Department of Developmental and Cell Biology

Thomas Schilling, Department Chair
Kavita Arora, Department Vice Chair
2212 Biological Sciences III
949-824-2458
http://devcell.bio.uci.edu/

Overview
Research programs of the Department of Developmental and Cell Biology focus on molecular aspects of the development of eukaryotic organisms, on the molecular interaction of cells in tissue differentiation, and expression and function of genes related to the biogenesis of organelles and cellular constituents. The main emphasis of research training is in the molecular aspects of cells and development, and the utilization of biotechnology. The Department maintains facilities for research that include genetic, molecular, and biochemical techniques and also has facilities in advanced electron optics, microsurgery, microinjection, and neurophysiology.

Undergraduate Major in Developmental and Cell Biology
The Developmental and Cell Biology major is intended to provide students with intensive training in cutting edge approaches to understanding the structure and function of cells and how they interact to produce a complex organism, starting with a fertilized egg. The focus of the B.S. in Developmental and Cell Biology is to provide students with intensive training aimed at preparing them for graduate programs in modern Developmental and Cell Biology or other biomedical sciences. In-depth training in the molecular basis of cell and developmental biology will be coupled with integrating knowledge obtained from the recent explosive advances in genomic technology to provide a strong working understanding of how to approach problems in basic research.

The major has distinctive features. The first is a reduction in the number of required courses, allowing students the opportunity to focus more deeply on training in Developmental and Cell Biology. The second is the implementation of a new course in Genomic and Proteomic analysis that is closely tied to problems in genetics, developmental, and cell biology. Understanding the connections among these disciplines and how to apply the appropriate tools for defining and answering fundamental questions in biomedical research is a critical tool for success in research. Another distinctive feature of the major is the opportunity to replace two upper-division laboratory courses with mentored BIO SCI 199 individual research in faculty laboratories. This offers students the opportunity to apply the tools they have acquired during formal course work to current problems at the frontiers of research. Lastly, students majoring in Developmental and Cell Biology have faculty advisors with whom they meet at least quarterly. The faculty advisors help students plan their curriculum, select appropriate 199 projects and sponsoring labs, and as a group grant petitions and certify the degree. The combination of new upper-division courses, more flexibility in the curriculum, the option for mentored research, and close interaction with faculty advisors will help the Developmental and Cell Biology majors to develop an appreciation of the nature of research and establish a strong foundation for future success in graduate or professional schools.

Requirements for the B.S. in Developmental and Cell Biology
All students must meet the University Requirements.
All students must meet the School Requirements.

Major Requirements

A. Required Major Courses:

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>BIO SCI D103</td>
<td>Cell Biology</td>
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<tr>
<td>BIO SCI D104</td>
<td>Developmental Biology</td>
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<tr>
<td>BIO SCI D114</td>
<td>Developmental and Cell Biology Majors Seminar</td>
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<tr>
<td>BIO SCI D145</td>
<td>Genomics, Development, and Medicine</td>
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B. Upper-Division Laboratories:

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>BIO SCI D111L</td>
<td>Developmental and Cell Biology Laboratory</td>
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and select two of the following: 1

<table>
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<tr>
<th>Course Code</th>
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<tr>
<td>BIO SCI E106L</td>
<td>Habitats and Organisms</td>
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<tr>
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<td>Physiology Laboratory</td>
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<tr>
<td>BIO SCI E115L</td>
<td>Evolution Laboratory</td>
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<tr>
<td>BIO SCI E131L</td>
<td>Image Analysis in Biological Research</td>
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<tr>
<td>BIO SCI E140L</td>
<td>Evolution and the Environment Laboratory</td>
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<tr>
<td>BIO SCI E160L</td>
<td>Biology of Birds Lab</td>
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<tr>
<td>BIO SCI E166L</td>
<td>Field Biology</td>
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<tr>
<td>BIO SCI E179L</td>
<td>Field Freshwater Ecology</td>
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<tr>
<td>BIO SCI M114L</td>
<td>Biochemistry Laboratory</td>
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</table>
BIO SCI M116L Molecular Biology Laboratory
BIO SCI M118L Experimental Microbiology Laboratory
BIO SCI M121L Advanced Immunology Laboratory
BIO SCI M127L Virology and Immunology Laboratory
BIO SCI M130L Advanced Molecular Lab Techniques
BIO SCI N113L Neurobiology Laboratory

C. Upper-Division Biology Electives:

Select one of the following:

- BIO SCI D136 Human Anatomy
- BIO SCI D137 Eukaryotic and Human Genetics
- BIO SCI D148 Development and Disease
- BIO SCI D170 Applied Human Anatomy

and select one of the following:

- BIO SCI D133 Advances in Regenerative Medicine
- BIO SCI D135 Cell Biology of Human Disease
- BIO SCI D190 Topics in Developmental and Cell Biology
- BIO SCI M120 Signal Transduction in Mammalian Cells
- BIO SCI M144 Cell Organelles and Membranes

and select three of the following:

- BIO SCI D105 Cell, Developmental, and Molecular Biology of Plants
- BIO SCI D130 Photomedicine
- BIO SCI D132 Introduction to Precision Medicine
- BIO SCI D133 Advances in Regenerative Medicine
- BIO SCI D136 Human Anatomy
- BIO SCI D137 Eukaryotic and Human Genetics
- BIO SCI D138 Critical Thinking in Cell Biology
- BIO SCI D148 Development and Disease
- BIO SCI D170 Applied Human Anatomy
- BIO SCI E109 Human Physiology
- BIO SCI E157 Comparative Vertebrate Anatomy
- BIO SCI M114 Advanced Biochemistry
- BIO SCI M116 Advanced Molecular Biology
- BIO SCI M125 Molecular Biology of Cancer
- BIO SCI M137 Microbial Genetics
- BIO SCI M143 Human Parasitology
- BIO SCI M144 Cell Organelles and Membranes
- BIO SCI N110 Neurobiology and Behavior
- BIO SCI N151 Neurobiology of Aging
- BIO SCI N153 Neuropharmacology
- BIO SCI N154 Molecular Neurobiology

NOTE: No course may be used to satisfy more than one requirement.

1 Students may petition to substitute Excellence in Research (BIO SCI 199) for two upper-division laboratories (other than BIO SCI D111L); 199 research is strongly encouraged. The 199 laboratory must be approved by the Department, and Excellence in Research must be successfully completed. Final approval is given by the Department.

Application Process to Declare the Major: The major in Developmental and Cell Biology is open to junior- and senior-level students only. Applications to declare the major can be made at any time. Information can also be found at the UCI Change of Major Criteria website (http://www.changeofmajor.uci.edu). Double majors within the School of Biological Sciences or with Public Health Sciences, Biomedical Engineering, Premedical, Nursing Science, or Pharmaceutical Sciences are not permitted.
Sample Program — Developmental and Cell Biology

Freshman

Fall | Winter | Spring
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BIO SCI 93 | BIO SCI 94 | MATH 2A or 5A
CHEM 1A | CHEM 1B | CHEM 1C- 1LC
Lower-Division Writing$^1$ | Lower-Division Writing$^1$ | Lower-Division Writing$^1$
BIO SCI 2A | | BIO SCI 194S

Sophomore

Fall | Winter | Spring
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BIO SCI 97 | BIO SCI 98 | BIO SCI 99
CHEM 51A | CHEM 51B- 51LB | CHEM 51C- 51LC
MATH 2B or 5B | General Education | STATS 7, 8, MATH 2D, or MATH 3A
CHEM 1LD | | |

Junior

Fall | Winter | Spring
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BIO SCI D103 | BIO SCI D104 | BIO SCI D111L
PHYSICS 3A | PHYSICS 3B- 3LB | PHYSICS 3C- 3LC
BIO SCI 100 | BIO SCI D145 | BIO SCI D114
General Education | General Education | General Education

Senior

Fall | Winter | Spring
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BIO SCI 199 or U-D Lab | BIO SCI 199 or U-D Lab | U-D Lab or Bio. Sci. elective
U-D Bio. Sci. elective | BIO SCI 199 or General Education | BIO SCI 199 or General Education
| General Education | General Education

$^1$ Students have the option of taking HUMAN 1AS, HUMAN 1BS, HUMAN 1CS or WRITING 39A, WRITING 39B, WRITING 39C in order to fulfill the lower-division writing requirement.

Undergraduate Major in Genetics

Genetics pervades every aspect of modern society, from newspaper articles to talk shows, from discussions on health care to discussions on cloning. With the sequencing of the human genome, it is more important than ever for biology students to have a broad background in the study of heredity and evolution. The Genetics major is designed to benefit motivated undergraduates who have a particular interest in learning about developmental genetics, evolutionary genetics, and molecular genetics and to allow them to explore how our knowledge of genetic mechanisms contributes to our understanding of human development and disease. The Genetics major will accommodate students interested in the study of inheritance either as a basic discipline or in terms of its applied aspects in biotechnology, medicine, and agriculture, but will be especially attractive to those students desiring focused study and preparation for graduate training.

Genetics majors begin their study in the junior year with three required major courses (BIO SCI D103, BIO SCI D104) and (BIO SCI D113. In addition to these required major courses, students will choose six additional upper-division Biology Elective courses. Certain courses are designed to give students an understanding of genetic mechanisms and teach them how to define and answer fundamental questions in biomedical research. Additionally, students choose at least two electives that deal with topics such as the molecular biology of cancer, human genetic diseases, developmental genetics, and the genetics of aging. Finally, Genetics majors are encouraged to explore laboratory research by enrolling in BIO SCI 199. Laboratory research not only expands a student’s technical skills, but is also designed to allow faculty members to mentor Genetics majors. All students majoring in Genetics have a faculty advisor with whom they meet at least quarterly. The faculty advisor helps students plan their curriculum and select appropriate Biological Sciences 199 research projects. Genetics majors also have an opportunity to meet with other Genetics majors on a regular basis and participate in research talks.

The Genetics major provides graduates with advanced training in the skills necessary to pursue graduate degrees in biomedical research. These include Ph.D. graduate programs, teacher-training programs, medical school, and veterinary school. Genetics graduates may also use their backgrounds effectively in planning careers in law, business, education, and public affairs.

Requirements for the B.S. in Genetics

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Major Requirements

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<td>Advanced Molecular Lab Techniques</td>
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<td>BIO SCI D148</td>
<td>Development and Disease</td>
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<td>Microbial Genetics</td>
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<td>BIO SCI E153</td>
<td>Functional and Structural Evolutionary Genomics</td>
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<td>BIO SCI N152</td>
<td>Developmental Neurobiology</td>
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<td>BIO SCI D136</td>
<td>Human Anatomy</td>
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Sample Program — Genetics

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<tr>
<th>Freshman</th>
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<td>BIO SCI 93</td>
<td>BIO SCI 94</td>
<td>MATH 2A or 5A</td>
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<td>CHEM 1B</td>
<td>CHEM 1C- 1LC</td>
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<td>Lower-Division Writing</td>
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<td>CHEM 51A</td>
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<td>BIO SCI D103</td>
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<td>U-D Lab or BIO SCI 199</td>
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<td>PHYSICS 3C- 3LC</td>
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<td>General Education</td>
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<td>U-D Bio. Sci. elective</td>
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Graduate Program

The Department offers graduate study in conjunction with the program in Cellular and Molecular Biosciences (CMB), the Interdepartmental Neuroscience Program (INP), and the program in Mathematical and Computational Biology (MCB).

Students admitted into the combined program who select a research advisor in the Department begin following the Departmental requirements for the Ph.D. at the beginning of their second year. Students participate in the Developmental or Cell Biology Journal Club and the Departmental seminar series, which meet weekly during the academic year.

Students must complete the advancement-to-candidacy examination by the end of the third year of graduate study by presenting and defending a proposal for specific dissertation research. The normative time for completion of the Ph.D. is five years, and the maximum time permitted is seven years.

Faculty

Joseph Arditti, Ph.D. University of Southern California, Professor Emeritus of Developmental and Cell Biology (developmental physiology of orchids)

Kavita Arora, Ph.D. University of Bombay, Professor of Developmental and Cell Biology (Drosophila development; TGF-β signal transduction; cell signaling)

Scott Atwood, Ph.D. University of Oregon, Assistant Professor of Developmental and Cell Biology

Pierre F. Baldi, Ph.D. California Institute of Technology, UCI Chancellor's Professor of Computer Science; Biological Chemistry; Biomedical Engineering; Developmental and Cell Biology; Mathematics (bioinformatics, computational biology)

Lee Bardwell, Ph.D. Stanford University, Professor of Developmental and Cell Biology (intracellular signaling in development and disease)
Claudia Benavente, Ph.D. University of Arizona, Assistant Professor of Pharmaceutical Sciences; Developmental and Cell Biology (genetics, epigenetics, cancer, pediatric cancer, retinoblastoma, osteosarcoma)

Michael W. Berns, Ph.D. Cornell University, Arnold and Mabel Beckman Chair in Laser Biomedicine and Professor of Surgery; Biomedical Engineering; Developmental and Cell Biology (photomedicine, laser microscopy, biomedical devices)

Bruce Blumberg, Ph.D. University of California, Los Angeles, Professor of Developmental and Cell Biology; Biomedical Engineering; Environmental Health Sciences; Pharmaceutical Sciences (gene regulation by nuclear hormone receptors in vertebrate development physiology, endocrine disruption)

Hans R. Bode, Ph.D. Yale University, Professor Emeritus of Developmental and Cell Biology (molecular basis of pattern formation in Hydra)

Peter J. Bryant, Ph.D. University of Sussex, Research Professor and Professor Emeritus of Developmental and Cell Biology (tumor-suppressor genes of Drosophila and humans)

Susan V. Bryant, Ph.D. University of London, Professor Emerita of Developmental and Cell Biology (molecular basis of limb development and regeneration)

Anne L. Calof, Ph.D. University of California, San Francisco, Professor of Anatomy and Neurobiology; Developmental and Cell Biology (neurogenesis and neuronal differentiation)

Richard D. Campbell, Ph.D. The Rockefeller University, Professor Emeritus of Developmental and Cell Biology (Morphogenesis; biology of Hydra; fractal geometry of biological forms)

Ken W. Cho, Ph.D. University of Pennsylvania, Professor of Developmental and Cell Biology (TGF-β signaling, gene regulatory networks in development)

Olivier Cinquin, Ph.D. University College London, Assistant Professor of Developmental and Cell Biology (mathematical modeling of networks, systems biology)

Olivier Civelli, Ph.D. Swiss Federal Institute of Technology in Zurich, Department Chair and Eric L. and Lila D. Nelson Chair in Neuropharmacology and Professor of Pharmacology; Developmental and Cell Biology; Pharmaceutical Sciences (novel neuroactive molecules)

Michelle Digman, Ph.D. University of Illinois at Chicago, Assistant Professor of Biomedical Engineering; Chemical Engineering and Materials Science; Developmental and Cell Biology (quantitative imaging techniques to study spatial-temporal dynamics of signaling protein networks in live cells and tissues)

Peter J. Donovan, Ph.D. University College London, Professor of Biological Chemistry; Developmental and Cell Biology (stem cell biology)

Aimee Lara Edinger, Ph.D. University of Pennsylvania, Associate Professor of Developmental and Cell Biology (cancer biology and metabolism, growth control, protein trafficking)

German A. Enciso Ruiz, Ph.D. Rutgers, the State University of New Jersey, Associate Professor of Mathematics; Developmental and Cell Biology (applied and computational mathematics, mathematical and computational biology)

Donald E. Fosket, Ph.D. University of Idaho, Professor Emeritus of Developmental and Cell Biology (regulation of cytoskeleton formation and function)

David M. Gardiner, Ph.D. University of California, San Diego, Professor of Developmental and Cell Biology (limb development and regeneration)

Enrico Gratton, Ph.D. University of Rome, Professor of Biomedical Engineering; Developmental and Cell Biology; Physics and Astronomy (design of new fluorescence instruments, protein dynamics, single molecule, fluorescence microscopy, photon migration in tissues)

Steven P. Gross, Ph.D. University of Texas at Austin, Professor of Developmental and Cell Biology; Biomedical Engineering; Physics and Astronomy (force generation by molecular motors in living cells)

Patrick L. Healey, Ph.D. University of California, Berkeley, Professor Emeritus of Developmental and Cell Biology (plant cellular differentiation and morphogenesis, ultrastructure and histochemistry of secretory systems, early reproductive development)

Franz J. Hoffmann, Ph.D. University of Hohenheim, Senior Lecturer with Security of Employment Emeritus of Developmental and Cell Biology (regeneration of cultured plant cells, somatic cell genetics)

Daniel J. Knauer, Ph.D. University of Nebraska, Professor Emeritus of Developmental and Cell Biology (human antithrombins and related serine protease inhibitors)

Stuart M. Krassner, SCE Johns Hopkins University, Professor Emeritus of Developmental and Cell Biology (developmental transitions of hemoflagellates)
Arthur D. Lander, Ph.D. University of California, San Francisco, *Donald Bren Professor and Professor of Developmental and Cell Biology; Biomedical Engineering; Logic and Philosophy of Science; Pharmacology* (systems biology of development, pattern formation, growth control)

Shin Lin, Ph.D. University of California, Los Angeles, *Professor of Developmental and Cell Biology* (combined use of biochemistry, cell biology, molecular biology, molecular biophysics to study the structure and function of proteins involved in cytoskeletal/contractile functions and signal transduction in muscle and nonmuscle cells)

Ulrike Luderer, M.D., Ph.D. Northwestern University, *Director of the Environmental Health Sciences Graduate Program and Professor of Medicine; Developmental and Cell Biology; Environmental Health Sciences; Program in Public Health* (reproductive toxicology, developmental toxicology, developmental basis of ovarian toxicity, ovarian cancer)

Grant R. MacGregor, Ph.D. University of Sussex, *Professor of Developmental and Cell Biology* (mouse reproduction, development, homeostasis)

J. Lawrence Marsh, Ph.D. University of Washington, *Professor of Developmental and Cell Biology* (mechanisms of neurodegeneration and molecular genetics of development)


Ronald L. Meyer, Ph.D. California Institute of Technology, *Professor Emeritus of Developmental and Cell Biology* (development of nerve connections, nerve injury, and regeneration)

Edwin S. Monuki, M.D., Ph.D. University of California, San Diego, *Department Chair and Associate Professor of Pathology and Laboratory Medicine; Developmental and Cell Biology*

R. Michael Mulligan, Ph.D. Michigan State University, *Biological Sciences Associate Dean of Graduate Studies and Professor of Developmental and Cell Biology; Ecology and Evolutionary Biology* (RNA editing in plant mitochondria and chloroplasts)

Diane K. O'Dowd, Ph.D. University of California, San Diego, *Professor of Developmental and Cell Biology; Anatomy and Neurobiology* (regulation of activity in developing and adult nervous systems)

Michael J. Parsons, Ph.D. University of London, *Associate Professor of Developmental and Cell Biology* (development and regeneration of the endocrine pancreas)

Maksim Plikus, Ph.D. University of Southern California, *Assistant Professor of Developmental and Cell Biology* (mechanisms of regeneration, stem cell control)

Thomas F. Schilling, Ph.D. University of Oregon, *Department Chair and Professor of Developmental and Cell Biology* (zebrafish development, vertebrate genetics, craniofacial development)


Christine Suetterlin, Ph.D. University of Basel, *Associate Professor of Developmental and Cell Biology* (centrosome and cilia regulation, Golgi, host-pathogen interaction)

Wenqi Wang, Ph.D. Shanghai Institutes for Biological Sciences, *Assistant Professor of Developmental and Cell Biology* (the signaling networks underlying tissue homeostasis and organ size control)

Zeba Wunderlich, Ph.D. Harvard University, *Assistant Professor of Developmental and Cell Biology* (understanding the organization of regulatory information in the genome)

Xiaohui Xie, Ph.D. Massachusetts Institute of Technology, *Associate Professor of Computer Science; Developmental and Cell Biology* (computational biology, bioinformatics, genomics, neural computation, machine learning)
Courses

DEV BIO 200A. Research in Developmental and Cell Biology. 2-12 Units.
Independent research with Developmental and Cell Biology faculty.
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

DEV BIO 200B. Research in Developmental and Cell Biology. 2-12 Units.
Independent research with Developmental and Cell Biology faculty.
Prerequisite: DEV BIO 200A
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

DEV BIO 200C. Research in Developmental and Cell Biology . 2-12 Units.
Independent research with Developmental and Cell Biology faculty.
Prerequisite: DEV BIO 200B
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

DEV BIO 200R. Research in Developmental & Cell Biology for First-year Students. 2-12 Units.
Independent research within the laboratories of graduate training faculty in the Department of Developmental and Cell Biology for first-year Ph.D. students.
Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be taken for credit 3 times.

DEV BIO 203A. Graduate Tutorial in Developmental and Cell Biology. 4 Units.
Advanced study in areas not represented by formal courses. May involve individual or small group study through discussion, reading, and composition. Time and subject matter arranged individually.
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

DEV BIO 203B. Graduate Tutorial in Developmental and Cell Biology. 4 Units.
Advanced study in areas not represented by formal courses. May involve individual or small group study through discussion, reading, and composition. Time and subject matter arranged individually.
Prerequisite: DEV BIO 203A
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

DEV BIO 203C. Graduate Tutorial in Developmental and Cell Biology. 4 Units.
Advanced study in areas not represented by formal courses. May involve individual or small group study through discussion, reading, and composition. Time and subject matter arranged individually.
Prerequisite: DEV BIO 203B
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

DEV BIO 206A. Developmental and Cell Biology Journal Club. 2 Units.
Advanced study of various topics in cell biology.
Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.
DEV BIO 206B. Developmental and Cell Biology Journal Club. 2 Units.
Advanced study of various topics in cell biology.
Prerequisite: DEV BIO 206A
Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.

DEV BIO 206C. Developmental and Cell Biology Journal Club. 2 Units.
Advanced study of various topics in cell biology.
Prerequisite: DEV BIO 206B
Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.

DEV BIO 207. Mouse Developmental Genetics. 4 Units.
Introduction to using the mouse in contemporary biomedical research. The biology and development of the laboratory mouse, methods for manipulation of the mouse genome and embryos, and examples of application of these methods to understand mammalian development and homeostasis.
Same as BIOCHEM 215.
Restriction: Graduate students only.

DEV BIO 208. Balancing the Academic Workload. 2 Units.
Students receive formal training in pedagogy and balancing graduate-level biology research with concurrent teaching commitment. Recommended for graduate students who have an active research program and are teaching in the same quarter.

DEV BIO 210. Advanced Developmental Genetics. 4 Units.
Focuses on discussion of critical concepts in developmental biology and regeneration, with emphasis on model organisms such as Drosophila, Zebrafish, and murine systems. Molecular mechanisms underlying key developmental decisions also discussed.
Repeatability: May be taken for credit 2 times.
Restriction: Graduate students only.

DEV BIO 212. Topics in Systems Biology. 2 Units.
Studies in selected areas of Systems Biology.
Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.
Restriction: Graduate students only.

DEV BIO 213. Scientific Skills . 2 Units.
Addresses and promotes the development of essential skills required in scientific and research careers, including scientific writing, effective presentation and communication, and mentoring skills.
Grading Option: Satisfactory/unsatisfactory only.
Restriction: Graduate students only.

DEV BIO 214. Principles of Genomics. 4 Units.
A survey course of the principal subfields of genomics and their applications to biological and health sciences that will cover genome assembly and annotation, genome structure, comparative genomics, population genomics, functional genomics, and medical genomics.
Same as MOL BIO 244.
Restriction: Graduate students only.

DEV BIO 231B. Cell Biology. 4 Units.
A broadly based course including topics in extracellular matrix, cytoskeleton, organelle biogenesis, receptor-mediated endocytosis, signal transduction, cell cycle, and developmental biology.
Concurrent with BIO SCI D154.
DEV BIO 232. Systems Cell and Developmental Biology. 4 Units.
Introduces concepts needed to understand cell and developmental biology at the systems level, i.e., how the parts (molecules) work together to create a complex output. Emphasis on using mathematical/computational modeling to expand/modify insights provided by intuition.

Same as BME 213.
Restriction: Graduate students only.

DEV BIO 245. Stem Cell Biology. 4 Units.
The basic characteristics and development roles of embryonic, adult, and cancer stem cells in the human body and in model systems and the use of experimental and genetic methods to analyze and manipulate their properties.

Restriction: Graduate students only.

DEV BIO 290A. Colloquium in Developmental and Cell Biology. 2 Units.
Contemporary research problems. Research students, faculty, and other invited speakers introduce research and review topics.

Restriction: Graduate students only.

DEV BIO 290B. Colloquium in Developmental and Cell Biology. 2 Units.
Contemporary research problems. Research students, faculty, and other invited speakers introduce research and review topics.

Prerequisite: DEV BIO 290A
Restriction: Graduate students only.

DEV BIO 290C. Colloquium in Developmental and Cell Biology. 2 Units.
Contemporary research problems. Research students, faculty, and other invited speakers introduce research and review topics.

Prerequisite: DEV BIO 290B
Restriction: Graduate students only.

DEV BIO 292A. Scientific Communication. 2 Units.
Small group meetings for graduate students to practice scientific writing, debate, and presentation skills.

Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.

DEV BIO 292B. Scientific Communication. 2 Units.
Small group meetings for graduate students to practice scientific writing, debate, and presentation skills.

Prerequisite: DEV BIO 292A
Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.

DEV BIO 292C. Scientific Communication. 2 Units.
Small group meetings for graduate students to practice scientific writing, debate, and presentation skills.

Prerequisite: DEV BIO 292B
Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.

DEV BIO 399. University Teaching. 4 Units.
Limited to Teaching Assistants.

Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.
Restriction: Graduate students only.