

# BIOLOGY (BIOL-SHU)

## BIOL-SHU 5 Nutrition, Fitness and Health (4 Credits)

*Typically offered occasionally*

Only in times of illness we usually realize that our most valuable possession is our health. To be in good health doesn't mean simply to be disease free. This course will focus on the essential role and interaction of exercise and diet in achieving total fitness and wellness. The students will build a strong understanding of the foundations of exercise physiology and nutrition. Students will learn how to evaluate their own wellness level with respect to various wellness components, such as fitness level and nutritional status and will build their own personalized program to maintain their health. Prerequisite: None. Fulfillment: Core Curriculum Science Experimental Discovery in the Natural World Courses.

**Grading:** Ugrd Shanghai Graded

**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Experimental Discovery in the Natural World

## BIOL-SHU 21 Foundations of Biology I (3 Credits)

*Typically offered Spring*

Prereq or Co-req for BIOL-SHU 21 is MATH-SHU 121 or MATH-SHU 201 Fulfillment: CORE ED; Biology, NS, Physics Foundational course; Math/Honors Math Science Lecture; DS concentration in Genomics.

**Grading:** Ugrd Shanghai Graded

**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Biology Foundation
- SB Crse Attr: NYU Shanghai: Experimental Discovery in the Natural World
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math and Science Requirements
- SB Crse Attr: NYU Shanghai: Mathematics Math and Science Requirements
- SB Crse Attr: NYU Shanghai: Neural Science Foundational Course
- SB Crse Attr: NYU Shanghai: Physics Foundational Course

## BIOL-SHU 22 Foundations of Biology II (3 Credits)

*Typically offered Fall*

Prerequisites: BIOL-SHU 21 Foundations of Biology I and (MATH-SHU 131 Calculus or MATH-SHU 123 Multivariable Calculus or MATH-SHU 201 Honors Calculus). Fulfillment: Biology Major Foundational Courses; Mathematics Major Science Lecture sections; Honors Mathematics Major Science Lecture sections; Neural Science Major Foundational Courses; Data Science Major Courses for Concentration in Genomics.

**Grading:** Ugrd Shanghai Graded

**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Biology Foundation
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math and Science Requirements
- SB Crse Attr: NYU Shanghai: Mathematics Math and Science Requirements
- SB Crse Attr: NYU Shanghai: Neural Science Foundational Course

## BIOL-SHU 30 Genetics (4 Credits)

*Typically offered occasionally*

Why do offspring often exhibit physical features of their parents? Why do combinations of certain features in offspring translate into specific characteristics that either enhance or diminish the organism's fitness? Answers to questions such as these fall partly within the discipline of genetics, which is the study of heredity. Principles from the Foundations of Science curriculum and Organismal Biology provide a framework for learning about classical genetics, chromosome structure and mutation, gene function and regulation, and aspects of molecular and developmental genetics. Recent studies in human genetics and their applications, particularly to health-related issues, are also investigated. Prerequisite: BIOL-SHU 22 Foundations of Biology II. Fulfillment: Core Curriculum Requirement Science, Technology and Society Courses; Biology Major Electives; Neural Science Major Approved upper-level Biology courses.

**Grading:** Ugrd Shanghai Graded

**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Biology Elective
- SB Crse Attr: NYU Shanghai: Neural Science Approved upper-level Biology Course
- SB Crse Attr: NYU Shanghai: Science, Technology and Society

## BIOL-SHU 31 Genetics Laboratory (4 Credits)

*Typically offered occasionally*

pre-req or co-req is BIOL-SH 30 Genetics or BIOL-UA 30 Genetics Fulfillment: Biology Major Electives.

**Grading:** Ugrd Shanghai Graded

**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Biology Elective

## BIOL-SHU 42 Biostatistics (4 Credits)

*Typically offered Spring*

The ability to organize and analyze biological and behavioral science data is an essential research tool. This course provides an introduction to the use of statistical methods for analyzing this data. It introduces methods for describing and displaying data, the role and use of probability in describing and understanding living systems, hypotheses testing, and how to design experiments. Biological and behavioral science data and R—a free, open-source statistical software package—are used to gain proficiency with these tools. Prerequisite: BIOL-SHU 21 Foundations of Biology I and BIOL-SHU 22 Foundations of Biology II. Fulfillment: Biology Required; Business Core course; IMB Business elective.

**Grading:** Ugrd Shanghai Graded

**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: BUSF Business Core
- SB Crse Attr: NYU Shanghai: BUSM Business Core
- SB Crse Attr: NYU Shanghai: Biology Required
- SB Crse Attr: NYU Shanghai: IMB Business Elective

**BIOL-SHU 58 Evolution (4 Credits)***Typically offered occasionally*

Evolution encompasses the patterns and mechanisms that explain the diversity of organisms we observe today and during the millions of years of the geological record. Evidence is reviewed that demonstrates the common ancestry of all living things, including humans, and the mechanisms, such as natural selection, that are required and sufficient to explain this pattern of ancestry, diversification, adaptation, speciation, and biogeographic distribution. The course also uses computer and mathematical modeling to explore the fundamentals of population genetics, molecular evolution, phylogenetic systematics, and the evolution of developmental systems. Prerequisite CHEM-SHU 126

Fulfillment: Biology elective

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Biology Elective

**BIOL-SHU 123 Foundations of Biology Lab (2 Credits)***Typically offered Spring*

The course will teach students the skills needed in molecular biology research such as the hand-on techniques of microscopy, transformation, gene expression, PCR, gel electrophoresis, SDS-PAGE, and chromatography. The students will first learn these basic biological techniques in short experiment sets and then apply them as part of a Genetically-Modified Food project. The lab course will also emphasize literature search, scientific writing, peer reviewing, lab notes taking, poster and power point presentations, data analysis, and best practices in lab safety. FoS 5&6 labs are regarded as an extension to what the course lectures teach rather than a direct linear relationship whereby a lecture is directly applied in the lab. The pre-labs that are given as lectures before the actual lab begins span a weekly 30-45 min and explain the principles behind the techniques that the students will apply that lab. Students are required to study the lab procedure in advance and be prepared for a quiz and discussion of the material. Learning Outcomes: This course aims at teaching students how to think like a true researcher as well as apply the key molecular biology techniques. During this course, students will be expected to: gain an understanding of the basics of molecular biology techniques and be able to apply these techniques in the lab; acquire the habits of a good scientist including accuracy, cleanliness, orderliness, safety, honesty, teamwork, curiosity, good time management, and self-reliance develop the ability to convey scientific information; this includes keeping good records with in a lab notebook, writing a satisfactory report, and oral communication; draw conclusions from observed facts and support these conclusions with peer-reviewed literature. pre-reqs: (MATH-SHU 131 Calculus or MATH-SHU 123 Multivariable Calculus or MATH-SHU 201 Honors Calculus) and BIOL-SHU 21 Foundations of Biology I. Fulfillment: Core Curriculum Requirement Experimental Discovery in the Natural World Courses; Biology Major Foundational Courses; Mathematics Major Science Lab sections; Honors Mathematics Major Science Lab sections; Neural Science Major Foundational Courses; Physics Major Foundational Courses; Data Science Major Courses for Concentration in Genomics.

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Biology Foundation
- SB Crse Attr: NYU Shanghai: Experimental Discovery in the Natural World
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math and Science Requirements
- SB Crse Attr: NYU Shanghai: Mathematics Math and Science Requirements
- SB Crse Attr: NYU Shanghai: Neural Science Foundational Course
- SB Crse Attr: NYU Shanghai: Physics Foundational Course

**BIOL-SHU 200 Topics: (4 Credits)***Typically offered occasionally*

Pre-req is BIOL-SHU 22 Foundations of Biology II Fulfillment: Biology elective.

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Biology Elective

**BIOL-SHU 250 Organismal Systems (4 Credits)***Typically offered occasionally*

The array of organisms that populates the globe is astounding in its diversity and adaptability. This course uses fundamental concepts from the Foundations of Science curriculum to examine essential elements of animal physiology, including adaptations to environments such as deserts. This course develops an understanding of the relationship between structure and function of the organism; how structure develops through evolutionary and developmental processes; and how structure is related to the environment surrounding the organism. Prerequisite: BIOL-SHU 21. Fulfillment: Biology required course.

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr. NYU Shanghai: Biology Required

**BIOL-SHU 261 Genomics and Bioinformatics (4 Credits)***Typically offered occasionally*

Fueled by recent advances in technical approaches to data collection and analysis, the biological sciences have entered a new era in which vast amounts of genome-scale sequence and functional data are becoming available for a large number of species, including human. Many medical and biological studies are being carried out on an unprecedented scale. The surge of biological data changes genomics and biology into one of the major research topics in data science. Familiarity with the fields of genomics and bioinformatics, which impact society on all levels, is vital for the next generation of scientists. The course of Genomics and Bioinformatics introduces to students a broad range of subjects in this field through lectures and hands-on exercises that use fundamental principles of biochemistry, computer science, and mathematics. Students are also expected to understand G&B applications such as how genomic analysis is used to facilitate precision medicine research, and how to study biology questions from a systemic perspective. Prerequisite: co-req/pre-req (one of Stats course BIOL-SHU 42 or MATH-SHU 235 or MATH-SHU 234 or BUSF-SHU 101) AND pre-req (CSCI-SHU 11 ICP or CSCI-SHU 101 ICDS) Fulfillment: Core Curriculum Requirement Science, Technology and Society Courses; Biology Major Biology Electives; Data Science Major Courses for Concentration in Genomics.

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr. NYU Shanghai: Biology Elective
- SB Crse Attr. NYU Shanghai: Science, Technology and Society

**BIOL-SHU 263 Developmental Biology (4 Credits)***Typically offered occasionally*

Multicellular organisms undergo a series of complex temporal and spatial changes in gene expression following fertilization, which results in the highly organized, coordinated cell divisions needed for growth and development. This course introduces students to the principles and experimental strategies of developmental biology. It covers the cellular and molecular basis for patterning in the embryo; the determination of cell fate; cell differentiation; the genes controlling these events; how the genes are identified and studied; and the cellular proteins that effect shape, movement, and signaling among cells. Prerequisite BIOL-SHU 250 Organismal Systems, or Foundations of Biology II. Fulfillment: Biology elective; Neural Science Approved upper-level Biology course.

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr. NYU Shanghai: Biology Elective
- SB Crse Attr. NYU Shanghai: Neural Science Approved upper-level Biology Course

**BIOL-SHU 267 Microbiology (4 Credits)***Typically offered occasionally*

Microbiology. Bacterial viruses. Assembly of macromolecular structures. Regulation of gene expression. Transduction. Phage that carry disease causing genes. Phage display. Animal viruses: HIV, influenza, polio. Bacteria. DNA replication. Cell walls. Division into Gram positive and negative. Control of gene expression. Turning on large sets of genes. Conjugation and transformation. Antibiotics and antibiotic resistance. Transposons. Immunology. Mechanisms of bacterial virulence. Major chemical cycles mediated by bacteria. Archaea and extreme environments. Protists and protozoa. The eukaryotic cell and single-celled organisms with sophisticated functions. Algae and algal products. Prerequisites: none Recommended: BIOL-SHU 21 and 22 – Foundations of Biology I and II, and BIOL-SHU 264 Genetics. Fulfillment: Biology elective.

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr. NYU Shanghai: Biology Elective

**BIOL-SHU 271 Cell biology: body's battle with cancer (4 Credits)***Typically offered occasionally*

This course is designed to provide comprehensive understanding of how cancer breaks our body's defense for its survival. Cancer is a devastating disease in a modern society and a plethora of efforts has been made to find its cure. In this course, students will learn how difficult fighting against cancer is in a molecular level. Furthermore, using cancer as an example, students will also learn how metazoan develops multiple defense mechanisms and survives in the hostile environment. Prerequisite: Foundations of Biology I (BIOL-SHU 21) Fulfillment: Biology elective

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr. NYU Shanghai: Biology Elective

**BIOL-SHU 314 Advanced Cell Biology Lab (4 Credits)***Typically offered Spring*

The course takes an in depth look to understand the fundamental and advanced methods for growing and studying cells—the smallest units of life. This course introduces students the fundamentals of cell biology and the experimental approaches used in research to examine the cell structure and function. Topics cover cell lines culture, the structure and function of the cells, metabolic pathways, cell signaling pathways, and gene function investigation in vitro in cells. The laboratory course will teach students the skills needed in advanced cellular biology research such as the hands-on techniques of cryopreservation, transfection, realtime PCR, immunofluorescence, RNA isolation, cDNA construction, gene expression and regulation. The lab course will also emphasize literature search, scientific writing, lab notes taking, data analysis, and best practices in lab safety. The course is designed as an upper level 4-credit major elective course, for biology and neural science majors mainly, and open to other natural science majors who have taken Foundation of Biology I or II, or FoS Biology Lab. Prereq for BIOL-SHU 314 is BIO-SHU 21 Foundations of Biology I or BIOL-SHU 22 Foundations of Biology II or BIOL-SHU 123 Foundations of Biology Lab. Fulfillment: Biology elective; Neural Science Approved upper-level Biology course.

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Biology Elective
- SB Crse Attr: NYU Shanghai: Neural Science Approved upper-level Biology Course

**BIOL-SHU 400 Independent Study - Biology Capstone (4 Credits)***Typically offered Fall*

Students must conduct two semesters of research (8 credits) with a faculty member in NYU Shanghai Biology or another faculty member approved by the Biology Area Director. One semester of research can be conducted in NYU NY or NYU AD upon approval of Biology Area Director and NYU SH faculty advisor. The students must take the Undergraduate Research Thesis course in Shanghai in the last semester of senior year and prepare a written thesis of the research. The students must submit the research thesis for approval by two NYU Shanghai biology faculty members. Presentation of the thesis work at the NYU Shanghai Undergraduate Research Conference is required. Once a student completes all of the requirements for the honors program, there is a competitive selection process for determining which students receive the Major Honors recognition. Prerequisite: department consent. Fulfillment: Biology Major Electives.

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Biology Elective

**BIOL-SHU 997 Independent Study – Biology (2-4 Credits)***Typically offered Fall and Spring*

Prerequisite: Foundations of Science I-III (or Physics I&II, Foundations of Chemistry I&II, Foundations of Biology I&II), and a minimum GPA of 3.0 overall and in all science and mathematics courses required for the major, permission of a biology faculty member (at NYU-Shanghai, NYU-Abu Dhabi, or NYU-New York) who will act as a sponsor and mentor, and approval of the Discipline Leader in Biology. The faculty mentor must be selected in consultation with the Discipline Leader in Biology. Offered in the Fall, Spring or Summer. 2 to 4 points per term for a maximum of 4 points. This course aims at engaging students in research. It is designed to offer students an opportunity to observe biological research up close and gain hands-on research experience by working as a member in an active research team. Independent Study I and II can be done with the same supervisor or two different supervisors. No lectures will be given. Student researchers are expected to attend and actively participate in lab/supervision meetings. A Proposal for Independent Study form must be filled out, signed by the Discipline Leader in Biology, and submitted to the student's academic advisor. Requires a written report on the research to be evaluated by the faculty sponsor, with a copy submitted to the Discipline Leader in Biology and a copy to the Dean of Arts & Sciences. Prerequisite: department consent. Fulfillment: Biology Major Electives.

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** Yes

- SB Crse Attr: NYU Shanghai: Biology Elective

**BIOL-SHU 998 Integrated Science Capstone (4 Credits)***Typically offered every year*

This course will provide students with a completion of their undergraduate science education by making use of the skills and knowledge they acquired over the course of completing their major to apply to scientific problems across disciplines. Students will be paired with a faculty mentor to engage either in Independent Research or Literature Review to address a scientific question of the student's design, culminating in a written report. Students are encouraged to work with faculty mentors outside of their own field. Open only to Biology, Chemistry, and Physics majors in the senior year. Prerequisite: senior students with Biology major Fulfillment: Biology required.

**Grading:** Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Biology Required

**BIOL-SHU 999 Biology Undergraduate Research Thesis (2 Credits)**

*Typically offered occasionally*

Prerequisites: Independent Study (BIOL-SHU 997 or 998), a minimum GPA of 3.65 overall, a minimum GPA of 3.65 in all science and mathematics courses required for the major, and permission of a sponsor and the Dean of Arts & Sciences. Open to Biology majors only. The faculty mentor must be selected in consultation with the Dean of Arts & Sciences. May not be used for the major in biology. Offered in the fall, spring, and summer. 2 points. For biology majors who have completed at least one semester of laboratory research (BIOL-SHU 997 or 998) and are able to expand this work into a thesis. Requires writing a Thesis (i.e., a full literature search of the subject and a formal written report on the research in publication form), which is defended in front of a committee of three faculty (which includes the faculty sponsor), chosen by the student in consultation with the faculty mentor. (The defense may be a brief oral presentation followed by a question-and-answer session.) The Thesis and defense must be evaluated by the committee, with the cover page of the thesis signed by all committee members, with a copy of the Thesis submitted to the Dean of Arts & Sciences. (It is recommended that the student meet with the faculty committee at least once mid-semester to evaluate and guide the student's progress on the thesis work.) Prerequisite: None. Fulfillment: Biology elective.

**Grading:** Ugrd Shanghai Graded

**Repeatable for additional credit:** Yes

- SB Crse Attr: NYU Shanghai: Biology Elective