BIOENG-399 **Immunoengineering**

Tang Li

Cursus	Sem.	Type
Bioengineering	MA2, MA4	Opt.
Life Sciences Engineering	BA6, MA2, MA4	Opt.
Sciences du vivant	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	**60**

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

Summary

Immunoengineering is an emerging field where engineering principles are grounded in immunology. This course provides students a broad overview of how engineering approaches can be utilized to study immunology, model immune systems, modulate immune response, and develop novel immunotherapies.

Content

Part 1. Understanding immunology with engineering tools
Introduction of the course and expectation
Overview of the fundamentals of immunology
Definition and scope of immunoengineering
Engineering tools and new technologies to understand immunology
Modeling lymphoid tissues

Part 2. Engineering novel immunotherapies for diseases
Cancer and cancer immunotherapies
Concept and overview of drug delivery
Materials engineering in the advancement of immunotherapies
Immune cell engineering and genetic engineering
Metabolic engineering and immune modulation
Overview of adaptive immunity and vaccines
Design of immunogenic vaccines
Cell based vaccines
Autoimmunity and tolerogenic vaccines
Protein and antibody engineering

Part 3. Applications and practical issues
Considerations on immune drug discovery and development

Keywords

immunology, immunoengineering, vaccines, infectious diseases, autoimmunity, cancer, materials engineering, drug delivery, protein engineering, drug discovery and development

Learning Prerequisites

Required courses

Physiologie par systèmes I

Learning Outcomes

By the end of the course, the student must be able to:

- Describe the concept of immunoengineering
- Make examples of how engineering approaches has led to advancements in immunotherapy
- Take into consideration how to apply engineering principles to immunology research and applications

Transversal skills

- Summarize an article or a technical report.
- Communicate effectively, being understood, including across different languages and cultures.
- Write a scientific or technical report.

Teaching methods

Lectures integrated with exercises

Expected student activities

Attending lectures, analysing figures from research papers, completing exercises, paper discussion, reading and presenting scientific literatures.

Assessment methods

Exercise: 30%
Final written exam: 70%

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Bibliography

Library resources
How the immune system works: Lauren Sompayrac. 3e
Kuby Immunology: Owen, Pung, Stranford. 7e
Cellular and Molecular Immunology: Abbas & Lichtman. 8e
Janeway's immunobiology: Kenneth Murphy ; Charles A. Janeway ; Allan Mowat. 8e

Ressources en bibliothèque

- How the immune system works / Sompayrac
- Kuby Immunology / Pung
- Cellular and Molecular Immunology / Abbas
- Janeway's immunobiology / Murphy