BME 1088: Concepts in Immunoengineering

Course Coordinator and Lecturer:

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TA: -, email: -

Course Description:

Immunoengineering is an emergent field that has significantly impacted numerous areas in biomedical sciences. This course will provide brief overviews on fundamental immunological concepts that are recurrent in immunoengineering followed by more in depth coverage of vaccines, cancer immunotherapies, and advances in immunological understanding associated with these fields. The course material will draw from both textbook and scientific articles that will be delivered as lectures.

Lecture Format:

One 2-hour lecture per week, Tuesday: 12:00 – 14:00.
Instructor office hours are available upon request. Please email me to set up an appointment.

Reference Textbook:

Janeway's Immunobiology, 9th edition by Casey Weaver and Kenneth Murphy. This textbook will be used as reference for course material and will supplement readings based on journal articles.

Course structure:

Lectures will be provided for ~ 1 hour followed by ~ 1 hour of student driven presentations that will be graded. There will be a total of 5 groups that will be assigned a scientific paper for presentation. Each group will present twice throughout the semester. The rubric will be posted on the course website.

For the final project, each student will be assigned a literature review in an area of immunoengineering; a list of these areas will be provided at a later date during the course. This review must be a maximum of 3 pages with 1 figure included that can consist of aggregate image from different manuscripts. References are excluded from the page limit. The report must be single spaced, Arial font size of 11, and with 1 inch margin. For a chosen area of focus, the content must cover (i) the motivation and benefits to the biomedical field, (ii) current literature within this area with a focus on at least 1 or 2 key publications supplemented with other minor articles, (iii) limitations in knowledge and therapies and future outlooks. The rubric will be posted at a later date on the course website.

Course Evaluation Breakdown:

Assessment	% of Grade	Date & Frequency
Journal club presentation #1	20	Weekly
Journal club presentation #2	30	Weekly
Final project	50	Week 12

Lecture outline and topic description

Lecture Week	Topics Covered
Lecture 1 (Sept. 10)	Innate Immunity and vaccines - Innate barriers, PAMPs sensors, and adjuvants
Lecture 2 (Sept. 17)	Lymph node architecture and antigen trafficking - Stromal populations and their functions Group 1: Journal club presentation
Lecture 3 (Sept. 24)	Lymph node architecture and antigen trafficking (Continued) - Stromal populations and their functions Group 2: Journal club presentation
Lecture 4 (Oct. 1)	Lymph node architecture and antigen trafficking (Continued) - Stromal populations and their functions Innate immune cells and initiation of immune response - Macrophages Group 3: Journal club presentation
Lecture 5 (Oct. 8)	Innate immune cells and initiation of immune response (Continued) - Macrophages and Dendritic Cells Group 4: Journal club presentation
Lecture 6 (Oct. 15)	Innate immune cells and initiation of immune response (Continued) - Dendritic Cells Group 5: Journal club presentation
Lecture 7 (Oct. 22)	Major histocompatibility complexes Group 1: Journal club presentation
No Lecture (Oct. 28)	Reading Week
Lecture 8 (Nov. 5)	T cell responses - TCR structure and recognition Group 2: Journal club presentation
Lecture 9	T cell responses

(Nov. 12)	- TCR signaling (Continued) Group 3: Journal club presentation
Lecture 10 (Nov. 19)	T cell responses - Metabolic programming - Mechanotransduction B cell Responses - Introduction Group 4: Journal club presentation
Lecture 11 (Nov. 26)	B cell responses - Progression of antibody response Group 5: Journal club presentation
Week 12 (Dec. 3)	B cell responses - Novel vaccination strategies