SCHOOL OF MEDICINE

PATHOLOGY

Emeriti: *(Professor)* Ronald Dorfman, Richard L. Kempson; *(Professor, Clinical)* Lawrence F. Eng, Luis Fajardo, Heinz Furthmayr, F. Carl Grumet, Jon Kosek; *(Associate Professor)* P. Joanne Cornbleet
Chair: Stephen J. Galli
Professors: Daniel Arber, Ellen Jo Baron, Gerald J. Berry, Eugene C. Butcher, Michael L. Cleary, Gerald R. Crabtree, Edgar G. Engleman, Andrew Fire, Steven Foung, Stephen J. Galli, Lawrence Tim Goodnough, Michael R. Hendrickson, Joseph S. Lipsick, Donald P. Regula, Robert V. Rouse, Richard K. Sibley, Raymond Sobel, Howard H. Sussman, Dolly Tyan, Matt van de Rijn, Hannes Vogel, Teresa S. F. Wang, Roger A. Warnke, Irving L. Weissman, James Zehnder
Associate Professors: Jeffrey D. Axelrod, Matt Bogyo, Athena M. Cherry, Andrew Connolly, Tina Cowan, James D. Faix, Dean Felsher, Susan A. Galel, Sharon M. Geaghan, John P. Higgins, Neeraja Kambham, Christina Kong, Teri A. Longacre, Sara A. Michie, Yasodha Natkunam, Bruce Patterson, Jonathan R. Pollack, Iris Schrijver, Arend Sidow
Assistant Professors: Niaz Banaei, Raffick Bowen, Magali Fontaine, Tracy George, Dita Gratzinger, F. Kim Hazard, Kristin Jensen, Bingwei Lu, Jesse McKenney, Erich Schwartz, Uma Sundram, Marius Wernig, Robert West
Courtesy Professors: Donna Bouley, Bertil Glader, Lucy Tompkins
Courtesy Associate Professor: Robert Shafer
Clinician Educators: Susan Atwater, David Bingham, Barbara Egbert, Christopher Gonzales, Terri Haddix, Jinah Kim, Amy McKenney, Melanie Manning, Reetesh Pai, Run Shi, Brent Tan, Maurene Viele
Instructors: Ching-Cheng Chen, Neng Chen, Franklin Mullins, Chris Park, Adrian Piliponsky
Adjunct Clinical Faculty: Robert Archibald, Jerome S. Burke, Glenn Cockerham, Stephen Shi-Hua Chen, Seth Haber, Maie K. Herrick, Paul W. Herrmann, Anthony Le, Steven Long, Charles Lombard, Judy Melinek, Gregory Moes, Joseph O'Hara, Girish Putcha, Mahendra Ranchod, Thomas W. Rogers, Joshua Sickel

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Web Site: http://pathology.stanford.edu

Courses offered by the Department of Pathology are listed under the subject code PATH on the *Stanford Bulletin's* Explore-Courses web site.

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 concerned with 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 neurodegenerative 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 http://pathology.stanford.edu.

PATHOLOGY (PATH)

UNDERGRADUATE COURSES IN PATHOLOGY

PATH 101. Cancer Biology
(Same as CBIO 101) 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. Prerequisite: Biology or Human Biology core or equivalent, or consent of instructor.
4 units, Win (Staff)

PATH 103Q. Lymphocyte Migration
(F,Dial) Stanford Introductory Dialogue. Preference to sophomores. How lymphocytes leave the blood stream and enter tissues to participate in immune surveillance and the development of inflammation. Known as lymphocyte migration, this process involves a complex series of adhesion, activation and diapedesis events. The cellular mechanisms involved in lymphocyte migration, including lymphocyte adhesion molecules that interact with their counter-receptors on endothelial cells, and molecules, including cytokines and chemokines, that attract or activate lymphocytes. The roles of these molecules in the development of human diseases such as asthma, type 1 diabetes, and multiple sclerosis.
1 unit, Aut (Michie, S)

PATH 105Q. Final Analysis: The Autopsy as a Tool of Medical Inquiry
(S,Sem) Stanford Introductory Seminar. Preference to sophomores. Based on review of patient medical histories and examination of formalin-fixed and unfixed tissues from autopsy. Student-directed problem-solving; students develop learning objectives for each case, and present findings. The effect of disease on normal structure and function, ethics of patient care, allocation of medical resources, efficiency of therapy, and medical error. Prerequisite: hepatitis-B vaccination; free vaccinations during the winter for accepted students.
3 units, Spr (Regula, D)

PATH 199. Undergraduate Research
Students undertake investigations sponsored by individual faculty members. Prerequisite: consent of instructor.
1-18 units, Aut (Staff), Win (Staff), Spr (Staff), Sum (Staff)

GRADUATE COURSES IN PATHOLOGY

PATH 206. Epigenetics
(Same as GENE 206) For graduate students; undergraduates by consent of instructor. Mechanisms by which phenotypes not determined by the DNA sequence are stably inherited in successive cell divisions. From the discovery of position-effect variegation in Drosophila in the 1920s to present-day studies of covalent modifications of histones and DNA methylation. Topics include: position effect, gene silencing, heterochromatin, centromere identity, genomic imprinting, histone code, variant histones, and the role of epigenetics in cancer. Prerequisite: BIO41 and BIO42 , or GENE 203, or consent of instructor.
2 units, Spr (Lipsick, J; Gozani, O), alternate years, not given next year

PATH 210. Stem Cells in Development and Disease
Molecular and cellular mechanisms underlying the basic self-renewal and differentiation properties of stem cells in multiple tissues and organisms. How abnormal stem cell behavior may contribute to diseases such as cancer. How to manipulate stem cell behavior in vitro or in vivo for therapeutic purposes. Classical papers and recent literatures in the field of stem cell biology. Open to graduate, medical, and advanced undergraduate students. Prerequisite: consent of instructor.
1-2 units, Aut (Lu, B)

PATH 213. Gross Autopsy Pathology Laboratory
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. Pre- or corequisite: HHD.
2-3 units, Aut (Regula, D), Win (Regula, D)

PATH 218. Computational Analysis of Biological Images
(Same as GENE 218) Physical and computational tools for acquisition, processing, interpretation, and archiving of biological images. Emphasis is on digital microscopy.
2 units, alternate years, not given this year

PATH 233. The Biology of Small Modulatory RNAs
(Same as GENE 233, MI 233) Open to graduate and medical students. How recent discoveries of miRNA, RNA interference, and short interfering RNAs reveal potentially widespread gene regulatory mechanisms mediated by small modulatory RNAs during animal and plant development. Required paper proposing novel research.
2 units, Aut (Fire, A; Chen, C), alternate years, not given this year

PATH 234. Fundamentals of RNA Biology
(Same as GENE 234, MI 234) For graduate or medical students and (if space allows) to active participants from other segments of the Stanford Community (e.g., TGR students); undergraduates by instructor consent. Fundamental issues of RNA biology, with the goal of setting a foundation for students to explore the expanding world of RNA-based regulation. Each week a topic is covered by a faculty lecture and journal club presentations by students.
2 units, Aut (Chen, C; Fire, A; Sarnow, P)

PATH 240. Clinical Studies in Pathology I
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. May 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.
3-9 units, Aut (Natkunam, Y; Higgins, J), Win (Natkunam, Y; Higgins, J), Spr (Higgins, J; Natkunam, Y), Sum (Natkunam, Y; Higgins, J)

PATH 241. Clinical Studies in Pathology II
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 autopsy pathology where students perform autopsy prosections and formulate final anatomic diagnoses under the supervision of faculty. Additional time may be spent observing in subspecialty areas of pathology that include dermatopatholgy, neuropathology, renal pathology, lymph node pathology or cytology. May 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).
3-9 units, Aut (Natkunam, Y; Higgins, J), Win (Natkunam, Y; Higgins, J), Spr (Staff), Sum (Higgins, J; Natkunam, Y)

PATH 296. Stem Cell Biology and Regenerative Medicine
(Same as DBIO 296) For graduate and medical students. Embryonic and adult stem cells, including origin, regulation, self-renewal, differentiation, fate, and relationship to cancer; biological mechanisms and methods to translate findings to therapeutic applications. Medical students must enroll for 5 units; graduate students may choose to take only the basic science part for 3 units. Prerequisites: DBIO 201 and 210, or consent of instructor.
3-5 units, Win (Weissman, I; Nusse, R; Fuller, M)

PATH 299. Directed Reading in Pathology
Prerequisite: consent of instructor.
1-18 units, Aut (Staff), Win (Staff), Spr (Staff), Sum (Staff)

PATH 370. Medical Scholars Research
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.
4-18 units, Aut (Staff), Win (Staff), Spr (Staff), Sum (Staff)

PATH 399. Graduate Research
Students undertake investigations sponsored by individual faculty members. Opportunities at the molecular, cellular, and clinicopathologic levels. Prerequisite: consent of instructor.
1-18 units, Aut (Staff), Win (Staff), Spr (Staff), Sum (Staff)