Biochemistry, Biology (BCH, BIO)

Majors and Minor in Biochemistry, Biology

Departments of Biochemistry and Cell Biology, Ecology and Evolution, Neurobiology and Behavior; College of Arts and Sciences

UNDERGRADUATE BIOLOGY WEB ADDRESS: http://www.bio.sunysb.edu

Minors of particular interest to students majoring in Biology or Biochemistry: Biomaterials (BES), Bioengineering (BNG), Environmental Studies (ENS), Health and Wellness (LHW), Philosophy (PHI), Science and Engineering (LSE)

Department of Biochemistry and Cell Biology

CHAIRPERSON: William J. Lennarz
DIRECTOR OF UNDERGRADUATE STUDIES: Harvard Lyman

Faculty

Paul M. Bingham, Associate Professor, Ph.D., Harvard University: Novel approaches to cancer chemotherapy; the biological basis of human origins, evolution, and history.

Deborah Brown, Professor, Ph.D., Stanford University: Structure and function of membrane microdomains and caveolae.

David Bynum, Professor, Ph.D., Dartmouth College: Cell Motility. Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1996; recipient of the President’s Award for Teaching, 1996; recipient of the National Science Foundation/Presidential Award for Science, Mathematics and Engineering Mentoring, 2002.

Manasi Chavan, Research Assistant Professor, Ph.D., University of Mumbai: Structural and functional studies of the Oligosaccharyl Transferase complex.

Vitaly Citovsky, Professor, Ph.D., Hebrew University: Nuclear targeting; intercellular communication in plants and chromatin remodeling.

Neta Dean, Associate Professor, Ph.D., University of California, Los Angeles: Role of glycans in genetic disorders and fungal pathogenesis.

Dale G. Deutsch, Professor, Ph.D., Purdue University: Molecular and cell biology of endocannabinoid action.

Hao-Peng Duffy, Research Associate Professor, Ph.D., SUNY Stony Brook/Cold Spring Harbor Laboratory: Cancer research.

Markus Eilers, Research Assistant Professor, Ph.D., Universität Dortmund/Max Planck Institute for Molecular Physiology: Structure and function of G-protein coupled receptors.

J. Peter Gergen, Professor, Ph.D., Brandeis University: Drosophila developmental genetics and the mechanisms of translational regulation.

Robert Haltiwanger, Professor, Ph.D., Duke University: Role of glycosylation in signal transduction events.

Bernadette Holdener, Associate Professor, Ph.D., University of Illinois-Chicago: Protein folding and trafficking in mouse development and signal transduction.

Nancy Hollingsworth, Professor, Ph.D., University of Washington, Seattle: Analysis of meiotic chromosome recombination, synopsis, and segregation in yeast.

Viktor Hornak, Research Assistant Professor, Ph.D., Slovak Technical University: Computational techniques for gaining insights into function and dynamics of biological macromolecules.

Jen-Chih Hsieh, Assistant Professor, Ph.D., Duke University: Wnt signaling by the Frizzled protein.

A. Wall Karzai, Assistant Professor, Ph.D., Johns Hopkins University: A system for protein tagging, directed deregulation, and ribosome rescue.

William Lennarz, Distinguished Professor, Ph.D., University of Illinois: The biosynthesis and degradation of glycoproteins in yeast and animal cells.

Chang-Jun Liu, Adjunct Assistant Professor, Ph.D., Shanghai Institute for Plant Physiology: Biosynthesis of plant natural products and structure-function relationship of key enzymes in natural product biosynthetic pathways.

Erwin London, Professor, Ph.D., Cornell University: Membrane biochemistry and biophysics.

Harvard Lyman, Associate Professor, Ph.D., Brandeis University: Photoregulation of chloroplast development and replication; redox regulation of phototaxis. Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1991 and the President’s Award for Excellence in Teaching, 1991. Director of Undergraduate Studies, Department of Biochemistry and Cell Biology.

Kenneth B. Marcu, Professor, Ph.D., Stony Brook University: Cellular gene expression programming in innate and adaptive immune responses and cancer. Foreign Scholar of the Institute of Advanced Studies of the University of Bologna, Italy.

Aaron Neiman, Associate Professor, Ph.D., University of California, San Francisco: Vesicle trafficking and intracellular signaling in yeast.

Nissim Schecter, Professor, Ph.D., Western Michigan University: Molecular basis of nerve growth and regeneration.

Richard Setlow, Adjunct Professor, Ph.D., Yale University: DNA repair, biological effects of ultraviolet and ionizing radiation.

John Shanklin, Adjunct Professor, Ph.D., University of Wisconsin-Madison: Structure and function of fatty acid desaturase.

Sanford Simon, Professor, Ph.D., Rockefeller University: Biochemistry and cell biology of inflammatory cells and their proteinases; development of natural and synthetic proteinase inhibitors.

Steven O. Smith, Professor, Ph.D., University of California, Berkeley: Membrane protein structure and function.

James V. Staros, Professor and Dean, College of Arts and Sciences, Ph.D. Yale: Molecular mechanisms of transmembrane signaling by the ErbB family of tyrosine kinases.

Rolf Stemmlanz, Distinguished Professor, Ph.D., Harvard University: Chromatin structure and function.

F. William Studier, Adjunct Professor, Ph.D., California Institute of Technology: Genetics and physiology of bacterial viruses.

Gerald H. Thomsen, Associate Professor, Ph.D., Rockefeller University: Molecular embryology, morphogenesis, growth factor signaling and ubiquitin pathways.

Zuzana Zachar, Research Assistant Professor, Ph.D., Stony Brook University: Director MAT Biology; Cancer chemotherapy drug discovery.

Department of Ecology and Evolution

CHAIRPERSON: Charles H. Janson
DIRECTOR OF UNDERGRADUATE STUDIES: Michael A. Bell

Faculty

Michael A. Bell, Professor, Ph.D., University of California, Los Angeles: Evolutionary biology; ichthyology; paleobiology and geographic variation.

Daniel E. Dykhuisen, Professor, Ph.D., University of Chicago: Population genetics and molecular evolution, especially of bacteria.


Douglas J. Futuyma, Distinguished Professor, Ph.D., University of Michigan: Evolutionary biology; coevolution; insects.

R. Geeta, Associate Professor, Ph.D., University of Arizona: Evolution of angiosperms; homeobox genes, genome size.

Lev R. Ginzburg, Professor, Ph.D., Agrophysical
Institute, St. Petersburg, Russia: Theoretical and applied ecology.

Catherine Graham, Assistant Professor, Ph.D., University of Missouri at St. Louis: Landscape-level analysis of factors affecting bird assemblages in fragmented landscapes.

Jessica Gurevitch, Professor, Ph.D., University of Arizona: Evolutionary ecology of plant populations and communities; plant physiological ecology.

George J. Hechtel, Associate Professor, Ph.D., Yale University: Systematics and zoogeography of marine demospongiae. Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1982.

Charles H. Janson, Professor, Ph.D., University of Washington: Social ecology of vertebrates; plant dispersal strategies.

Manuel T. Lerdau, Professor, Ph.D., Stanford University: Plant ecology and physiology: global change.

Jeffrey S. Levitt, Distinguished Professor, Ph.D., Yale University: Marine benthic ecology; population genetics of bivalve mollusks; paleoecology; State University Chancellor’s Award for Excellence in Teaching and President’s Award for Excellence in Teaching, 1997.

Dianna Padilla, Associate Professor, Ph.D., University of Alberta, Canada: Phenotype plasticity; plant-herbivore functional ecology; ecology of evading species.

Massimo Pigliucci, Associate Professor, Ph.D., University of Connecticut, University of Tennessee: Plant evolutionary ecology; quantitative genetics; philosophy of science.

F. James Rohlf, Distinguished Professor, Ph.D., University of Kansas: Multivariate data analysis techniques applied to problems in taxonomy and ecology; computer modeling; applied ecology.

John True, Assistant Professor, Ph.D., Duke University: Genetic basis of differences among closely related species; natural selection.

John Weins, Assistant Professor, Ph.D., University of Texas: Phylogenetic approaches to questions in evolution and ecology; the theory and methods of systematics, and the systematics, evolution, morphology, and ecology of reptiles and amphibians.

Department of Neurobiology and Behavior
CHAIRPERSON: Lorne M. Mendell
DIRECTOR OF UNDERGRADUATE STUDIES: John B. Cabot

Faculty
Paul R. Adams, Professor, Ph.D., London University: Synaptic plasticity and network models.
Paul Brehm, Professor, Ph.D., University of California, Los Angeles: Cellular neurobiology; synaptic transmission.
John B. Cabot, Professor, Ph.D., University of Virginia: Autonomic system.
William F. Collins III, Associate Professor, Ph.D., University of Pennsylvania: Physiology; neurobiology. Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1997, and President’s Award for Excellence in Teaching, 1997.
L. Craig Evinger, Professor, Ph.D., University of Washington: Integrative neuroscience.
Simon Halegoua, Professor, Ph.D., Stony Brook University: Molecular neurobiology.
Maurice Kerman, Associate Professor, Ph.D., University of Wisconsin-Madison: Molecular neurobiology.
Mary Kritzer, Associate Professor, Ph.D., Yale University: Neurobiology of cognition.
Joel M. Levine, Professor, Ph.D., Washington University: Developmental neurobiology, nerve regeneration.
Gail Mandel, Distinguished Professor, Ph.D., University of California, Los Angeles: Molecular neurobiology.
Gary G. Matthews, Professor, Ph.D., University of Pennsylvania: Cellular neurobiology; synaptic transmission.
David McKinnon, Professor, Ph.D., Australian National University: Molecular biology of ion channels.
Lorne M. Mendell, Distinguished Professor, Ph.D., Massachusetts Institute of Technology: Modifiability of spinal synapses.
Howard Sirotkin, Assistant Professor, Ph.D., Albert Einstein College of Medicine: Vertebrate development and genetics.
Lonnie Wollmuth, Associate Professor, Ph.D., University of Washington, Seattle: Psychology and biophysics.
Stephen Yazulla, Professor, Ph.D., University of Delaware: Physiology.

Affiliated Faculty
Marian Evinger, Pediatrics
Stuart S. McLaughlin, Physiology and Biophysics

Teaching Assistants (all areas)
Estimated number: 65

Courses in Biology
See the Course Descriptions listing in this Bulletin for complete information.

BIO 101-E Human Biology
BIO 103-E Introduction to Biotechnology
BIO 104 How Science Works
BIO 111-E The Aquatic World
BIO 113-E General Ecology
BIO 115-E Evolution and Society
BIO 150-E The Living World
BIO 201-E Fundamentals of Biology: Organisms to Ecosystems
BIO 202-E Fundamentals of Biology: Molecular and Cellular Biology
BIO 203-E Fundamentals of Biology: Cellular and Organ Physiology
BIO 205-H Cell, Brain, Mind
BIO 310 Cell Biology
BIO 311 Techniques in Molecular and Cellular Biology
BIO 312 Bioinformatics and Computational Biology
BIO 315 Microbiology
BIO 316 Molecular Immunology
BIO 317 Principles of Cellular Signaling
BIO 318-H Bioethics and Policy
BIO 320 General Genetics
BIO 325 Animal Development
BIO 327 Developmental Genetics Laboratory
BIO 328 Mammalian Physiology
BIO 334 Principles of Neurobiology
BIO 335 Animal Physiology Laboratory
BIO 335 From Synapse to Circuit: Selforganization of the Brain
BIO 339 Molecular Development of the Nervous System
BIO 340 Zoology
BIO 341 Plant Diversity
BIO 343 Invertebrate Zoology
BIO 344 Chordate Zoology
BIO 346 Aquatic Arthropods and Vertebrates
BIO 348 Diversity and Evolution of Reptiles and Amphibians
BIO 350-H Darwinian Medicine
BIO 351-H Ecology
BIO 352 Ecology Laboratory
BIO 353 Marine Ecology
BIO 354 Evolution
BIO 356  Applied Ecology and Conservation Biology Laboratory
BIO 358-H  Biology and Human Social and Sexual Behavior
BIO 359  Behavioral Ecology
BIO 361, 362  Biochemistry I, II
BIO 365  Biochemistry Laboratory
BIO 367  Molecular Diversity Laboratory
BIO 380  Entomology
BIO 385-H  Plant Ecology
BIO 386-H  Ecosystem Ecology and the Global Environment
BIO 401-405  Seminars in Biology
BIO 407  Colloquium in Ecology and Evolution for Biology Majors
BIO 444  Readings in Biology and Society
BIO 446  Readings in Neurobiology and Physiology
BIO 447  Readings in Molecular, Cellular, and Developmental Biology
BIO 448  Research in Neurobiology and Physiology
BIO 475, 476  Undergraduate Teaching Practica in College Biology I, II
BIO 484  Research in Biology and Society
BIO 486  Research in Neurobiology and Physiology
BIO 487  Research in Molecular, Cellular, and Developmental Biology
BIO 488  Internship in Biological Sciences
BIO 489  Research in Ecology and Evolution

The Biochemistry Program

DIRECTOR OF UNDERGRADUATE STUDIES: Harvard Lyman
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EMAIL: Harvard.Lyman@stonybrook.edu
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The Biochemistry Undergraduate Major Program provides a challenging and exciting introduction to the chemical basis of biological phenomena. The major is designed to prepare students who intend to pursue graduate study, attend health-related professional schools, pursue secondary school teaching careers, and fill entry-level positions in private, state, and federal laboratories or in pharmaceutical and biotechnical industries. The undergraduate curriculum provides a fundamental background in biology, chemistry, genetics, cell biology, and biochemistry, with courses in mathematics and physics necessary for advanced understanding of this broad field. Students may not declare a double major among biochemistry, biology, and pharmacology majors.

Requirements for the Major in Biochemistry (BCH)
All courses offered for the major must be taken for a letter grade. A minimum grade of C must be obtained in all courses in requirements A, B, and C below. Completion of the major requires approximately 68-72 credits.

Note:
Students may be exempted from BIO 150 with AP Biology scores of 4 or higher. Students with advanced courses in Biology may petition for an exemption from BIO 150

*BIO 361 and 362 should be taken in sequence.

**CHE 301 is offered only in the fall;
CHE 312 is offered only in the spring

***BIO 365 is 2 credits; BIO 311 is 3 credits;

****BIO electives for the major must be chosen from the approved list. Electives not on the list must be approved by a Biochemistry advisor.
**A. Courses in Related Fields**
1. CHE 131, 132 General Chemistry
   or CHE 141, 142 Honors Chemistry
2. CHE 133, 134 General Chemistry Laboratory
   or CHE 143, 144 Honors Chemistry Laboratory
3. CHE 321, 326 Organic Chemistry I, IIB (See Note)
4. CHE 327 Organic Chemistry Laboratory A
   or CHE 333 Introductory Synthetic and Spectroscopic Laboratory Techniques
5. CHE 301 or 312 Physical Chemistry
6. MAT 125, 126, 127 Calculus A, B, C
   or MAT 131, 132 Calculus I, II
   or MAT 141, 142 or MAT 171 or level 9 on mathematics placement examination.
7. PHY 121/123, 122/124 Physics for the Life Sciences and Labs
   or PHY 125, 126, 127 Classical Physics A, B, C
   or PHY 141, 142 Classical Physics I, II: Honors

Note: The Chemistry Department offers two Organic Chemistry II Courses, CHE 322 (IIA) and CHE 326 (IIB). Biochemistry majors must take CHE 326 Organic Chemistry IIB.

**B. Core Courses in Biology**
1. BIO 150 The Living World
   (See Note)
2. BIO 201 Fundamentals of Biology: Organisms to Ecosystems
3. BIO 202 Fundamentals of Biology: Molecular and Cellular Biology
4. BIO 203 Fundamentals of Biology: Cellular and Organ Physiology

Note: Students with documented high school AP Biology scores of 4 or 5 receive a waiver for BIO 150. Other students with approved backgrounds in biology may request a waiver of BIO 150 from the Department of Biochemistry.

**C. Advanced Courses in Biology**
1. BIO 320 General Genetics
2. BIO 310 Cell Biology
3. BIO 361, 362 Biochemistry I, II
   (See Note 1)
4. One of the following laboratories:
   BIO 365 Biochemistry Laboratory (fall only)
   BIO 311 Techniques in Molecular and Cellular Biology
5. Two additional courses, totaling at least five credits, chosen after consultation with an advisor from the following list. It is highly recommended that students take more than the suggested minimum number of electives. (See Note 2)
   - BCP 401 Principles of Pharmacology
   - BCP 402 Advanced Pharmacology
   - BIO 311 Techniques in Molecular and Cellular Biology
   - or BIO 365 Biochemistry Laboratory
   (See Note 3)
   - BIO 315 Microbiology
   - BIO 316 Molecular Immunology
   - BIO 317 Principles of Cellular Signaling
   - BIO 325 Animal Development
   - BIO 328 Mammalian Physiology
   - BIO 334 Principles of Neurobiology
   - BIO 339 Molecular Development of the Nervous System
   - BIO 358-H Biology of Human Social and Sexual Behavior
   - BME 304 Genetic Engineering
   - CHE 346 Bio-molecular Structure and Activity
   - HBP 390 Basic Mechanisms in Pathology

Notes:
1. BIO 361 and 362 should be taken in order. Students wishing to take BIO 362 before BIO 361 must get permission from the course instructor.
2. Students may petition to have additional courses accepted as electives. Students wishing to have an additional course accepted as an elective should consult their Department of Biochemistry advisor.
3. BIO 365 cannot count for both laboratory and elective credit.

**D. Upper-Division Writing Requirement**
To fulfill the upper-division writing requirement in Biochemistry, a sample of writing from an upper-division course in the biological sciences must be submitted to the Department of Biochemistry and Cell Biology for evaluation by the Biochemistry Writing Evaluation Committee. This writing sample can be a graded laboratory report, a graded term paper, or a report for a readings or research course, and it must contain at least 750 words of text. It is to be accompanied by a form (available in the Biochemistry and Cell Biology office) signed by the student and by the instructor of the course for which the material was written. The deadline for submission of the writing sample is February 1 for students graduating the following May or August, and October 1 for students graduating the following December. If the writing in this sample is judged satisfactory by the Writing Evaluation Committee, the requirement is fulfilled. If the writing is judged unsatisfactory, the student is advised to seek help from the Writing Center before resubmitting the writing sample.

**Honors Program in Biochemistry**
Graduation with Honors in Biochemistry requires the following:
1. A cumulative g.p.a. of at least 3.50 in all courses required for the major.
2. Presentation of an acceptable thesis based on laboratory research project.

Students interested in graduation with Honors must contact the Biochemistry Honors Coordinator for more detailed information no later than the second week of classes during their last semester.

**Bachelor of Science Degree in Biochemistry / Master of Science Degree in Chemistry Program**
A student interested in this research intensive graduate program, intended to prepare students for professional employment in the chemical or pharmaceutical industries, may apply for admission at the end of the junior year. The program leads to a Bachelor of Science Degree in Biochemistry at the end of the fourth year, followed by a Master of Science in Chemistry at the end of the fifth year. During the senior year the student is expected to take two 500-level CHE courses and begin research. In the fifth year, the student works full-time on research, earning 24 credits in CHE 599. The two 500-level CHE courses taken during the senior year may be counted toward the two electives required by the Biochemistry major.
The Biology Program

UNDERGRADUATE DIRECTOR: Eugene R. Katz
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Biology is the study of organisms, including the molecular and cellular basis of life, development of the individual and its genetic basis, maintenance of the individual, and interaction of organisms with their biotic and physical environment.

The Biology major introduces students to the concepts and methodologies associated with the multiple levels of biological complexity. Following BIO 150 The Living World, an introduction to the research tools, models, and concepts of modern biology, students explore the Fundamentals of Biology (BIO 201-203), a thorough introduction to organisms, ecosystems, cellular and molecular biology, and physiology. These courses also provide a solid background for students interested in the health professions. Students go on to advanced laboratory work and have the opportunity to specialize in any of several areas, including: developmental genetics, ecology and evolution, environmental biology, and neuroscience. Students may also elect the General Biology specialization. Students may design their own curriculum, in consultation with an advisor, within the context of these specializations, based on individual interest. The Biology major requires approximately 65-67 credits.

Most positions for biologists require graduate training. Most students majoring in biology prepare for professional study in the biological or health sciences. Some prepare for secondary school teaching, and others for technical positions in industry, including biotechnology, government agencies, and research institutes.

Students should contact the Undergraduate Biology Office for information and brochures related to the Biology major and minor, and for the forms mentioned in requirements and some course descriptions. The office receives completed forms and petitions concerning the Biology major and minor and all requests for evaluations of transferred biology courses. The office also coordinates advising and processes graduation clearances for major and minor requirements. Students may not declare a double major among biology, biochemistry, and pharmacology.

Requirements for the Major in Biology (BIO)

Students must complete a minimum of 32 credits in Requirements A and C on page 126. (See Note 1). All courses used to satisfy requirements A and C must be passed with a letter grade of C or higher. At least one semester of each of the following two-semester sequences must be passed with a letter grade of C or higher: calculus, general chemistry lecture, organic chemistry lecture, and physics lecture. Courses taken under the Pass/No Credit option may not be used to satisfy major requirements.

Completion of the major requires approximately 65-67 credits.

A. Biology Core

1. BIO 150 The Living World
   (See Note 1)

2. BIO 201, 202, 203 Fundamentals of Biology
   (See Note 2)

B. Courses Required in Related Fields

1. MAT 125, 126 Calculus A, B
   or MAT 131, 132 Calculus I, II
   or MAT 141, 142 Calculus I, II: Honors
   or MAT 171 Accelerated Single Variable Calculus
   or level 8 or 9 on the Mathematics Placement Examination.
2. CHE 131, 132 General Chemistry and CHE 133, 134 General Chemistry Laboratory or CHE 141, 142 Honors Chemistry and CHE 143, 144 Honors General Chemistry Laboratory

3. CHE 321, 322 or 326 Organic Chemistry I, IIA or IIB or CHE 331, 332 Honors Organic Chemistry

4. CHE 327 Organic Chemistry Laboratory or CHE 383 Introductory Synthetic and Spectroscopic Laboratory Techniques

5. PHY 121/123, 122/124 Physics for Life Sciences I, II and labs or PHY 125, 126, 127 Classical Physics A, B, C or PHY 131/133, 132/134 Classical Physics I, II and labs or PHY 141, 142 Classical Physics I, II: Honors

6. AMS 110 Probability and Statistics in Life Sciences or AMS 310 Survey of Probability and Statistics

C. Advanced Courses

Students must complete one of the following specializations using the advanced biology lecture and laboratory courses listed below, and courses offered by related departments where specified:

Advanced Lecture Courses:
Area I: Cell Biology and Biochemistry
- BIO 310, 314, 315, 316, 317*, 318*, 361, 362
Area II: Genetics and Development
- BIO 318*, 320, 325, 339*
Area III: Neurobiology and Physiology
- BIO 317*, 328, 334, 339*
Area IV: Organisms
- BIO 318*, 340, 341, 343, 344, 346, 348, 380, MAR 371
Area V: Ecology and Evolution
- BIO 318*, 350, 351, 353, 354, 358, 359, 385, 386

* BIO 317, 318, and 339 may each be used to satisfy only one area.

Advanced Laboratory Courses:
Area I
- BIO 311, 365
Area II
- BIO 327
Area III
- BIO 335
Area IV
- BIO 340, 341, 343, 344, 346, 380
Area V
- BIO 352, 356, 367, MAR 301, 303, 305, 320
Area VI
- BIO 312

1. General Biology Specialization

a. Advanced Lecture Courses: At least one lecture course in four of the five areas above. Students in the Biology Secondary Teacher Education Program must take a course in each of the five areas.

b. Advanced Laboratory Courses: Two advanced laboratory courses chosen from any two of the six areas above.

c. Study in Depth:
   A second lecture course in one of the five areas of inquiry or any 400-level BIO course for majors or SCI 454 (for students enrolled in the Biology Secondary Teacher Education Program).

d. Biology Electives:
   Additional advanced biology lecture, laboratory, and independent research courses, as needed, for a minimum of 32 credits in Requirements A and C. (See Note 3)

2. Ecology and Evolution Specialization

a. BIO 351 Ecology
b. BIO 354 Evolution
c. Area Lecture/Laboratory Requirement: Students must choose one course from
   i. Lecture/Laboratory Courses or one course each from ii. Lecture Courses and iii. Laboratory Courses below.
   i. Lecture/Laboratory Courses
      - BIO 340 Zoology
      - BIO 341 Plant Diversity
      - BIO 343 Invertebrate Zoology
      - BIO 344 Chordate Zoology
      - BIO 346 Aquatic Arthropods and Vertebrates
      - BIO 380 Entomology
   ii. Lecture Courses

3. Environmental Biology Specialization

a. BIO 351 Ecology
b. Area Lecture/Laboratory Requirement: Two courses chosen from the lists below. In choosing courses, students must include at least one course with laboratory. Students may take no more than one course from i. Organisms, and no more than one course from iii. The Environment.
   i. Organisms
      - BIO 340 Zoology (with lab)
      - BIO 341 Plant Diversity (with lab)
4. Neuroscience Specialization
   a. Area Lecture/Laboratory Requirement:
      i. BIO 334 Principles of Neurobiology
      ii. BIO 328 Mammalian Physiology
      iii. BIO 335 Animal Physiology Laboratory
   iv. One of the following:
       BIO 317 Principles of Cellular Signaling
       BIO 338 Self Organization of the Brain
       BIO 339 Molecular Development of the Nervous System
       BCP 401 Principles of Pharmacology
   b. Breadth Requirement
      i. Two advanced biology lecture courses chosen from any area excluding Area III, Neurobiology and Physiology.
      ii. One advanced biology laboratory (or lecture with laboratory) course chosen from any area excluding Area III, Neurobiology and Physiology.
   c. Biology Electives
      Additional advanced biology lecture, laboratory, and independent research courses, as needed, for a minimum of 32 credits in Requirements A and C.
      (See Note 3)

5. Developmental Genetics Specialization
   a. Area Lecture/Laboratory Requirement:
      i. BIO 320 General Genetics
      ii. BIO 325 Animal Development
      iii. BIO 327 Developmental Genetics Laboratory
   iv. BIO 310 Cell Biology or BIO 339 Molecular Development of the Nervous System
   b. Breadth Requirement
      i. Two advanced biology lecture courses from outside the Developmental Genetics specialization, chosen in consultation with the undergraduate biology advisor.
      ii. One advanced biology laboratory (or lecture with laboratory) from outside the Developmental Genetics specialization, chosen in consultation with the undergraduate biology advisor.
   c. Biology Electives
      Additional advanced biology lecture, laboratory, and independent research courses, as needed, for a minimum of 32 credits in
      (See Note 3)

D. Upper-Division Writing Requirement
   The advanced writing component of the major in Biology requires approval by the writing committee of either:
   a. A term paper written for an upper-division course in biological sciences at Stony Brook (including readings and research), or
   b. two laboratory reports from a single upper-division course in biological sciences at Stony Brook.
   A list of currently participating courses is available in the Undergraduate Biology Office. Students who wish to use material from a participating course should obtain the necessary form and present it to the course director prior to submission of the material. The course director will provide a special evaluation of the writing (in addition to a grade), and send the completed form to the Biology Writing Committee (through the Undergraduate Biology Office). Materials from other biology courses may be used if they include a suitable writing component. They must be submitted to the writing committee, together with the form signed by the instructor.
   Students are urged to submit appropriate materials in their junior year, or by the end of their next-to-last term, in order to allow for evaluation and possible remedial effort. Later submissions are considered, but may delay graduation. If material is rejected, the student is urged to attend the Writing Center (or to take an appropriate course) before resubmitting the paper or material from another biology course.

Notes:
1. All students with documented high school AP biology scores of 3 or higher receive a waiver of BIO 150 The Living World.
2. Requests for waivers of major requirements must be approved by the Undergraduate Biology Studies Committee. Biology majors must meet the major requirements of the bulletin of their latest matriculation date.
3. Up to six credits of electives may be chosen from a list of courses offered outside the department; see the Undergraduate Biology Office for the current list.
Advanced Courses
All advanced Biology courses have one or more 200-level BIO courses as a prerequisite(s). A C or better grade is required in each 200-level prerequisite in order to enroll in any 300-level Biology course.

Application of Transfer Credits to Biology Requirements
Biology courses taken elsewhere apply to major requirements only if authorized by the biology transfer evaluator or if listed as equivalent to a Stony Brook course in Stony Brook Transfer Guides. Transfer students must take at least 15 of the 32 credits in Requirements A and C at Stony Brook in courses for majors at the 200 level or higher. At least 12 of the 15 credits must be in BIO-designator courses. At least two of the advanced laboratory experiences, including one area laboratory, must be taken at Stony Brook. Transfer students may meet Section B requirements with transferred courses, if the courses are approved as being equivalent (even if the number of credits is different).

Biology Secondary Teacher Education Program
See the Education and Teacher Certification entry in the alphabetical listings of Approved Majors, Minors, and Programs.

Honors Programs in Biology and in Biology and Society
Graduation with departmental honors in Biology or in Biology and Society requires both of the following:

1. A cumulative grade point average of 3.50 or higher in all courses for the major.
2. Presentation of an honors thesis based on a research project (see list of approved research and internship courses for each specialization below) written in the form of a paper for a scientific journal.

A student interested in becoming a candidate for honors should submit an outline of the proposed thesis research project to the director of undergraduate biology as early as possible but no later than the second week of classes in the last semester. The director of undergraduate biology and the research sponsor appoint a thesis committee consisting of the research sponsor and two additional faculty members, one of them from a different department than that of the research sponsor. The student must present a copy of the finished thesis to each member of the thesis committee and the director of undergraduate biology at least 28 days before the date of graduation.

Approved Research and Internship Courses
1. General Biology Specialization
   - BIO 484, 486, 489 Independent Research
   - BIO 488 Internship
2. Bioengineering Specialization
   - BIO 488 Internship
   - BME 499 Research in Bioengineering
3. Developmental Genetics Specialization
   - BIO 487 Independent Research
   - BIO 488 Internship
4. Ecology and Evolution Specialization
   - BIO 489 Research in Ecology and Evolution
   - BIO 488 Internship
5. Environmental Biology Specialization
   - ATM 487, BIO 489, MAR 487 Independent Research
   - BIO 488, MAR 488 Internship
6. Neuroscience Specialization
   - BIO 486 Research in Neurobiology and Physiology
   - BIO 488 Internship

Requirements for the Minor in Biology (BIO)
Only students with majors other than Biology, Biochemistry, or Pharmacology may elect the Biology minor. All courses for the minor must be taken for a letter grade. (See Note 1) All credits for the minor, except for those in Requirement A, must be in BIO-major courses taken at Stony Brook. Requests for waivers of minor requirements must be approved by the Undergraduate Biology Studies Committee.

Completion of the minor requires at least 20 credits in those biology courses designed for the Biology major, including:

A. Two of the following courses:
   - BIO 201 Fundamentals of Biology: Organisms to Ecosystems
   - BIO 202 Fundamentals of Biology: Cell and Molecular Biology
   - BIO 203 Fundamentals of Biology: Cellular and Organ Physiology

B. Nine credits at the 300 level

C. A lecture course in at least two of the five areas of inquiry (I-V) listed under the biology major.

Note:
1. All 20 credits of biology courses intended for the biology minor must be passed with a grade of C or higher, including 9 credits at the 300 level. A grade of Satisfactory in readings, internship, and research courses applies to the quality requirements within credit limitations noted below:

   Up to two credits of biology independent research (BIO 484, 486, 487, 489) and one credit of tutorial readings (BIO 444, 446, 447, 449) may be applied toward the minor. The list of substitute electives for the major does not apply to the minor.