# Immune Engineering

BME 6938

***Class Periods:*** MWF | Period 4 (10:40 – 11:30 AM)

***Location:*** COMM-033

***Academic Term:*** Fall 2025

***Instructor:***
Benjamin Keselowsky
bgk@ufl.edu

Office Hours: by appointment; BMS J297, or
Zoom: https://ufl.zoom.us/j/93563699656?pwd=RzRXUlc1dXBuODBwckg1K0NDZTk1UT09

***Teaching Assistants:***
N/A

***Course Description***
3 credit hours
This course introduces immunology and engineering approaches to study and control immune responses, with an emphasis on applications for therapy and diagnostics.

***Course Pre-Requisites / Co-Requisites***
None

***Course Objectives***
Immune engineering represents the intersection of engineering and immunology to design new technologies that can be used to better understand the immune system as well as direct it to improve health. Students will gain proficiency in the field by becoming capable of integrating basic concepts in immunology with emerging technologies, understanding primary research literature, critically analyzing data, and designing experiments. Toward this objective, the course will be taught using modules: (1) fundamentals of immunology, covering nomenclature of immunology, components of innate and adaptive immunity, and more; (2) the immunologist's toolbox, covering key experimental tools used to study immune responses, enabling students to critically analyze data in the literature and design experiments; (3) vaccines and immunotherapies, describing established and emerging vaccines and immunomodulatory drugs and mechanisms of action; and (4) the immune engineer's toolbox, providing a foundation of drug-delivery, material science and molecular engineering principles in the context of vaccines and immunomodulatory drugs.

***Materials and Supply Fees***
None

***Required Textbooks and Software***
None

***Recommended Materials***
Provided in class: introductory immunology textbook materials from *Janeway's Immunobiology*, and *Cellular and Molecular Immunology*, by Abdul K. Abbas, Andrew H.H. Lichtman, and Shiv Pillai.

***Course Schedule (Subject to change)***

| | |
|---|---|
| 1 | handout syllabus/discuss, meet&greet |
| 2 | Introductory lecture |
| 3 | Introductory lecture |
| 4 | Introductory lecture |

| | |
|---|---|
| 5 | Overview of the Immune System |
| 7 | Overview of the Immune System |
| 8 | Overview of the Immune System |
| 9 | Overview of the Immune System |
| 10 | Innate Immunity |
| 11 | Innate Immunity |
| 12 | Innate Immunity |
| 13 | Innate Immunity |
| 14 | Innate Immunity / Ab Overview |
| 15 | Ab Overview |
| 16 | Antigen Capture & Presentation |
| 17 | Antigen Capture & Presentation |
| 18 | Technique Presentations |
| 19 | Technique Presentations |
| 20 | Antigen Capture |
| 21 | Antigen Recognition by T cells |
| 22 | Antigen Recognition by T cells |
| 23 | Guest lecture - Clayton Mathews |
| 24 | Antigen Recognition by T cells |
| 25 | Journal paper presentations |
| 26 | Journal paper presentations |
| 27 | Journal paper presentations |
| 28 | Journal paper presentations |
| 29 | Antigen Recognition by T cells |
| 30 | Antigen Recognition by T cells |
| 31 | Drug Delivery - Overview; Biodistribution, PK |
| 32 | Drug Delivery - Biodistribution, PK |
| 33 | Drug Delivery - Biodistribution, PK |
| 34 | Drug Delivery - Biodistribution, PK |
| 35 | Materials for Immunotherapeutic Delivery |
| 36 | Materials for Immunotherapeutic Delivery |
| 37 | Drug Delivery - Transport barriers |
| 38 | Drug Delivery - Transport barriers |

***Attendance Policy, Class Expectations, and Make-Up Policy***

Attendance is required. During certain activities, attendance may be recorded and absences or excessive tardiness may be penalized. Arrangements can be made with the instructor for missed assignments other than those which require attendance on specified days (TBA). Excused absences must be consistent with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations) and require appropriate documentation. Additional information can be found here: https://gradcatalog.ufl.edu/graduate/regulations/

***Evaluation of Grades***

| Assignment | Percentage of Final Grade |
|---|---|
| Concept Checkups | 20% |
| Technique Presentation | 20% |
| Journal Club Assignment | 20% |
| Proposal Aims | 5% |
| Research Proposal | 20% |
| Review Panel Critique | 15% |
| | 100% |

***Grading Policy***

| Percent | Grade | Grade Points |
|---|---|---|
| 93.4 - 100 | A | 4.00 |
| 90.0 - 93.3 | A- | 3.67 |
| 86.7 - 89.9 | B+ | 3.33 |
| 83.4 - 86.6 | B | 3.00 |
| 80.0 - 83.3 | B- | 2.67 |
| 76.7 - 79.9 | C+ | 2.33 |
| 73.4 - 76.6 | C | 2.00 |
| 70.0 - 73.3 | C- | 1.67 |
| 66.7 - 69.9 | D+ | 1.33 |
| 63.4 - 66.6 | D | 1.00 |
| 60.0 - 63.3 | D- | 0.67 |
| 0 - 59.9 | E | 0.00 |

***Academic Policies & Resources***

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies.

***Commitment to a Positive Learning Environment***

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu