

Biological Sciences

Department Office 927 North Building; 772-5293

Chair Shirley Raps

Distinguished Professor Filbin

Marie L. Hesselbach Professor Eckhardt

Professors Chappell, Cohen, Dottin, Foster, Friedman, Henderson, Lipke, Raps, Rudner, Shahn

Associate Professors Angulo, Bargonetti-Chavarria, Figueiredo-Pereira, Persell, Rockwell, Schmidt-Glenewinkel

Assistant Professors Brazill, Ortiz, Qiu

Advisors Advisors are assigned to majors on an individual basis. Contact department office.

The Department of Biological Sciences at Hunter College stresses excellence in both teaching and research. Fully equipped research laboratories are supported by major federal grants, and students are strongly encouraged to get involved in laboratory research. Additional advanced research facilities have been established via the Center for Gene Structure and Function, which consists of faculty from the Departments of Biological Sciences, Chemistry, Physics, and Psychology working in the areas of biomolecular structure and function. These include a state-of-the-art DNA and protein sequencing synthesis and separations facility, and a bioimaging laboratory housed within the department.

The core curriculum in biological sciences prepares students for admission to both graduate and medical schools and for careers in the biological sciences, including teaching and the growing industry of biotechnology. The curriculum emphasizes cell biology, molecular biology, developmental biology, genetics, and neurobiology as the foundation for future careers in fields related to the biological sciences.

General Education Requirement (GER) BIOL 100 and 102 may be used to fulfill Broad Exposure/Stage 2, Group E (GER credit awarded *only* if both semesters are completed); BIOL 250(W) may be used to fulfill Focused Exposure/Stage 3, Group B.

Distribution Requirement See Appendix A for the Distribution Requirement, which was replaced by the General Education Requirement in fall 2001 and which may be binding on students who matriculated prior to fall 2001.

Majoring in the Biological Sciences The Department of Biological Sciences offers two major programs: Major I is for students who intend to prepare for graduate study, medicine, dentistry, secondary school teaching, biotechnology and industry. Major II is for students preparing to teach in elementary schools. Students planning to pursue Major I are strongly encouraged to declare their major as soon as possible after completing one semester of Principles of Biology. Declared majors are assigned a permanent faculty advisor who will assist in individual curriculum planning. Students are required to meet with their advisor at least once each semester throughout their undergraduate career to discuss their program and progress.

MAJOR I

This plan consists of 9 credits of introductory biology (BIOL 100-102) and a 28-credit concentration in biology at the 200 level and higher. **The Biology Concentration** consists of an 18-credit core—BIOL 200, 202, 300, 302—and 10 credits of electives. Together, introductory biology and the concentration (37 cr) satisfy the major requirement for certification as a teacher of biology in grades 7-12.

Additional science and math requirements for Major I CHEM 102, 103, 104, 105, 222, 223, 224; PHYS 110, 120 (or 111, 121); MATH 150; MATH 155 or STAT 213.

Electives (10 cr) Students may select the remainder of their credits toward Major I from advanced courses in the biological sciences. At least one course must be at the 300 level, in addition to BIOL 300 and 302. At least one special-topics course must also be taken (BIOL 470 or 471; various topics offered each semester). Students with strong interdisciplinary interests may select advanced course offerings in other departments or SCI 302 (an interdisciplinary course), after approval by their advisor.

Minor for Major I 12 credits in a field approved by faculty advisor. Note that although other minors may be taken, chemistry is the usual minor, as the required courses CHEM 102-105 and 222-224 fulfill the minor requirements. For students preparing to teach biology at the secondary school level, secondary education is an appropriate minor.

Curriculum Guide for Major I

	Fall	Spring
Year 1	BIOL 100 *CHEM 102, 103	BIOL 102 *CHEM 104,105
Year 2	BIOL 200 *CHEM 222, 223 *MATH 150	BIOL 202 *CHEM 224 *MATH 155 or STAT 213
Year 3	BIOL 300 *PHYS 110 or 111 BIOL electives (300 level)	BIOL 302 *PHYS 120 or 121 BIOL electives (300 and 400 level)
Year 4	BIOL electives (300 & 400 level)	BIOL electives (300 and 400 level)

*We recommend that math, physics and chemistry courses be completed as early as the student's schedule allows. Note that CHEM 224 must be taken prior to or corequisite with BIOL 300; otherwise, instructor permission is required. Students who are behind in the chemistry sequence are urged to take advantage of the summer session, during which these chemistry courses are usually offered.

MAJOR II

(for students planning to teach in childhood education, grades 1-6)

This plan consists of 26 credits in biological science, 12 credits in additional science, and 6 credits in math. Major II satisfies the major requirements for certification as a teacher for grades 1-6.

- A. BIOL 100, 102 (9 cr)
- B. Courses approved by advisor selected from the 200 or 300 level (17 cr)

Minor for Major II Childhood education (grades 1-6) is a collateral major. See the School of Education section of this catalog for requirements.

Additional science and math requirements for Major II CHEM 100, 101, 120, 121; PHYS 101 (or PHYS 110 or 120); MATH 104 and 105.



GRADES IN MAJOR: Only a letter grade (A, B, C, D, including + or –) will be accepted by the department in the required science and mathematics courses for the biology Major I and Major II.

Minor For the biology minor, the department recommends at least two courses beyond the Distribution or General Education Requirement (BIOL 100, 102), at the 200 level or above. Please note that the major department approves the minor.

OPPORTUNITIES FOR UNDERGRADUATES IN BIOLOGICAL SCIENCES

Undergraduate Research Students who wish to undertake a research project under the supervision of a faculty member must first obtain written permission from that faculty member and then register for BIOL 480-483. Research opportunities for undergraduates at Hunter are available in cell and molecular biology, developmental biology, neuroscience, cancer biology, AIDS, microbiology, and a variety of other contemporary areas. In some cases students may be permitted to work at one of the several neighboring research institutions. Synopses of faculty research interests can be obtained in the department office or from the Department of Biological Sciences Web site. Please note that, to qualify for departmental honors at graduation, there is a research requirement (see below).

Honors Work In order to qualify for departmental honors, students must have a departmental GPA of at least 3.5 and an overall GPA of at least 2.8. They must also satisfy a research requirement consisting of either (a) at least 2 credits of BIOL 480-483, or (b) at least one course chosen from among BIOL 375, 390, or 410. The research requirement includes a written report resulting from work in any of these courses.

MA Program in Biological Sciences See Career Planning—Graduate Study below

BA/MA Program in Biopharmacology A special biological sciences BA/MA combined degree program in biopharmacology is open to a limited number of undergraduate majors. It offers students the opportunity to complete both the bachelor's and master's degree requirements in five years, taking the final two years of lab and course work in the Department of Pharmacology at the Mount Sinai School of Medicine. Interested students should contact the Department of Biological Sciences as early as possible regarding eligibility and curriculum requirements.

BA/MA Program with Specialization in Biotechnology In this five-year program, qualified biology majors begin graduate work as seniors and receive the MA one year after completing BA requirements. Students are provided with theoretical knowledge and skills in molecular biology, and a foundation for application of these skills in careers in the biotechnology/pharmaceutical industry, academic research, or public health. Successful completion of the biotechnology workshop, an essential program component, entitles students to a summer internship in an industrial or private research laboratory. Interested biology majors should contact a departmental advisor as early as possible.

BA/MS Program in Biological Sciences/Environmental and Occupational Health Sciences This is an accelerated program leading to a BA in biology and an MS in environmental and occupational health sciences in five years. Biology majors admitted to the program start graduate work in their senior year. Interested students should contact a departmental advisor early in their undergraduate studies, as well as the office of the director of the Environmental and Occupational Health Sciences Program at the Brookdale Campus. The program provides biology majors with a career option in public health.

CAREER PLANNING

Graduate Study The department offers a master of arts in the biological sciences, and courses taken in the MA program can later be credited toward the PhD upon acceptance into the CUNY doc-

toral program in biology. Interested students should obtain the Hunter College Graduate Catalog and contact the biology master's program advisor. Laboratory research under faculty supervision (see undergraduate research, above) is extremely valuable for gaining admission to graduate schools. Students planning to apply to graduate school should consult with their advisor as early in their college career as possible.

Professional Schools Students who plan to apply to schools of medicine, dentistry, or veterinary medicine should consult with their advisor and see the preprofessional advisor in 812 HE.

Preparation for Teaching In cooperation with the School of Education, the Department of Biological Sciences offers opportunities for students to prepare for a teaching career in elementary and secondary schools. Major I in biology satisfies the requirements for New York State certification of at least 30 credits for teachers in adolescence education, grades 7-12. Major II in biology satisfies the requirements for New York State certification for teachers in childhood education, grades 1-6. (See above.) See the School of Education section of this catalog and consult with an advisor in the School of Education for additional information and requirements.

Preparation for Biotechnology Students interested in careers in the rapidly growing field of biotechnology should select Major I and consult with their advisor as early as possible. Advanced courses taken as electives should include BIOL 410 and those special topics courses (BIOL 470-471) that are most relevant to biotechnology. Qualified students are also encouraged to pursue the BA/MA Program in Biotechnology (see above).

COURSE LISTINGS

†**BIOL 100 Principles of Biology I** 7 hrs (3 lec, 3 lab, 1 disc), 4.5 cr. Prereq: MATH 101 or equivalent; GER/2/E (Core credit awarded only if BIOL 100 and BIOL 102 are completed); PD/C or D (PD credit awarded only upon completion of BIOL 100 and 102). Offered fall. The chemical basis of life; basic structure and function of pro- and eucaryotic cells; bioenergetics; Mendelian and molecular genetics; development and mechanisms of control of gene expression at all levels; population genetics and evolution.

†**BIOL 102 Principles of Biology II** 7 hrs (3 lec, 3 lab, 1 disc), 4.5 cr. Prereq: BIOL 100 or perm instr; and MATH 101 or equivalent; GER/2/E (Core credit awarded only if BIOL 100 and 102 are completed); PD/C or D (PD credit awarded only upon completion of BIOL 100 and 102). Offered spring. Taxonomy; homeostasis; internal transport and gas exchange in plants and animals; plant hormones; osmoregulation; mechanisms of action in the muscular, nervous, and neuroendocrine systems; the senses, behavior; ecology.

BIOL 120 Anatomy and Physiology I 6 hrs (3 lec, 3 lab), 4.5 cr. Prereq: CHEM 100, 101. Coreq: CHEM 120, 121. Offered fall. Cell structure and function; histology; nervous, muscular, and skeletal systems; integument. (Required for admission to the nursing program. Not accepted for credit toward the biology major.)

BIOL 122 Anatomy and Physiology II 6 hrs (3 lec, 3 lab), 4.5 cr. Prereq: BIOL 120 or equiv. Offered spring. Structure and function of circulatory, digestive, excretory, endocrine, and reproductive systems. Basic concepts of metabolism, embryology. (Required for admission to the nursing program. Not accepted for credit toward the biology major.)

††**BIOL 200 Cell Biology I: Microorganisms** 7 hrs (3 lec, 3 lab, 1 disc), 4.5 cr. Prereq: BIOL 100 and 102 or equiv, CHEM 102, 103, 104, 105 or equiv. Coreq: CHEM 222, 223 or perm instr. Offered fall. Structure and function of prokaryotic cells and viruses; cultivation, growth, evolution, metabolism, and genetics of microorganisms. Laboratories include light microscopy techniques, cultivation, growth, metabolism, and genetics of microorganisms and viruses. (For Major II students, chem. prereq is CHEM 100, 101. Coreq: CHEM 120,121).

††**BIOL 202 Cell Biology II: Eucaryotic Systems** 7 hrs (3 lec, 3 lab, 1 disc), 4.5 cr. Prereq: BIOL 200. Coreq: CHEM 224 or perm instr. Offered spring. Structure and function of eucaryotic cells and organelles; membrane systems, cell cycle, cell division, signaling, cytoskeletal systems, motility; specialized cells; modern research tools and approaches. Laboratories include plant and animal cell culture; studies of cell division, the cytoskeleton, motility; light and electron microscopic methods; fluorescence labeling; protein electrophoresis, immunoblotting, and immunolocalization.

BIOL 220 Topics in Genetics and Evolution 3 hrs (lec), 3 cr. Prereq: BIOL 100 or equiv. Classical genetic phenomena as related to multicellular organisms; genetic anomalies; genetics of populations as related to evolution.

BIOL 230 Fundamentals of Microbiology 5 hrs (2 lec, 3 lab), 3 cr. Prereq: CHEM 100, 101, 120, 121 or equivalent and BIOL 120. Coreq: BIOL 122. Offered spring. Topics include scope, historical aspects, taxonomy, survey of the microbial world, viruses, infectious diseases, control of microorganisms, and immunology. (Required for admission to the nursing program. Not accepted for credit toward the biology Major I.)

BIOL 250(W) Current Topics in the Biosciences 3 hrs 3 cr. Pre- or coreq: ENGL 120 or equiv; 2 semesters of introductory laboratory science or equiv; or perm instr; GER/3/B. Seminar for non-science majors focusing on topics of current relevance such as the science of emerging diseases, bioterrorism, genetic engineering, stem cell research, and global warming. Coverage includes the social, legal, political, and ethical issues associated with each topic. (Not accepted for credit toward biology Major I.)

BIOL 280 Biochemistry of Health and Nutrition 3 hrs (lec), 3 cr. Prereq: BIOL 100, 102 or 120, 122, CHEM 100, 120. Basic biochemistry in areas related to human health and nutrition. Designed for students in the dietetics program. (Not accepted for credit toward biology Major I.)

††**BIOL 300 Biological Chemistry** 7 hrs (3 lec, 3 lab, 1 disc), 4.5 cr. Prereq: BIOL 202, CHEM 222, 223. Coreq: CHEM 224. Offered fall. Molecular aspects of cellular function; properties of biomolecules, their biosynthesis and breakdown; structure and function of proteins and enzymes, metabolites, membranes, and nucleic acids; cellular mechanisms of energy transduction; integration and control of cell metabolism. Experiments cover a variety of modern techniques in molecular biology.

††**BIOL 302 Molecular Genetics** 7 hrs (3 lec, 3 lab, 1 disc), 4.5 cr. Prereq: BIOL 300. Offered spring. A comparison of viral, prokaryotic, and eucaryotic systems; review of classical Mendelian principles; bacterial DNA replication, transcription, and their control; mechanisms of gene mutation, repair, recombination, and transposition; applications of recombinant DNA technology; organization of nucleic acid into chromosomes; control of gene expression, the cell cycle, and cell development in eucaryotes.

BIOL 304 Environmental Microbiology 3 hrs (lec), 3 cr. Prereq: BIOL 100, 102, 200 or perm instr. Offered spring alt yrs. Role of microorganisms in normal and polluted environments: bioremediation, waste and water treatment, heavy metals, nutrient cycles, microbes as a food source, algal toxins, microbial pesticides, microbial indicators of mutagens and pollutants, microbial leaching of ores.

BIOL 306 Developmental Biology 3 hrs (lec), 3 cr. Prereq: BIOL 300. Offered fall. Major topics include molecular and cellular mechanisms of early embryonic development in amphibians, mammals, and model organisms such as *Drosophila*, as well as the related subjects of vertebrate organ system development, biology of stem cells, and animal cloning. Emphasis is placed on seminal and current research in cell-cell communication, signal transduction, and differential gene regulation in developmental processes.

BIOL 322 Evolution 3 hrs (lec), 3 cr. Prereq: BIOL 300. Modern synthetic theory, genetic basis of variation, gene pool in populations.

BIOL 350 Regulation of Cell Proliferation 3 hrs (lec), 3 cr. Prereq: BIOL 202, 300, or perm instr. Offered spring alt yrs. Control of cell division examined in the context of cancer, which is the loss of this control. Topics include: cell culture, the cell cycle, hormones, receptors, intracellular signal transduction, oncogenes, tumor suppressor genes, and the etiology of human cancer.

BIOL 360 Cellular and Molecular Immunology 4 hrs (3 lec, 1 disc), 3.5 cr. Prereq or coreq: BIOL 300 and perm instr. Offered fall. Study of the immune system from a molecular perspective. Molecular genetics of antibody and T cell receptor diversity, hematopoiesis and lymphocyte development, humoral and cellular immunity, histocompatibility.

†\$5 materials fee required

††\$10 materials fee required

BIOL 370 Physiology of the Nervous System 5 hrs (2 lec, 3 lab), 3 cr. Prereq: BIOL 100, 102, 200, 202 or perm instr. Offered spring. Neuron structure, conduction; neuroanatomy, synapses, integration; neuroembryology. Laboratory covers major concepts presented in lectures: neurophysiological experiments, histology, anatomy and development of the nervous system.

BIOL 375 Molecular Systematics 3 hrs, 3 cr. Prereq: BIOL 300 or perm instr. An overview of the various methods and kinds of data used in systematics, the study of organism diversity and biological relationships. Emphasis is on modern molecular and genetic approaches to identification of individual species and strains, and full phylogenetic analyses of suites of species to determine their evolutionary history. The knowledge base is provided for experimental investigation of questions of current interest in phylogeny and population biology.

BIOL 376 Endocrinology 3 hrs (lec), 3 cr. Prereq: BIOL 202 or perm instr. Cellular organization of the endocrine system; molecular mechanisms of hormone action; hormonal physiology of metabolism and reproduction; integration of endocrine responses by the central nervous system.

BIOL 380 Molecular Neurobiology 3 hrs (lec), 3 cr. Prereq: BIOL 300 or perm instr. Offered fall alt yrs. Molecular components and molecular mechanisms involved in the cell biology of neurons and glia, neuronal signaling, neuronal development, learning, memory, and diseases of the nervous system.

BIOL 390 Laboratory in Cell Structure 5 hrs (1 lec/demo, 4 lab), 3 cr. Prereq or coreq: BIOL 300, or BIOL 202 and perm instr. Offered fall. Applications of light and electron microscopy to study of cell structure and function. Lab projects utilize thin sectioning, negative staining, scanning, darkroom printing, digital imaging, and other techniques.

BIOL 400 Special Topics in Advanced Laboratory Techniques 4 hrs (lab), 2 cr. Prereq: BIOL 300 or perm instr. Advanced laboratory techniques used in contemporary biological research, including areas such as immunology, microbiology, and molecular neurobiology. Topics change from term to term.

BIOL 410 Workshop in Biotechnology 30 hrs/week for 4 weeks, 4 cr. Prereq: BIOL 200, 202, and perm instr. A series of laboratory-intensive experimental projects, each lasting one week or more, which introduce current research techniques and include individual participation in planning and preparation of experiments. The focus is on a broad biotechnology topic such as the isolation, cloning, and expression of a gene, utilizing the techniques of molecular genetics. This course satisfies the research requirement for graduation with departmental honors, and is a component of the interdisciplinary BS/MA (MLS/Biol) Program in Biotechnology.

BIOL 450 Individual Tutorial in Biology 1 or 2 cr. Prereq: 18 cr in biology, approval of advisor in addition to the sponsor. This course may be taken only once. Research paper written under the direction of a full-time faculty member in Department of Biological Sciences.

BIOL 460 Introduction to Planning and Teaching of Laboratory Work in Biology 5 hrs (2 planning, 3 lab), 2 cr. Prereq: 16 cr in BIOL, 12 cr in CHEM, 2 letters from faculty required. Participation in discussions and assisting in the teaching of laboratories in an introductory course, or peer mentoring in the undergraduate biological sciences research Techniques Facility.

BIOL 470, 471 Special Topics in Biology 2 hrs (lec), 2 cr per sem. Prereq: BIOL 300. Specific area of contemporary interest in biology. Topics change from term to term. An oral presentation and a written paper are required.

BIOL 480-483 Introduction to Experimental Biology 1 or 2 cr per sem; hours to be arranged. Prereq: BIOL 100 and 102, BIOL 200 or 202 (or the equiv), and written permission of instructor prior to registration. Laboratory research under guidance of faculty member. Work at another institution may be permitted in some cases, under auspices of a faculty member. Written report required upon completion of research. A minimum of 2 credits satisfies the research requirement for graduation with departmental honors.

Courses not offered in 2003-2004

BIOL 208 Ecology

BIOL 210 Advanced Physiology, lec

BIOL 211 Advanced Physiology, lab

BIOL 252 Comparative Anatomy of the Vertebrates

BIOL 274 Physiology of Activity

BIOL 335 Comparative Animal Physiology

BIOL 340 Plant Physiology

Chemistry

Department Office 1307 North Building; 772-5330

Chair Dixie Goss

Professors Alexandratos, Dannenberg, Diem, Franck, Goss, Grohmann, Massa, Mills, Mootoo, Quigley, Santoro, Sweeney, Tomasz

Associate Professors Drain, Francesconi

Assistant Professors Kawamura, Krishnamachari, Matsui, Polenova

Advisors (day) Pamela Mills, (evening) William Sweeney

Web Site: <http://patsy.hunter.cuny.edu/chemistry.html>

The Department of Chemistry offers courses to prepares the science major for professional work and further study in chemistry and other fields of pure and applied science. Courses for the non-science major are designed to present those essentials of chemical fact and theory which will contribute to the student's understanding of present-day scientific knowledge.

General Education Requirement (GER) CHEM 100-101, 102-103, 104-105, 111, 112, or 120-121 may be used to fulfill Broad Exposure/Stage 2, Group E (GER credit only if both lecture and corresponding lab are completed).

Distribution Requirement See Appendix A for the Distribution Requirement, which was replaced by the General Education Requirement in fall 2001 and which may be binding on students who matriculated prior to fall 2001.

Major There are two chemistry majors: Major I, a 41-credit concentration in addition to a 9-credit general chemistry core, is designed to prepare the student with intensive training for professional research and graduate study. Major II consists of two options: Option 1 for students interested in the chemical industry; and Option 2 (the biochemistry option) for students interested in the pharmaceutical industry, medicine, dentistry, veterinary medicine and physical therapy. Major II includes a minimum concentration of 26 credits (Option 1) or 24 credits (Option 2) in 200-level and above chemistry courses, in addition to a 9-credit general chemistry core. Both Options 1 and 2 are appropriate for students pursuing teacher education programs.

Students considering a chemistry major should consult the departmental advisor during their first semester to plan the proper sequence of courses, and they are urged to consult with the advisor at least once each succeeding semester. General Chem lecture I and II and General Chem Labs 1 and 2 are prerequisites for admission to both Major I and Major II.

Chemistry Major I The requirements for this major consist of 41 credits in chemistry. There is no allied minor. This major is recommended for students preparing for admission to graduate school or for careers in chemical research. It will also be useful to students seeking a position in the chemical or allied industries, as it is accredited by the Committee on Professional Training of the American Chemical Society.

The 41-credit major consists of CHEM 222-223, 224-225, 249, 349, 352, 354 or 356 with 355, 357, 366, 376 and 390. One further laboratory course must be chosen from 291.02 (research), 491.02 (honors research) or 378. In addition, one additional lecture course must be chosen from among the following: CHEM 322, 345, 354, 356, or 377. Also acceptable for completion of Major I are PHYS 330, PHILO 362 or 379. Students should be aware, however, that if either