The undergraduate curricula of the Department of Biological Sciences are designed (1) to provide for potential biologists a solid background based on the substantial new information comprising modern biology and (2) to meet the needs of students with different career goals and scientific interests. The Department offers students the opportunity to earn the Bachelor of Arts degree in two areas of specialization: Major in Biology I and Major in Biology II, the latter designed for prospective elementary school teachers. In addition, the Department offers students the opportunity to earn the Bachelor of Science degree in the interdisciplinary Major in Anthropology (Physical), Biology, and Chemistry, which is offered jointly with the Departments of Anthropology and Chemistry.

Career Preparation: In cooperation with the Department of Middle and High School Education, the Department of Biological Sciences offers students the opportunity to prepare for a teaching career in grades 7-12. Prospective middle- and high school biology teachers should consult the advisor in either of these departments. Students preparing for elementary teaching should consult the Department of Early Childhood and Child- hood Education. In addition to teaching, other careers arising from an undergraduate major in biology include research in one of its areas, medicine, veterinary medicine, dentistry, and work in the paramedical professions, and opportunities in public health, forestry, agriculture, fisheries, and conservation.

Graduate Study: Students who plan to attend graduate school should consult the Departmental adviser early in their college careers. They should examine the Lehman College Graduate Bulletin and the bulletins of various graduate schools for specific entrance requirements. A reading knowledge of one or two foreign languages is usually required. French, German, and Russian are most acceptable. In special cases, graduating seniors meeting the prerequisites may be permitted to offer credit from graduate courses listed in the College’s Graduate Bulletin toward their undergraduate degrees.

Programs

60-CREDIT INTERDISCIPLINARY MAJOR IN ANTHROPOLOGY (PHYSICAL), BIOLOGY, AND CHEMISTRY, B.S.  
See page 66 for information on this program.

MINOR IN BIOLOGY

A Minor in Biology consists of a minimum of 16 credits in biology, including one course (4 credits) selected from BIO 166, BIO 167, BIO 183, or BIO 184, and three courses (12 credits) selected from the 200, 300, or 400 levels, with at least two of these at the 300 or 400 level. The selected 100-level course will satisfy the distribution requirement in biology.

INDIVIDUALIZED B.A. IN PLANT STUDIES

This program, emphasizing the plant sciences, is administered through the Office of Individualized and Continuing Education. It is a collaborative program, with students taking some plant studies courses at the New York Botanical Garden, and others at Lehman College. Further details may be obtained from the departmental adviser in biological sciences or the Office of Individualized and Continuing Education.

70-CREDIT MAJOR IN BIOLOGY I, B.A.

The required courses and credits are distributed as follows:

Credits (70)
8  In BIO 166 and 167; one counts as distribution and the other toward the major. Both are prerequisite to all other biology courses.
24  In advanced biology courses (200, 300, and 400 levels), with at least 12 credits at the 300 level or higher. Course schedules to be approved by the department's student adviser
10  In general chemistry: CHE 166-167 and 168-169
10  In organic chemistry: CHE 232-233 and 234-235
10  In general physics: PHY 166*-167*
8  In mathematics: Either MAT 175 and 176 or 175 and 231

Qualified students may also take BIO 450; Seminar in Biology; BIO 489; Introduction to Experimental Biology; BIO 490; Honors in Biological Sciences. Biology majors MUST consult with Departmental undergraduate advisers on completion of BIO 166 or 167 and when making course selections.

Special Note: Biology majors are not required to select a minor because of the extensive course work in ancillary sciences required in the course of study.

43-CREDIT MAJOR IN BIOLOGY II, B.A.

This major is appropriate only for students planning to teach in elementary school. The required sequence of courses in elementary education must be completed by all students selecting this biology major. The required credits are distributed as follows:

Credits (43)
8  In BIO 166-167
20  Selected from other BIO courses
10  In general chemistry: CHE 166-167 and 168-169
5  In general physics: PHY 166*

*Please note that the Physics Department has increased the credit requirements for this course to 5 credits.
**Courses in Biological Sciences**

**BIO 166: Introduction to Organismic Biology.** 6 hours (2, lecture; 1, discussion; 3, lab), 4 credits. Introduction to the principles of biology governing the unity and diversity of living organisms, with special emphasis on subcellular, cellular, and organismal levels of organization in plants and animals, and on genetics and evolution. Laboratory exercises consist of experimental procedures illustrating basic concepts of biology.

**BIO 167: Principles of Biology.** 6 hours (2, lecture; 1, discussion; 3, lab), 4 credits. Introduction to the principles of biology governing the unity and diversity of living organisms, with special emphasis on energy production, nutrition, hormonal control, reproduction, and other physiological mechanisms involved in the coordination of activity in plants and animals. Laboratory exercises consist of experimental procedures illustrating basic concepts of biology.

**BIO 181: Anatomy and Physiology I.** 5 hours (3, lecture; 2, lab), 4 credits. (Open only to students majoring in nursing; dietetics, foods, and nutrition; health education; and physical education.) Study of human anatomy and physiology. Lecture topics include cell structure and function, tissues, and the study of the skeletal, muscular, and nervous systems. Laboratory exercises complement the lecture material with the use of a workbook, models, and animal preparations.

**BIO 182: Anatomy and Physiology II.** 5 hours (3, lecture; 2, lab), 4 credits. (Open only to students majoring in nursing; dietetics, health education, and physical education.) Continuation of BIO 181. Lecture topics include the cardiovascular, respiratory, digestive, renal, endocrine, and reproductive systems. Emphasis is given to the physiological functioning of these systems. Laboratory experiments illustrate the concepts discussed in the lectures. PREREQ: BIO 181.

**BIO 183: Human Biology.** 5 hours (3, lecture; 2, lab), 4 credits (closed to students majoring in biology.) Introduction to the structure and function of the human body, with emphasis on the physiological mechanisms in health and disease. Topics include: the molecules of life; cells and tissues; the skeleton; muscles; the heart; blood; skin; the eye; the ear; reproduction theory; brain; genetics; infectious disease; the immune system; cancer; nutrition.

**BIO 184: Plants and People.** 5 hours (3, lecture; 2, lab), 4 credits (closed to students majoring in biology.) Introduction to the world of plants, with emphasis on the interactions and interdependency of plants and people. PREREQ: COR 106.

Note: All 200-, 300-, and 400-level BIO courses carry the following PREREQ: BIO 166-167 (or equivalents). Additional prerequisites are listed.

**BIO 226: Human Physiology.** 5 hours (2, lecture; 3, lab), 3.5 credits. (Closed to students majoring in biology.) Study of human anatomy and physiology, with emphasis on the integration and regulation of physiological processes. Laboratory work illustrates the principles discussed in the lectures.

**BIO 227: Mammalian Histology.** 6 hours (2, lecture; 4, lab), 4 credits. Microscopic study of cells, tissues, and organs from prepared slides— with emphasis on the correlation between structure and function. Recent advances grounded in electron microscopy and histochemistry are discussed.

**BIO 228: Mammalian Physiology.** 6 hours (2, lecture; 4, lab), 4 credits. Study of the basic principles of mammalian physiology. Various organ systems will be presented to illustrate their mechanisms of operation, their nervous and hormonal control, and their interrelationships with other organ systems in maintaining homeostasis. Emphasis will be given to the cardiovascular, neuromuscular, renal, and respiratory systems. PREREQ: CHE 168-169.

**BIO 230: Microbiology.** 6 hours (2, lecture; 4, lab), 4 credits. (Open only to students majoring in nursing; dietetics, foods, and nutrition; health education; and physical education.) A survey of microbes and their structure, chemical composition, cultivation, ecology, and metabolism; special emphasis on applied aspects (infectious diseases and human resistance, food and industrial microbiology, biotechnology). PREREQ: Two semesters of 100-level biology, or instructor’s consent.

**BIO 238: Genetics.** 6 hours (2, lecture; 4, lab), 4 credits. Basic principles of genetics and modern developments in the field, with their theoretical and practical implications: the inheritance, structure, and mode of action of the genetic material in microorganisms, plants and animals, including man. Laboratory work consists of preparation and examination of chromosome material and experiments with segregating characters in a variety of organisms.

**BIO 241: Evolution, Species, and Biogeography.** 3 hours (lecture), 3 credits. This course will explore the three major themes of Evolution, Species, and Biogeography from their historical antecedents to modern ideas. The course will provide the student with a full understanding of the ideas that shape current thinking in organismic biology and advance the dialogue in systematics, ecology, biodiversity, and conservation. The structure of the course will be a web-based asynchronous course, which will lead the student to the discovery of ideas based on extensive but guided readings and interpretation of key primary and secondary literature on the three interconnected themes. Important guiding ideas will be presented in forum format in which the student will be an active participant. Guiding principles will include the notion of the biological species concept and that the species has a unique ecological role and longevity, and may occupy a specific geographic region. This concept will be linked to the evolutionary ideas of descent with modification, monophyletic taxa, and the attempt to understand both the current and historical distribution of the world’s flora and fauna. At least two models, dispersal and vicariance, will be used to understand that distribution. PREREQ: BIO 166 and 167, or equivalents. NOTE: Basic computer skills and Internet familiarity are strongly recommended.

**BIO 242: Flowering Plants.** 6 hours (2, lecture; 4, lab), 4 credits. Identification and classification of flowering plants by the use of manuals. The characteristics and evolutionary position of selected families, including a discussion of economically important plants. Laboratory work is supplemented by field trips.

**BIO 244: Growth and Development of Lower Plants.** 6 hours (2, lecture; 4, lab), 4 credits. Algae, fungi, liverworts, and mosses are cultured and studied macroscopically and microscopically through all phases of their life cycles. Emphasis is on growth and differentiation, reproductive processes, and the phylogenetic interrelationships among groups. Laboratory work will be supplemented by field trips.

**BIO 246: Growth and Development of Higher Plants.** 6 hours (2, lecture; 4, lab), 4 credits. Vegetative and reproductive structures of primitive tracheophytes, gymnosperms, and angiosperms are studied in living, cultured, preserved, and fossilized materials in an attempt to trace the growth and phylogenetic development of these groups. Laboratory work will be supplemented by field trips.

**BIO 266: Invertebrate Zoology.** 6 hours (2, lecture; 4, lab), 4 credits. Survey of the anatomy and natural history of the invertebrates. Emphasis is not only on the evolutionary relationships, but also on functional problems presented by the environment and the mechanisms by which they are solved.

**BIO 267: Comparative Anatomy of Vertebrates.** 6 hours (2, lecture; 4, lab), 4 credits. Evolution of chordates, with emphasis on comparative anatomical, functional, and developmental aspects of vertebrate organ systems. Laboratory dissections of representatives of each of the vertebrate classes will be performed.

**BIO 268: Vertebrate Embryology.** 6 hours (2, lecture; 4, lab), 4 credits. Experimental studies and modern theories of development. Laboratory study of the frog, chick, and mammal.

*Not expected to be offered in 2003-2005*
BIO 269: The Biology of Insects. 6 hours (2, lecture; 4, lab), 4 credits. Anatomy, behavior, classification, ecology, and physiology of insects. The laboratory will include field trips and projects.

BIO (GEP) 302: Biogeography. 5 hours (3, lecture; 2, lab), 4 credits. Analysis of origin, distribution, adaptation, and association of plants and animals. Development of living communities considered particularly in space but also in time. Stress placed on broad distributional relationships. PREREQ: GEP 226.

BIO 310: Parasitology. 5 hours (2, lecture; 3, lab), 3.5 credits. PREREQ: One 200-level BIO course, BIO 266 recommended.

BIO 330: Plant Physiology. 6 hours (2, lecture; 4, lab), 4 credits. Consideration of the major physiological processes of plants, with special emphasis on water relations, inorganic nutrition, photosynthesis, metabolism, and hormonal relationships. Laboratory studies consist of physiological experiments with living plants. PREREQ: CHE 234-235.

*BIO 331: Experimental Microbiology. 6 hours (2, lecture; 4, lab), 4 credits. PREREQ: CHE 234-235.

BIO (GEO) 332: Advanced Oceanography. 5 hours (2, lecture; 3, lab or seminar; several day-long research exercises), 3.5 credits. Interaction between the geologic and biotic elements of the oceans and their basins. Emphasis is on correlating the broad spectrum of approaches in modern oceanography. CUNY oceanographic facilities will be used. Field experience. PREREQ (BIO major): BIO 166-167, either GEO 166 or 168, and either CHE 114 or 166-167. PREREQ (GEO major): Either GEO 166 or GEO 168, GEO 167, either BIO 166 or BIO 167, and either CHE 114 or CHE 166-167. NOTE: BIO (GEO) 332 is accepted toward fulfillment of either the BIO or the GEO major requirements.

BIO 333: Endocrine Physiology. 6 hours (3, lecture; 4, lab), 4 credits. Endocrine regulation of growth, development, metabolism, and reproduction. Laboratory experiments on endocrine regulation of physiological processes with use of small animals (rats, frogs, and fishes) include experience with surgical techniques and radiotopes. PREREQ: CHE 234-235.

BIO 335: Marine Biology. 6 hours (2, lecture; 4, lab; and field trips), 4 credits. PREREQ: One 200-level BIO course (BIO 238 or BIO 266 recommended).

BIO 338: Genetics of Man. 6 hours (2, lecture; 4, lab), 4 credits. PREREQ: CHE 238.

BIO 339: Ecology. 6 hours (2, lecture; 4, lab; and field trips), 4 credits. Introduction to the factors comprising biotic communities, with special emphasis on the properties of populations and communities. Laboratory and fieldwork stress techniques useful in basic environmental and community analyses. PREREQ: One 200-level BIO course (BIO 242 or 266 recommended).

BIO 400: Biological Chemistry. 6 hours (2, lecture; 4, lab), 4 credits. Stress on the central role of nucleic acids and proteins in living cells: biological oxidation and intermediary metabolism of carbohydrates, lipids, and proteins, and the general properties of enzymes and enzyme-catalyzed reactions in the intact cell and cell-free systems. Laboratory work stresses use of modern techniques used in biochemical analysis and in enzyme assays. Selected experiments to demonstrate the dynamic aspects of biochemical in living cells and in cell-free systems. PREREQ: Two additional BIO courses and CHE 234-235.

BIO 401: Biological Systematics. 6 hours (2, lecture; 4, lab), 4 credits. A study of the theoretical basis and methodologies of each of the current schools of systematics, and the arguments used by each school in uncovering the phylogenetic relationships among organisms. Topics to be covered will include Aristotelian essentialism, evolutionary systematics, phenetics, cladistics (phylogenetic systematics), transformed (pattern) cladistics, monophyly, paraphyly, polyphary, parsimony, homology, homoplasy, character state analysis, and polarity. PREREQ: Two additional BIO courses.

BIO 404: Plant Biochemistry. 6 hours (2, lecture; 4, lab), 4 credits. Biochemical activities of plants, including photosynthesis, respiratory pathways, sulfate and nitrate reduction, and cell-wall metabolism will be discussed. The biosynthesis by plants of drugs of pharmacological significance such as alkaloids and vitamins will also be considered. Laboratory work will include techniques for fractionating plant cells and isolating intermediates and products’ metabolic pathways. PREREQ: Two additional BIO courses and CHE 234-235.

BIO 406: Biochemistry of Differentiation. 3 hours, 3 credits. PREREQ: BIO 238, one other BIO course, and CHE 234-235.

BIO 410: Cell Physiology and Biochemistry. 6 hours (2, lecture; 4, lab), 4 credits. Consideration of structure in relation to function in the intact cell system. Metabolic regulation and the properties of cell membranes, the cytoplasm, the nucleus, and the genes are discussed in terms of some of the integrated activities of the living cell, including permeability, active transport, excitation, conduction, contraction, differentiation, and aging. PREREQ: Either two additional BIO courses or one BIO course plus one semester of physical chemistry, and CHE 234-235.

BIO 420: Molecular Biology. 6 hours (2, lecture; 4, lab), 4 credits. Discussion of structure and function of nucleic acids and proteins and their synthesis in vivo and in vitro. Basic concepts in molecular genetics are studied, with special emphasis on the molecular architecture of the gene, its action, and regulations in bacteria and bacteriophages. Laboratory experiments include techniques for isolation and quantitation of nucleic acids from cells, use of the cell-free synthesizing systems, and basic procedures in microbial genetics. PREREQ: CHE 234-235 and either two additional BIO major courses (200-level or above) or one additional BIO major course (200-level or above) and physical chemistry.

BIO 424: Ichthyology. 6 hours (2, lecture; 4-seminar, lab, or fieldwork), 4 credits. In-depth consideration of the life histories of fishes. Emphasis on the general and specific physiological adaptations of these organisms to the functional problems presented by the aquatic environment. PREREQ: Two additional BIO courses.

BIO 431: Comparative Animal Physiology. 6 hours (2, lecture; 4, lab) 4 credits. Comparative aspects of cellular and organ physiology, the evolutionary basis for development of homeostatic mechanisms, and structure-function correlation within the animal kingdom. Laboratory work includes the use of modern techniques to elucidate and illustrate the principles discussed in the lectures. PREREQ: Two additional BIO courses and CHE 234-235.

BIO 432: Biological Fine Structure. 3 hours, 3 credits. Detailed description of cell structure at the macromolecular level as revealed by modern methods of fine-structure analysis, especially by electron microscopy. Emphasis on structure-function relationships in cellular and tissue components. Demonstration of the various methods used in fine-structure analysis. PREREQ: Two additional BIO courses. COREQ: BIO 433.

BIO 433: Techniques in Electron Microscopy. 6 hours, 3 credits. Fundamental training in techniques used in obtaining structural cellular information at the macromolecular level. Emphasis is on methods and applications of electron microscopy to the study of biological materials. PREREQ: Two additional BIO courses. COREQ: BIO 432.

BIO 434: Radiation Biology. 6 hours (2, lecture; 4, lab), 4 credits. PREREQ: Two additional BIO course and CHE 168-169.

BIO 435: Neurophysiology. 3 hours, 3 credits. A general consideration of nervous systems, excitable membrane physiology, synapses, sensory receptors, trophic function, regeneration of nervous tissue, and behavior. PREREQ: Two additional BIO courses, including at least one course in animal physiology, and CHE 234-235.

BIO 436: Neurophysiology Laboratory. 4 hours, 2 credits. The laboratory will introduce the students to instrumentation and neurophysiological techniques. The experiments will examine bioelectricity, receptor processes, central processes, behavior, and regeneration. COREQ: BIO 435.

BIO 450: Biology Seminar. One semester, 1 credit (maximum 2 credits). The seminar provides opportunity for reading current literature in selected areas of interest for study of reports and for discussions. PREREQ: 15 credits in BIO and CHE 168-169.

BIO 465: Microbial Physiology and Genetics. 6 hours (2, lecture; 4, lab), 4 credits. The organization of physiological processes in microorganisms including structure, energy yielding mechanisms, macromolecular biosynthesis, growth, and regulation. The genetics of microorganisms including the organization, maintenance, and expression of genetic information, cell growth and differentiation, and genetic engineering. PREREQ: Experimental Microbiology (BIO 331).
*BIO (GEO) 470: Oceanographic Research Cruise. 90 hours (fieldwork and lab), 3 credits. (Between spring and summer sessions.) PREREQ: Either BIO (GEO) 332 or BIO 335. NOTE: Please consult the Department chair before registering for this course.

BIO 489: Introduction to Experimental Biology. One semester, 1 credit (maximum 3 credits). Individual laboratory investigation for advanced students, under the guidance of a faculty member. PREREQ: Sponsorship of a faculty member, Departmental permission prior to preliminary registration, and 15 BIO credits.

Special Program in Plant Sciences
In Conjunction with The New York Botanical Garden

The purpose of the New York Botanical Garden's Continuing Education Program is to interest and instruct the general public in the various facets of plant life. Several major programs of study are offered: Botany, Genetics and Evolution, Field Botany, Plant Morphology and Taxonomy, and Home Landscaping. Among the offerings at the Garden, the courses listed below may be counted for elective credit at Lehman College. These courses are not open to students in the biology major except in special circumstances to be decided in consultation with the biological sciences department. They are taught by members of the New York Botanical Garden staff, all specialists and experienced teachers in their specific areas. In general they involve lectures, discussions, demonstrations, and films. Laboratory activity is indicated as part of the course description.

Courses in Botany

BBG 111: Basic Botany. 15 hours, 1 credit. Among the topics covered are: plant cells and tissues, cell division, reproduction, genetics, anatomy, plant diversity and systematics, evolution, water relationships, respiration, photosynthesis, and ecology.

BBG 112: Plant Form and Function. 12 hours, 1 credit. An introduction to the anatomy and physiology of plant cells and organs. The difference between physiology and anatomy (or morphology) is that physiology is dynamic—concerned with the functions and vital function of organisms—while the morphologist’s concern is primarily geared toward form and structure. Includes laboratory work. PREREQ: BBG 111.

BBG 113: Physiology of Plants. 12 hours, 1 credit. Plant growth and development, hormones, tropisms, phytochrome, dormancy, responses to low temperature, flowering, senescence and abscission, with emphasis on the physiological variations that occur from season to season. PREREQ: BBG 112.

BBG 114: Ecology. 12 hours, 1 credit. The relationship of vegetation study to ecology; the classification and description of forest and woodland communities; the influence of climate, soil, topography, geology, and man on the vegetation. Local flora will be compared to that in other parts of the United States.

BBG 115: Field Botany (Cryptogams). 12 hours, 1 credit. The cryptogams are seedless plants: algae, fungi, mosses, hepatics, lichens, ferns, and fern allies. The recognition and collection of cryptogams for observation in herbariums. Weather permitting, some classes will be field trips in or near the New York Botanical Garden. PREREQ: BBG 114.

BBG 116: Field Botany (Phanerogams). 12 hours, 1 credit. Identification of common trees, shrubs, and flowers in the area; naming and basic plant structure; practice in using taxonomic keys of identification. Students are required to make their own personal plant collections. PREREQ: BBG 114.

BBG 117: Evolutionary Biology. 12 hours, 1 credit. Learning to read the fossil record: an introduction to such disciplines as paleoecology, geochemistry, paleobotany. Computer analysis applied to historical biology. PREREQ: BBG 111.

BBG 118: General Genetics. 12 hours, 1 credit. Specific patterns of gene inheritance by Mendelian and nonMendelian mechanisms; the use of probability and statistics; the role of DNA-RNA as the “code of life.” PREREQ: BBG 111.

BBG 119: Paleobotany. 12 hours, 1 credit. A history of the large fossil plant groups and their characters, with emphasis on evolution, ecology, dispersal, paleoclimates, and practical applications. PREREQ: BBG 111.

BBG 120: Morphology of Flowering Plants. 20 hours, 1 credit. The basic structure of flowering plants as viewed by a dissecting microscope for the examination of living flowers of highly specialized structure and with the compound microscope for the observation of anatomical slides. The student will have the opportunity to make botanical illustrations of the dissection specimen.

BBG 121: Systematic Botany. 12 hours, 1 credit. The principles of classifying plants into species, genus, family, etc. Typical flower structure and modifications that affect classification. PREREQ: BBG 111.