GENETICS

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Courses given in Genetics have the subject code GENE. For a complete list of subject codes, see Appendix B.

GRADUATE PROGRAMS

University requirements for the Ph.D. degree are described in the "Graduate Degrees" section of this bulletin.

The Ph.D. program in the Department of Genetics offers graduate students the opportunity to study in all the major areas of modern genetics research, including many aspects of human genetics (linkage mapping, physical mapping, cytogenetics, genetic epidemiology and population genetics), bacterial genetics, yeast genetics, vertebrate and Drosophila developmental genetics, mouse genetics, gene therapy, immunogenetics, host/pathogen interactions, computational and mathematical biology, and evolutionary genetics. The department also includes the Stanford Human Genome Center, which is engaged in large-scale genomic research on humans and other organisms, the *Saccharomyces* Genome Database (SGD) project, which is the repository for genetic information pertaining to the model organism *S. cerevisae* (Baker's or Brewer's yeast), and the Stanford Microarray Database (SMD) which is a local resource for DNA microarray data storage and analysis.

The department believes that genetics should be viewed as a discipline that encompasses not just a set of tools but a coherent and fruitful way of thinking about biology and medicine. The department emphasizes the broad scope of genetic thinking, including not just molecular genetics, but also classical, medical, and population genetics as well as many aspects of genomics and quantitative analysis. The department provides training through laboratory rotations, dissertation research, a series of advanced courses in genetics and other areas of biomedical science, several seminar series and colloquia, journal clubs, and an annual three-day retreat that includes faculty members, students, postdoctoral fellows, and staff scientists. A strong emphasis is placed on interactions and collaborations among students, postdoctoral students, and faculty members within the department and throughout the campus.

The Department of Genetics is located in the School of Medicine and includes modern, well-equipped laboratories. Extensive computer support and advanced instrumentation are available for research projects. The department has 35-40 graduate students and 30-35 postdoctoral fellows. In addition to interacting with the faculty and laboratories in the department, students have contacts with a much larger number of students, fellows, and faculty in other biological and biomedical programs throughout the University.

During their first year, graduate students in the department take advanced graduate courses and sample several areas of research by doing rotations in three or four of the department's laboratories. At the end of the first three quarters, students select a laboratory in which to do their dissertation research. While the dissertation research is generally performed in one laboratory, collaborative projects with more than one faculty member are encouraged. In addition to interacting with their faculty preceptor, graduate students receive input regularly from other faculty members who serve as advisers on their dissertation committee. Study for the Ph.D. generally requires between four and five years of graduate work, most of which is spent on the dissertation research.

Students are generally enrolled in the program to receive the Ph.D. degree, although a limited number of M.D. candidates can combine research training in genetics with their medical studies. Ph.D. candidates who have passed the qualifying exam in the second year can opt to receive the M.S. degree.

There are opportunities for graduate students to teach in graduate level and professional-school courses, although there is no formal teaching requirement. In addition, students are encouraged to participate in education outreach activities that are administered through the department, which involves numerous opportunities to interact with secondary school students and teachers, lay groups, and local science museums.

Students who have recently received a bachelor's, master's, M.D., or Ph.D. degree in related fields may apply for graduate study in the Department of Genetics. Prospective students must have a background in general biology, mathematics, physics and chemistry. Decisions for admission are based on comparison of the relative merits of all the candidates' academic abilities and potential for research. Interviews take place in late February or early March. Students who wish to pursue a combined M.D./Ph.D. degree are considered for admission into the graduate program in the Department of Genetics after they have been admitted to the M.D. program in the School of Medicine. All applicants are considered equally regardless of race, color, creed, religion, national origin, sexual preference, age, or gender.

Students are admitted to the graduate program in the Autumn Quarter. Prospective students are encouraged to begin the application process early enough to ensure that they are able to submit a complete application by the previous December 15. All students accepted into the Ph.D. program in the Department of Genetics are provided with full tuition and a stipend to cover the cost of living. Two training grants from the National Institutes of Health provide major support for the graduate training program in the department. Other student support is provided by departmental funds and from research grants, both federal and private, of the faculty. In addition, a number of graduate students are funded by fellowships from the National Science Foundation or the Howard Hughes Medical Institute. Prospective students are encouraged to apply for fellowships from these institutes by requesting applications from the National Science Foundation, Oakridge Associated Universities, P.O. Box 3010, Oak Ridge, TN 37831-3010, telephone (615) 483-3344; http://www.nsf.gov or the Howard Hughes Medical Institute, Fellowship Office, National Research Council, 2101 Constitution Avenue NW, Washington, DC 20418, telephone (202) 334-2872, http://www.hhmi.org. These applications are due on November 1 of each year.

COURSES

For further information on the availability of courses, consult the quarterly *Time Schedule*, or inquire at the department office. Additional courses in or related to genetics are included in the listings of the departments of Biological Sciences, Biochemistry, Developmental Biology, Microbiology and Immunology, and Structural Biology.

GENE 104Q. Legal and Social Issues in Human Genetics—Stanford Introductory Seminar. Preference to sophomores. Recent developments in human genetics. Two sessions devoted to scientific background. Issues include DNA databases for forensic use, human cloning, genetic testing for adult onset disease, genetic discrimination, pre-natal genetic trait selection by parents, state-sponsored eugenics, and gene patenting. Research paper on a topic of student's choice.
3 units, Spr (Greely)

GENE 106Q. The Heart of the Matter—(Same as BIOSCI 106Q.) Stanford Introductory Seminar. Preference to sophomores. The molecular and biochemical basis of life. Emphasis is on the methods and

scientific logic that lead to advances in knowledge. The human heart and circulatory system is the unifying theme for topics such as the constituents and activities of cells, tissues, and organs; the chemicals and proteins that carry on life processes; the biotechnology revolution; the role of genes in human disease and normal functions; and the Human Genome Project. How scientific knowledge is built up through research; how biology initiates advances in medicine; and how science, engineering, and economics interact in biotechnology. Student presentations, demonstrations, and field trips.

3-4 units, Win (Myers, Simoni)

GENE 199. Undergraduate Individual Research—Prerequisite: consent of instructor.

1-18 units (Staff)

GENE 201. Human Genetics—The theoretical and experimental basis for the genetics of human health and disease. Lectures and clinical case discussions in molecular, chromosomal, biochemical, developmental, cancer, and medical genetics, emphasizing the latter. Prerequisites: knowledge of biochemistry and basic genetics.

4 units, Spr (Ford)

GENE 203. Advanced Genetics—(Same as BIOSCI 203, DBIO 203.) The genetic toolbox. Examples of analytic methods and modern synthetic genetic manipulation, including original papers. Emphasis is on use of genetic tools in dissecting complex biological pathways, developmental processes, and regulatory systems. Graduate students in biological sciences welcome; those with minimal experience in genetics should prepare themselves by working out problems in college level textbooks.

4 units, Aut (Botstein, Kim, Stearns, Villeneuve, Sidow)

GENE 208. Ethical Issues for Geneticist—Major ethical issues facing geneticists and scientists in related fields. Topics include authorship, peer review, mentoring, scientific error and misconduct, conflict of interest, human experimentation, genetic technology, intellectual property. No final exam. Sign-up list requested.

2 units, Win (Cohen, Cox)

GENE 211. Genomics—Focus is on developing a knowledge base of facts about genome evolution, organization, and function; technical, computational, and experimental approaches; hands-on experience with a small but representative number of computational tools used in genome science; and a beginning working knowledge of PERL.

3 units, Win (Cherry, Botstein, Myers, Sidow)

GENE 214. Human and Mouse Genetics: Principles and Approaches—Fundamental aspects of human and mouse genetics building on 203, with emphasis on human biology. The mouse considered as a model system of human disease. Topics include methods to assess the genetic contribution to a phenotype in humans, parametric and non-parametric linkage analysis, linkage disequilibrium analysis, human genetic variation and evolution, experimentation using inbred strains of mice, positional closing of genes in mice and humans, recombinant inbred and congenic mouse strains for QTL analysis, peri-implantation development in mouse, the molecular pathogenesis of human disease, and medical applications of human genetics.

3 units, Spr (Risch)

GENE 215. Frontiers in Biological Research—(Same as BIOC 215, DBIO 215.) Literature discussion on how to critically evaluate biological research. Held in conjunction with a seminar series, hosted in alternate weeks by Biochemistry, Developmental Biology, and Genetics. Each Wednesday, distinguished investigators present their current work at the Frontiers in Biological Research seminar. Beforehand, students and faculty meet to discuss one or more papers from the speaker's primary research literature on a related topic. After the seminar, students meet with the speaker to discuss their research and future direction, the techniques most commonly used to study problems in biology, and a comparison between the genetic and biochemical approaches in biological research.

1 unit, Aut, Win (Harbury, Kingsley, Baker)

GENE 222. Method and Logic in Experimental Genetics—For graduate students only. Experimental design. Weekly topics central to research in genetics, biochemistry, and molecular biology: protein subunit equilibrium, domain structure of proteins, cooperativity, precursor/product relationships, and macromolecular interactions. Emphasis is on student participation and analysis of the logical principles underlying experiments in these areas. Papers, classic and contemporary, from primary literature relevant to the weekly topic.

3 units, Win (Myers, Vollrath)

GENE 260. Supervised Study—Genetics graduate students lab research from the first quarter until candidacy has been filed. Prerequisite: consent of instructor.

1-18 units, any quarter (Staff)

GENE 299. Directed Reading—Prerequisite: consent of instructor.

1-18 units, any quarter (Staff)

GENE 344A. Genetic Epidemiology—(Same as STATS 344A.) Methods for the design and analysis of studies in human genetics, focusing on the epidemiology of Mendelian disorders, and the genetic and environmental contributions to common, complex familial traits. Topics: study designs for assessing the importance of genetic factors (family, twin, and adoption studies); methods for determining modes of inheritance (segregation analysis); identification and mapping of major genes through linkage analysis and disease marker associations.

3 units (Risch) alternate years, given 2003-04

GENE 344B. Topics in Statistical Genetics—(Same as STATS 344B.) Statistical methods currently used in human genetic analysis. Topics depend on interests of the students and instructors: concepts of likelihood as used in the genetic context; measures of familial aggregation, including issues of censoring and age-dependent data; genetic modeling of quantitative traits; mode of inheritance analysis, including segregation analysis; analysis of extended pedigrees; parametric and nonparametric approaches to linkage analysis and gene mapping, including family studies; linkage disequilibrium; analysis of DNA profiles for individual identification.

3 units (Risch) alternate years, given 2003-04

GENE 344C. Genetic Epidemiology: Applications—Sequel to 344A, focusing on application of methods from genetic epidemiology to various diseases: family studies, segregation analysis, linkage analysis, and population association studies. The disease topics are tailored to the interests of the students, from cancer (breast or colon), neurological disorders (multiple sclerosis, epilepsy), birth defects (cleft lip and palate, pyloric stenosis), psychiatry (schizophrenia, manic depression, Alzheimer's disease), cardiovascular disease, autoimmune disease (diabetes, coeliac disease).

2 units, Spr (Risch) not given 2003-04

GENE 399. Research—Prerequisite: consent of instructor.

1-18 units, any quarter (Staff)