

BIOENG-399

Immunoengineering

Tang Li

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

Language of teaching	English
Credits	4
Withdrawal Session	Unauthorized 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

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 digesting scientific literatures, and presenting opinions in a form of scientific essay.

Assessment methods

Scientific essay writing: 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](#)
- [Janeway's immunobiology / Murphy](#)
- [Cellular and Molecular Immunology / Abbas](#)
- [Kuby Immunology / Pung](#)