not in lab)

Participation at all experimental projects (presence will be registered)

Assessment methods

Written exam in exam period (75%)

Laboratory paper (25%, hand in at last day, dec 18)

100% participation at DLL practicum (deduction of 0.5 per day missed from lab paper grade)

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