

BIOENG-399

**Immunoengineering**

Tang Li

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

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

**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](#)
- [Janeway's immunobiology / Murphy](#)
- [Cellular and Molecular Immunology / Abbas](#)
- [Kuby Immunology / Pung](#)