MSE-471  
Biomaterials (pour MX)

<table>
<thead>
<tr>
<th>Cursus</th>
<th>Sem.</th>
<th>Type</th>
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<tbody>
<tr>
<td>Materials Science and Engineering</td>
<td></td>
<td>MA1, MA3 Opt.</td>
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<tr>
<th>Language of teaching</th>
<th>Credits</th>
<th>Withdrawal</th>
<th>Session</th>
<th>Semester</th>
<th>Exam</th>
<th>Workload</th>
<th>Weeks</th>
<th>Hours</th>
<th>Lecture</th>
<th>Practical work</th>
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<tbody>
<tr>
<td>English</td>
<td>4</td>
<td>Unauthorized</td>
<td>Winter</td>
<td>Fall</td>
<td>Written</td>
<td>120h</td>
<td>14</td>
<td>4 weekly</td>
<td>2 weekly</td>
<td>2 weekly</td>
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It is not allowed to withdraw from this subject after the registration deadline.

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

Biomaterials (pour MX)
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
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