

# PATHOLOGY

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

## Programs of Study in Pathology

The Department of Pathology offers advanced courses in aspects of pathology. The department does not offer advanced degrees in pathology, but qualified graduate students who are admitted to department-based or interdepartmental graduate programs may elect to pursue their thesis requirements in the department's research laboratories. The discipline of pathology has served as a bridge between the preclinical and clinical sciences and is focused on the application of advances in the basic biological sciences, both to the diagnosis of human disease and the elucidation of the mechanisms of normal molecular, cellular, and organ structure and function that manifest themselves in clinical disease. Accordingly, the department's research interests extend from fundamental molecular biology to clinical-pathological correlations, with an emphasis on experimental oncology.

Investigation in the department includes basic studies in areas using molecular biological, biochemical, and genetic cell biological techniques: DNA replication in yeast and cultured eukaryotic cells, cell cycle control in animal cells and yeast, identification and pathogenetic role of chromosomal aberrations in human malignancies and mechanisms of activation of oncogenes in human and animal cells, lymphocyte and neutrophil-interactions with endothelial cells, cell type specification and signal transduction pathways leading to specific gene expression or modulation of cytoskeletal behavior; cytoskeletal architecture, cell-matrix interaction, developmental biology of hematopoietic stem cells and thymus, regulation of the immune system, mechanisms of immune and other responses in the central nervous system, and neuro-degenerative diseases. Various studies focus on the development of novel diagnostic and immunotherapeutic treatment modalities and techniques for solid tumors, lymphomas, HIV, and genetic diseases. Research training in all of these areas is available for qualified medical and graduate students by individual arrangement with the appropriate faculty member.

A summary of the research interests of the department faculty is available at Sanford's School of Medicine (<http://pathology.stanford.edu>) web site.

*Emeriti: (Professor)* Ellen Jo Baron, Susan Galel, Sharon Geaghan, Michael Hendrickson, Richard L. Kempson, Jon Kosek, Roger Warnke

*Chair:* Stephen J. Galli

*Professors:* Daniel Arber, Jeffrey D. Axelrod, Gerald J. Berry, Matt Bogoyo, Eugene C. Butcher, Athena Cherry, Michael L. Cleary, Gerald R. Crabtree, Edgar G. Engleman, Dean Felsner, Marcelo Fernandez-Vina, Andrew Fire, Steven Foung, Stephen J. Galli, Lawrence Tim Goodnough, John Higgins, Neeraja Kambham, Christina Kong, Teri Longacre, Joseph S. Lipsick, Bingwei Lu, Sara Michie, Yasodha Natkunam, Donald P. Regula, Robert V. Rouse, Kang Shen, Iris Schrijver, Hua Shan, Richard K. Sibley, Raymond Sobel, Dolly Tyan, Matt van de Rijn, Hannes Vogel, Irving L. Weissman, Eduardo Zambano, James Zehnder

*Associate Professors:* Kim Allison, Jeffrey D. Axelrod, Matt Bogoyo, Niaz Banaie, Andrew Connolly, Tina Cowan, Jonathan R. Pollack, Arend Sidow, Marius Wernig, Robert West

*Assistant Professors:* Sean Bendall, Scott Boyd, Ann Folkins, Isabella Graef, Dita Gratzinger, F. Kim Hazard, Kristin Jensen, Chia-Sui Kao, Jinah Kim, Jason Merker, Stephen Montgomery, Robert Ohgami, Benjamin Pinsky, Ed Plowey, Erich Schwartz, Gerlinde Wernig, Monte Winslow, Ellen Yeh

*Courtesy Professors:* Donna Bouley, John Day, Bertil Glader

*Courtesy Associate Professor:* Euan Ashley, Robert Shafer

*Courtesy Assistant Professor:* Michaela Liedtke, Michelle Monje-Deisseroth

*Clinician Educators:* Jennifer Andrews, Raffick Bowen, Susan Atwater, David Bingham, Brittany Holmes, Christian Kunder, Steven Long, Melanie Manning, Roberto Novoa, David Oh, Tho Pham, Kerri Rieger, Matthew Rumery, Darren Salmi, Neil Shah, Run Shi, Carlos Suarez, Brent Tan, Eric Yang

*Instructors:* Mike Angelo, Joseph Hernandez, Marisa Juntilla, Franklin Mullins, Justin Odegaard, Riccardo Sibiliano, Albert Tsai, Kitchener Wilson

*Adjunct Clinical Faculty:* Swaroop Aradhya, Robert Archibald, Jerome S. Burke, Glenn Cockerham, Seth Haber, Maie K. Herrick, Paul W. Herrmann, Michelle Jorden, Charles Lombard, Robert Luo, Gregory Moes, Joseph O'Hara, William Rueh, Matrina Schmidt, Thomas W. Rogers

*Clinical Educators (Affiliated):* Melissa Clark, Dean Fong, Barbara Egbert

## Courses

### PATH 21N. The Living Genome: Implications for Biology and Beyond. 3 Units.

IntroSem with Freshmen preference. The human genome carries the instructions for normal human development and reproduction. But it also carries predispositions to disease and clues to our evolution, ancestry, and identity. The genome may also be pliable to environmental influences and genetic engineering. Through directed readings, discussion, and activities, students will learn about the human genome and applications of genome science and technology across diverse disciplines including medicine, comparative biology, evolutionary biology, paternity testing, and forensics. The broad goal is to become informed and engaged about genome science and its implications for both the individual and society. Prerequisites: High School Biology.

### PATH 101. Cancer Biology. 4 Units.

Experimental approaches to understanding the origins, diagnosis, and treatment of cancer. Focus on key experiments and discoveries with emphasis on genetics, molecular biology, and cell biology. Topics include carcinogens, tumor virology, oncogenes, tumor suppressor genes, cell cycle regulation, angiogenesis, invasion and metastasis, cancer genomics, cancer epidemiology, and cancer therapies. Discussion sections based on primary research articles that describe key experiments in the field. Satisfies Central Menu Areas 1 or 2 for Bio majors. Prerequisite: Biology or Human Biology core or equivalent, or consent of instructor. Same as: CBIO 101

### PATH 103Q. Lymphocyte Migration. 1 Unit.

Preference to sophomores. Lymphocytes migrate from blood vessels into tissues to participate in immune surveillance and the development of inflammation. The lymphocyte and blood vessel endothelia molecules that control lymphocyte migration, and are implicated in the development of human diseases such as asthma, type 1 diabetes, and multiple sclerosis are discussed.

### PATH 199. Undergraduate Research. 1-18 Unit.

Students undertake investigations sponsored by individual faculty members. Prerequisite: consent of instructor.

**PATH 213. Gross Autopsy Pathology Laboratory. 2-3 Units.**

Examine/discuss unfixed dissected organs from current autopsies and correlate morphologic findings with the clinical history. Students view postmortem examinations and may participate (in a small group) in one postmortem examination with the assistance of residents and staff, and present the case to the class. Class scheduling is flexible. Additional unit for participation in a postmortem examination. Class may not be repeated. Concurrent enrollment in INDE223 required.

**PATH 218. Computational Analysis of Biological Information: Introduction to Python for Biologists. 2 Units.**

Computational tools for processing, interpretation, communication, and archiving of biological information. Emphasis is on sequence and digital microscopy/image analysis. Intended for biological and clinical trainees without substantial programming experience.

Same as: GENE 218, MI 218

**PATH 240. Clinical Studies in Pathology I. 3-9 Units.**

A broad exposure to the practice of pathology in an academic medical center. Students are assigned a faculty mentor and work closely with pathology residents, fellows and faculty. Two months are spent in surgical pathology where students help examine surgical resection specimens and biopsies and participate in making a final diagnosis. One month is spent in autopsy pathology where students perform autopsy prosections and formulate final anatomic diagnoses under the supervision of faculty. This course must be combined with Clinical Studies in Pathology II, and two additional quarters of PATH 399, Directed Research, to fulfill a 12 month Post-Sophomore year Fellowship in Pathology. Prerequisite: MD candidate; instructor consent.

**PATH 241. Clinical Studies in Pathology II. 3-9 Units.**

An in-depth exposure to the practice of pathology for students who have completed Clinical Studies in Pathology I. Students are assigned a faculty mentor and work closely with pathology residents, fellows and faculty. Two months are spent in surgical pathology where students help examine surgical resection specimens and biopsies and participate in making a final diagnosis. One month is spent in sub-specialty areas of pathology that include dermatopathology, neuropathology, renal pathology, lymph node pathology or cytology. This course must be combined with Clinical Studies in Pathology I and two additional quarters of PATH 399, Directed Research, to fulfill a 12-month Post-Sophomore year Fellowship in Pathology. Prerequisite: consent of instructor and successful completion of Clinical Studies in Pathology I (PATH 240).

**PATH 280. Early Clinical Experience in Pathology. 1-2 Unit.**

Provides an observational experience as determined by the instructor and student. Prerequisite: consent of instructor.

**PATH 290. Pediatric Nonmalignant Hematology and Stem Cell Biology. 2 Units.**

Pediatric hematologic disorders provide an important paradigm to study other developmental systems. Subjects covered include hematopoiesis, basic stem cell biology, endothelial cell development, alternative models to study nonmalignant hematology and stem cell biology (zebrafish and drosophila), defects in white cell function, basic research in stem cell transplantation, state of the art methods in nonmalignant hematology and stem cell biology (genomics, proteomics, and gene therapy), and bioinformatics. The course is also open to graduate students and junior and senior undergraduate students who are pre-med.

**PATH 299. Directed Reading in Pathology. 1-18 Unit.**

Prerequisite: consent of instructor.

**PATH 302A. Pathology Clerkship. 5 Units.**

**VISITING:** Open to visitors. **TYPE OF CLERKSHIP:** Elective. **DESCRIPTION:** The purpose of this clerkship is to introduce students to pathology clinical services. The clerkship is customizable based on student interests, with experiences on services in both anatomic and clinical pathology or just one of these fields. For students contemplating a career in pathology, this clerkship provides an excellent opportunity for exposure to the field and to the residency program in pathology at Stanford. Students interested in other fields will learn how pathology interfaces with other areas in medicine, as well as the basic sciences. Student rotations are typically by week on a specific service. Anatomic Pathology services include surgical pathology subspecialties (breast, CT/ENT, GYN, GI, Pediatric, Bone/Soft tissue and GU pathology), intra-operative consultation/frozen service, cytopathology, dermatopathology, neuropathology, hematopathology and autopsy. Clinical Pathology services include hematology, coagulation, transfusion medicine, chemistry/immunology, biochemical genetics, cytogenetics, microbiology/virology, and molecular diagnostics. Exposure to some services may be limited based on service specific scheduling. Students are expected to work-up cases and review findings with faculty at signout times. Occasional presentations on educational cases/topics are also sometimes a component of the clerkship depending on rotation/service. AP rotations may require handling gross specimens and learning the basics of gross dissection for pathology diagnosis (with supervision). Attendance at pathology conferences is an essential part of the clerkship. **Internal Rotators:** please download the Department of Pathology Clerkship Application and return to pathology clerkship coordinator as soon as your registration is complete, or you receive an approval from the program director. **Visiting Rotators:** must complete the Department of Pathology Clerkship Application at: <http://med.stanford.edu/pathology/education.html> and submit for approval to the clerkship coordinator, prior to applying for this course. **Score Program:** This clerkship participates in the SCORE program, a diversity promotion program run by the Stanford Clerkship Office that provides other support for outside rotators. Please note that if you are a visiting student and a minority, you may qualify for this program. Please see the following for further details: <https://med.stanford.edu/clerkships/score-program.html>. **PREREQUISITES:** None. **PERIODS AVAILABLE:** 1-12, full-time for 4 weeks, 4 students per period (location and rotation dependent). **CLERKSHIP DIRECTOR:** Kimberly H Allison, M.D. (650-723-7211 or 650-498-6460), John Higgins, M.D. (650-724-4340) Niaz Banaei, M.D. (650-736-8052). **CLERKSHIP COORDINATOR:** Gabby Barela, 650-721-5755, [gbarela@stanford.edu](mailto:gbarela@stanford.edu), Markell Stine, 650-497-6371, [markell@stanford.edu](mailto:markell@stanford.edu). **REPORTING INSTRUCTIONS:** Where: will be arranged by Chief Resident; Time: 8:00 am. **CALL CODE:** 2 (weekend review of cases for Monday morning signout). **OTHER FACULTY:** G. Berry, T. Longacre, B. Howitt, G. Bean, M. Van de Rijn, C. Kong, N. Kambham, M. Troxell, D. Bingham, H. Vogel, R. Sibley, K. Hazard, A. Folkins, R. West, T. Cowan, T. Cherry, J. Zehnder, Y. Natkunam, B. Pinsky, C.J. Suarez, N. Shah, M. Virk, H. Shan, D. Gratzinger, J. Oak, S. Fernandez-Pol, B. Tan, C. Kunder, R. Bowen, J. Kurzer, T. Goodnough, K. Jensen. **LOCATION:** SHC, LPCH, PAVMC.

**PATH 370. Medical Scholars Research. 4-18 Units.**

Provides an opportunity for student and faculty interaction, as well as academic credit and financial support, to medical students who undertake original research. Enrollment is limited to students with approved projects.

**PATH 398A. Clinical Elective in Pathology. 5 Units.**

VISITING: Open to visitors. TYPE OF CLERKSHIP: Elective. DESCRIPTION: Provides an opportunity for a student in the clinical years to have an in-depth experience in one of the fields of Pathology, of a quality and duration to decide upon by the student and a faculty preceptor in the Department of Pathology. Please note: Students cannot add 398A clerkships directly to their fishbowl schedules through the regular shuffles. Please contact Caroline Cheang in the Office of Medical Student Affairs at [cheang@stanford.edu](mailto:cheang@stanford.edu) or 650-498-7619 with the faculty preceptors name and email address to add this clerkship. Please note: INTERNAL ROTATORS: please download the Department of Pathology Clerkship Application at: <http://med.stanford.edu/pathology/education.html> and return to pathology clerkship coordinator as soon as your registration is complete, or you receive an approval from the program director. VISITING ROTATORS: must complete the Department of Pathology Clerkship Application at: <http://med.stanford.edu/pathology/education.html> and submit for approval to the clerkship coordinator, prior to applying for this course. PREREQUISITES: None. PERIODS AVAILABLE: 1-12. CLERKSHIP DIRECTOR: Kimberly Allison, M.D. CLERKSHIP COORDINATOR: Gabby Barela, 650-721-5755, [gbarela@stanford.edu](mailto:gbarela@stanford.edu). REPORTING INSTRUCTIONS: Where: TBA (designated faculty preceptor); Time: TBA. CALL CODE: 2 (varies according to preceptor). OTHER FACULTY: Staff. LOCATION: SHC.

**PATH 399. Graduate Research. 1-18 Unit.**

Students undertake investigations sponsored by individual faculty members. Opportunities at the molecular, cellular, and clinicopathologic levels. Prerequisite: consent of instructor.