GENETICS

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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 and yeast genetics, Drosophila developmental genetics, mouse genetics, immunogenetics, and mathematical biology. The department also includes the Stanford Human Genome Center, which is engaged in state-of-the-art mapping and sequencing of the human genome, the *Saccharomyces* Genome Database project which is the repositor for genomic information pertaining to the model organism *S. cerevisae* (baker's or brewer's yeast), and the Stanford Microarray Database which is a local resource for DNA microarray data storage and analysis.

The department believes 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. It emphasizes, in the teaching of doctoral students and physician-scientists, the broad scope of genetic thinking, including not just molecular genetics, but also classical, medical, and population genetics. 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, students, postdoctoral fellows, and staff scientists. A strong emphasis is placed on interactions among students, postdoctoral students, and faculty 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 25 to 30 graduate students and 30 to 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 laboratory rotations in three or four labs in the department. At the end of the first year, students select a lab in which to do their dissertation research. While the dissertation research is generally performed in one lab, 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.

Graduate students are generally enrolled in the Ph.D. program, 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 an education outreach program that is administered through the department and 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, chemistry, mathematics, and physics. Decisions for admission are based on a comparison of the relative merits of all the candidates' academic abilities and potential for research. 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, and are able to apply for fellowships by the previous November 15. All students accepted into the Ph.D. program are provided with full tuition and a stipend to cover costs of living. Three training grants from the U.S. National Institutes of Health provide major support for the graduate training program in the department. Other student support is provided by department funds and from the 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; Howard Hughes Medical Institute, Fellowship Office, National Research Council, 2101 Constitution Avenue, NW, Washington, D.C. 20418, telephone (202) 334-2872. 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.

201. Human Genetics—The theoretical and experimental basis for human genetics. Lectures/reading in molecular, chromosomal, cellular, developmental, population, and medical genetics, emphasizing the latter. Prerequisites: knowledge of biochemistry and basic genetics.

4 units, Spr (Cox, Francke, Barsh)

203. Advanced Genetics—(Same as Biological Sciences 203, Developmental Biology 203.) Explores 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 Suzuki, et al, or Hartl, et al.

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

208. Ethical Issues for Geneticists—Lectures and discussions on 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.

1 unit (Cohen, Cox) alternate years, given 2002-03

210. Advanced Human Genetics—For students in the Genetics Ph.D. program; other graduate students by arrangement. Companion course for 201. Advanced principles of human and medical genetics. In-depth discussion of human genetics; examples from recent literature. Emphasis is on molecular genetics and on experimental approaches.

2 units, Spr (Cox, Risch)

217. Mammalian Developmental Genetics—(Same as Developmental Biology 217.) Topics: imprinting; early development and implantation; germ cell allotment; phenotypic consequences of targeted knockouts of developmental, hox, and other developmental genes in mammals; tumorigenesis; coat color mutations; classical mutations and positional cloning; mutagenesis and insertional and gene traps; growth controls and Igfs; muscle and limb development; sex determination; classical genetics and gene mapping and inbred strains; segregation and T locus; and germ and embryonic stem cells and teratocarcinomas. Weekly lecture, plus guest lecture or a literature discussion.

2 units (Barsh, Nusse) alternate years, given 2002-03

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)

344A. Genetic Epidemiology—(Same as Statistics 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. Applications to birth defects, coronary heart disease, psychiatry, neurology, cancer, and immunology.

3 units, Win (Risch) alternate years, not given 2002-03

344B. Topics in Statistical Genetics—(Same as Statistics 344B.) In-depth discussion of 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, radiation hybrid data, sperm typing, and DNA contig mapping; linkage disequilibrium; analysis of DNA profiles for individual identification; DNA sequence analysis.

3 units, Spr (Risch) alternate years, not given 2002-03

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), etc.

2 units (Risch) alternate years, given 2002-03

260. Supervised Study—Prerequisite: consent of instructor.

any quarter (Staff)

299. Directed Reading—Prerequisite: consent of instructor.

any quarter (Staff)

399. Individual Research—Prerequisite: consent of instructor.

any quarter (Staff)