

Biology (BIO)

Majors and Minor in Biology

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

Minors of particular interest to students in the Biology BS major: Biomaterials (BES), Bioengineering (BNG), Chemistry (CHE), Environmental Studies (ENS), Health and Wellness (LHW), Science and Engineering (LSE), Writing and Rhetoric (WRT)

The list of approved minors for the Biology BA can be found on Undergraduate Biology's website here.

The Undergraduate Biology Program

Director: John Peter Gergen

Assistant Director: Kaitlyn Cozier

Advisors: Kelsie Poe, Rachel Ulysse

Schedule advising appointments online through navigate

Office: Biology Learning Laboratories, Undergraduate Biology Office Suite, Rooms 104-112

Program Secretary: Lynette Giordano

Phone: (631) 632-8530

Website: <http://www.stonybrook.edu/biology>

Department of Biochemistry and Cell Biology

Chair: Wali Karzai

Assistant to the Chair: Carol Juliano

Website: <http://www.stonybrook.edu/biochem>

Department of Ecology and Evolution

Co-Chairs: Resit Akcakaya, Jessica Gurevitch

Assistant to the Chair: Donna DiGiovanni

Website: <https://www.stonybrook.edu/commcms/ecoevo/>

Department of Neurobiology and Behavior

Chair: Alfredo Fontanini

Assistant to the Chair: Catherine Costanzo

Website: <https://medicine.stonybrookmedicine.edu/neurobiology>

The Undergraduate Biology Program

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.

Undergraduate Biology offers both Bachelor of Sciences (BS) and a Bachelor of Arts (BA) degree programs in Biology. Both degree programs build on a strong foundation in chemistry, mathematics and physics that provides the concepts and methodologies needed to understand biological complexity at multiple levels. Students explore the Fundamentals of Biology through three foundational courses that provide a thorough introduction to organisms, ecosystems, cellular and molecular biology, and physiology. These courses are complemented by an innovative two-semester, inquiry-based biology laboratory curriculum designed to develop skills in the collection and analysis of data from biological experiments, including explorations into the primary scientific literature and capstone student-designed experiments on human physiology. For the BS degree this core foundation is followed by advanced course and laboratory work that includes an in depth program of study in an area of Specialization along with complementary studies that ensure breadth of exposure to other areas of biology. These Specializations include Developmental Genetics, Ecology and Evolution, Environmental Biology, Interdisciplinary Biological Sciences, Neuroscience, Quantitative Biology and Bioinformatics, and Bioengineering. The BIO BA program involves fewer advanced courses in biology but instead requires completion of a non-overlapping minor in the College of Arts and Sciences. The BA provides an option for students interested in careers that build on foundational knowledge in the biosciences who also have strong interests in areas such as the fine arts, humanities or social sciences. The BS program is most appropriate for students interested in graduate studies in the biological sciences or technical positions in industry, including biotechnology, government agencies, and research institutes. Both programs provide excellent preparation for professional careers in the health sciences.

Students in the Biology BA or BS programs may not declare a double major among Biology, Biochemistry, Pharmacology, Marine Sciences and Marine Vertebrate Biology. A double major in Biology and Human Evolutionary Biology requires a certain course combination in the Human Evolutionary Biology electives as specified in the requirements for the EBH major.

Information related to the BIO major and minor is available from the Undergraduate Biology Office and website: <http://www.stonybrook.edu/biology>. The office processes completed forms and petitions concerning the Biology major and minor and all requests for evaluations of transferred biology courses. The Undergraduate Biology office also coordinates advising, BIO course administration and registration and processes graduation clearances for BIO major and minor requirements.

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.

Biology Undergraduate Degree Options

Undergraduate Biology offers both Bachelor of Arts (B.A.) and Bachelor of Science (B.S.) degree programs in Biology, along with a minor in Biology.

Students in the Biology BA or BS programs may not declare a double major among Biology, Biochemistry, Pharmacology, Marine Sciences and Marine Vertebrate Biology. A double major in Biology and Human Evolutionary Biology requires a certain course combination in the Human Evolutionary Biology electives as specified in the requirements for the EBH major.

Requirements for the Major in Biology B.A. (BIO)

Completion of the B.A. major in Biology requires a minimum of 55 credits for the major, along with a required minor (18-24 credits). **All foundational courses in related fields must be taken for a letter grade; courses taken under the Pass/No Credit option will not count towards completion of the major, with the exception of the Spring 2020 semester.** All core and advanced courses in biology must be taken for a letter grade and passed with a grade of C or higher. At least one semester of the two-semester sequences of required courses in general chemistry lecture, organic chemistry lecture, and physics lecture/lab must be passed with a letter grade of C or higher. The organic chemistry lab must be passed with a C or higher.

A. Foundational Courses in Related Fields

1. Chemistry Sequence Lecture Options:

- CHE 129/CHE 130, CHE 132 General Chemistry IA and II OR CHE 131, CHE 132 General Chemistry IB and II OR CHE 152 Molecular Science I

2. Chemistry Sequence Laboratory Options

- CHE 133, CHE 134 General Chemistry Laboratory I and II, OR CHE 154 Molecular Science Lab I

3. Organic Chemistry Lecture Options

- CHE 321, CHE 322 Organic Chemistry I and IIA OR CHE 321, CHE 326 Organic Chemistry I and IIB OR CHE 331, 332 Molecular Science II and III

4. Organic Chemistry Laboratory Options

- CHE 327 Organic Chemistry Laboratory OR CHE 383 Introductory Synthetic and Spectroscopic Laboratory Techniques

5. Calculus Course Options

- MAT 125 Calculus A (or MAT 130/MAT 125) OR MAT 131 Calculus I OR MAT 141 Analysis I OR MAT 171 Accelerated Single Variable Calculus OR AMS 151 OR Level 7, 8, or 9 on the Mathematics Placement Examination.

If students do not place into MAT 125 or higher on the basis of the math placement examination, MAT 123 (or MAT 119/MAT 123) is a required course for the major.

6. Physics Sequence Options

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

If students select one of the Classical Physics options (PHY 125/PHY 126/PHY 127/PHY 133/PHY 134 or PHY 131/PHY 132/PHY 133/PHY 134 or PHY 141/PHY 142/PHY 133/PHY 134), then a mathematics course at the level of Calculus B (AMS 161, MAT 126, MAT 132, MAT 142, or MAT 171) or higher is required for the major.

7. Statistics Course Options

- BIO 211 Statistics and Data Analysis OR AMS 110 Probability and Statistics in Life Sciences OR AMS 310 Survey of Probability and Statistics or EBH 230 Computer-based Biostatistics

Students who transfer in AMS 102 from another institution with a grade of 'A' or higher will receive credit for the statistics course.

B. Core Courses in Biology

1. BIO 201 Fundamental of Biology; Organisms to Ecosystems

2. BIO 202 Fundamentals of Biology: Molecular and Cellular Biology
3. BIO 203 Fundamentals of Biology: Cellular and Organ Physiology
4. BIO 204 and BIO 205 Fundamentals of Scientific Inquiry in the Biological Sciences I and II OR BIO 204 and BIO 207 Fundamentals of Scientific Inquiry in the Biological Sciences I and IIB

C. Advanced Courses in Biology

At least one of the following 3 credit upper division BIO courses:

1. BIO 320 General Genetics
2. BIO 321 Ecological Genetics and Genomics
3. BIO 354 Evolution
4. EBH 302 Human Genetics

D. Advanced Biology Electives

Two additional upper division BIO courses. Research, readings, teaching practica and internship courses cannot be used to satisfy upper-division BIO course requirements. Students cannot take both BIO 320 and BIO 321 for biology major credit. Only one of these courses may be taken for biology major credit.

E. Minor within the College of Arts and Sciences

Completion of a Minor within the College of Arts and Sciences with no more than a 3 credit overlap with the major requirements for the BIO B.A. The list of approved minors for the Biology BA can be found on Undergraduate Biology's website here.

F. Upper-Division Writing Requirement

The advanced writing component of the major in Biology requires registration in the 0-credit BIO 459 and approval of either a term paper or a laboratory report written for an advanced course in biological sciences at Stony Brook (including Readings and Research courses) or a paper or report written for an advanced course taken as part of the student's minor that addresses a topic pertinent to the biological sciences. Students must register for BIO 459 **AT THE SAME TIME** that they are taking the advanced course in the biological sciences that has the ability to fulfill the upper-division writing requirement.

Students who wish to use material from a participating course should complete the necessary google form and receive the appropriate email confirmation from their professor prior to submission of the material. The course director will give the student confirmation, via email or as mentioned in their syllabus, to confirm that the writing sample that is submitted to the undergraduate biology department is the same writing sample that was submitted for their course, without variation. The completed google form must be submitted on the undergraduate biology website. The Writing Center will evaluate the submission and contact the student directly if remedial efforts are needed. 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 revision. Later submissions are considered, but may delay graduation. If material is initially found to be unsatisfactory, the student will be instructed by the Writing Program before resubmitting a revised paper or material from another course.

Students should consult with the department advisor to ensure that their plan for completing the Upper Division Writing Requirement is consistent with university graduation requirements for General Education. Students completing the Stony Brook Curriculum (SBC) must complete a course that satisfies the "Write Effectively within One's Discipline" (WRTD) learning objective to graduate. The Upper Division Writing Requirement is consistent in most cases with the SBC learning outcomes for WRTD.

Courses that can fulfill the WRTD requirement:

- BIO 312
- BIO 320
- BIO 321 (Fall and Spring semesters ONLY)
- BIO 327
- BIO 335
- BIO 336
- BIO 344
- BIO 352
- BIO 353
- BIO 354
- BIO 364
- BIO 365
- BIO 366
- BIO 367
- BIO 385
- BIO 386
- EBH 302

Application of Transfer Credits to the Biology BA Requirements:

Core biology courses taken elsewhere apply to major requirements only if listed as equivalent to a Stony Brook course in the official Stony Brook Transfer Course Database maintained by Academic and Transfer Advising Services. Transfer students may satisfy the requirements for courses

in related fields with transferred courses, if the courses are approved as being equivalent. **Upper-division or upper-division equivalent courses taken elsewhere and transferred to Stony Brook can satisfy the requirement for BIO 320, BIO 321, BIO 354 or EBH 302 for the Biology BA; however, students must still take three advanced courses (300-level BIO courses) here at Stony Brook.**

Requirements for the Major in Biology B.S. (BIO)

Completion of the B.S. major in Biology requires a minimum of 70 credits, including foundational courses in chemistry, mathematics and physics. **All of these foundational courses in related fields must be taken for a letter grade; courses taken under the Pass/No Credit option will not count towards completion of the major, with the exception of the Spring 20 semester.** At least one semester of the two-semester sequences of required courses in calculus, general chemistry lecture, organic chemistry lecture, and physics lecture/lab must be passed with a letter grade of C or higher. The organic chemistry lab must be passed with a C or higher. Completion of the BIO major requires completion of the foundational courses in related fields, core curriculum and a minimum of 20 credits of advanced courses in biology. A list of advanced courses in biology from other Departments that are accepted for Biology major credit is provided below. All core and advanced courses in biology, including advanced courses in biology from other departments, must be taken for a letter grade and passed with a grade of C or higher with the exception of 400 level Reading and Research courses that are graded on an S/U basis. Biology majors must meet the major requirements as published in the official undergraduate Bulletin for the semester in which the student declares the major or minor. Requests for a waiver of major or minor requirements may be granted at the discretion of faculty.

A. Foundational Courses in Related Fields

1. Chemistry Sequence Lecture Options

- CHE 129/CHE 130, CHE 132 General Chemistry IA and II OR CHE 131, CHE 132 General Chemistry IB and II OR CHE 152 Molecular Science I

2. Chemistry Sequence Laboratory Options

- CHE 133, CHE 134 General Chemistry Laboratory I and II, OR CHE 154 Molecular Science Lab I Organic Chemistry Lecture Options

3. Organic Chemistry Lecture Options

- CHE 321, CHE 322 Organic Chemistry I and IIA OR CHE 321, CHE 326 Organic Chemistry I and IIB OR CHE 331, 332 Molecular Science II and III

4. Organic Chemistry Laboratory Options

- CHE 327 Organic Chemistry Laboratory OR CHE 383 Introductory Synthetic and Spectroscopic Laboratory Techniques

5. Calculus Sequence Options

- MAT 125 (or MAT 130/MAT 125), MAT 126 Calculus A and B OR MAT 131, MAT 132 Calculus I and II OR MAT 141, MAT 142 Analysis I and II OR MAT 171 Accelerated Single Variable Calculus OR AMS 151, AMS 161 OR Level 8 or 9 on the Mathematics Placement Examination.

6. Physics Sequence Options

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

7. Statistics Course Options

- BIO 211 Statistics and Data Analysis OR AMS 110 Probability and Statistics in Life Sciences OR AMS 310 Survey of Probability and Statistics or EBH 230 Computer-based Biostatistics

Students who transfer in AMS 102 from another institution with a grade of 'A' or higher will receive credit for the statistics course.

B. Core Courses in Biology

1. BIO 201 Fundamental of Biology; Organisms to Ecosystems
2. BIO 202 Fundamentals of Biology: Molecular and Cellular Biology
3. BIO 203 Fundamentals of Biology: Cellular and Organ Physiology
4. BIO 204 and BIO 205 Fundamentals of Scientific Inquiry in the Biological Sciences I and IIA or BIO 204 and BIO 207 Fundamentals of Scientific Inquiry in the Biological Sciences IIB

C. Advanced Courses in Biology

Programs of study in the Biology major are organized into 7 Specializations that promote in-depth explorations of different areas while also insuring a breadth of exposure to other areas in the biological sciences. **DECLARING A SPECIALIZATION IS REQUIRED TO COMPLETE THE BIOLOGY BS.** The standard program of study includes 5 Advanced BIO lecture courses and 2 advanced BIO laboratory courses for a total of 20 advanced BIO credits. The specific program of advanced courses is dependent on the area of Specialization, and may also include the

option to use advanced elective courses from other Departments to count towards the Biology major. The 6 Specializations are: Developmental Genetics, Ecology and Evolution, Environmental Biology, Interdisciplinary Biology, Neuroscience, and Quantitative Biology and Bioinformatics. There is also a special degree program for students who choose to double major in Biology and Clinical Laboratory Sciences; if students would like to pursue this double major, please speak with a biology advisor. The requirements for each Specialization are provided after the list of Advanced BIO courses. A complete list of Advanced Courses from other Departments that are accepted for the Biology Major credit is provided after the requirements for the different Specializations.

Students cannot take both BIO 320 and BIO 321 for biology major credit. Only one of these courses may be taken for biology major credit.

Advanced BIO Courses:

Area I: Biochemistry, Molecular and Cellular Biology:

- BIO 306 Principles of Virology (Lecture)
- BIO 310 Cell Biology (Lecture)
- BIO 312 Bioinformatics and Computational Biology (Lecture with Laboratory)
- BIO 314 Cancer Biology (Lecture)
- BIO 316 Molecular Immunology (Lecture)
- BIO 320 General Genetics (Lecture)
- BIO 361 Biochemistry I (Lecture)
- BIO 362 Biochemistry II (Lecture)
- BIO 364 Laboratory Techniques in Cancer Biology (Laboratory)
- BIO 365 Biochemistry Laboratory (Laboratory)
- BIO 368 Food Microbiology (Lecture)
- AMS 333 Mathematical Biology (Lecture)
- BIO 511 Topics in Biotechnology (Laboratory)
- BIO 515 Current Topics in Microbiology (Laboratory)
- BME 304 Genetic Engineering (Lecture)
- BME 404 Essentials of Tissue Engineering (Lecture)
- CHE 346 Biomolecular Structure and Reactivity (Lecture)
- EBH 302 Human Genetics (Lecture, previously crosslisted with BIO 302)
- EBH 370 Advanced Human Genetics (Lecture with Laboratory, previously crosslisted with BIO 303)

Area II: Neurobiology and Physiology

- BIO 317 Principles of Cellular Signaling (Lecture)
- BIO 328 Mammalian Physiology (Lecture)
- BIO 332 Computational Modeling of Physiological Systems (Lecture)
- BIO 334 Principles of Neurobiology (Lecture)
- BIO 335 Neurobiology Laboratory (Laboratory)
- BIO 337 Neurotransmission and Neuromodulation: Implications for Brain Function (Lecture)
- BIO 338 From Synapse to Circuit: Selforganization of the Brain (Lecture)
- BIO 339 Molecular Development of the Nervous System (Lecture)
- BIO 347 Introduction to Neural Computation
- BCP 401 Principles of Pharmacology (Lecture)
- BME 301 Biophotonics (Lecture)
- BME 303 Biomechanics (Lecture)
- EBH 316 The Evolution of the Human Brain (Lecture, previously listed as ANP 316)
- EBH 331 Hormones and Behavior (Lecture)

Area III: Organisms

- BIO 315 Microbiology (Lecture)
- BIO 325 Animal Development (Lecture)
- BIO 327 Developmental Genetics Laboratory (Laboratory)
- BIO 341 Plant Diversity (Lecture with Laboratory)
- BIO 342 Invertebrate Zoology (Lecture)
- BIO 343 Invertebrate Zoology Laboratory (Laboratory)
- BIO 344 Chordate Zoology (Lecture with Laboratory)
- BIO 348 Diversity and Evolution of Reptiles and Amphibians (Lecture)
- BIO 366 Molecular Microbiology Laboratory (Lecture with Laboratory)
- BIO 380 Entomology (Lecture with Laboratory)
- MAR 370 Marine Mammals (Lecture)
- MAR 375 Marine Mammal and Sea Turtle Rehabilitation (Lecture)
- MAR 376 Biology and Conservation of Sea Turtles (Lecture)

- MAR 377 Biology and Conservation of Seabirds (Lecture)
- MAR 380 Ichthyology (Lecture with Laboratory)

Area IV: Ecology and Evolution

- BIO 301 Sustainability of the Long Island Pine Barrens (Lecture)
- BIO 319 Landscape Ecology Laboratory (Laboratory)
- BIO 321 Introduction to Ecological Genetics and Genomics (Lecture)
- BIO 336 Conservation Biology (Lecture)
- BIO 350 Darwinian Medicine (Lecture)
- BIO 351 Ecology (Lecture)
- BIO 352 Ecology Laboratory (Laboratory)
- BIO 353 Marine Ecology (Lecture)
- BIO 354 Evolution (Lecture)
- BIO 356 Applied Ecology and Conservation Biology Laboratory (Laboratory)
- BIO 358 Biology and Human Social and Sexual Behavior (Lecture)
- BIO 367 Molecular Diversity Laboratory (Laboratory)
- BIO 371 Restoration of Aquatic Systems (Lecture with Laboratory)
- BIO 383 Paleobiology (Lecture with Laboratory)
- BIO 385 Plant Ecology (Lecture)
- BIO 386 Ecosystem Ecology and the Global Environment (Lecture)
- ANP 304 Modern and Ancient Environments of Eastern Africa (Lecture with Laboratory)
- ANP 305 Vertebrate Paleontology of the Turkana Basin (Laboratory)
- ANP 306 Paleoanthropological Discoveries of the Turkana Basin (Lecture with Laboratory)
- ANP 307 Comparing Ecosystems in Madagascar (Lecture)
- ANP 325 Primate Behavior (Lecture)
- ANP 326 Lemurs of Madagascar (Lecture)
- ANP 350 Methods of Studying Primates (Lecture)
- ANP 351 Biodiversity Assessment Methods for Tropical Field Research (Lecture)
- ANP 360 Primate Conservation (Lecture)
- ANP 391 Topics in Physical Anthropology (Lecture)
- EBH 359 Behavioral Ecology (Lecture) (formerly BIO 359)
- EBH 380 Genomics (Lecture)
- EBH 381 Genomics Laboratory (Lecture with Laboratory, previously crosslisted with BIO 305)
- ENS 311 Ecosystem Ecology and the Global Environment (Lecture, not for credit in addition to BIO 386)
- MAR 301 Environmental Microbiology (Lecture with Laboratory)
- MAR 302 Marine Microbiology and Microbial Ecology (Lecture, not for credit in addition to MAR 301)
- MAR 303 Long Island Marine Habitats (Lecture with Laboratory)
- MAR 305 Experimental Marine Biology (Laboratory)
- MAR 315 Marine Conservation (Lecture)
- MAR 320 Limnology (Lecture with Laboratory)
- MAR 366 Plankton Ecology (Lecture)
- MAR 373 Marine Apex Predators: Ecology and Conservation (Lecture)
- MAR 384 Diseases of Aquatic Organisms (Lecture)
- MAR 386 Ecosystem Science for Fisheries Management (Lecture)
- MAR 388 Tropical Marine Ecology (Lecture with Laboratory)

Environmental Biology (May only be used for the Environmental Biology Specialization)

- ATM 305 Global Atmospheric Change (Lecture)
- ATM 397 Air Pollution and its Control (Lecture)
- MAR 318 Engineering Geology and Coastal Processes (Lecture)
- MAR 333 Coastal Oceanography (Lecture)

Advanced Course Requirements for the Specialization in Developmental Genetics

1. BIO 325 Animal Development
2. BIO 320 General Genetics, or BIO 321 Introduction to Ecological Genetics and Genomics
3. BIO 327 Developmental Genetics Laboratory
4. At least one of the following six courses:
 - BIO 310 Cell Biology
 - BIO 314 Cancer Biology
 - BIO 317 Principles of Cellular Signaling
 - BIO 339 Molecular Development of the Nervous System

- BIO 354 Evolution
 - EBH 302 Human Genetics (previously cross-listed with BIO 302)
 - EBH 380 Genomics (previously cross-listed with BIO 304)
5. Two additional advanced BIO lecture courses including at least one from either Area I (Biochemistry, Molecular and Cellular Biology), or Area II (Neurobiology and Physiology) or Area IV (Ecology and Evolution) or from the list of advanced courses offered by other Departments and accepted for BIO Major credit in these three areas.
 6. One additional advanced BIO laboratory course from any of the four areas of BIO courses or from the list of advanced courses offered by other Departments and accepted for BIO major credit in these four areas. Note, the elective advanced laboratory course can be replaced by two semesters of independent research for a total of at least 4 credits in a BIO research course.
 7. Additional advanced BIO lecture, laboratory, reading, or independent research courses, as needed, for a minimum of 20 credits of advanced biology coursework.

Advanced Course Requirements for the Specialization in Ecology and Evolution

1. BIO 351 Ecology
2. BIO 354 Evolution
3. One additional advanced BIO lecture course and one advanced BIO laboratory course from either Area III (Organisms), or Area IV (Ecology and Evolution) or from the list of advanced courses offered by other Departments that are accepted for BIO major credit in these two areas.
Note: 4 credit courses identified as a Lecture with Laboratory may be used to satisfy both requirements.
4. Two additional advanced BIO lecture courses including at least one course from either Area I (Biochemistry, Molecular and Cellular Biology), or Area II (Neurobiology and Physiology) or from the list of advanced courses offered by other Departments and accepted for BIO major credit in these two areas.
5. One advanced BIO laboratory course from either Area I (Biochemistry, Molecular and Cellular Biology), or Area II (Neurobiology and Physiology) or from the list of advanced laboratory courses offered by other Departments and accepted for BIO major credit in these two areas. Note, the elective advanced laboratory course can be replaced by two semesters of independent research for a total of at least 4 credits in a BIO research course.
6. Additional advanced BIO lecture, laboratory, reading, or independent research courses, as needed, for a minimum of 20 credits of advanced biology coursework.

Advanced Course Requirements for the Specialization in Environmental Biology

1. BIO 351 Ecology
2. One advanced BIO laboratory course from either Area III (Organisms) or Area IV (Ecology and Evolution) or from the list of advanced laboratory courses offered by other Departments and accepted for BIO major credit in these two areas.
3. Two additional advanced BIO courses from Area IV (Ecology and Evolution) that may include at most one of the advanced courses in Environmental Biology offered by other Departments and accepted for BIO major credit.
4. Two additional advanced BIO lecture courses including at least one course from either Area I (Biochemistry, Molecular and Cellular Biology), or Area II (Neurobiology and Physiology) or from the list of advanced courses offered by other Departments and accepted for BIO major credit in these two areas.
5. One advanced BIO laboratory course from either Area I (Biochemistry, Molecular and Cellular Biology), or Area II (Neurobiology and Physiology) or from the list of advanced courses offered by other Departments and accepted for BIO major credit in these two areas. Note, the elective advanced laboratory course can be replaced by two semesters of independent research for a total of at least 4 credits in a BIO research course.
6. Additional advanced BIO lecture, laboratory, reading, or independent research courses, as needed, for a minimum of 20 credits of advanced biology coursework.

Advanced Course Requirements for the Specialization in Interdisciplinary Biology

1. At least one advanced BIO lecture Course in Area I (Biochemistry, Molecular and Cellular Biology), and Area II (Neurobiology and Physiology), and Area III (Organisms), and Area IV (Ecology and Evolution) or from the list of advanced courses offered by other Departments and accepted for BIO major credit in these four areas.
2. Two advanced BIO laboratory courses chosen from two of the four different areas of advanced courses or advanced courses from other Departments and accepted for BIO major credit in these four areas. Note, one advanced laboratory course can be replaced by two semesters of independent research for a total of at least 4 credits in a BIO research course.
3. A second advanced BIO lecture course in one of the four areas of advanced biology courses or from the list of advanced courses offered by other Departments and accepted for BIO major credit.
4. Additional advanced BIO lecture, laboratory, reading, or independent research courses, as needed, for a minimum of 20 credits of advanced biology coursework.

Advanced Course Requirements for the Specialization in Neuroscience

1. BIO 334 Principles of Neurobiology
2. BIO 335 Neurobiology Laboratory

3. Two courses from the following list:
 - BIO 317 Principles of Cellular Signaling
 - BIO 328 Mammalian Physiology
 - BIO 337 Neurotransmission and Neuromodulation: Implications for Brain Function
 - BIO 338 From Synapse to Circuit: Self-organization of the Brain
 - BIO 339 Molecular Development of the Nervous System
 - BIO 347 Introduction to Neural Computation
 - BCP 401 Principles of Pharmacology
 - EBH 316 Evolution of the Human Brain (previously listed as ANP 316)
4. Two additional advanced BIO lecture courses including at least one course from either Area I (Biochemistry, Molecular and Cellular Biology), or Area III (Organisms), or Area IV (Ecology and Evolution) or from the list of advanced courses offered by other Departments and accepted for BIO major credit in these three areas.
5. One advanced BIO laboratory course from either Area I (Biochemistry, Molecular and Cellular Biology), or Area III (Organisms), or Area IV (Ecology and Evolution) or from the list of advanced courses offered by other Departments and accepted for BIO major credit in these three areas. Note, the elective advanced laboratory course can be replaced by two semesters of independent research for a total of at least 4 credits in a BIO research course.
6. Additional advanced BIO lecture, laboratory, reading, or independent research courses, as needed, for a minimum of 20 credits of advanced biology coursework.

Advanced Course Requirements for the Specialization in Quantitative Biology and Bioinformatics

Unlike other specializations, the Quantitative Biology and Bioinformatics Specialization requires completion of foundational courses in mathematics that cover differential equations.

1. MAT 127 Calculus C, or MAT 132 Calculus II, or MAT 142 Honors Calculus II, or AMS 161 Applied Calculus II
2. AMS 333 Mathematical Biology
3. BIO 332 Computational Modeling of Physiological Systems
4. BIO 312 Bioinformatics and Computational Biology
5. At least one of the following five courses:
 - BIO 317 Principles of Cellular Signaling
 - BIO 320 General Genetics
 - BIO 321 Introduction to Ecological Genetics and Genomics
 - CHE 346 Biomolecular Structure and Reactivity
 - EBH 380 Genomics (previously cross-listed with BIO 304)
6. Two additional advanced BIO lecture courses, including at least one course from either Area III (Organisms), or Area IV (Ecology and Evolution) or from the list of advanced courses offered by other Departments and accepted for BIO Major credit in these four areas.
7. One additional advanced BIO laboratory course from any of the four areas of BIO courses or from the list of advanced courses offered by other Departments and accepted for BIO Major credit in these four areas. Note, the elective advanced laboratory course can be replaced by two semesters of independent research for a total of at least 4 credits in a BIO research course.
8. Additional advanced BIO lecture, laboratory, reading, or independent research courses, as needed, for a minimum of 20 credits of advanced biology coursework.

D. Upper-Division Writing Requirement

The advanced writing component of the major in Biology requires registration in the 0-credit BIO 459 and approval of either a term paper or a laboratory report written for an advanced course in biological sciences at Stony Brook (including Readings and Research courses) or a paper or report written for an advanced course taken as part of the student's minor that addresses a topic pertinent to the biological sciences. Students must register for BIO 459 **AT THE SAME TIME** that they are taking the advanced course in the biological sciences that has the ability to fulfill the upper-division writing requirement.

Students who wish to use material from a participating course should complete the necessary google form and receive the appropriate email confirmation from their professor prior to submission of the material. The course director will give the student confirmation, via email or as mentioned in their syllabus, to confirm that the writing sample that is submitted to the undergraduate biology department is the same writing sample that was submitted for their course, without variation. The completed google form must be submitted on the undergraduate biology website. The Writing Center will evaluate the submission and contact the student directly if remedial efforts are needed. 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 revision. Later submissions are considered, but may delay graduation. If material is initially found to be unsatisfactory, the student will be instructed by the Writing Program before resubmitting a revised paper or material from another course.

Students should consult with the department advisor to ensure that their plan for completing the Upper Division Writing Requirement is consistent with university graduation requirements for General Education. Students completing the Stony Brook Curriculum (SBC) must complete a course that satisfies the "Write Effectively within One's Discipline" (WRTD) learning objective to graduate. The Upper Division Writing Requirement is consistent in most cases with the SBC learning outcomes for WRTD.

Courses that can fulfill the WRTD requirement:

- BIO 312
- BIO 320
- BIO 321 (Fall and Spring semesters ONLY)
- BIO 327
- BIO 335
- BIO 336
- BIO 344
- BIO 352
- BIO 353
- BIO 354
- BIO 364
- BIO 365
- BIO 366
- BIO 367
- BIO 385
- BIO 386
- EBH 302
- EBH 380

Application of Transfer Credits to the Biology BS Requirements

Biology courses taken elsewhere apply to major requirements only if listed as equivalent to a Stony Brook course in the official Stony Brook Transfer Course Database maintained by Academic and Transfer Advising Services. Transfer students must take at least 15 credits of required core and advanced biology 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. Both of the two advanced laboratory experiences must be taken at Stony Brook. Transfer students may satisfy the requirements for courses in related fields with transferred courses, if the courses are approved as being equivalent.

Honors Programs in Biology and in Biology and Society

Graduation with Honors in Biology or in Biology and Society requires the following:

1. A cumulative grade point average of 3.50 or higher in all courses required for the major.
2. Presentation of an acceptable thesis based on a project involving independent research for credit in an approved Research or Internship Course for at least two semesters written in the form of a paper for a scientific journal. A student interested in becoming a candidate for honors should submit a completed Honors Application to the Undergraduate Biology office as early as possible but no later than the second week of classes in the last semester (form available at: <http://www.stonybrook.edu/commcms/biology/advising/Forms.html>). On the application the student identifies the research project and provides an endorsement from their faculty research sponsor along with recommended names of at least two additional faculty members who have agreed to evaluate the written thesis, including at least one faculty member from a department different from that of the research sponsor. Applications approved by the Biology Program are returned to the student for inclusion with the completed thesis research project. The student must present a copy of the finished thesis along with a completed application form indicating written approval by their research sponsor and the two readers at least one week prior to the date of graduation.

Approved Research and Internship Courses:

- 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
- MAR 487 Research in Marine Sciences (Environmental Biology Specialization only)
- MAR 488 Internship in Marine Sciences (Environmental Biology Specialization only)
- ATM 487 Research in Atmospheric Sciences (Environmental Biology Specialization only)
- BME 499 Research in Bioengineering (Biomedical Engineering Specialization only)

Requirements for the Minor in Biology (BIO)

Only students with majors other than Biology, Biochemistry, Human Evolutionary Biology, Pharmacology, Marine Sciences or Marine Vertebrate Biology may elect the Biology minor. Completion of the minor requires at least 20 credits in BIO courses designed for the Biology major. All courses for the minor must be taken for a letter grade and must be passed with a grade of C or higher, including at least 9 credits at the 300 level. All advanced courses for the minor must be in BIO-designator courses taken at Stony Brook. The specific course requirements for the BIO minor are:

1. At least 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
2. Both BIO 204 and BIO 205 Fundamentals of Scientific Inquiry in the Biological Sciences I and IIA or BIO 204 and BIO 207 Fundamentals of Scientific Inquiry in the Biological Sciences I and IIB
 3. Advanced lecture, laboratory or lecture/laboratory courses in at least two of the four areas of inquiry (I-IV) listed under the biology major. Only courses with BIO indicators are accepted for the Biology minor with the exception of: EBH 302, EBH 370, EBH 359, EBH 380, EBH 381.
 4. At least nine credits of 300 level BIO courses. Note, a grade of Satisfactory in at most two credits of biology independent research (BIO 484, BIO 486, BIO 487, BIO 489) and at most one credit of tutorial readings (BIO 444, BIO 446, BIO 447, BIO 449) may be applied toward the minor.

Biology Secondary Teacher Education Program

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

Sample Course Sequence for the Major in Biology, B.A.

A course planning guide for this major may be found here. The major course planning guides are not part of the official Undergraduate Bulletin, and are only updated periodically for use as an advising tool. The Undergraduate Bulletin supersedes any errors or omissions in the major course planning guides.

FRESHMAN

FALL	Credits
First Year Seminar 101	1
WRT 101	3
CHE 131	4
CHE 133	1
MAT 125	3
SBC	3
Total	15

SPRING	Credits
First Year Seminar 102	1
WRT 102	3
CHE 132	4
CHE 134	1
AMS 110 or BIO 211	3-4
BIO 201	3
Total	15-16

SOPHOMORE

FALL	Credits
CHE 321	4
BIO 202 or BIO 203	3
course for minor	3
SBC	3
Total	13

SPRING	Credits
CHE 322	4
CHE 327	2
BIO 202 or BIO 203	3
course for minor	3
BIO 3xx elective	3
Total	15

JUNIOR

FALL	Credits
BIO 204	3
PHY 121	4
course for minor	3
SBC	3
elective	3
Total	16

SPRING	Credits
BIO 205 or BIO 207	2
BIO 3XX elective	3
PHY 122	3
upper-division course for minor	3
SBC	3
SBC	3
Total	17

SENIOR

FALL	Credits
BIO 3xx elective	3
upper-division course for minor	3
SBC	3
upper-division elective	3
upper-division elective	3
Total	15

SPRING	Credits
upper-division course for minor	3
SBC	3
upper-division elective	3
upper-division elective	3
elective	3
Total	15

Sample Course Sequence for the Major in Biology, B.S.

A course planning guide for this major may be found here. The major course planning guides are not part of the official Undergraduate Bulletin, and are only updated periodically for use as an advising tool. The Undergraduate Bulletin supersedes any errors or omissions in the major course planning guides.

FRESHMAN

FALL	Credits
First Year Seminar 101	1
WRT 101	3
CHE 131	4
CHE 133	1
MAT 125	3
SBC	3
Total	15

SPRING	Credits
First Year Seminar 102	1
WRT 102	3
CHE 132	4
CHE 134	1
BIO 201	3
MAT 126	3
Total	15

SOPHOMORE

FALL	Credits
CHE 321	4
AMS 110 or BIO 211	3-4
BIO 202 or BIO 203	3
BIO 204	2
SBC	3
Total	15-16

SPRING	Credits
CHE 322 or CHE 326	4

BIO 202 or BIO 203	3
BIO 205 or BIO 207	2
CHE 327	2
SBC	3
Total	14

JUNIOR

FALL	Credits
Advanced BIO Lecture	3
PHY 121	4
SBC	2
SBC	3
SBC	3
Total	16

SPRING	Credits
PHY 122	4
Advanced BIO Lecture	3
Advanced BIO Lab	2
SBC	3
SBC	3
Total	15-16

SENIOR

FALL	Credits
Advanced BIO Lecture	3
Advanced BIO Lab	2-3
Upper-division Elective	3
SBC	3
SBC	3
Total	14-15

SPRING	Credits
Advanced BIO Lecture	3
Advanced BIO Lecture	3
Upper-division Elective	3
Upper-division Elective	3
Upper-division Elective	3
Total	15

BIO

Biology

BIO 103: Introduction to Biotechnology

Gene therapy, genetic modification, cloning, stem cells, and vaccines are covered in this course. Lectures and four supplemental laboratory activities use modern equipment and techniques to illustrate core concepts which class discussions relate to health, society, and public policy. Not for Biology major credit.

DEC: E
SBC: SNW

3 credits

BIO 113: General Ecology

A survey of the principles of ecology in the context of finding solutions to local, national, and global environmental problems. Not for Biology major credit.

DEC: E
SBC: SNW

3 credits

BIO 114: Dinosaur Paleontology

A study of paleontology that includes evolution of dinosaurs, their classification system, a study of the important dinosaur families, dinosaur behavior, ecology, current controversies, hot topics and the KT extinction. Dinosaur paleontology will also cover the excavation of dinosaurs and the colorful history of the 'dinosaur hunters.' This course will emphasize the science and research involved in studying dinosaurs. Using dinosaurs as a vehicle, students will be exposed to the scientific method of inquiry and will leave this course with a better understanding on how to evaluate science in the real world. Not for Biology major credit.

Advisory prerequisite: Entry level biology

DEC: E
SBC: SNW

3 credits

BIO 115: Evolution and Society

An introduction to the historical and theoretical aspects of evolutionary biology, and also considers the implications of evolution for current social and public issues. The course examines both the original Darwinian and Modern Synthetic arguments for evolution by natural selection, how to differentiate scientific and non-scientific theories, and how historical sciences are practiced by scientists. Evolution is the key to understanding much of biology and influences

a number of issues that we as citizens will have to consider in coming years. In particular, the evolutionary perspective and its implications for the development of humans and other social systems, the advent of agriculture, and its integral role in human health are considered. Not for Biology major credit.

DEC: E
SBC: SNW

3 credits

BIO 201: Fundamentals of Biology: Organisms to Ecosystems

An introduction to the major concepts in evolution, ecology, and biodiversity at the genetic, organismal, community, and ecosystem levels. Topics are presented in relation to five overall themes: Nature and Process of Science, Evolution, Information Flow, Systems, and Structure-Function. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so.

Prerequisite: Level 4 or higher on the mathematics placement examination or Corequisite MAT 123 or higher
Advisory Prerequisite: High School Biology

DEC: E
SBC: SNW

3 credits

BIO 202: Fundamentals of Biology: Molecular and Cellular Biology

The fundamentals of cell biology, biochemistry, and genetics. The biochemical and molecular bases of cell structure, energy metabolism, gene regulation, heredity, and development in living organisms from bacteria to man are discussed. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so.

Prerequisite: C or higher in CHE 129 or CHE 131 or Corequisite CHE 152

DEC: E
SBC: STEM+

3 credits

BIO 203: Fundamentals of Biology: Cellular and Organ Physiology

The fundamentals of cell and organ physiology in mammalian and non-mammalian organisms. The structure and function of cell membranes and the physiology of cell to cell signaling, cellular respiration, and homeostasis of organs and organisms are examined with an emphasis on the comparative physiology of vertebrates and invertebrates. This course has

been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so.

Prerequisite: C or higher in CHE 129 or CHE 131 or Corequisite CHE 152

Pre- or Corequisite: MAT 125 or higher or AMS 151

DEC: E
SBC: STEM+

3 credits

BIO 204: Fundamentals of Scientific Inquiry in the Biological Sciences I

First course in the foundational laboratory sequence for all biology students, and students in related fields. Students will experience the laboratory process, research process, a wide range of laboratory tools, methods, skills, learn to read and write scientific presentations, and collaborate in formal inquiry. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information. This course includes assignments that can be used to satisfy the SBC objective SPK if co-registered for BIO 458.

Prerequisite: C or higher in CHE 129, CHE 131, or Corequisite: CHE 152

Pre- or Corequisite: BIO 201 or BIO 202 or BIO 203

2 credits

BIO 205: Fundamentals of Scientific Inquiry in the Biological Sciences IIA

Second course in the foundational laboratory sequence for all biology students, and students in related fields. Students will experience the laboratory process, research process, a wide range of laboratory tools, methods, skills, learn to read and write scientific presentations, and collaborate in formal inquiry. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so. Not for credit in addition to BIO 207. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisite: BIO 204

Pre- or Corequisite: BIO 201 or BIO 202 or BIO 203

2 credits

BIO 207: Fundamentals of Scientific Inquiry in the Biological Sciences IIB

An alternative to BIO 205, this course focuses on a relatively narrow range of current

research topics but in greater depth. BIO 207 is the second course in the foundational laboratory sequence for all biology majors and students in related fields. Students will experience the laboratory process, research process, a wide range of laboratory tools, methods, and skills, learn to read and write scientific works, and collaborate in formal inquiry. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so. Not for credit in addition to BIO 205. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisite: BIO 204

Pre- or Corequisite: BIO 201 or BIO 202 or BIO 203

2 credits

BIO 208: Cell, Brain, Mind

An introduction to the human brain and how it is the target of diseases, drugs, and psychological disturbances. The course explores these topics through a knowledge of basic cell neurobiology. The implications of brain science for human behavior in society are also considered. Not for major credit.

Advisory Prerequisite: High school chemistry

DEC: H

SBC: STAS

3 credits

BIO 211: Statistics and Data Analysis: A Conceptual Approach

A conceptually-focused introduction to probability and data analysis emphasizing statistical literacy and critical thinking. Topics will include probability, t-tests, chi-squared tests, correlation, regression, and Analysis of Variance, as well as special topics of interest to undergraduate Biology majors such as case-control studies and meta-analysis. This course includes a one-hour recitation in which students will do hands-on activities, discuss papers from the primary literature, and gain experience with data analysis. May not be taken by students with credit for AMS 110, 310, 311, 412, EBH 230, or ECO 320.

Pre- or Corequisite: MAT 123 or higher, or level 4 or higher on the mathematics placement examination. May not be taken by students with credit in AMS 110, 310, 311, 412, EBH 230, or ECO 320

DEC: C

SBC: STEM+

4 credits

BIO 231: Cannabis: History, Culture, Science & Medicinal Uses

Provide a sound background in all aspects of cannabis, including the history of use worldwide, cannabis plant biology, the chemistry of cannabinoids and endocannabinoids, and the relationship to political, legal, and racism issues throughout history to the present. The purpose of this broad familiarization is to prepare students to contribute knowledgeably to the discussion and debate regarding the present and future uses of cannabis.

Advisory prerequisites: BIO 202

SBC: STAS

3 credits

BIO 299: Advanced Microbiology for Nursing and Allied Health

This course will include lectures, laboratory recitations, and laboratory sessions focused on fundamental clinical Microbiology techniques. The lectures will cover Bacteria, Viruses, Helminths, and medically important Protozoans. In the laboratory, students will learn basic and applied clinical microbiology methods, including microscopy; staining and quantitative analysis of bacteria; analysis of throat and urine cultures; and determination of sensitivity to various antimicrobial agents. Priority for this course will be given to allied health, pre-nursing, and pre-veterinary students. May not be used for credit towards either the Biology major or minor. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information. Formerly offered as BIO 266; not for credit in addition to BIO 266.

Prerequisite: C or higher in BIO 202 and BIO 204

4 credits

BIO 306: Principles of Virology

Covers the principles of virology, focusing mainly on animal and human viruses, but also including plant viruses and bacteriophage. Topics include the classification of viruses, virus entry, genome replication and assembly, and viral pathogenesis. Particular emphasis is placed on virus-host cell interactions and common features between different virus families. Recommended for those planning to attend medical school, graduate school or Veterinary college, or anyone who is interested in what viruses are and how they cause disease.

Prerequisite: C or higher in BIO 202

SBC: ESI, STEM+, WRTD

3 credits

BIO 310: Cell Biology

The cell is studied as the unit of structure, biochemical activity, genetic control, and differentiation. The principles of biochemistry and genetics are applied to an understanding of nutrition, growth, and development.

Prerequisites: C or higher in BIO 202; and C or higher in BIO 203; and CHE 321 or CHE 331 or CHE 341

3 credits

BIO 312: Bioinformatics and Computational Biology

This course uses computational methods to analyze current problems and solutions in molecular biology research. Students are exposed to algorithms and tools available for both single gene and larger scale genome research. Emphasis is on practical application. Laboratories allow students to apply their knowledge to real life molecular biology problems.

Prerequisites: C or higher in BIO 202; and C or higher in BIO 204; and MAT 125 or higher or AMS 151

Advisory Pre- or Corequisite: AMS 110, or BIO 211

SBC: ESI, TECH

3 credits

BIO 314: Cancer Biology

An examination of the biology of cancer. Emphasis is on molecular and cellular events, such as regulation of gene expression, genome maintenance, cell growth and death, differentiation, cell-cell recognition, signaling and homeostasis that are frequently disrupted in cancer. Recent advances in diagnosis and therapy will also be discussed.

Prerequisite: C or higher in BIO 202

3 credits

BIO 315: Microbiology

The organization, structure, energetics, and reproduction of microorganisms. Interactions of bacteria and viruses are discussed. This course does not include a laboratory component. Not for credit in addition to HBM 320. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so.

Prerequisites: C or higher in BIO 202
Advisory Pre- or Corequisite: BIO 201

3 credits

BIO 316: Molecular Immunology

Structure, function, and organization of the immune response at the molecular and cellular levels. Molecular mechanisms of

immunological responses to microorganisms and various disease states are explored.

Prerequisites: BIO 202 and BIO 203

Pre- or corequisite: CHE 322 or CHE 326 or CHE 332

3 credits

BIO 317: Principles of Cellular Signaling

Basic principles of cellular signaling and maintenance of cellular and organismic homeostasis through intra- and intercellular signaling mechanisms. The roles of membrane and nuclear receptors, second-messenger pathways and gene regulation in controlling diverse mammalian systems such as sensory physiology, organic metabolism, growth control, and neuronal development are discussed.

Prerequisite: C or higher in BIO 202

Advisory Prerequisite: BIO 203

3 credits

BIO 319: Landscape Ecology Laboratory

A computer lab course focusing on spatial concepts, methods, and tools for addressing ecological and environmental problems.

The course will be based on fundamental concepts in ecology and environmental science and extend that knowledge, as well as teaching technical skills, including the use of geographic information systems (GIS) software, image processing, spatially explicit modeling, and spatial statistics. The lab exercises will introduce a variety of spatial approaches addressing problems in environmental protection, ecotoxicology, natural resource management, conservation biology, and wildlife management.

Pre- or Corequisite: BIO 201

Advisory Prerequisites: AMS 110 or BIO 211; and BIO 351

SBC: ESI

3 credits

BIO 320: General Genetics

Integrates classical and molecular approaches to the transmission and expression of biological information. Topics include: Mendelian and non-Mendelian inheritance; linkage analysis; population genetics; DNA replication, mutation and recombination; gene expression and its regulation; current genetic technology; developmental and cancer genetics, quantitative and complex traits, and relevant ethical issues. Cannot be taken for major credit with BIO 321 (applies to Biology majors Only).

Prerequisite: C or higher in BIO 202; and C or higher in MAT 125, completion of MAT 126 or higher, or MPE score of 6+

3 credits

BIO 321: Ecological Genetics

An introduction to the concepts, research questions, and methods involved in modern ecological genetics. The goal of the course is to provide a broad conceptual framework and an introduction to basic quantitative methods for students planning to engage in empirical work in conservation, management, ecology, and evolutionary biology. The course will cover basic Mendelian genetics, meiosis, and mating systems, standard population genetics methods for describing variation within and between populations, basic quantitative genetics, methods for molecular marker genotyping, informatic and genomic concepts, and organism-specific methods and case studies. Cannot be taken for major credit with BIO 320 (applies to Biology majors only).

Prerequisites: C or higher in BIO 201 and C or higher in BIO 202

Advisory Pre- or Corequisite: BIO 351

3 credits

BIO 325: Animal Development

An overview of animal embryonic development, emphasizing molecular mechanisms regulating embryonic growth and differentiation. General areas to be discussed include: molecular basis of human birth defects, stem cells, identification of developmental genes, establishing polarity in *Drosophila* and vertebrates, regulation of cell differentiation, morphogenesis and organ development, development of cancer.

Prerequisite: C or higher in BIO 202

3 credits

BIO 327: Developmental Genetics Laboratory

Exploration of the fundamental concepts in developmental biology and genetics through a combination of classical and modern molecular genetic approaches. Experiments are conducted using *Xenopus* and *Drosophila*, two important animal models for research in developmental biology and genetics. Students gain hands-on experience with the approaches used to investigate processes that control embryonic development on these two model systems, including the use of modern molecular methods for examining the regulation of gene expression during development. Exposure to the genetic approaches that are available in the *Drosophila* system will include participation in a genetic screen for new mutations. This

course has an associated fee. Please see www.stonybrook.edu/coursefees for more information. This course includes assignments that can be used to satisfy the SBC objective SPK if co-registered for BIO 458.

Prerequisites: C or higher in BIO 325; and C or higher in BIO 205 or BIO 207

Pre- or corequisite: BIO 320 or BIO 321

SBC: ESI

3 credits

BIO 328: Mammalian Physiology

A continuation of the fundamental principles of cellular and organ physiology introduced in BIO 203. The subject matter includes advanced topics covering the origins of membrane potentials, describing properties of synaptic transmission, identifying the genetics and consequences of channelopathies in cellular and organ cardiac physiology, and advanced treatment of selected topics in endocrine, cardiac, respiratory, renal and nervous system physiology. The focus is on mammals in general and humans more particularly. May not be taken for credit in addition to HBY 350.

Prerequisite: C or higher in BIO 203

Advisory Prerequisite: CHE 132 or CHE 142 or CHE 331

3 credits

BIO 332: Computational Modeling of Physiological Systems

Introduces students to the fundamental principles underlying computational modeling of complex physiological systems. A major focus of the course will be on the process by which a model of a biological system is developed. Students will be introduced to the mathematical methods required for the modeling of complex systems (including stochastic processes and both temporal and spatial dynamics) as well as to tools for computational simulation. Roughly one half of the class will focus on models for general cellular physiology, while the remaining half will focus on the development of higher-level models of a particular physiological system (for example, the neurobiological systems underlying learning). This course is offered as both AMS 332 and BIO 332 and is intended for STEM majors who have already completed the foundational courses in their major. Students who satisfy the prerequisites but do not have a deeper background in some STEM field may find the class very challenging and should ask the instructor for guidance before registering.

Prerequisite: MAT 127 or MAT 132 or higher and any one of the following: BIO 202 or BIO

203 or CHE 132 or CHE 331 or PHY 127 or PHY 132

3 credits

BIO 334: Principles of Neurobiology

The ionic basis of nerve potentials, the physiology of synapses, sense organs and effectors, and the integrative action of the nervous system are discussed.

Prerequisite: C or higher in BIO 203

3 credits

BIO 335: Neurobiology Laboratory

A laboratory course in physiology with a focus on neuromuscular function. Topics include acquisition and analysis of electrophysiological data; ion channels, electrical excitability and action potentials; synaptic transmission and muscular contraction; development of physiological functions; central control of movement; sensory function and behavior; cardiac function and regulation; and ethical and political issues of physiological relevance. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisite: C or higher in BIO 203; and C or higher in BIO 205 or 207 and the following: PHY 122/PHY 124 or PHY 127 or PHY 132

SBC: ESI

3 credits

BIO 336: Conservation Biology

Society and individual lives are increasingly affected by environmental degradation at different scales. From the decline of local fisheries to global climate change, multiple crises threaten the biodiversity and ecosystems that sustain us humans. This course introduces the scientific foundations of conservation biology, along with examples from real-world conservation. The course reviews the biological concepts that underlie conservation including habitat requirements, population dynamics, biogeography, and population genetics. Analysis of case studies on the effects of human activities on biological diversity and ecosystem services will be used to explore the interdisciplinary nature of the practice of conservation. This course will prepare students for careers in environmental sciences and ecology.

Prerequisite: C or higher in BIO 201

Advisory Pre- or Corequisite: BIO 320 or BIO 321; and BIO 351

DEC: H

SBC: STAS

3 credits

BIO 337: Neurotransmission and Neuromodulation: Implications for Brain Function

Exploration of fundamental concepts of neurotransmission and neuromodulation of synaptic transmission. The subject matter includes an overview of the basic principles of neurotransmission and of the neuromodulatory systems in the brain. The involvement of these systems in behavior and neurological disorders is emphasized. We will discuss how specific neurological disorders can be investigated experimentally and how experimental results can contribute to understanding and treating these disorders.

Prerequisite: C or higher in BIO 203

3 credits

BIO 338: From Synapse to Circuit: Self-organization of the Brain

Exploration of basic neural and synaptic mechanisms and the operation of representative brain circuits, using both theoretical approaches and experimental evidence. Particular attention is given to Hebb's Rule, its cellular basis, its consequences for circuit selforganization, and its limits. A solid background in a mathematical, physical, or biological science is desirable, but most relevant background material is covered in the course.

Prerequisite: Instructor permission and BIO 203 or CHE 132 or CHE 331 or PHY 122

Advisory Prerequisite: BIO 334

3 credits

BIO 339: Molecular Development of the Nervous System

An introduction to the molecular events that underlie development and plasticity of both the peripheral and central nervous systems, with a focus on neuronal mechanisms. Molecular and genetic approaches to the analysis of neural induction, neuronal differentiation, neuronal death and survival, neurotrophic factors, synapse formation and plasticity are presented.

Prerequisite: C or higher in BIO 202 or BIO 203

3 credits

BIO 341: Plant Diversity

An introduction to the study of plants, especially green plants, including the origin and evolution of land plants. Topics include cellular structure and function, photosynthesis and respiration, gross anatomy, taxonomy and the diversity of organisms, plant ecology, agriculture. Three hours of lecture and one three-hour laboratory per week. This course has an associated fee. Please see

www.stonybrook.edu/coursefees for more information.

Prerequisites: BIO 201; and BIO 202; and BIO 204

4 credits

BIO 342: Invertebrate Zoology

Aspects of the diversity, comparative and functional morphology, natural history, evolution, and water-land transitions of invertebrate animals. Three hours of lecture per week. Must be taken concurrently with the Invertebrate Zoology Laboratory, BIO 343.

Prerequisite: BIO 204; and C or higher in BIO 201 or MAR 104

Corequisite: BIO 343

SBC: STEM+

3 credits

BIO 343: Invertebrate Zoology Laboratory

Aspects of the diversity, comparative and functional morphology, natural history, evolution, and water-land transitions of invertebrate animals. One three-and-one-half hour laboratory per week plus a recitation. Must be taken concurrently with the Invertebrate Zoology lecture, BIO 342. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information

Prerequisites: C or higher in BIO 201 or MAR 104; and BIO 204

Corequisite: BIO 342

2 credits

BIO 344: Chordate Zoology

Introduction to the diversity, natural history, and evolution of chordates, emphasizing the living vertebrates. Three hours of lecture or discussion and one three-hour laboratory per week. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisite: BIO 201

4 credits

BIO 347: Introduction to Neural Computation

A broad introduction to neural computation. This course will discuss what counts as 'computation' and in what sense the brain computes, how it computes, and whether those computations look anything like those performed by digital computers. These ideas and concepts will be introduced through examples of computation in the brain, including the neural bases of sensory perception, decision making, learning and memory, and motor control. Students will

learn through in-class demonstrations and activities, as well as homework assignments that give students the opportunity to analyze real neural recordings relevant to each of the topic modules.

Prerequisite: MAT 126, MAT 132, or higher; and BIO 211, AMS 110, or AMS 310; and any one of BIO 202, BIO 203, CHE 132, CHE 331, PHY 127 or PHY 132. It is recommended that students take MAT 127.

SBC: STEM+

3 credits

BIO 348: Diversity and Evolution of Reptiles and Amphibians

The course will survey the diversity and natural history of the major groups of reptiles and amphibians, including snakes, lizards, turtles, crocodylians, frogs, and salamanders. Extinct groups (such as dinosaurs and pterosaurs) will also be covered. Furthermore, the course will showcase how studies of reptiles and amphibians have increased our general understanding of evolution and ecology, and will illustrate how diverse aspects of organismal biology (such as physiology, ecology, behavior, morphology) evolve and are interconnected.

Prerequisite: BIO 201

3 credits

BIO 350: Darwinian Medicine

The ecology and evolution of disease, including evolution of human resistance to infection by pathogens, pathogen evolution in response to natural and technological defenses, and the ecological context of disease. Evolutionary phenomena are treated from molecular, organismal, population, and environmental perspectives.

Prerequisite: C or higher in BIO 201 and C or higher in BIO 202

DEC: H

SBC: STAS

3 credits

BIO 351: Ecology

An examination of the interactions of living organisms with their physical and biological environments. Attention is given to population dynamics, the interactions among organisms, the structure and function of biological communities, the evolution of organisms and their interactions, spatial relationships and scale, and patterns and explanations for biodiversity and its loss.

Prerequisite: C or higher in BIO 201

DEC: H

SBC: STEM+

3 credits

BIO 352: Ecology Laboratory

Stresses the collection, analysis, and interpretation of ecological data, mostly in terrestrial settings. Laboratory and field exercises demonstrate the operation of general ecological principles in specific populations and communities. One lecture, one three-hour field trip or laboratory, and one hour of recitation per week. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisite: BIO 205 or BIO 207

Pre- or corequisite: BIO 351

SBC: ESI

3 credits

BIO 353: Marine Ecology

A survey of biotic responses to ecological challenges in different marine realms. Controls of diversity and trophic structure in the marine ecosystem, historical aspects of marine realms, productivity in the oceans, plankton, soft-bottom communities, intertidal habitats, coral reefs, deep-sea environments, and effects of pollution in the ocean are discussed.

Prerequisite: C or higher in BIO 201 or MAR 104

Advisory Prerequisite: BIO 343

SBC: STEM+

3 credits

BIO 354: Evolution

A detailed discussion of the mechanisms of evolution, focusing on the ways in which genetic changes in populations lead to adaptation, speciation, and historical patterns of evolutionary change.

Prerequisites: C or higher in BIO 201 and BIO 202

Advisory pre- or corequisite: BIO 320 or 321

3 credits

BIO 356: Applied Ecology and Conservation Biology Laboratory

A computer laboratory course where population and community ecology concepts are applied to real-world datasets and simulated data. Laboratories are based on free interactive software. Techniques for data wrangling and computer simulation of ecological models are emphasized.

Prerequisite: BIO 201, BIO 202, or BIO 203; and BIO 204; and MAT 126 or higher

SBC: ESI, STEM+

2 credits

BIO 358: Biology and Human Social and Sexual Behavior

Major features of human social and sexual behavior are examined from a biological perspective. Insights from ethology, evolutionary biology, and neurobiology are synthesized into a picture of human nature and behavior. Implications of this picture for human sexual and social behavior are considered. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so.

Prerequisites: U3 or U4 standing; and one of the following: ANP 101, BIO 115, BIO 201, BIO 202, or BIO 203

DEC: H

SBC: ESI, STAS

3 credits

BIO 361: Biochemistry I

First course of an advanced two-semester study of the major chemical constituents of the cell, including carbohydrates, lipids, and proteins. Emphasis is on enzyme structure, enzyme kinetics, reaction mechanisms, and metabolic pathways.

Prerequisite: C or higher in BIO 202 and C or higher in CHE 322 or 332 or 326

3 credits

BIO 362: Biochemistry II

Second course of an advanced two-semester study of biochemistry. BIO 362 is the Molecular Biochemistry section that treats nucleic acid structure, replication, and transcription, both in vivo and in vitro. The machinery and regulation of prokaryotic and eukaryotic protein synthesis is also covered, including amino acid activation; transfer RNA; ribosomes; the genetic code; and peptide chain initiation, elongation, and termination.

Prerequisites: C or higher in BIO 361 or CHE 346

3 credits

BIO 364: Laboratory Techniques in Cancer Biology

This course will introduce contemporary concepts of cancer initiation, progression, metastasis and therapy. The lectures and recitations will include discussions of appropriate review articles, textbook readings and research articles. In the laboratory, students will be introduced to and recapitulate key techniques used in the selected research articles. This course will require significant work on computers outside of class time (more than 3 hours per week).

This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisite: C or higher in BIO 205 or BIO 207

Pre- or corequisite: BIO 314 with a grade of C or higher if used as a prerequisite

3 credits

BIO 365: Biochemistry Laboratory

Biochemistry 365 Laboratory is divided into four modules. They include: (1) classical biochemistry techniques to extract and quantify cellular constituents such as chlorophyll, DNA, RNA and proteins in *Euglena gracilis*, (2) the study of bovine catalase enzyme kinetics and the students design an experiment to measure their blood catalase, (3) the purification of a His-tagged protein and the evaluation of its purity with SDS gel electrophoresis and western blot analysis and (4) students' amplifying their mitochondrial control region DNA by PCR for sequencing and comparing their sequence to known sequences dating back to the earliest hominids, in terms of the evolutionary tree. These experiments are designed to teach basic biochemistry techniques as well as develop the skills of problem solving and analytical thinking. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisite: C or higher in BIO 205 or BIO 207

Pre- or corequisite: BIO 310 or BIO 361

SBC: ESI

2 credits

BIO 366: Molecular Microbiology Laboratory

This course will include both lectures as well laboratory sessions focused on conventional and contemporary Molecular Microbiological techniques. The lectures will cover a variety of microorganisms; Bacteria, Fungi, Viruses, and Protozoans based on textbook readings and current research articles. In the laboratory, students will learn fundamental and applied microbiological methods, biochemical and DNA profiling of microorganisms, and the molecular basis of physiological processes used for the identification of unknown bacteria. This course will serve as an upper-division elective for BIO majors. The course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisite: BIO major; and C or higher in BIO 205 or 207; and C or higher in BIO 315

4 credits

BIO 367: Molecular Diversity Laboratory

Hands-on experience with methods to detect and analyze molecular (DNA, RNA, protein) variation to study ecology, adaptation, and evolutionary history using natural populations of *Drosophila*, plankton, and other locally available species. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisite: C or higher in BIO 201; and C or higher in BIO 202; and BIO 205 or BIO 207

Advisory pre- or corequisite: One of the following: BIO 320, BIO 321, BIO 351, or BIO 354

3 credits

BIO 368: Food Microbiology

This course is designed to give students an understanding of subtle relationship between food borne microorganisms and human health. Course will cover various topics focused on microorganisms involved in food processing, preservation, spoilage, and methods to control their growth in food items. The lectures will be presented based on textbook readings and current research articles and cover in depth the role of food borne microorganisms in illness as well health promotion. This course will serve as an upper-division elective for BIO majors.

Prerequisite: C or higher in BIO 315

2 credits

BIO 369: Animal Nutrition

Nutrient classes, requirements, use, and sources will be explored. Gastrointestinal anatomy and feeding standards for small, large, and exotic animal species during reproduction, growth, maintenance, and in disease are evaluated in the context of mechanisms underlying differences in nutritional requirements. Finally, laws, labeling, and marketing of animal feed will be examined. This course satisfies the prerequisite of an upper division animal nutrition course for AVMA-accredited veterinary schools.

Prerequisite: C or better in BIO 201 and BIO 202

Pre- or corequisite: BIO 203

3 credits

BIO 371: Restoration of Aquatic Ecosystems

A field and laboratory course designed to introduce students to field methods in assessing the long-term effects of pollution and restoration of aquatic and marsh systems. Students will work in teams to collaborate on measuring exchange of pollutants between a

restored Superfund site and adjacent areas, the long-term effects of ecological restoration, habitat assessment, aquatic community structure in restored and adjacent systems, and long-term evolutionary effects on aquatic pollutants. Other restoration systems will be compared. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisites: BIO 201; and BIO 202; and BIO 204

Advisory Prerequisite: BIO 353

DEC: H

SBC: STAS

4 credits

BIO 383: Paleobiology

An upper-division course in paleobiology that emphasizes the use of the fossil record to explore evolutionary and ecological concepts across time scales and in relation to environmental change. Topics from introductory biology courses will be explored in greater detail, including classification and phylogenetic systematics, morphological variation, and the history of life and extinction. Additional advanced topics will include fossil preservation, macroevolution, biomechanics, paleoecology, biogeography, human evolution, and conservation paleobiology. The course format includes lecture, discussion, and lab activities. In lab, students will engage in specimen-based activities as well as data analysis using open-source R software.

Prerequisite: BIO 201

SBC: STEM+

3 credits

BIO 384: Intermediate Statistics

This is an intermediate-level course in biostatistics, emphasizing the use of statistics as a tool to answer scientific questions in ecology and other biological disciplines. Topics from introductory statistics courses will be explored in greater depth using the R software package. Additional advanced topics will include experimental design, meta-analysis, general linear models, complex regression, multifactor analysis of variance, and multivariate analyses. Within each topic, the assumptions of statistical tests will be examined, as well as methods to cope with violations of those assumptions. Students will develop skills in graphical display of quantitative data, exploratory data analysis, and critical evaluation of published statistical analyses. Students will use R software throughout the course to develop their coding skills.

Prerequisite: BIO 211, AMS 110, or EBH 230; and BIO 201, BIO 202, or BIO 203; or permission of instructor

SBC: STEM+

3 credits

BIO 385: Plant Ecology

Basic ecological principles as applied to the biology of individual plants, plant populations, communities, and ecosystems in relation to their environments. Examples from Long Island pine barrens, tropical rain forests, beaches, deserts, and other plant communities are studied. Examination of the connections between human societies and plant communities, which are rapidly being altered or destroyed worldwide.

Prerequisite: C or higher in BIO 201

Advisory Pre- or Corequisite: BIO 351

DEC: H

SBC: STAS

3 credits

BIO 386: Ecosystem Ecology and the Global Environment

Ecosystem ecology with an emphasis on biogeochemical cycling in oceans and on land, as well as on biosphere-atmosphere interactions. Topics include earth system processes such as climate and atmospheric composition, the hydrological cycle, cycling of chemicals such as nutrients and metals in the oceans, the soil cycle, and the fate and transport of materials in the atmosphere. Natural and perturbed systems are discussed. This course is offered as both BIO 386 and ENS 311.

Prerequisites: C or higher in BIO 201; and CHE 129 or CHE 131 or CHE 141 or CHE 152

Advisory Prerequisite: MAR 104

DEC: H

SBC: STAS

3 credits

BIO 444: Experiential Learning

This course is designed for students who engage in a substantial, structured experiential learning activity in conjunction with another class. Experiential learning occurs when knowledge acquired through formal learning and past experience are applied to a "real-world" setting or problem to create new knowledge through a process of reflection, critical analysis, feedback and synthesis. Beyond-the-classroom experiences that support experiential learning may include: service learning, mentored research, field work, or an internship.

Prerequisite: WRT 102 or equivalent; permission of the instructor and approval of the EXP+ contract (http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/degree_requirements/EXPplus.php)

SBC: EXP+

0 credit, S/U grading

BIO 446: Readings in Neurobiology and Physiology

Tutorial readings in the biological sciences. These courses may be repeated, but not more than two credits may be used toward biology major requirements. Limit of one topic per semester.

Prerequisite: Undergraduate Biology program approval and permission of instructor

SBC: ESI

1-2 credits, S/U grading

BIO 447: Readings in Molecular, Cellular, and Developmental Biology

Tutorial readings in the biological sciences. These courses may be repeated, but not more than two credits may be used toward biology major requirements. Limit of one topic per semester.

Prerequisite: Undergraduate Biology program approval and permission of instructor

SBC: ESI

1-2 credits, S/U grading

BIO 449: Readings in Ecology and Evolution

Tutorial readings in the biological sciences. These courses may be repeated, but not more than two credits may be used toward biology major requirements. Limit of one topic per semester.

Prerequisite: Undergraduate Biology program approval and permission of instructor

SBC: ESI

1-2 credits, S/U grading

BIO 458: Speak Effectively Before an Audience

A zero credit course that may be taken in conjunction with any BIO course that provides an opportunity to achieve the learning outcomes of the Stony Brook Curriculum's SPK learning objective.

Corequisite: BIO 204 or BIO 311 or BIO 327 or BIO 486 or BIO 487 or BIO 488 or BIO 489 or departmental permission

SBC: SPK

0 credit, S/U grading

BIO 459: Write Effectively in Biology

A zero credit course that is taken in the same semester as a 300- or 400-level BIO course that provides opportunity to achieve the learning outcomes of the Stony Brook Curriculum's WRD learning objective. For information on approved co-requisite courses and the registration form for Biology and Biochemistry majors see: <http://www.stonybrook.edu/commcms/biology/advising/Forms.php>

Corequisite: BIO 311 or BIO 365 for Biochemistry majors; an approved upper-division Biology course for Biology BS majors; an approved upper-division course in Biology or in the minor degree program of BIO BA majors; or departmental permission

SBC: WRD

0 credit, S/U grading

BIO 475: Undergraduate Teaching Practicum in College Biology I

Study of the literature, resources, and teaching strategies in a field of biology, coordinated with a supervised clinical experience in instruction. Not for major credit. Students may not serve as teaching assistants in the same course twice.

Prerequisite: Permission of instructor; and Undergraduate Biology Program approval

SBC: EXP+

0-3 credits, S/U grading

BIO 476: Undergraduate Teaching Practicum in College Biology II

Study of the literature, resources, and teaching strategies in a field of biology, coordinated with a supervised clinical experience in instruction. Not for major credit. Students may not serve as teaching assistants in the same course twice.

Prerequisite: BIO 475; and permission of instructor; and Undergraduate Biology Program Approval

SBC: EXP+

0-3 credits, S/U grading

BIO 477: Undergraduate Teaching Practicum in College Biology III

Study of the literature, resources, and teaching strategies in a field of biology, coordinated with a supervised practical experience in instruction. In the practical instructional experience, the Undergraduate Teaching Assistant works with guidance from a faculty sponsor to provide support to students in labs, recitations, conferences, tutorials, or demonstrations associated with a course being taught by the sponsor. The student should have different and/or greater responsibilities as a Teaching Assistant if the course is not different

from a prior teaching practicum experience. Not for BIO major or minor credit. May be repeated.

Prerequisite: BIO 476; permission of instructor; Undergraduate Biology Program Approval

SBC: EXP+

0-3 credits, S/U grading

BIO 484: Research in Biology and Society

Students work under the supervision of a faculty member in developing an individual project that makes use of the knowledge and techniques acquired in previous courses. The student reports on the project in a format agreed upon with their faculty sponsor that allows reflection on learning outcomes. This course may be repeated, but no more than four credits of research may be used for Biology major requirements. With prior permission from the faculty sponsor, this course could include assignments that can be used to satisfy the SBC objective SPK if co-registered for BIO 458, and/or the SBC objective WRTD if co-registered for BIO 459.

Prerequisite: Permission of instructor; and Undergraduate Biology Program approval

SBC: EXP+

0-6 credits, S/U grading

BIO 486: Research in Neurobiology and Physiology

Students work under the supervision of a faculty member in developing an individual project that makes use of the knowledge and techniques acquired in previous courses. The student reports on the project in a format agreed upon with their faculty sponsor that allows reflection on learning outcomes. This course may be repeated, but no more than four credits of research may be used for Biology major requirements. With prior permission from the faculty sponsor, this course could include assignments that can be used to satisfy the SBC objective SPK if co-registered for BIO 458 and/or the SBC objective WRTD if co-registered for BIO 459.

Prerequisite: Permission of instructor; and Undergraduate Biology Program approval

SBC: EXP+

0-6 credits, S/U grading

BIO 487: Research in Molecular, Cellular, and Developmental Biology

Students work under the supervision of a faculty member in developing an individual project that makes use of the knowledge and techniques acquired in previous courses. The student reports on the project in a format

agreed upon with their faculty sponsor that allows reflection on learning outcomes. This course may be repeated, but no more than four credits of research may be used for Biology major requirements. With prior permission from the faculty sponsor, this course could include assignments that can be used to satisfy the SBC objective SPK if co-registered for BIO 458 and/or the SBC objective WRTD if co-registered for BIO 459.

Prerequisite: Undergraduate Biology program approval and permission of instructor

SBC: EXP+

0-6 credits, S/U grading

BIO 488: Internship in Biological Sciences

Students work under the supervision of a faculty member or approved professional sponsor to obtain a career-related experience in the life sciences. The student reports on the project in a format agreed upon with their sponsor that allows reflection on learning outcomes. Students must be accepted into an internship program before registering for credit. May be repeated up to a limit of 12 credits. Not for biology major credit.

Prerequisite: Undergraduate Biology Program approval and permission of sponsor

SBC: EXP+

0-6 credits, S/U grading

BIO 489: Research in Ecology and Evolution

Students work under the supervision of a faculty member in developing an individual project that makes use of the knowledge and techniques acquired in previous courses. The student reports on the project in a format agreed upon with their faculty sponsor that allows reflection on learning outcomes. This course may be repeated, but no more than four credits of research may be used for Biology major requirements. With prior permission from the faculty sponsor, this course could include assignments that can be used to satisfy the SBC objective SPK if co-registered for BIO 458 and/or the SBC objective WRTD if co-registered for BIO 459.

Prerequisite: Permission of instructor; and Undergraduate Biology Program approval

SBC: EXP+

0-6 credits, S/U grading