Foundations of Tissue Engineering: Synergy Between Cells, Biomaterials, and Biofabrication

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Registration: send an email to fmaiullari@ichf.edu.pl by April 1, 2026
The course starts between April 9 and April 15.

(The availability of this lecture course depends on whether at least three Warsaw4PhD students are registered.)

Course Description:

This PhD-level lecture series introduces the fundamental pillars of tissue engineering, emphasizing the synergy between cells, biomaterials, and biofabrication techniques. Students will explore essential biological and material foundations for designing functional tissue constructs, with focus on cell sources, bioactive biomaterials, and fabrication strategies enabling translational applications in regenerative medicine.

Course Objectives:

- To provide a foundational understanding of tissue engineering principles.
- To explore the role of diverse cell sources in tissue engineering.
- To examine classical and bioactive biomaterials used in the field.
- To present key biofabrication technologies shaping current and future applications.
- To stimulate critical discussion on translational strategies and future perspectives.

Week-by-Week Outline (2h lectures per week):

1. **Week 1: Introduction to Tissue Engineering and Biomaterials**
   Historical context; basic concepts and terminology.

2. **Week 2: Cell Sources for Tissue Engineering**
   Stem cells, primary cells, organoids and spheroids: applications and challenges.

3. **Week 3: Polymers in Tissue Engineering**
   Polymer properties and classifications; scaffold design and fabrication with polymers; bioresorbable polymers.

4. **Week 4: Functionalized and Composite Biomaterials**
   Bioactive biomaterials; Polymer-metal composites and polymer-ceramic composites.

5. **Week 5: Biofabrication Techniques**
   3D printing and bioprinting; Electrospinning; Microfabrication techniques.

6. **Week 6: Organ-on-a-Chip Technologies**
   Microfluidics and lab-on-a-chip; Organ-on-a-chip applications; Integration with biomaterials

7. **Week 7: Research Proposals and Future Directions**
   Student proposal presentations; discussion of emerging trends and translational challenges.

Assessment Methods:

Final written exam and research proposal presentation.