DEVELOPMENTAL BIOLOGY

Emeritus: (Professor) David A. Clayton, David S. Hogness
Chair: Margaret Fuller
Associate Chair: Lucy Shapiro
Professors: Gerald Crabtree, Margaret Fuller, A. Dale Kaiser, Roeland Nusse, Matthew Scott, Lucy Shapiro, James Spudich, Irving Weissman
Associate Professors: Ben Barres, Stuart Kim, David Kingsley, William Talbot, Anne Villeneuve
Assistant Professor: Seung Kim,
Associate Professor (Teaching): Ellen Porzig
Associate Professor (Research): Harley McAdams

Courses given in Development Biology have the subject code DBIO. For a complete list of subject codes, see Appendix B.

A fundamental problem in biology is how the complex set of multicellular structures that characterize the adult animal is generated from the fertilized egg. Advances at the molecular level, particularly with respect to the genetic control of development, have been explosive. These advances represent the beginning of a major movement in the biological sciences toward the understanding of the molecular mechanisms underlying developmental decisions and the resulting morphogenetic processes. This new thrust in developmental biology derives from the extraordinary methodological advances of the past decade in molecular genetics, immunology, and biochemistry. However, it also derives from groundwork laid by the classical developmental studies, the rapid advances in cell biology and animal virology, and from models borrowed from prokaryotic systems. Increasingly, the work is directly related to human diseases, including oncogene function and inherited genetic disease.

The Department of Developmental Biology includes a critical mass of scientists who are leading the thrust in developmental biology and who can train new leaders in the attack on the fundamental problems of development. Department labs work on a wide variety of organisms from microbes to worms, flies, and mice. The dramatic evolutionary conservation of genes that regulate development makes the comparative approach of the research particularly effective. Scientists in the department labs have a very high level of interaction and collaboration. The discipline of developmental biology draws on biochemistry, cell biology, genetics, and molecular biology.

The department is located in the Beckman Center for Molecular and Genetic Medicine within the Stanford University Medical Center.

GRADUATE PROGRAM

MASTER OF SCIENCE

Students in the Ph.D. program in Developmental Biology may apply for an M.S. degree, assuming completion of their course requirements and preparation of a written proposal. The master's degree awarded by the Department of Developmental Biology does not include the possibility of minors for graduate students enrolled in other departments or programs.

Students are required to take, and satisfactorily complete, at least three lecture courses offered by the department, including 210, Developmental Biology. In addition, students are required to take three courses outside the department. Students are also expected to attend Developmental Biology seminars and journal clubs. In addition, the candidate must complete a research paper proposing a specific experimental approach and background in an area of science relative to developmental biology.

DOCTOR OF PHILOSOPHY

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

The graduate program in Developmental Biology leads to the Ph.D. degree. The department also participates in the Medical Scientists Training Program in which individuals are candidates for both the M.D. and Ph.D. degrees.

Students are required to take, and satisfactorily complete, at least six courses, including Developmental Biology (210); Advanced Genetics (203); Frontiers in Biological Sciences (215); and an advanced molecular biology, biochemistry, or biophysics course. Students are also expected to attend Developmental Biology seminars and journal clubs.

Successful completion of a qualifying examination is required for admission to Ph.D. candidacy. The examination consists of two parts. One proposal is on a subject different from the dissertation research and the other proposal is on the planned subject of the thesis. The final requirements of the program include the presentation of a Ph.D. dissertation as the result of independent investigation and constituting a contribution to knowledge in the area of developmental biology. The student must then successfully pass the University oral examination which is taken only after the student has substantially completed his or her research. The examination is preceded by a public seminar in which the research is presented by the candidate. The oral examination is conducted by a dissertation reading committee.

COURSES

Course and lab instruction in the Department of Developmental Biology conforms to the "Policy on the Use of Vertebrate Animals in Teaching Activities," the text of which is available at http://www.stanford.edu/dept/DoR/rph/8-2.html.

DBIO 11N. Human Development: Egg to Embryo—Stanford Introductory Seminar. Preference to freshmen.
3-4 units, Spr (Porzig)

DBIO 198. Research
1-18 units, by arrangement (Staff)

DBIO 199. Undergraduate Research
1-18 units, Aut, Win, Spr, Sum (Staff)

DBIO 201. Development and Disease Mechanisms—Mechanisms that direct human development from conception to birth. Conserved molecular and cellular pathways regulate tissue and organ development; errors in these pathways result in congenital anomalies and human diseases. Topics: molecules regulating development, cell induction, developmental gene regulation, cell migration, programmed cell death, pattern formation, stem cells, cell lineage, and development of major organ systems. Emphasis is on links between development and clinically significant topics including infertility, assisted reproductive technologies, contraception, prenatal diagnosis, multiparity, teratogenesis, inherited birth defects, fetal therapy, adolescence, cancer, and aging. Interested undergraduates must contact Ellen Porzig (eporzig@stanford.edu).
4 units, Aut (Scott, Crabtree, Porzig, Kingsley, Kim)

DBIO 203. Advanced Genetics—(Same as BIOSCI 203, GENE 203.) For graduate students in biological sciences; may be appropriate for graduate students in other programs. The genetic toolbox. Examples of analytic methods, genetic manipulation, genome analysis, and human genetics. Emphasis is on use of genetic tools in dissecting complex biological pathways, developmental processes, and regulatory systems. Faculty-led discussions sections with critical evaluation of papers. Students with minimal prior experience in genetics should prepare themselves by working out problems in college level textbooks.
4 units, Aut (Stearns, Kim, Sidow, Villeneuve)

DBIO 210. Developmental Biology—Current areas of research in developmental biology. How organismic complexity is generated during embryonic and post-embryonic development. The roles of genetic networks, induction events, cell lineage, maternal inheritance, cell-cell communication, and hormonal control in developmental processes in well-studied organisms such as vertebrates, insects, and nematodes. Team-taught. Students meet with faculty to discuss current papers from the literature. Prerequisite: graduate standing, consent of instructor. Recommended: familiarity with basic techniques and experimental rationales of molecular biology, biochemistry, and genetics.
5 units, Spr (Talbot, Nusse, Crabtree, Fuller, Kim, Kingsley, Scott)

DBIO 215. Frontiers in Biological Research—(Same as BIOC 215, GENE 215.) Literature discussion. 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, Spr (Harbury, Kingsley, Baker)

DBIO 225. Molecular Motor Proteins and the Cytoskeleton—(Same as BIOC 225.) The molecular basis of energy transduction leading to movements generated by microfilament-based and microtubule-based motors. Forms of myosin, dynein, and kinesin and their roles in the cell as a model for understanding the structural, biochemical, and functional properties of biological machines. Topics: structure of the molecular motors and their accessory proteins; regulation of the function of motile assemblies; functions of molecular motors in cells; spatial and temporal controls on the formation of motile assemblies in cells. Experimental approaches: genetic analysis, DNA cloning and expression, reconstitution of functional assemblies from purified proteins, x-ray diffraction, three-dimensional reconstruction of electron microscope images, spectroscopic methods, and high-resolution light microscopy. Prerequisites: basic biochemistry and cell biology.

3 units, Spr (Spudich) not given 2004-05

DBIO 232. Readings in the History of Molecular Biology—Prerequisite: graduate standing.

2 units (Kaiser) not given 2003-04

DBIO 237. Introduction to Biotechnology—(Enroll in CHEMENG 450, BIOC 450.)

3 units, Spr (Kao)

DBIO 299. Directed Reading—Prerequisite: consent of instructor. See faculty list for section numbers.

1-18 units, Aut, Win, Spr, Sum, by arrangement

DBIO 399. Research—Investigations sponsored by faculty members. Prerequisite: consent of instructor. See faculty list for section numbers.

1-18 units, Aut, Win, Spr, Sum, by arrangement

DBIO 459. Frontiers in Interdisciplinary Biosciences—(Crosslisted in multiple departments in the schools of Humanities and Sciences, Engineering, and Medicine. Students should enroll through their affiliated department; otherwise enroll in CHEMENG 459.) See CHEMENG 459 or http://biox.stanford.edu/chemeng_index.html for description.

1 unit, Aut, Win, Spr (Robertson)