

IMMUNOLOGY

Courses offered by the Immunology Program are listed under the subject code IMMUNOL on the (<http://explorecourses.stanford.edu/CourseSearch/search/?view=catalog&catalog=&page=0&q=IMMUNOL&filter-catalognumber=IMMUNOL=on>) Stanford Bulletin's (<http://explorecourses.stanford.edu/CourseSearch/search/?view=catalog&catalog=&page=0&q=IMMUNOL&filter-catalognumber=IMMUNOL=on>) ExploreCourses web site (<http://explorecourses.stanford.edu/CourseSearch/search/?view=catalog&catalog=&page=0&q=IMMUNOL&filter-catalognumber=IMMUNOL=on>).

Stanford Immunology is home to faculty, students, postdocs, and staff who work together to produce internationally recognized research in many areas of immunology. The long tradition of collaboration among the immunology laboratories at Stanford fosters productive interdisciplinary research, with an emphasis on the application of current approaches to problems in cellular, molecular and clinical immunology. Faculty research interests include both basic science research and bench-to-bedside research. Graduate students and postdoctoral scholars receive outstanding training through their participation in research, teaching, seminars, journal clubs, and the annual Stanford Immunology Scientific Conference.

Mission of the Ph.D. Program in Immunology

The Immunology doctoral program offers instruction and research opportunities leading to a Ph.D. in Immunology. Two tracks are offered:

1. Track 1: Molecular, Cellular, and Translational Immunology
2. Track 2: Computational and Systems Immunology

The goal of the Ph.D. Program in Immunology is to develop investigators who have a strong foundation in Immunology and related sciences in order to carry out innovative research. The program features a flexible choice of courses and seminars combined with extensive research training in the laboratories of participating Immunology faculty. Specifically, immunology graduate students:

1. acquire a fundamental, broad, and comprehensive body of knowledge and skills through an extensive curriculum.
2. identify important scientific questions, design, and conduct experiments using the most appropriate methods.
3. read and critically analyze current literature in immunology and other relevant fields.
4. present research findings and communicate ideas effectively to a variety of audiences.
5. prepare manuscripts that will be published in leading journals.
6. learn to teach effectively.

Master of Science in Immunology

Students in the Ph.D. program in Immunology may apply for an M.S. degree in Immunology only under special circumstances, assuming completion of appropriate requirements. Students must complete:

1. At least 45 units of academic work, all of which must be in courses at or above the 100 level, 36 units of which must be at or above the 200 level.
2. 3 quarters of graduate research (IMMUNOL 399 Graduate Research), consisting of rotations in the labs of three faculty members.
3. Participation in the Immunology journal club (IMMUNOL 305 Immunology Journal Club), and attendance at the Immunology

seminar series (Immunol 311 Seminar in Immunology) and at the annual Stanford Immunology Scientific Conference.

4. First Year Rotations Presentations and General Advising Sessions, June. Students present on one of three lab rotations.
5. Students must submit a master's thesis paper on one of their rotations. This requirement may be waived under special circumstances.

Course work in Immunology as follows:

Track: Molecular, Cellular and Translational Immunology

		Units
BIOS 200	Foundations in Experimental Biology	5
IMMUNOL 201	Advanced Immunology I	3
IMMUNOL 202	Advanced Immunology II	3
IMMUNOL 203	Advanced Immunology III	3
IMMUNOL 311	Seminar in Immunology	1
IMMUNOL 305	Immunology Journal Club	1
IMMUNOL 399	Graduate Research	1-15
BIO 141	Biostatistics	5
MED 255	The Responsible Conduct of Research	1
Take one of the following courses:		
MI 210	Advanced Pathogenesis of Bacteria, Viruses, and Eukaryotic Parasites	4
BIO 214	Advanced Cell Biology	4
IMMUNOL 206	Introduction to Applied Computational Tools in Immunology	2

Track: Computational and Systems Immunology

		Units
BIOS 200	Foundations in Experimental Biology	5
IMMUNOL 201	Advanced Immunology I	3
IMMUNOL 202	Advanced Immunology II	3
IMMUNOL 206	Introduction to Applied Computational Tools in Immunology	2
IMMUNOL 207	Essential Methods in Computational and Systems Immunology	3
IMMUNOL 310	Seminars in Computational and Systems Immunology	1
BIOMEDIN 212	Introduction to Biomedical Informatics Research Methodology	3
BIOMEDIN 214	Representations and Algorithms for Computational Molecular Biology	3-4
IMMUNOL 399	Graduate Research	1-15
MED 255	The Responsible Conduct of Research	1

Doctor of Philosophy in Immunology

The University's basic requirements for the Ph.D. degree are outlined in the "Graduate Degrees (<http://exploreddegrees.stanford.edu/graduatedegrees/>)" section of this bulletin.

Admissions

Students seeking admissions to the Immunology Ph.D. Program typically have an undergraduate major in biological sciences, but majors from other areas are acceptable if the applicants have sufficient coursework in biology, chemistry, general physics, and mathematics (through calculus). Applications are evaluated by the Immunology Graduate Program committee based upon: grades; evidence of research experience; letters of recommendation, including letters from research sponsor(s); and commitment to a career in biomedical research. The GRE Subject test is optional. If an applicant chooses to submit a GRE score, they should

plan on taking the GRE at least one month prior to the application deadline of Tuesday, December 1, 2020, to ensure that official scores are available when applications are evaluated. Candidates who are selected to visit Stanford and interview are notified in January. The selected applicants are invited to the Biosciences interview session, March 3-6, 2021 (Wednesday-Saturday). This is the program's only interview session.

Interested Stanford medical students are welcome to apply to the program and should also submit a formal application by Tuesday, December 1, 2020.

Prospective graduate students must apply via Stanford's online graduate application (<https://gradadmissions.stanford.edu/applying/>).

Financial Aid

Students admitted to the program are offered financial support for tuition, a living stipend, health insurance coverage, and for first-year graduate students, a small allowance (tech funds). Applicants are urged to apply for independent fellowships such as from the National Science Foundation or National Defense Science and Engineering Graduate Fellowships. NSF Fellowship applications are due in October of the year prior to matriculation in the graduate program, and only one more NSF application is permitted in the first or second year. Immunology graduate students may continue to apply for outside fellowships after matriculation. Admitted students are typically offered financial support in the form of Stanford Graduate Fellowships, NIH traineeships, or research assistantships.

General Requirements

Immunology Startup and the First-Year Advising Process

Since students enter with differing backgrounds, each student is assisted by the first-year adviser in selecting courses and lab rotations in the first year and in choosing a lab for the dissertation research. In addition, the Immunology Startup, a five-day introduction to immunology in early September, exposes incoming Immunology Ph.D. students to a variety of techniques and concepts. Students learn basic laboratory techniques in immunology and participate in in-depth discussions with faculty.

All students must be enrolled in exactly 10 units during Autumn, Winter, Spring, and Summer quarters until reaching Terminal Graduate Residence (TGR) status in the spring or summer quarter of their fourth year. Students are required to pass all courses in which they are enrolled; required and elective courses must be taken for a letter grade. Students must earn a grade of 'B-' or better in all courses applicable to the degree that are taken for a letter grade. Satisfactory completion of each year's general and track specific requirements listed below is required. During the first year, degree progress is monitored closely by the first-year adviser in quarterly meetings and by the Stanford Graduate Program Committee in a final advising session in June.

First-year students are required to complete three rotations in at least two immunology labs. In the Spring Quarter, two mini-rotations of six weeks each may be arranged. After joining a lab, students are required to meet with their thesis adviser within 30 days to complete the Individual Development Plan (IDP). Students continue to complete the IDP annually.

Students apply for any fellowships for which they are eligible (NSF, NDSEG, AHA, NIH NRSA are just a few).

A specific program of study for each student is developed individually with the first-year adviser.

Immunology Ph.D. Curriculum:

All students in the two tracks, Molecular, Cellular, and Translational Immunology (MCTI) and Computational and Systems Immunology (CSI) are required to enroll in the following core courses:

		Units
BIOS 200	Foundations in Experimental Biology	5
BIO 141	Biostatistics	5
IMMUNOL 201	Advanced Immunology I	3
IMMUNOL 202	Advanced Immunology II	3
IMMUNOL 258	Ethics, Science, and Society	1
IMMUNOL 290	Teaching in Immunology	1-15
IMMUNOL 305	Immunology Journal Club	1
IMMUNOL 311	Seminar in Immunology	1
IMMUNOL 399	Graduate Research	1-15
MED 255	The Responsible Conduct of Research	1

Candidates for Ph.D. degrees at Stanford must satisfactorily complete a program of study that includes 135 units of graduate course work and research. At least 3 units must be taken with each of four different Stanford faculty members. Students in the MCTI track are expected to complete all their core course requirements by the end of their second year; students in the CSI track should complete their core course work by the end of the third year.

In the third through fifth year, students are required to take IMMUNOL 258 Ethics, Science, and Society, a refresher ethics course that is required by NIH and is offered every other year.

Immediately after the final examination period in Spring Quarter of the first year, first-year immunology graduate students are required to give a presentation on one of their three rotations to the Immunology graduate program committee (Qualifying Examination Process, Part I). After the rotation presentation, the first-year student will meet with the Stanford Graduate Program Committee in a one-on-one advising session to review degree progress and choice of a Ph.D. thesis lab.

In Autumn Quarter of the second year, students focus on preparing for Part II of the Qualifying Examination Process, the general oral examination and the Ph.D. thesis dissertation proposal. The student is required to pass the oral examination and write a thesis dissertation proposal which is presented to and evaluated by a qualifying examination committee composed of three faculty members, two of whom must be from the Immunology program faculty and the third faculty member may be from a department outside the program. The Ph.D. adviser is not present for Part II, but is required to submit an evaluation and grade for the Ph.D. thesis dissertation proposal. Upon successful completion of Part II, the student files a petition for Ph.D. candidacy and form their reading dissertation committee.

The dissertation reading committee (generally known as the Ph.D. thesis committee) must be comprised of at least four faculty members who guide the student in the Ph.D. research, and read and approve the final dissertation. Typically three of the four dissertation reading committee members are from the Immunology program faculty.

In the first through third years, the student must meet with the Ph.D. thesis committee at least once a year. In the fourth and fifth years, the student is expected to meet twice a year with the Ph.D. thesis committee.

In addition, if requested by the student, a secondary adviser is assigned who can provide additional advice on issues such as career path choices and other non-academic issues.

Individual Development Plan: Graduate students are required to meet with their faculty mentors once a year to discuss an individual development plan (IDP). The IDP is intended to help the students take ownership of their training and professional development. The goals of the IDP are to: 1) pause, reflect and intentionally think on short-, mid- and long-term goals; 2) identify resources that help to achieve these goals; and 3) have open and direct dialogue with the Ph.D. thesis adviser and establish clear expectations and steps.

Track Specific Requirements

In addition to the general requirements listed above, students must also complete requirements within their track. Written petitions for exemptions to core curriculum and lab rotation requirements are considered only in the first year by the advising committee and the chair of the Graduate Program committee. Approval is contingent upon special circumstances and is not routinely granted.

Molecular, Cellular, and Translational Immunology

In addition to the core courses listed above, MCTI first-year students are required to take the following courses in their first year for a letter grade:

		Units
IMMUNOL 203	Advanced Immunology III	3
Take one of the following courses:		
BIO 214	Advanced Cell Biology	4
IMMUNOL 206	Introduction to Applied Computational Tools in Immunology	2
MI 210	Advanced Pathogenesis of Bacteria, Viruses, and Eukaryotic Parasites	4

Electives:

One elective (see suggested elective list below)

		Units
CBIO 240	Molecular and Genetic Basis of Cancer	4
CSB 210	Cell Signaling	4
DBIO 210	Developmental Biology	4
IMMUNOL 223	Biology and Disease of Hematopoiesis	3
IMMUNOL 275	Tumor Immunology	3
IMMUNOL 286	Neuroimmunity	2-3
SBIO 241	Biological Macromolecules	5

Computational and Systems Immunology

In addition to the core courses listed above, the CSI curriculum trains students to be computational and experimental scientists, who are expected to identify important problems in immunology and to devise integrated computational/ experimental plans for addressing them.

CSI Core (Required):

Students in the CSI track are required to take the following core courses in their first and second years, unless demonstrated by proficiency or coursework. For example, a student, with proficiency in concepts taught in CS 106A, may petition to be exempt from this course and go on to take CS 106B. Petitions to exempt from the courses CS 106A, CS 109, and CS 161 must be approved by the Chair of the CSI track.

		Units
BIOMEDIN 214	Representations and Algorithms for Computational Molecular Biology	3-4
CS 106A	Programming Methodology	3-5
CS 106B	Programming Abstractions	3-5
CS 109	Introduction to Probability for Computer Scientists	3-5
CS 161	Design and Analysis of Algorithms	3-5
IMMUNOL 206	Introduction to Applied Computational Tools in Immunology	2
IMMUNOL 207	Essential Methods in Computational and Systems Immunology	3
IMMUNOL 310	Seminars in Computational and Systems Immunology	1

CSI Electives:

Two electives (see suggested elective list below):

		Units
BIOMEDIN 212	Introduction to Biomedical Informatics Research Methodology	3-5
BIOMEDIN 217	Translational Bioinformatics	4
BIOMEDIN 260	Computational Methods for Biomedical Image Analysis and Interpretation	3-4
CME 206	Introduction to Numerical Methods for Engineering	3
CME 263	Introduction to Linear Dynamical Systems	3
CME 309	Randomized Algorithms and Probabilistic Analysis	3
CME 364A	Convex Optimization I	3
CME 372	Applied Fourier Analysis and Elements of Modern Signal Processing	3
EE 276	Information Theory	3
EE 278	Introduction to Statistical Signal Processing	3
STATS 116	Theory of Probability	4
STATS 202	Data Mining and Analysis	3
STATS 216	Introduction to Statistical Learning	3
STATS 217	Introduction to Stochastic Processes I	3
Other		

Journal Clubs

Both MCTI and CSI students are required to attend the IMMUNOL 305 Immunology Journal Club for their first through third years. Attendance is optional for fourth year and above graduate students.

Immunology and CSI Seminar Series

Graduate seminars are an important means of attaining a broad and comprehensive exposure to all areas in immunology as well as gaining a professional perspective and competence in the field. First-year students are required to attend all immunology seminars (IMMUNOL 311 Seminar in Immunology). Students in their second year and above are required to attend 50% of the seminar series each academic year until the last quarter in which their Ph.D. oral defense takes place. Students in the CSI track are required to attend the Computational and Systems Immunology Seminar Series (IMMUNOL 310 Seminars in Computational and Systems Immunology) held every Summer Quarter.

Immunology Scientific Retreat

In the autumn quarter, the annual Retreat is held at the Asilomar Conference Grounds, Pacific Grove, CA, and is attended by students, staff, postdocs and faculty of the Stanford immunology community. All immunology graduate students are required to attend. In the third through fifth years, students will present a poster and give a talk on their graduate research.

Teaching Assistantships

Teaching experience and training are part of the graduate curriculum. Each student assists in teaching two courses in the immunology core or electives. A TA match process is held in summer quarter in order to match the graduate student's research and teaching preferences to the appropriate courses. Before beginning their assigned teaching assistantships, students are required to attend a TA orientation workshop held by VPTL before the teaching quarter begins.

First Author Paper Submission

By the fourth or fifth year, graduate students are expected to submit a first author paper for publication. This milestone should be completed before defending a Ph.D. thesis.

Doctoral Dissertation

Before embarking on the dissertation defense process, the graduate student must submit a Petition to Defend to the Director of the Immunology Graduate Program. Important milestones and degree requirements must be met before proceeding to the oral examination. A substantial draft of the dissertation must be turned in to the student's oral examination committee at least one month before the oral exam is scheduled to take place. At the time of the Ph.D. orals defense, an orals chair is chosen to lead the orals committee, which is a distinct committee, but the basic membership is identical to that of the dissertation reading committee. The correct number of faculty committee members for the orals committee is five. For students with two Ph.D. thesis co-advisors, the exact number of faculty committee members is still five. The final written dissertation must be approved by the student's reading committee and submitted to the Registrar's Office. Upon completion of this final requirement, a student is eligible for conferral of the Ph.D. degree.

COVID-19 Policies

On July 30, the Academic Senate adopted grading policies effective for all undergraduate and graduate programs, excepting the professional Graduate School of Business, School of Law, and the School of Medicine M.D. Program. For a complete list of those and other academic policies relating to the pandemic, see the "COVID-19 and Academic Continuity (<http://exploreddegrees.stanford.edu/covid-19-policy-changes/#tempdepttemplatetabtext>)" section of this bulletin.

The Senate decided that all undergraduate and graduate courses offered for a letter grade must also offer students the option of taking the course for a "credit" or "no credit" grade and recommended that deans, departments, and programs consider adopting local policies to count courses taken for a "credit" or "satisfactory" grade toward the fulfillment of degree-program requirements and/or alter program requirements as appropriate.

Graduate Degree Requirements

Grading

The Immunology Program counts all courses taken in academic year 2020-21 with a grade of 'CR' (credit) or 'S' (satisfactory) towards satisfaction of graduate degree requirements that otherwise require a letter grade provided that the instructor affirms that the work was done at a 'B-' or better level.

Graduate Advising Expectations

The Immunology Program is committed to providing academic advising in support of graduate student scholarly and professional development. This includes first year advising by the program director and ongoing advising with the research mentor in subsequent years. When most effective, this advising relationship entails collaborative and sustained engagement by both the adviser and the advisee. The Individual Development Plan (IDP) is required to be completed by the adviser and advisee annually and entails an extensive interactive written and personal assessment of trainee goals, accomplishments, coursework, and areas for development. As a best practice, advising expectations should be periodically discussed and reviewed to ensure mutual understanding. Both the adviser and the advisee are expected to maintain professionalism and integrity.

Faculty advisers guide students in key areas such as selecting courses, designing and conducting research, developing of teaching pedagogy, navigating policies and degree requirements, and exploring academic opportunities and professional pathways.

In addition, the advising process includes guidelines and expectations for graduate student professional conduct, which prepares the student to be responsible members of professional communities. <https://gap.stanford.edu/handbooks/gap-handbook/chapter-5/subchapter-6/page-5-6-1>.

Graduate students are active contributors to the advising relationship, proactively seeking academic and professional guidance and taking responsibility for informing themselves of policies and degree requirements for their graduate program.

For a statement of University policy on graduate advising, see the "Graduate Advising (<http://exploreddegrees.stanford.edu/graduatedegrees/#advisingandcredentialstext>)" section of this bulletin.

Faculty

Director, Stanford Immunology and Chair, Executive Committee for the Immunology Program and Director, Ph.D. Program in Immunology: Olivia Martinez (Professor, Surgery, Abdominal Transplantation)

Director of Graduate Studies: Olivia Martinez (Professor, Surgery, Abdominal Transplantation)

Participating Departments and Faculty (Molecular, Cellular, Translational Immunology Track)

Biochemistry: Peter Kim (Professor), Lingyin Li (Assistant Professor)

Bioengineering: Jennifer Cochran (Professor and Chair, and by courtesy, Chemical Engineering), Stephen Quake (Professor, and Applied Physics and Physics)

Biology: Patricia P. Jones (Professor)

Chemistry: Carolyn Bertozzi (Professor, Director, ChEM-H, and by courtesy, of Radiology and of Chemical and Systems Biology)

Genetics: William Greenleaf (Associate Professor, and by courtesy, Applied Physics), Leonore A. Herzenberg (Professor, Research), Karla Kirkegaard (Professor, and of Microbiology & Immunology), Stephen Montgomery (Associate Professor), Michael Snyder (Professor)

Medicine/Biomedical Informatics Research: Purvesh Khatri (Associate Professor, Research, and of Biomedical Data Science), Andrew Gentles (Assistant Professor, Research, and by courtesy, of Biomedical Data Science)

Medicine/Blood and Bone Marrow Transplantation Program: Everett Meyer (Assistant Professor), David Miklos (Associate Professor), Robert Negrin (Professor), Judith Shizuru (Professor, and of Pediatrics, Stem Cell Transplantation)

Medicine/Cardiovascular Medicine: Joseph Wu (Professor, Director, Stanford Cardiovascular Institute, and Radiology)

Medicine/Endocrinology, Gerontology, & Metabolism: Joy Wu (Assistant Professor)

Medicine/Gastroenterology and Hepatology: Aida Habtezion (Associate Professor)

Medicine/Hematology: Ravi Majeti (Professor)

Medicine/Immunology and Rheumatology: C. Garrison Fathman (Professor, Emeritus), Jorg Goronzy (Professor), William Robinson (Professor),

Samuel Strober (Professor), Paul J. Utz (Professor), Cornelia Weyand (Professor)

Medicine/Infectious Diseases: Catherine Blish (Associate Professor), Paul Bollyky (Assistant Professor, and of Microbiology & Immunology), Prasanna Jagannathan (Assistant Professor, and of Microbiology & Immunology), Taia T. Wang (Assistant Professor, and of Microbiology & Immunology)

Medicine/Oncology: Ash Alizadeh (Associate Professor), Gilbert Chu (Professor, and of Biochemistry), Dean Felsher (Professor, and of Pathology), Michael Khodadoust (Assistant Professor), Ronald Levy (Professor), Shoshana Levy (Professor, Research)

Medicine/Nephrology: Jonathan Maltzman (Associate Professor)

Medicine/Pulmonary and Critical Care Medicine: Mark Nicolls (Professor)

Microbiology and Immunology: John Boothroyd (Professor), Yueh-Hsiu Chien (Professor), Mark M. Davis (Professor, and Director, Institute for Immunity, Transplantation and Infection), Juliana Idoyaga (Assistant Professor), Holden Maecker (Professor, Research), Hugh McDevitt (Professor, Emeritus), Denise Monack (Professor), Garry P. Nolan (Professor), David Schneider (Professor)

Molecular and Cellular Physiology: K. Christopher Garcia (Professor, and of Structural Biology), Richard S. Lewis (Professor)

Neurology and Neurological Sciences: Katrin Andreasson (Professor), May Han (Associate Professor), Lawrence Steinman (Professor, and of Pediatrics), Tony Wyss-Coray (Professor)

Neurosurgery: Theo Palmer (Professor)

Otolaryngology/Head and Neck Surgery (ENT): Jayakar Nayak (Associate Professor, and by courtesy, Neurosurgery), John B. Sunwoo (Professor, and by courtesy, Dermatology)

Pathology: Robert Michael Angelo (Assistant Professor), Sean Bendall (Assistant Professor, Research), Scott Boyd (Associate Professor), Eugene C. Butcher (Professor), Michael Cleary (Professor), Gerald R. Crabtree (Professor, and of Developmental Biology), Edgar G. Engleman (Professor, and of Medicine/Immunology and Rheumatology), Andrew Fire (Professor, and Genetics), Stephen Galli (Professor, and of Microbiology & Immunology), Michael Howitt (Assistant Professor), Siddhartha Jaiswal (Assistant Professor), Sara Michie (Professor), Bali Pulendran (Professor, and of Microbiology & Immunology), Ansuman Satpathy (Assistant Professor), Raymond A. Sobel (Professor), Irving Weissman (Professor, and Director, Stem Cell and Regenerative Medicine Institute, and of Developmental Biology, Biology)

Pediatrics: Rosa Bacchetta (Associate Professor, Research, Stem Cell Transplantation), Alice Bertaina (Associate Professor, Stem Cell Transplantation), Agnieszka Czechowicz (Assistant Professor, Stem Cell Transplantation), David B. Lewis (Professor, Immunology and Allergy), Crystal Mackall (Professor, Hematology/Oncology, and of Medicine), Maria Grazia Roncarolo (Professor, Stem Cell Transplantation, and of Medicine/Blood and Marrow Transplantation), Elizabeth Mellins (Professor, Human Gene Therapy), Kari Nadeau (Professor, Allergy and Clinical Immunology, and of Otolaryngology, Head & Neck Surgery)

Psychiatry and Behavioral Sciences: Emmanuel Mignot (Professor, Sleep Medicine)

Radiology: Parag Mallick (Assistant Professor, Research, and of Diagnostic Radiology)

Structural Biology: Peter Parham (Professor, and of Microbiology and Immunology), Theodore Jardetzky (Professor)

Surgery/Multi-Organ Transplantation: Charles F. Chan (Assistant Professor, Plastic Surgery and Reconstructive Surgery), Sheri Krams (Professor, Research), Olivia Martinez (Professor)

Participating Departments and Faculty (Computational and Systems Immunology)

Anesthesiology, Perioperative and Pain Medicine: Nima Aghaeepour (Assistant Professor)

Bioengineering: Stephen Quake (Professor, and Applied Physics and Physics)

Genetics: Michael Snyder (Professor), Karla Kirkegaard (Professor, and of Microbiology & Immunology)

Biomedical Data Science: Aaron Newman (Assistant Professor, and of Medicine/Biomedicine Biomedical Informatics)

Medicine/Biomedical Informatics Research: Andrew Gentles (Assistant Professor, Research, and by courtesy, of Biomedical Data Science), Purvesh Khatri (Assistant Professor, Research, and of Biomedical Data Science)

Medicine/Immunology and Rheumatology: Paul J. Utz (Professor)

Medicine/Oncology: Ash Alizadeh (Associate Professor)

Microbiology and Immunology: John Boothroyd (Professor), Mark M. Davis (Professor, and Director, Institute for Immunity, Transplantation and Infection), Holden Maecker (Professor, Research), Garry Nolan (Professor)

Pathology: Sean Bendall (Assistant Professor, Research), Scott Boyd (Associate Professor), Andrew Fire (Professor, and of Genetics)

Radiology: Parag Mallick (Assistant Professor, Research, and of Diagnostic Radiology)

Affiliate Members:

Biochemistry: Ron Davis (Professor, and of Genetics)

Health and Research Policy - Biostatistics: Robert Tibshirani (Professor, and of Statistics)

Courses

IMMUNOL 199. Undergraduate Research. 1-18 Unit.

Presentations and discussions focus on how current research has progressed from the classic findings in Immunology. This third course in the Immunology core curriculum develops effective presentation skills that are appropriate for a given audience and situation. Students will gain experience in developing and presenting chalk talks, formal presentations, and the all-important elevator pitch on current research. Students will benefit from peer, TA and instructor feedback on all presentations.

IMMUNOL 201. Advanced Immunology I. 3 Units.

For graduate students, medical students and undergraduates. Topics include the innate and adaptive immune systems; genetics and function of immune cells and molecules; lymphocyte activation and regulation of immune responses. Recommended: undergraduate course in immunology.

IMMUNOL 202. Advanced Immunology II. 3 Units.

Readings of immunological literature. Classic problems and emerging areas based on primary literature. Student and faculty presentations. Prerequisite: IMMUNOL 201/MI 211.

IMMUNOL 203. Advanced Immunology III. 3 Units.

Key experiments and papers in immunology. Course focuses on the history of Immunology and how current research fits into the historical context. Students work on developing effective presentation skills.

IMMUNOL 205. Immunology in Health and Disease. 4 Units.

Concepts and application of adaptive and innate immunology and the role of the immune system in human diseases. Case presentations of diseases including autoimmune diseases, infectious disease and vaccination, hematopoietic and solid organ transplantation, cancer immunotherapy, genetic and acquired immunodeficiencies, hypersensitivity reactions, and allergic diseases. Problem sets based on lectures and current clinical literature. Laboratory in acute and chronic inflammation.

IMMUNOL 206. Introduction to Applied Computational Tools in Immunology. 2 Units.

Introduction to computational tools for analyses of immunological data sets, including but not limited to single-cell data such as that from flow cytometry or CyTOF, Luminex, and genomic analyses. Students become familiar with major web-based databases and analysis suites for immunological and genomic data; gain a working knowledge of the major software/algorithms for working with major data types, and be able to apply at least one computational tool in these areas to analyze a public data set. Lectures will be followed by a demonstration and interaction session on the topic. Students will complete a computational analysis project and present it to the class.

IMMUNOL 207. Essential Methods in Computational and Systems Immunology. 3 Units.

Introduction to the major underpinnings of systems immunology: first principles of development of computational approaches to immunological questions and research; details of the algorithms and statistical principles underlying commonly used tools; aspects of study design and analysis of data sets. Prerequisites: CS106a and CS161 strongly recommended.

IMMUNOL 209. Translational Immunology. 1 Unit.

Open to medical students (regardless of whether they are in foundations or applications), graduate students, and undergraduates (by consent of instructor). The format is a seminar series with weekly lectures from Immunology Faculty and guest speakers focusing on current basic immunology research and how it is translated into immunotherapies and clinical trials. Topics include hematopoiesis, transplantation, tolerance, immune monitoring, vaccination, autoimmunity and antibodies, rheumatoid arthritis, chronic pulmonary disease, and asthma. Med students in the immunology concentration major are allowed to take Imm 209 repeatedly for credit.

IMMUNOL 210. Immunology Research Seminars for Medical Students. 2 Units.

Required for medical students selecting the Immunology Concentration. Attendance at a minimum of ten seminars related to immunology outside of required medical school classes. A one-page essay on each seminar, what was presented and how it relates to a clinical immunologic problem, is required.

IMMUNOL 223. Biology and Disease of Hematopoiesis. 3 Units.

Hematopoiesis is the formation, development, and differentiation of blood cells. Lecture and journal club. Topics will include definitive and adult hematopoiesis, myeloid and lymphoid development, hematopoietic diseases, stem cell niche, bone marrow transplant, and methods and models used to study hematopoiesis. For upper level undergraduates or graduate students. Pre-requisite for undergraduates: Biology or Human Biology core, or consent of instructor.

Same as: STEMREM 223

IMMUNOL 258. Ethics, Science, and Society. 1 Unit.

This discussion focused Ethics, Science, and Society interactive mini-course will engage Immunology graduate students, postdoctoral fellows, and faculty in learning and conversations on topics in responsible research (including animal subjects, authorship, collaboration, conflicts of interest, data management, human subjects, mentor-mentee relationships, peer review, publication, research misconduct, and social responsibility) and diversity in science, informed by readings, case studies, individual reflections, and more. Some of the driving themes in this course include: what it means to do research well and how to and not to achieve this, why doing research well and with integrity is important, and who are researchers currently and who should they be. Prerequisite: MED 255.

Same as: INDE 281

IMMUNOL 275. Tumor Immunology. 3 Units.

Tumor Immunology focuses on the mechanisms by which tumors can escape from and subvert the immune system and conversely on the ability of innate and adaptive arms of the immune system to recognize and eliminate tumors. Topics include: tumor antigens, tumor immunosurveillance and immunoediting, tumor microenvironment, tumor induced immunosuppression, tumor immunotherapy (including cancer vaccines, CARs, TILs, checkpoint antibodies, monoclonal antibodies and bispecific antibodies, as well as bone marrow transplantation and radiation therapy). Tracks the historical development of our understanding of modulating tumor immune response and discusses their relative significance in the light of current research findings. Prerequisite: for undergraduates, human biology or biology core.

Same as: C BIO 275

IMMUNOL 280. Early Clinical Experience in Immunology. 1-3 Unit.

Clinical observation experience for medical students in the Immunology Scholarly Concentration. At the end of the observation period, which may span over one to two quarters, the student submits a case observation paper to his/her faculty sponsor. Prerequisite: IMMUNOL 205.

IMMUNOL 286. Neuroimmunity. 2-3 Units.

Focus is on the homeostatic and pathogenic interactions between the immune and central nervous system. Topics include the role of immune cells and inflammatory mediators in the physiological functions, neural development, neuroexcitation, and the pathogenic impact of inflammatory responses. Prerequisite of Molecular and Cellular Immunology (Bio 230) or Advanced Immunology (Immunol 201). Otherwise, request permission from the course director to enroll.

IMMUNOL 290. Teaching in Immunology. 1-18 Unit.

Practical experience in teaching by serving as a teaching assistant in an immunology course. Unit values are allotted individually to reflect the level of teaching responsibility assigned to the student. May be repeated for credit.

IMMUNOL 299. Directed Reading in Immunology. 1-18 Unit.

Prerequisite: consent of instructor.

IMMUNOL 305. Immunology Journal Club. 1 Unit.

Required of first- to third-year graduate students. Graduate students present and discuss recent papers in the literature. May be repeated for credit.

IMMUNOL 310. Seminars in Computational and Systems Immunology. 1 Unit.

Presentation of CSI technologies from recent literature. Discussion of emerging application areas and limitations. Dissemination of computational resources.

IMMUNOL 311. Seminar in Immunology. 1 Unit.

Enrollment limited to Ph.D., M.D./Ph.D., and medical students whose scholarly concentrations are in Immunology. Current research topics.

IMMUNOL 399. Graduate Research. 1-18 Unit.

For Ph.D., M.D./Ph.D. students, and medical students whose scholarly concentrations are in Immunology.

IMMUNOL 801. TGR Project. 0 Units.

IMMUNOL 802. TGR Dissertation. 0 Units.