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## BIOLOGY (Ph.D.)

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*Executive Officer:* Professor Laurel Eckhardt

The Graduate Center

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URL: <http://web.gc.cuny.edu/sciences/pages/biology.html>

### FACULTY (AS OF JULY 2009)

Kenneth F. Abraham n Alejandra del Carmen Alonso n Mary L. Alpaugh n Barbara A. Ambrose n Robert P. Anderson n Jesus A. Angulo n Ivica Arsov n Mitchell B. Baker n Michael J. Balick n Maryam Bamshad n Probal Banerjee n Shailesh P. Banerjee n Jill Bargonetti-Chavarria n Kerry Alan Barringer n George F. Barrowclough n Jennifer Anne Basil n Dominick Basile n Paola Bellosta n Amy C. Berkov n Marom Bikson n Jeffrey A. Bird n Richard J. Bodnar n Stephane Boissinot n David C. Bolton n Brian Morey Boom n Diana P. Bratu n Christopher B. Braun n Derrick T. Brazill n Eric D. Brenner n Patricia Broderick n Joshua C. Brumberg n William R. Buck n Rochelle Buffenstein n Frank T. Burbrink n David H. Calhoun n Avrom J. Caplan n Richard Carp n James M. Carpenter n Christopher Y. Chan n Richard L. Chappell n Abha Chauhan n Hai-Ping Cheng n Gregory P. Cheplick n Joel L. Cracraft n Susan D. Croll n Douglas C. Daly n Lesley Davenport n Eric Delson n John J. Dennehy n Rob DeSalle n Jason B. Dichtenberg n Carl S. Dobkin n Robert Dottin n Laurel Ann Eckhardt n Jay Alan Edelman n Abdeslem El Idrissi n Dan Eshel n Jimmie Eugene Fata n Karl R. Fath n Paul G. Feinstein n Maria E. Figueiredo-Pereira n Marie T. Filbin n Else J. Fjerdingstad n John J. Flynn n Charlene L. Forest n David A. Foster n John J. Foxe n Robert L. Freedland n Eitan Friedman n Darrel R. Frost n Ray H. Gavin n Mitchell Goldfarb n Cheng-Xi Gong n Jeffrey H. Goodman n James Gordon n Dixie J. Goss n Paul Gottlieb n Shubha Govind n Sanna M. Goyert n Frank W. Grasso n David Alan Grimaldi n David F. Gruber n Jianying Gu n Marilyn R. Gunner n Jerry C. Guyden n Gerhard J. Haas n Roy Edward Halling n Cheryl Harding n Mark E. Hauber n Qi He n Andrew J. Henderson n Ann S. Henderson n George R. Hendrey n Michael J. Hickerson n Timothy J. Hoellein n Nathalia Glickman Holtzman n Sally Gail Hoskins n Karen Hubbard n Amy E. Ikuí n Khalid Iqbal n Anuradha Janakiraman n Edmund C. Jenkins n Thomas E. Jensen n Liesl B. Jones n Bernard Z. Karmel n Kenneth G. Karol n Khosrow Kashfi n Lawrence M. Kelly n Edward J. Kennelly n Benjamin Kest n Dwight Kincaid n Frida Esther Kleiman n Maria Knikou n William J. L'Amoreaux n John J. Lee n Daniel E. Lemons n Louis F. Levinger n Jonathan B. Levitt n Christine Li n Peter N. Lipke n Amy Litt n Damon P. Little n Diego Loayza n Glenis R. Long n Victoria N. Luine n PoKay M. Ma n Margaret A. MacNeil n John G. Maisey n Itzhak Mano n Robert Matlock n Dani L. McBeth n Daniel P. McCloskey n Gerald P. McNeil n Alicia Meléndez n Carmen V. Melendez-Vasquez n Jin Meng n Fabian Armando

Michelangeli n Corinne A. Michels n David L. Miller n James Miller n Shaibal S. Mitra n Peter Moller n Carol Wood Moore n Robbin Craig Moran n Scott Mori n Paul C. Mundinger n Jason Munshi-South n Martin S. Muntzel n Theodore Raymond Muth n Robert F. C. Naczi n Michael Nee n James T. Nishiura n Michael J. Novacek n Alam Nur-E-Kamal n Benjamin D. Ortiz n Rafael Ovalle n Christine Padoch n Lucas C. Parra n Paola L. Pedraza-Peñalosa n Susan L. Perkins n Charles M. Peters n Mark T. Pezzano n Serafín Piñol-Roma n Norman Platnick n Bertram O. Ploog n Gregory M. Plunkett n Andrew C. Poje n Juergen E.W. Polle n Lorenzo Prendini n Carolyn L. Pytte n Weigang Qiu n Vanya Quiñones-Jenab n Joseph W. Rachlin n Robert Ranaldi n Shirley Raps n Boojala Reddy n Patricia Boyle Rockwell n Robert F. Rockwell n Adrian Rodriguez-Contreras n Susan A. Rotenberg n Wilma Saffran n Shireen Saleque n Renuka P. Sankaran n Cathy Savage-Dunn n Anjana D. Saxena n Scott Allen Schaefer n Valerie A. Schawaroch n Thomas Schmidt-Glenewinkel n Randall Schuh n Chang-Hui Shen n Timothy W. Short n Mark Edward Siddall n Nancy Bingham Simmons n Shaneen M. Singh n Gillian M. Small n Linda Spatz n Ruth E. Stark n Mark Steinberg n Michael E. Steiper n Eleanor J. Sterling n Dennis W. Stevenson n Gillian M. Stewart n Melanie L. J. Stiassny n Barbara Studamire n Larissa Swedell n Ofer Tchernichovski n Wm. Wayt Thomas n Benjamin Torke n Edward B. Tucker n Richard R. Veit n Tadmiri Venkatesh n Robert S. Voss n John H. Wahlert n John R. Waldman n William G. Wallace n Joshua Wallman n Hoau-Yan Wang n Daniel W. Weinstein n Guang Y. Gary Wen n Ward C. Wheeler n Andrzej Wieraszko n Eleanore T. Wurtzel n Song-Yu Yang n Wan-hua Amy Yu n Zahra F. Zakeri n Chester B. Zarnoch n H. Philip Zeigler n Zhi-Liang Zheng n Hualin Zhong

*For the most up-to-date faculty listings and specializations, see the program's Web site.*

## THE PROGRAM

The Ph.D. Program in Biology offers graduate studies in four broad areas of concentration: ecology, evolutionary biology, and behavior; molecular, cellular, and developmental biology; neuroscience; and plant sciences. The faculty and their research laboratories are based at six campuses (Brooklyn, City, Hunter, Lehman, and Queens colleges and the College of Staten Island) and several affiliated institutions (the American Museum of Natural History, the New York Botanical Garden, and the Institute for Basic Research). The Ph.D. is awarded by the Graduate School and University Center of the City University of New York, through which an en-route M.A. degree may also be awarded. The Graduate Center administers the program through the Executive Officer for the Ph.D. Program in Biology, an Executive Committee, which includes student representatives, and an advisory committee representing each of the above subject areas.

The course of study is determined by the student's background and selected area of interest. Guidance is initially provided by the Graduate Deputy Chair at the campus at which the student is based and overseen by the program office and the appropriate advisory committee. During the first year, study is directed toward preparation for the First Examination, which is offered annually in the four above-mentioned subject areas. In the second year, students pursue more specialized work under the guidance of their mentor and advisory committee, directed toward the knowledge and techniques necessary to become an effective research

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scientist. Students may take courses or use facilities located at any unit of CUNY or at the affiliated institutions. Laboratory and field studies stress independent research—training that should enable the student to evaluate related literature critically and to respond successfully to future advances in his or her field. Advanced seminars, colloquia, tutorials, lectures by visiting scientists, and other student-faculty contacts also contribute to the widening of the student's outlook and experience.

### *Courses*

Diverse course offerings within each of the four major areas of specialization provide students with the basic knowledge and skills on which to build for more specialized training and research. The areas vary in the manner by which students are directed in their initial year in the program. The areas of molecular, cellular, and developmental biology and neuroscience recommend a more directed "core" of three to four basic courses. On the other hand, students in the ecology, evolutionary biology, and behavior and plant sciences areas are, in consultation with an adviser, directed toward courses most appropriate to their career aims and research directions. The ultimate aim of a student's first year in the program is to develop the comprehensive background necessary to complete the First Examination successfully in the chosen area.

Advanced-level courses, along with seminars, tutorials, and advanced-study courses as well as courses offered by other Ph.D. programs (Biochemistry, Earth and Environmental Sciences, Psychology, etc.), complete the menu of offerings from which the student and the adviser may choose. In addition, students may take up to 10 credits of independent doctoral research.

Each semester, the program office compiles a listing of course offerings, including the name of the professor(s) and a paragraph describing the course. Students should also consult the listing of faculty and specializations in order to select opportunities for potential research areas.

### *En-route M.A.*

Upon completing 45 credits with an average grade of B, passing the First Examination, and satisfactorily completing a major research paper, the student may apply for an M.A. degree. Those seeking an en-route master's degree should have the Executive Officer initiate the appropriate action. The degree is awarded formally by one of the participating CUNY senior colleges.

### **SPECIAL REQUIREMENTS FOR ADMISSION**

In addition to the general requirements for admission stated earlier in this bulletin, undergraduate preparation should include an adequate background in biology, chemistry, physics, and mathematics, including morphology, physiology, genetics, biochemistry or organic chemistry, and calculus or statistics. The Admissions Committee considers basic training in the sciences and mathematics and the capacity for independent study to be more important than the completion of specific undergraduate courses. Students trained in fields other than biology may apply and may be admitted with conditions determined by the Admissions Committee. The deadline for admission in the fall semester is February 1.

## **SPECIAL REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY**

The following requirements are in addition to the general University requirements for the Ph.D. stated earlier in this bulletin.

*Course of Study* A minimum of 60 credits of approved course work is required for a Ph.D. in biology. The student must follow an approved program of study, which will be prepared in consultation with an advisory committee and filed with the Executive Officer. The first year's work will normally include a number of fundamental courses designed to complete the students' basic preparation in the areas of biology to be covered by the First Examination and second-level courses to prepare them for their areas of specialization. Certain campuses offer course prescriptions for first-year students (inquire at individual campuses for details). The program of study for each student will be planned by the student and an advisory committee so as best to meet the student's interests and needs.

Of the 60 graduate credits required for the degree, no more than 9 may be offered in lower-level (60000) graduate courses. These courses are listed in the program handbook and the college graduate bulletins. The remainder of the graduate credits must be in second- and third-level graduate courses. Students should consult with their advisory committee concerning prerequisites for these courses. A maximum of 20 credits in a minor approved by the student's graduate committee will be accepted. No more than 10 credits of independent Ph.D. dissertation research may be accepted as part of the 60 graduate credits required. A summer of field or laboratory work at a biological station is recommended and may be required in some areas. After completion of formal course work and advancement to candidacy, the candidate must register for BIOL 90000 Dissertation Supervision until the degree is completed.

The student's record will be evaluated at the end of each academic year, and matriculation may be terminated for unsatisfactory scholastic performance. A time limit of six years is set for the completion of all requirements for the degree, except for the writing and defense of the dissertation. The maximum time period for the completion of all requirements is eight years (seven years for those entering with a master's degree).

*First Examination* This examination tests a graduate student's ability to think, synthesize information, and solve problems in one of the following areas of biology: molecular, cellular, and developmental biology, plant sciences, neuroscience, or ecology, evolutionary biology, and behavior. This examination is normally taken after completion of two semesters in the program, but may be taken earlier with permission of the campus advisory committee. Students who fail this examination will be permitted one additional opportunity to take and pass any of the four examinations the next time they are given. Students who do not take this examination at the time specified by their advisory committee and the Executive Officer will be judged as having failed the examination.

*Foreign Language and Research Techniques* An individual's research mentor and advisory committee with the approval of the Executive Committee may require a student to acquire functional mastery of computer programming or a working knowledge of a foreign language or languages in which there is a substantial body of literature relevant to the student's research. Should the student be required to develop such skills, the Executive Officer should be notified of this requirement, in writing by the student's mentor, no later than the student's fourth semester.

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*Second Examination* Students must demonstrate advanced understanding and research competence in their areas of specialization and related fields in biology by passing the Second Examination. This oral examination, administered by the student's examination committee, is normally taken after fulfilling any language requirement and a minimum of 30 credits of course work.

*Dissertation* Before enrolling for dissertation work, the student must have passed the Second Examination and must be accepted by a faculty sponsor. The student's thesis research proposal must be approved by an advisory committee and must be judged by this committee to be of a caliber warranting publication in approved journals. After completion of the dissertation, the student must pass a final examination, which will be a defense of the dissertation. The final examination is given by a committee, including the student's advisory committee and additional members from both within and outside the University.

*College Teaching and Field Experience* A minimum of two semesters of teaching experience is required. In those subdisciplines of biology where field experience is considered to be particularly appropriate by the student's advisory committee, such experience may take the place, wholly or in part, of the teaching experience requirement. As part of their training for future roles including those as teachers in colleges and universities, graduate students, where possible, may be required to teach more than one year and to acquire experience in teaching several different courses in biology at the elective as well as at the elementary level. Teaching assignments serve as a principal means of support for biology graduate students.

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## **Courses**

60000-level graduate courses are listed in the graduate bulletins of City, Hunter, Brooklyn, Queens, and Lehman colleges. A maximum of 9 credits in such courses may be offered toward the Ph.D. degree. 70000- and 80000-level graduate courses creditable toward the doctoral degree are listed below. Each course is offered periodically at one or more units of the University as indicated. Courses listed under the same number cover substantially similar material at comparable levels. For course descriptions consult the several graduate bulletins of each college of the University. The prerequisite for admission to all courses is prior approval by the student's advisory committee. The specific offerings at the Graduate Center and each campus are listed each semester on the Graduate Center Web site at [https://banner.gc.cuny.edu/catalog\\_range.htm](https://banner.gc.cuny.edu/catalog_range.htm).

### ***Ecology, Evolutionary Biology, and Behavior***

BIOL 70003 Genetics: Lecture

*30 or 45 hours lecture, 2 or 3 credits*

BIOL 70004\* Genetics: Laboratory

*60 or 90 hours laboratory, 2 or 3 credits*

BIOL 70005 Genetics: Lecture

*60 or 75 hours lecture, 4 or 5 credits*

*Prerequisite: Undergraduate genetics and molecular biology or biochemistry*

BIOL 70006\* Genetics: Lecture

*45 hours lecture, 3 credits*

- BIOL 70103\* Microbial Genetics  
*45 hours lecture, 3 credits*
- BIOL 70104\* Problems in Microbial Genetics: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 70201\* Genetics of Multicellular Organisms, I  
*45 hours lecture, 3 credits*
- BIOL 70202\* Genetics of Multicellular Organisms, II  
*45 hours lecture, 3 credits*
- BIOL 70301\* 70302 Cell Heredity I, II  
*45 hours lecture, 3 credits each semester*
- BIOL 70503 Evolution  
*30 or 45 hours lecture, 2 or 3 credits*
- BIOL 70504\* Evolution: Laboratory  
*60 hours laboratory, 2 credits*
- BIOL 70505\* The Evolutionary Biology of Vertebrates  
*45 hours lecture, 3 credits*
- BIOL 70506\* Macroevolution: Patterns of Evolution above the Species Level  
*45 hours, 3 credits*
- BIOL 70603 Principles of Systematics  
*45 hours lecture plus conferences, 4 credits*
- BIOL 70604\* Animal Systematics: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*
- BIOL 70609\* Biological Museology  
*45 hours, 3 credits*
- BIOL 70611\* Systematics and Evolution of Insects and Arachnids: Lecture  
*2 hours, 2 credits*
- BIOL 70612\* Systematics and Evolution of Insects and Arachnids: Laboratory  
*4 hours, 2 credits*
- BIOL 70713\* Zoology and Phylogeny of Chordata (Fishes)  
*30 hours lecture, 2 credits*
- BIOL 70714\* Zoology and Phylogeny of Chordata (Fishes)  
*60 hours laboratory, 2 credits*
- BIOL 70723\* Zoology and Phylogeny of Chordata (Reptiles and Amphibians)  
*30 hours lecture, 2 credits*
- BIOL 70724\* Zoology and Phylogeny of Chordata (Reptiles and Amphibians)  
*60 hours laboratory, 2 credits*
- BIOL 70733 Zoology and Phylogeny of Chordata (Mammals)  
*30 hours lecture, 2 credits*
- BIOL 70734 Zoology and Phylogeny of Chordata (Mammals)  
*60 hours laboratory, 2 credits*
- BIOL 70735\* Functional and Adaptational Biology of the Mammalia  
*45 hours, 3 credits*  
*Prerequisite: 70733, 70734*

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- BIOL 70743\* Zoology and Phylogeny of Chordata (Birds)  
*30 hours lecture, 2 credits*
- BIOL 70744\* Zoology and Phylogeny of Chordata (Birds)  
*60 hours laboratory, 2 credits*
- BIOL 70800\* Biochemical Evolution and Systematics  
*45 hours lecture, 3 credits*
- BIOL 70803 Molecular Evolution  
*45 hours, 3 credits*
- BIOL 70901 Population Genetics: Lecture  
*45 hours lecture, 3 credits*
- BIOL 70902\* Population Genetics: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 70903\* Quantitative Genetics  
*45 hours lecture, 3 credits*
- BIOL 70907\* Behavior Genetics  
*30 hours lecture, 120 hours laboratory, 4 credits*
- BIOL 72403\* Animal Behavior I: Lecture  
*45 hours lecture, 3 credits*
- BIOL 72404\* Biological Basis of Animal Behavior: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 72405\* Current Issues in Behavioral Ontogeny  
*45 hours lecture, 3 credits*
- BIOL 72406\* Behavior and Evolution  
*45 hours lecture, 3 credits*
- BIOL 72407\* Animal Behavior II  
*45 hours, 3 credits*
- BIOL 72505\* Animal Communication: Lecture  
*45 hours lecture, 3 credits*
- BIOL 72800\* Field Studies in Animal Behavior  
*90 hours fieldwork and conferences, 3 credits*
- BIOL 73103\* Microbial Ecology: Lecture  
*30 hours lecture, 2 credits*
- BIOL 73104\* Microbial Ecology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 74103\* Radiation Biology: Lecture  
*30 or 45 hours lecture, 2 or 3 credits*
- BIOL 74104\* Radiation Biology: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*
- BIOL 76001\* Ecology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 76002\* Ecology: Laboratory and Field Study  
*90 hours laboratory, 3 credits*
- BIOL 76003\* Community Ecology: Lecture  
*45 hours lecture, 3 credits*

- BIOL 76004\* Community Ecology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 76005\* Population Ecology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 76006\* Population Ecology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 76007\* Limnology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 76008\* Limnology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 76101\* Marine Plankton Dynamics: Lecture  
*45 hours lecture, 3 credits*
- BIOL 76102\* Marine Plankton Dynamics: Laboratory  
*90 hours laboratory and field trips, 3 credits*
- BIOL 76103\* Marine Benthos: Lecture  
*45 hours lecture, 3 credits*
- BIOL 76104\* Marine Benthos: Laboratory  
*90 hours laboratory and field trips, 3 credits*
- BIOL 76105\* Fishes and Fisheries Biology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 76106\* Fishes and Fisheries Biology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 76107\* Marine Microbiology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 76108\* Marine Microbiology: Laboratory  
*90 hours laboratory and field trips, 3 credits*
- BIOL 76113\* Marine Ecology: Lecture  
*30 hours lecture, 2 credits*
- BIOL 76114\* Marine Ecology: Laboratory  
*60 hours laboratory, 2 credits*
- BIOL 76200\* Physiological Ecology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 76201\* Physiological Ecology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 76701\* The Biology of Fishes  
*45 hours lecture, 3 credits*
- BIOL 76702\* The Biology of Fishes  
*90 hours laboratory, 3 credits*
- BIOL 76830\* World Vegetation  
*45 hours, 3 credits*
- BIOL 77200 Biological Electron Microscopy  
*30 hours lecture or demonstration, 90 hours laboratory, 4 credits*
- BIOL 78001 Mathematical Biology: Lecture  
*30 hours lecture and conferences, 3 credits*

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- BIOL 78002 Mathematical Biology: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*
- BIOL 78101 Advanced Mathematical Biology: Lecture  
*30 hours lecture and conferences, 3 credits*
- BIOL 78102\* Advanced Mathematical Biology: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*
- BIOL 78201 Biostatistics I  
*Lecture/Laboratory 3 hours lecture/6 hours laboratory, 6 credits*
- BIOL 78202\* Biostatistics II  
*Lecture/Laboratory 3 hours lecture/6 hours laboratory, 6 credits*
- BIOL 79001 Colloquium in Ecology, Evolution, and Behavior  
*15 hours, 1 credit*
- BIOL 79030 Seminar in Ecology, Evolution, and Behavior  
*15 hours, 1 credit*
- BIOL 80803\* Microevolutionary Processes: Lecture  
*30 or 45 hours lecture, 2 or 3 credits*
- BIOL 80804\* Microevolutionary Processes: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*

***Molecular, Cellular, and Developmental Biology***

- BIOL 70400\* Problems in Nuclear Cytology  
*30 hours lecture, 60 hours laboratory, 4 credits*
- BIOL 70610 Biological Systematics  
*30 hours lecture, 60 hours laboratory, 4 credits*
- BIOL 70801\* Developmental Genetics: Lecture  
*45 hours lecture, 3 credits*
- BIOL 70802\* Developmental Genetics: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 71013 Molecular Biology: Lecture  
*75 hours lecture, 5 credits*
- BIOL 71014\* Molecular Biology: Laboratory  
*15 hours lecture, 90 hours laboratory, 4 credits*
- BIOL 71015 Molecular Biology: Lecture  
*60 hours, 4 credits*
- BIOL 71016\* Molecular Biology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 71101 Laboratory Rotation  
*90 hours, 3 credits*
- BIOL 71103\* Experimental Microbiology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 71104\* Experimental Microbiology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 71203\* Comparative Biochemistry: Lecture  
*30 hours lecture plus conferences or 45 hours lecture; 3 credits*

- BIOL 71204\* Comparative Biochemistry: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*
- BIOL 71300\* Biology of Aging  
*45 hours lecture, 3 credits*
- BIOL 71401 Cell Biology: Lecture  
*60 or 75 hours lecture, 4 or 5 credits*
- BIOL 71402\* Cell Biology: Laboratory  
*180 hours laboratory, 6 credits*
- BIOL 71403\* Cell Biology: Lecture  
*30 hours lecture, 2 credits*
- BIOL 71404\* Cell Biology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 71405 Current Topics in Cellular Signaling  
*45 hours lecture, 3 credits, permission of instructor required*
- BIOL 71500\* Cell Biology Internship  
*20 hours week, literature assignments and laboratory work, 10 credits*
- BIOL 71600\* Cells in Culture  
*60 hours laboratory, 15 hours recitation, 3 credits*
- BIOL 71700\* Bacteriophage  
*45 hours lecture, 3 credits*
- BIOL 71710\* Virology  
*45 hours lecture, 3 credits*
- BIOL 71800 Immunology  
*45 or 60 hours, 3 or 4 credits*
- BIOL 71903 Medical Microbiology and Immunology  
*67.5 hours lecture, 22.5 hours laboratory, 22.5 hours conference, 6 credits*  
*Prerequisite: BIOL 71800 or equivalent and permission of instructor*
- BIOL 74000\* Introduction to Biophysics  
*45 hours lecture, 3 credits*
- BIOL 74001\* Biophysical Techniques in Physiology  
*90 hours laboratory, 3 credits*
- BIOL 74200\* Radioisotopes in Biology  
*60 hours lecture, laboratory and demonstrations, 4 credits*
- BIOL 74300\* Photobiology  
*45 hours lecture, 3 credits*
- BIOL 74400\* Electrobiolgy  
*45 hours lecture, 3 credits*
- BIOL 74700\* Structure and Metabolism of Macromolecules  
*30 hours lecture, 30 hours laboratory, 3 credits*
- BIOL 75003 Developmental Biology: Lecture  
*45, 60, or 75 hours lecture, 3, 4, or 5 credits*
- BIOL 75004\* Developmental Biology: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*

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- BIOL 75101\* Special Problems in Developmental Biology: Lecture  
*30 hours lecture, 2 credits*
- BIOL 75102\* Special Problems in Developmental Biology: Laboratory  
*60 hours laboratory, 2 credits*
- BIOL 75301 Computational Molecular Biology: Lecture and Laboratory  
*60 hours, 3 credits*
- BIOL 75303\* Molecular Basis of Development: Lecture  
*30 or 45 hours lecture, 2 or 3 credits*
- BIOL 75304\* Molecular Basis of Development: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 76300\* Experimental Parasitology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 76301\* Experimental Parasitology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 77003 Cytology: Lecture  
*30 or 45 hours lecture, 2 or 3 credits*
- BIOL 77004\* Cytology: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*
- BIOL 77100\* Problems in Experimental Cytology  
*30 hours lecture, 90 hours laboratory, 5 credits*
- BIOL 77101\* Analysis of Mammalian Cells in Tissue Culture  
*30 hours lecture, 90 hours laboratory, 5 credits*
- BIOL 77301\* Cytogenetics: Lecture  
*45 hours lecture, 3 credits*
- BIOL 77302\* Cytogenetics: Laboratory  
*60 hours laboratory, 2 credits*
- BIOL 77400\* Basic Principles of Cellular Microsurgery and Micromanipulation  
*60 or 90 hours laboratory, 2 or 3 credits*
- BIOL 77500 Biotechnology of Algae  
*30 hours lecture, 15 hour discussion, 3 credits*

### **Neuroscience**

- BIOL 71003\* Cellular Physiology: Lecture  
*30 or 45 hours lecture, 2 or 3 credits*
- BIOL 71004\* Cellular Physiology: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*
- BIOL 72001\* Animal Physiology: Lecture  
*45 or 60 hours lecture, 3 or 4 credits*
- BIOL 72002\* Animal Physiology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 72101\* Animal Physiology I  
*60 hours, 4 credits*
- BIOL 72102\* Animal Physiology II  
*60 hours, 4 credits*

- BIOL 72201\* Endocrinology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 72202\* Endocrinology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 72301 Neurosciences I: Lecture  
*45 hours lecture plus recitation, 4 credits*
- BIOL 72302 Neurosciences II: Lecture  
*45 hours lecture plus recitation, 4 credits*
- BIOL 72303\* Neurosciences II: Laboratory  
*120 hours laboratory, 4 credits*
- BIOL 72304 Modules in Neuroscience  
*15, 30, or 45 hours, 1, 2, or 3 credits*
- BIOL 72401\* Comparative Neuroendocrine Mechanisms  
*45 hours lecture, 3 credits*
- BIOL 72403 Animal Behavior I: Lecture  
*45 hours lecture, 3 credits*
- BIOL 72404\* Biological Basis of Animal Behavior: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 72405\* Current Issues in Behavioral Ontogeny  
*45 hours lecture, 3 credits*
- BIOL 72406\* Behavior and Evolution  
*45 hours lecture, 3 credits*
- BIOL 72407 Animal Behavior II  
*45 hours, 3 credits*
- BIOL 72503\* Sensory Physiology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 72504\* Sensory Physiology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 72505\* Animal Communication: Lecture  
*45 hours lecture, 3 credits*
- BIOL 72603 Comparative Animal Physiology: Lecture  
*30 or 45 hours lecture, 2 or 3 credits*
- BIOL 72604 Comparative Animal Physiology: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*
- BIOL 72605 Human Neuroanatomy Laboratory  
*4 hours, 3 credits*
- BIOL 72703\* Endocrine Cytology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 72704\* Endocrine Cytology: Laboratory  
*60 hours laboratory, 2 credits*
- BIOL 72800\* Field Studies in Animal Behavior  
*90 hours fieldwork and conferences, 3 credits*

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- BIOL 72901\* Trends and Issues in Physiology/Neuroscience I  
*3 hours lecture during the Fall, alternate weeks for 1 credit by two or three doctoral faculty at the Graduate Center*
- BIOL 72902\* Trends and Issues in Physiology/Neuroscience II  
*3 hours lecture during the Spring, alternate weeks for 1 credit by two or three doctoral faculty at the Graduate Center*

***Plant Sciences***

- BIOL 70601\* Plant Systematics: Lecture  
*30 hours lecture, 2 credits*
- BIOL 70602\* Plant Systematics: Laboratory  
*60 hours laboratory, 2 credits*
- BIOL 70605 Taxonomy of Vascular Plants: Lecture  
*45 hours lecture, 3 credits*
- BIOL 70606 Taxonomy of Vascular Plants: Laboratory  
*60 hours laboratory, 2 credits*
- BIOL 73001 Plant Physiology: Lecture  
*30 or 45 hours lecture, 2 or 3 credits*
- BIOL 73002 Plant Physiology: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits*
- BIOL 74501 Phytochemistry: Lecture  
*30 hours lecture, 2 credits*
- BIOL 74502 Phytochemistry: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 75200 Plant Morphogenesis: Lecture  
*45 hours lecture, 3 credits*
- BIOL 75201 Plant Morphogenesis: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 75301 Computational Molecular Biology: Lecture and Laboratory  
*60 hours, 3 credits*  
*Prerequisites or co-requisite: BIOL 71013 or instructor permission*
- BIOL 75401 Comparative Morphology of Vascular Plants: Lecture  
*30 hours lecture, 2 credits*
- BIOL 75402 Comparative Morphology of Vascular Plants: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 76403\* Plant Ecology: Lecture  
*45 hours lecture, 3 credits*
- BIOL 76404\* Plant Ecology: Laboratory  
*90 hours laboratory, 3 credits*
- BIOL 76405\* Economic Botany  
*30 hours lecture, 30 hours laboratory, 3 credits*
- BIOL 76501\* Paleobotany: Lecture  
*30 hours lecture, 2 credits*

BIOL 76502\* Paleobotany: Laboratory  
*60 hours laboratory, 2 credits*

**Seminars: General and Special Topics**

- BIOL 79001 Seminar in Evolution  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79002\* Seminar in Genetics  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79003\* Seminar in Behavioral Genetics  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79004\* Seminar in Molecular Genetics  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79005 Seminar in Developmental Biology  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79006 Seminar in Ecology  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79007\* Seminar in Cytology  
*45 hours, 3 credits each semester*
- BIOL 79008\* Seminar in Biomathematics  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79009\* Seminar in Biophysics  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79010\* Seminar in Biochemistry  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79011\* Seminar in Systematics  
*45 hours, 3 credits each semester*
- BIOL 79012\* Seminar in Zoogeography  
*45 hours, 3 credits each semester*
- BIOL 79021 Seminar in Physiology  
*45 hours, 3 credits each semester*
- BIOL 79022\* Seminar in Animal Behavior  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79023\* Seminar in Cell Biology  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79063\* Seminar in Biological Oceanography  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79064 Seminar in Behavioral Aspects of Ecology  
*30 hours plus conferences, 3 credits each semester*
- BIOL 79065\* Seminar in Tropical Forest Ecology and Conservation  
*45 hours, 3 credits*
- BIOL 79091\* Selected Topics in Animal Behavior - Biopsychology  
*15 hours, 1 credit*
- BIOL 79093\* Seminar in Acoustic Communication in Animals  
*30 hours plus conferences, 3 credits each semester*

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- BIOL 79301, 79302, 79303, 79304 Seminar in Special Topics  
*15, 30, 45 or 60 hours, 1, 2, 3 or 4 credits each semester*
- BIOL 79401\* Experimental Biology: Lecture  
*30 or 45 hours, 2 or 3 credits each semester*
- BIOL 79402\* Experimental Biology: Laboratory  
*60 or 90 hours laboratory, 2 or 3 credits each semester*
- BIOL 79500\* Basic Laboratory Techniques for Research  
*15 hours lecture, 60 hours laboratory, 3 credits each semester*
- BIOL 79501 Laboratory in Biotechnology  
*45 hours, 3 credits*

**General**

- BIOL 79100 Colloquium  
*15 or 30 hours each semester, 1/2 or 1 credit each semester*
- BIOL 79200 Tutorial  
*15, 30, 45, or 60 hours each semester, 1 through 4 credits each semester*
- BIOL 79201 Advanced Study  
*15, 30, 45, or 60 hours each semester, 1-4 credits each semester*
- BIOL 89900 Independent Doctoral Research  
*Credit to be assigned, up to a maximum of 10 credits. Required of all candidates for the doctorate.*
- BIOL 90000 Dissertation Supervision  
*1 credit*

\*offered infrequently