Department of Biology

Chairperson: Knio, Khouzama M.
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Associate Professors: Bariche, Michel J.; Osta, Mike A.; Smith, Colin A.
Assistant Professors: Dohna, Heinrich zu; Ghanem, Noel D.; Jaalouk, Diana E.; Kambris, Zakaria S.; Sadek, Riyad A.; Zahawi, Rakan A.
Lecturers: Rizkallah, Hind D.; Sinno-Saoud, Nada; Tarraf, Charbel G.
Instructor: Hajjar, Layane A.M.

BS in Biology

Mission Statement

The BS program in Biology prepares students for advanced study and careers in research, education, and service in Biology-related disciplines. Students will acquire descriptive, experimental, quantitative, and conceptual abilities spanning molecular, cellular, organismal, and ecological levels. Lecture and laboratory courses will emphasize model systems, the role of evolution, diversity of living systems, hypothesis-based reasoning, and communication skills. Science, social science, and humanities coursework will foster creativity, free thought, interdisciplinary skills, and commitment to ethical scholarship.

Degree Requirements

All students admitted as sophomores are eligible to continue in the program provided they obtain, by the end of their third regular semester at AUB, a minimum average of 70 in their biology courses. Students seeking to be readmitted to the program after being dropped must meet transfer requirements. Students will be considered for transfer to Biology provided they obtain a minimum grade of 75 in BIOL 201 and 75 in BIOL 202 and a 70 or above in CHEM 201 and a 75 or above overall average. If the student has taken biology courses in addition to BIOL 201 and BIOL 202, the overall average must be 75 or above (excluding Freshman courses). Transfer to Biology from other departments within the Faculty of Arts and Sciences is competitive and requires departmental approval.

The requirements for a BS degree in Biology are 90 credits for students entering the department at the sophomore level. The distribution of these courses is as follows:

University General Education Requirements

6 credits in English Communication Skills and 3 credits in Arabic Communication Skills; 12 credits in the humanities including 6 credits of CVSP; 6 credits in the Social Sciences; (37+15) credits in the Natural Sciences; 3 credits in Quantitative Thought; STAT 210.
Major Requirements

- 37 credits of Biology: BIOL 201, 202, 220, 223; two of the following four courses: BIOL 224, 252, 260, 270; BIOL 293 (these courses are offered every semester); and a minimum of 13 credits in biology elective courses, including a minimum of one 4 credit course. Additionally, BIOL 296 (a 0-credit exit survey) must be taken in the last semester of study.

- 15 credits of Natural Sciences. CHEM 201, 210, 211, 212; and PHYS 204 with PHYS 204L, or PHYS 205 with PHYS 205L.

The minor in biology requires 15 credits of BIOL courses. The courses are BIOL 201 (4 credits), BIOL 202 (4 credits), plus at least two courses (provided the prerequisites of these courses are satisfied) to complete the 15 credits required for the minor.

Unless otherwise stated, only senior undergraduate biology majors with an average of 80 or above can register in biology graduate courses with consent of the instructor.

Students from any field can minor in aquatic and environmental sciences by completing, in addition to BIOL 202 or BIOL 200, a total of 15 credits chosen from the following three lists:

- List 1: BIOL 252, BIOL 250, BIOL 256.
- List 2: BIOL 266, BIOL 246, BIOL 267, BIOL 255.

- Plant Sciences: AGSC 284, AGSC 295.
- Landscape: LDEM 211, LDEM 215.
- Ecosystem Management: LDEM 203.
- Environmental Health: ENHL 220.
- Civil Engineering: CIVE 350, CIVE 450.

One course from each of lists 1 and 2 is required. All students should take at least three of the total required courses in a field outside their major field of study, and these courses should be from at least two different disciplines. Only one of the courses taken from lists 1 and 2 by biology majors minoring in environmental and aquatic studies is counted toward the major.

Course Descriptions

**BIOL 101 Basic Concepts in Biology** 3.0; 3 cr.
A course that deals with the basic concepts in biology, and prepares students for BIOL 201 and BIOL 202. This course introduces the student to the forms and functions of plants and animals, and to the principles of genetics, evolution, and ecology. *Every semester.*

**BIOL 105 Introductory Biology** 3.3; 4 cr.
An introduction to the fundamental principles of biology. This course covers the basis of life, the structure and function of cells and systems, the general classification and diversity of plants and animals, as well as genetics and ecology. *Occasionally.*

**BIOL 106 Contemporary Issues in Biology** 3.0; 3 cr.
A course designed to provide freshman students with the scientific background to some of the current topics in biology today. The course introduces students to the general concepts
of biology, including origins of life, evolution and organic building blocks. Moreover, the course will cover socially important contemporary topics such as human evolution, fresh water issues, ecology, environmental conservation, cloning, stem cell research, GMOs, diseases and nutrition. Topics will be added and removed as new discoveries are made and news changes. Every semester.

**BIOL 200  Diversity of Life**  
A course that deals with the basic aspects of cell structure and function, heredity, diversity, classification, evolution and interrelationships of living things, and briefly covers organs and systems in animals and plants. Laboratory activity reflects the contents of the course. **Not open to biology majors and minors. Sophomore standing is required. Every semester.**

**BIOL 201  General Biology I**  
An integrated approach to the biology of organisms covering the organization of life, energy transfer through living systems, perpetuation of life, and diversity of life. **Every semester.**

**BIOL 202  General Biology II**  
A study of the anatomy and physiology of plants and animals covering their structure, growth, nutrition, transport, reproduction, development, and control systems. This course focuses also on the relationships between structure and function, and stresses the evolutionary adaptation and changes in the different systems of the major plant and animal groups. **Prerequisite: BIOL 201. Every semester.**

**BIOL 209  Concepts and Connections**  
A course that covers the basic aspects of cell structure and function. An overview of heredity, diversity and evolution. Interrelationships of living things and a brief coverage of organs and systems in animals. Not open to biology majors and minors. **Sophomore standing is required. Every semester.**

**BIOL 210  Human Biology**  
A course that covers the fundamental principles of cell biology, genetics, and human biology, with emphasis on the morphology, physiology, and disorder of body systems. **Not open to biology majors and minors. Students cannot receive credit for all three of the following: BIOL 201, BIOL 202, BIOL 210. Every semester.**

**BIOL 220  Introductory Biochemistry**  
An introduction to the structure-function relationships of biomolecules, cells, enzymes, and the metabolic reactions of living cells. **Prerequisites: BIOL 202 and CHEM 211. Every semester.**

**BIOL 223  Genetics**  
A course that deals with the basic principles of classical and modern genetics with emphasis on the analysis of genetic material and genetic processes at the molecular level. **Prerequisite: BIOL 202. Every semester.**

**BIOL 224  Microbiology**  
A course that deals with micro-organisms, especially bacteria, and in particular those of pathogenic and industrial importance. Basic knowledge on isolation, classification, and the various metabolic processes is included in this course. **Prerequisite: BIOL 223. Every semester.**
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
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<tbody>
<tr>
<td>BIOL 225</td>
<td>Molecular Biology</td>
<td>3.0; 3 cr.</td>
<td>A course that introduces the different techniques of molecular biology and recombinant DNA technology, and discusses the most recent advances in the field. <em>Prerequisite: BIOL 223. Occasionally.</em></td>
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<tr>
<td>BIOL 230</td>
<td>Plant Morphology</td>
<td>3.3, 4 cr.</td>
<td>A study of the form and structure of the different plant divisions on the basis of similarity of plan and origin. Both reproductive and non-reproductive organs are studied. <em>Prerequisite: BIOL 202. Occasionally.</em></td>
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<tr>
<td>BIOL 233</td>
<td>Non-Vascular Autotrophs and Fungi</td>
<td>2.3; 3 cr.</td>
<td>A survey of the biology and classification of bacteria, algae, bryophytes, lichens, and fungi. Life cycles, anatomy, morphology, physiology, and ecology of each group are covered, and their role in diseases and production of food and antibiotics is emphasized. <em>Prerequisite: BIOL 202. Occasionally.</em></td>
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<tr>
<td>BIOL 234</td>
<td>Vascular Plants</td>
<td>2.3; 3 cr.</td>
<td>A course that deals with the structure, life history, and classification of vascular plants, including psilophytes, club mosses, horsetails, ferns, conifers, and flowering plants, emphasizing their evolutionary relationships. <em>Prerequisite: BIOL 202. Occasionally.</em></td>
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<tr>
<td>BIOL 235</td>
<td>Plant Anatomy</td>
<td>2.3; 3 cr.</td>
<td>A course that deals with the structure and function of tissues and organs of higher plants, their origin, and differentiation. <em>Prerequisite: BIOL 202. Occasionally.</em></td>
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<tr>
<td>BIOL 236</td>
<td>Plant Systematics</td>
<td>2.3; 3 cr.</td>
<td>A course that deals with the relationships between and among vascular plants based on evolutionary principles as expressed by systematics. The underlying principles of systematics, including modern molecular technological approaches are provided. Students deal with plant identification, and classification of the major families of local vascular plants. <em>Prerequisite: BIOL 202. Occasionally.</em></td>
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<td>BIOL 240</td>
<td>Animal Behavior</td>
<td>3.0; 3 cr.</td>
<td>A course that covers the basic concepts of animal behavior including physiological, genetic, ecological, and evolutionary aspects, as well as exploration of the controversial ideas of sociobiology. <em>Prerequisite: BIOL 202. Occasionally.</em></td>
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<tr>
<td>BIOL 241</td>
<td>Biology of Invertebrates</td>
<td>3.3; 4 cr.</td>
<td>A study of invertebrates, excluding insects, emphasizing their morphological and functional diversity, phylogenetic relationships, classification, development, and adaptation. <em>Prerequisite: BIOL 202. Annually.</em></td>
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<tr>
<td>BIOL 242</td>
<td>Comparative Vertebrate Anatomy</td>
<td>3.3; 4 cr.</td>
<td>A comparative study of the structure and function of selected examples of chordate animals with a presentation of the history of structural organization and association of structural changes with functional adaptations. <em>Prerequisite: BIOL 202. Occasionally.</em></td>
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BIOL 243  Behavioral Neuroscience  3.0; 3 cr.
An introduction to the neural basis of behavior. The course surveys the structure and organization of the human brain and how complex behavior arises from it. Prerequisite: PSYC 101 or PSYC 201. Annually.

BIOL 244  Introduction to Neurobiology  3.0; 3 cr.
A comprehensive introduction to neural signaling, brain development and regeneration in the adult brain. The course covers molecular to higher organizational level of neural functions. It emphasizes the fundamental principles and mechanisms associated with brain development and physiology including nerve communication, neurogenesis, patterning and regionalization as well as neural stem cells function. Prerequisite: BIOL 202. Annually.

BIOL 245  Environmental Physiology of Aquatic Organisms  3.0; 3 cr.
A course that describes the strategies used by aquatic animals to deal with environmental variations. Various animal physiological systems are covered with an emphasis on aquatic adaptations. Some topics such as air bladder control, electrical generation and reception, and gill excretion are specific to aquatic organisms and are introduced herein. Prerequisite: BIOL 200 or BIOL 202. Annually.

BIOL 246  Marine Biology  3.3; 4 cr.
A course that introduces the biology of life in the marine environment (microbial world, seaweeds and plants, marine animals) as well as the structure and function of the marine ecosystem (e.g., coral reefs, the ocean depths, estuaries). The impact of humans on the marine environment is also covered. Prerequisite: BIOL 202. Every semester.

BIOL 247  Animal Physiology  3.0; 3 cr.
A study of the fundamental principles and mechanisms that govern body functions in animals, with an emphasis on the molecular aspects. Prerequisites: BIOL 202 and senior standing. Annually.

BIOL 249  Parasitology  3.3; 4 cr.
A general overview on the classification, morphology, development, and physiology of human and animal parasites. Prerequisite: BIOL 202. Annually.

BIOL 250  Biosphere  3.0; 3 cr.
A course that focuses on defining global environmental problems such as global warming, acid rain, deforestation, and loss of biodiversity, and introduces methods that can help eliminate or reduce these problems. Annually.

BIOL 251  Bioinformatics  3.0; 3 cr.
Advances in high-throughput technology create a flood of biological data. The field of bioinformatics concerns computational tools for the storage, manipulation and analysis of biological data. Students will learn how to retrieve, analyze and display biological data (mainly gene sequence and gene expression data) using the statistical programming language R. The course will assume that students have a basic background in genetics and will provide the necessary background in statistics and computer programming. A background in computer programming is not required but the student should be willing to learn computational and analytical approaches. Prerequisite: BIOL 202. Annually.
BIOL 252  Ecology  
3.3; 4 cr.
A study of organisms in relation to their biotic and abiotic environment. This course deals with population growth and regulation, species diversity, age structure, succession, food chains, energy flow, and recycling of nutrients. Prerequisite: BIOL 202 or LDEM 209. Every semester.

BIOL 253  Phylogenetics  
3.0; 3 cr.
Phylogenetics is the discipline that deals with reconstructing trees of shared ancestry (i.e. phylogenetic trees). The course introduces the concept of phylogenetic trees, presents different techniques to estimate them and shows how phylogenetic trees form the basis for understanding a wide range of phenomena in Biology, such as ecological adaptation, disease spread or tumor evolution. Prerequisite: BIOL 202. Annually.

BIOL 254  Evolution  
3.0; 3 cr.
A study of the processes that bring about evolutionary changes in organisms, evolutionary trends, patterns of adaptations, and principal factors that influence the patterns of speciation. Prerequisite: BIOL 223. Annually.

BIOL 255  Marine Ecology  
3.0; 3 cr.
An introduction to the ecology of marine and brackish water ecosystems, structures and processes, with special attention to the eastern Mediterranean Sea. Interrelationships among animals, plants, and chemical and physical aspects of the environment are studied, as well as the unique adaptations for survival in these habitats. Prerequisite: BIOL 200 or BIOL 202. Occasionally.

BIOL 256  Conservation Biology  
3.0; 3 cr.
A course that deals with various environmental issues in the world today; introduces the science of conservation; and describes typical methods of conservation. Students are trained in reading scientific literature and scientific writing, and are required to research a conservation topic. Prerequisite: BIOL 200 or BIOL 202. Annually.

BIOL 258  Introduction to Aquaculture  
3.0; 3 cr.
An introduction to the general concepts of aquaculture. Topics such as culture species, culture methods, water quality, filtration, feeding, and harvesting are discussed. Uses of aquaculture for food production, biomedical research, ornamentals, or restocking programs are also introduced. Pre- or corequisite: BIOL 200 or BIOL 202. Occasionally.

BIOL 258L  Aquaculture Laboratory  
0.3; 1 cr.
The course will introduce students to the practical side of aquaculture. Students will get their hands wet. They will set up fish maintenance systems, evaluate progressive changes in water chemistry, evaluate effects of water chemistry on fish health and most importantly learn techniques used to maintain fish in healthy and sustainable environments. Students will be expected to keep a detailed log of their activities and that will be part of assessment. Pre- or corequisite: BIOL 258. Annually.

BIOL 259  Microbes and the Environment  
3.0; 3 cr.
A course that explores the various habitats of micro-organisms in nature and the interactions within. Microbial metabolic activities and their impact on the environment are discussed. The course explores the role of microbes as pathogens, particularly environmentally transmitted ones. The beneficial role of microbes in the biodegradation of pollutants is also discussed, in
addition to public health topics in microbiology. The course includes a substantial component of reading and analysis of primary research papers in environmental microbiology, in addition to presenting a poster session. *Prerequisite: BIOL 202. Annually.*

**BIOL 260  Cell Biology**
A course that provides an understanding of the structure and function of cellular organelles and components, and the functional interaction of the cell with its microenvironment. *Prerequisite: BIOL 223. Every semester.*

**BIOL 261  Biology of Cancer**
This course compares the basic biology of normal versus the malignant neoplastic state and provides a comprehensive overview of the basic biology of cancer. *Prerequisite: BIOL 223. Annually.*

**BIOL 262  Virology**

**BIOL 263  Immunology**
An introduction to basic immunology, types of immune responses, and basic aspects of the specific and non-specific body defense mechanisms, as well as primary immunological diseases and disorders. *Prerequisite: BIOL 202. Annually.*

**BIOL 264  Biology of Retroviruses**
A course that provides an understanding of the composition, genomic organization, and life cycle of animal RNA-containing retroviruses, with special emphasis on HIV, the etiological agent of AIDS. An overview of other sexually transmitted diseases and of animal viruses of pathological significance is also provided. *Prerequisite: BIOL 223. Annually.*

**BIOL 266  Oceanography**
An introduction to the basic concepts of oceanography and marine science. The course focuses on the chemical, physical, and geological processes that affect life in the oceans and on planet earth in general. Additional topics such as environmental science, conservation, world fisheries, marine resources, and effects of coastal development on life in the oceans are discussed. *Annually.*

**BIOL 266L  Oceanography Lab**
A course that introduces students to the basic concepts of oceanographic science applications. The course focuses on the chemical, physical, and geological processes that affect life in the oceans and on planet earth in general. Methods of research used by oceanographers past and present are introduced and demonstrated. *Annually.*

**BIOL 267  Limnology**
A course that introduces students to the basic concepts of freshwater riverine and limnetic systems. The course focuses on the chemical, physical, and nutrient cycling processes that affect life in freshwater bodies. It introduces various freshwater life forms, including kingdoms and phyla, and gives examples of various families. Physiological adaptations of various animals are discussed. Additional topics such as environmental science, conservation, fisheries, aquatic resources, and effects of development on life in streams, rivers, and lakes are discussed when relevant. *Annually.*

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BIOL 268  Introduction to Biotechnology  3.0; 3 cr.
An introduction of both the principles and the applications of molecular biology methods with an emphasis on the application of recombinant DNA technology to animals, plants, and microbial organisms. This course describes the use of genetically engineered products to solve environmental problems and cure human diseases. *Prerequisite: BIOL 223. Annually.*

BIOL 270  Plant Physiology  3.3; 4 cr.
A study of the vital processes that occur in flowering plants, including biophysical and metabolic processes, with emphasis on photosynthesis, growth, and development. This course also deals with plant responses to the physical environment. *Prerequisite: BIOL 220. Every semester.*

BIOL 273  Economic Plants 3.0; 3 cr.
Economic plants is the study of the relationship between people and plants. It encompasses the fields of botany, systematic, evolution, anatomy and anthropology. It explores the countless ways humans employ plants for food, medicine, textiles, shelter and more. *Prerequisite: BIOL 202. Every semester.*

BIOL 280  Endocrinology  3.0; 3 cr.
A study of the role of chemical messengers in the control of physiological and metabolic processes. This course deals with the biosynthesis, chemistry, and secretion of hormones, as well as their mechanism of action. *Prerequisite: BIOL 202. Annually.*

BIOL 281  Ichthyology  3.0; 3 cr.
A study of the different types of fish, their natural history, and environmental and ecological adaptations. It also deals with methods of conserving and culturing fish of economic value, as well as the effect of pollution on fish fauna. *Prerequisite: BIOL 202. Annually.*

BIOL 283  Reproductive Physiology  3.0; 3 cr.
An examination of the mechanisms of all major aspects of male and female mammalian reproductive physiology. Emphasis is also given to species variation with regard to reproductive function and to a detailed examination of key reproductive events in both sexes. *Prerequisite: BIOL 202. Annually.*

BIOL 284  Developmental Biology  3.3; 4 cr.
A study of basic mechanisms and molecular basis that control embryonic development in both Vertebrates and Invertebrates with special emphasis on early development and axis formation. Animal models covered include chicken, frog, mouse, drosophila, sea urchin, C. elegans and zebrafish. *Prerequisite: BIOL 202. Annually.*

BIOL 286  Entomology  3.3; 4 cr.
An introduction to the study of insects, their diversity, classification, morphology, biology, behavior; and their medical, ecological, and agricultural importance. *Prerequisite: BIOL 202. Annually.*

BIOL 290  Special Topics in Biology  1, 2, 3, or 4 cr.
Topics in biology that warrant an extensive coverage in a separate course not typically offered by the department. *May be repeated for credit. Every semester.*
BIOL 291  Undergraduate Tutorial  2 or 3 cr.
Prerequisites: Senior standing, a minimum average of 80 in the major, and consent of instructor. Graded Pass/Fail. Every semester.

BIOL 293  Undergraduate Seminar  1 cr.
Prerequisite: Senior standing. Every semester.

BIOL 295  Summer Undergraduate Research.  4 cr.
A course intended to train and recruit well-prepared students for graduate work in biology at AUB. Students will conduct a research project during the summer term, and then present and defend their findings. Prerequisites: completion of 80/120 credits, a minimum average of 75 in the major, consent of instructor and approval of the department. Every summer.

BIOL 296  Exit Survey  0.0; 0 cr.
A computer-based exit exam taken in the last semester in the BS in Biology program. Prerequisite: completion of graduation requirements for BS in Biology by the end of semester. Graded Pass/Fail. Every semester.

37 Credits in Biology

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<thead>
<tr>
<th>Modes Of Analysis</th>
<th>English and Arabic (9)</th>
<th>Humanities (12)</th>
<th>Social Sciences (6)</th>
<th>Natural Sciences (37+15)</th>
<th>Quantitative Thought (3)</th>
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<tr>
<td>Lecture courses</td>
<td>• Required Arabic course: 201A or any General Education Arabic communication skills (3) • Required English courses: 203(3), 204(3) • Required credits in the humanities: 12 credits including 6 credits from CVSP • Required (6) • Required biology (23) BIOL 201(4), 202(4), 223(4), 220(3), and two from the following four courses: 224(4), 260(4), 270(4), 252(4) • Elective biology (12+1 lab): a total of 13 credits, including a minimum of one 4-credit course • Required chemistry (9): CHEM 201(3), 211(3), 212(3) • Required physics (3): PHYS 204(3) or 205(3) • Required mathematics (3): STAT 210(3)</td>
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<tr>
<td>Seminar (1)</td>
<td>• Required: BIOL 293(1)</td>
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<td>Laboratory</td>
<td>• Required biology(5): BIOL 201(4), 202(4), 223(4), and two from the following four courses: BIOL 224(4), 252(4), 260(4), 270(4) • Elective biology(1): minimum of one 4-credit course • Required chemistry (2): CHEM 210(2) • Required physics (1): PHYS 204L(1) or 205(1)</td>
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<td>Research Project</td>
<td>• Elective biology courses (2–3): • BIOL 291(2 or 3)</td>
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<tr>
<td>Exit Survey</td>
<td>• Required: BIOL 296 (0)</td>
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</table>

1 Plus 8 free elective credits
2 At least 37 credits in Biology and 15 credits in the sciences
3 These courses include a 1-credit laboratory component and have been listed under both lecture and laboratory courses.