

Biological Sciences

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Chair: Dr. Paul Wolf (<https://www.uah.edu/science/departments/biology/faculty-staff/paul-wolf/>)

The Department of Biological Sciences offers the following undergraduate degrees:

- Biological Sciences, BS (<http://catalog.uah.edu/undergrad/colleges-departments/science/biological-sciences/biological-sciences-bs-ba/>)
- Biological Sciences, BS - Biochemistry Concentration (<http://catalog.uah.edu/undergrad/colleges-departments/science/biological-sciences/biological-sciences-bs-ba-biochemistry-concentration/>)
- Biological Sciences, BS - Ecology & Evolution Concentration (<http://catalog.uah.edu/undergrad/colleges-departments/science/biological-sciences/biological-sciences-bs-ba-ecology-evolution-concentration/>)
- Biological Sciences, BS - Pre-Professional Health Careers Concentration (<http://catalog.uah.edu/undergrad/colleges-departments/science/biological-sciences/biological-sciences-bs-ba-preprofessional-health-careers-concentration/>)

Program Objectives

The UAH Department of Biological Sciences prepares students for jobs in an evolving marketplace. Our graduates comprise the next generation of highly skilled environmental, clinical, data scientists, and other fields related to biological sciences. Our comprehensive curricula include instruction through lecture, field, and laboratory experience for our undergraduates, and meet the highest national standards.

Learning Outcomes

The UAH Department of Biology program fosters an advanced understanding of biology through phenomenon-based learning and research. Throughout the biology program, students engage in the scientific process, allowing them to understand the applications of biology to real-life scenarios.

- Biological Sciences, BS (<http://catalog.uah.edu/undergrad/colleges-departments/science/biological-sciences/biological-sciences-bs-ba/>)
- Biological Sciences, BS - Biochemistry Concentration (<http://catalog.uah.edu/undergrad/colleges-departments/science/biological-sciences/biological-sciences-bs-ba-biochemistry-concentration/>)
- Biological Sciences, BS - Ecology and Evolution Concentration (<http://catalog.uah.edu/undergrad/colleges-departments/science/biological-sciences/biological-sciences-bs-ba-ecology-evolution-concentration/>)
- Biological Sciences, BS - Pre-Professional Health Careers Concentration (<http://catalog.uah.edu/undergrad/colleges-departments/science/biological-sciences/biological-sciences-bs-ba-preprofessional-health-careers-concentration/>)
- Biological Sciences (<http://catalog.uah.edu/undergrad/colleges-departments/science/biological-sciences/biological-sciences-minor/>)

BYS 100 - INTRO HEALTH PROFESSIONS

Semester Hour: 1

Career options for undergraduate students interested in health professions. Basics of health-care delivery systems and terminology of health care. No BYS major or minor credit. Primarily for freshman and sophomores.

BYS 109 - FUNDAMENTALS OF BIOLOGY

Semester Hours: 4

This course emphasizes an understanding of the living world through discussion of biological concepts and how they relate to social sciences and humanities. Biological concepts covered include the nature of science, cellular biology, biochemistry, heredity, evolution, biological diversity, ecology, anatomy, and physiology. Not intended for biology majors. Lab included in the lecture.

BYS 119 - PRINCIPLES OF BIOLOGY

Semester Hours: 3

Introduction to biological principles of cell structure, function, metabolism, and reproduction. Prerequisite w/ Concurrency: BYS 121.

BYS 120 - ORGANISMAL BIOLOGY

Semester Hours: 3

Discussion of biological function with special emphasis on contrasting strategies employed by organisms in meeting similar biology needs. Prerequisite w/ concurrency: BYS 122.

BYS 121 - LABORATORY

Semester Hour: 1

Laboratory exercised to introduce students to accurate measurement techniques, observation, and the development of relevant hypotheses. Several formal lab reports are required as an introduction to scientific writing. Prerequisite w/ concurrency: BYS 119.

BYS 122 - ORGANISMAL BIOLOGY LAB

Semester Hour: 1

Introduction to the basic concepts of natural selection, population biology, and the biodiversity of animals and plants. Several formal lab reports are required as further introduction to scientific writing, along with a lab practical on the biodiversity of animals and plants. Prerequisite w/ concurrency: BYS 120.

BYS 205 - CODING ALGORITHMS FOR BIOLOGY

Semester Hours: 3

Prerequisites: BYS 119, BYS 120, MA 112.

BYS 214 - INFECTION & IMMUNITY

Semester Hours: 4

Lecture/Lab. Two 2-hour labs a week. Principles of microbiology with emphasis on infectious disease of humans; epidemiological and immunological aspects. No credit for students who have credit for BYS 321 or advanced microbiology courses. Recommended for students in the College of Nursing.

Prerequisites: BYS 119 and either CH 101 or CH 121 or CH 151.

BYS 214L - LABORATORY

Semester Hours: 0

BYS 215 - HUMAN ANATOMY & PHYSIOLOGY I

Semester Hours: 4

BYS 215 (I) and laboratory (one 3-hour lab per week), is designed primarily for the Nursing and Kinesiology majors. Course and laboratory material focus on the use of anatomical terminology, major tissues of the body and in-depth study of skeletal, muscular and nervous system physiology. Basic pathology is also presented to prepare students for clinicals. Laboratory material reinforces the lecture content with detailed identification of bones, joints, surface markings, and human musculature. Prerequisites: BYS 119, and one chemistry course and lab. Choose from: CH 101/CH 105; CH 121/CH 125; CH 151/CH 155.

BYS 215L - HUMAN ANAT & PHYS I LAB

Semester Hours: 0

An introduction to anatomical terminology; basic histology of normal tissues versus common pathologies. Focus on the human skeletal and muscular systems. Students are engaged in recognition of individual bones, surface markings, and major muscles through dissection and use of muscular models.

BYS 216 - HUMAN ANATOMY & PHYSIOLOGY II

Semester Hours: 4

BYS 216 (II) and laboratory (one 3-hour lab per week) is designed as a continuum for the Nursing and Kinesiology majors. Course and laboratory material focus on the structures and organization of the central and peripheral nervous system, neurotransmitters, cardiovascular, renal, respiratory, digestive, and detailed study of the endocrine systems. Basic pathology is also presented to prepare students for clinicals. Laboratory material reinforces the lecture content with dissections of key organs, study of blood flow, identification of major blood vessels and nerves, and explanations of various diagnostic tests (EKG/ECG). Prerequisite: BYS 215.

BYS 216L - HUMAN ANAT & PHYS II LAB

Semester Hours: 0

Study of the anatomy of the nervous, cardiovascular, respiratory, renal, and digestive systems. Dissections of eye, brain, heart, lung, and kidney. Basic EKG/ECG reading and a study of factors affecting blood pressure. Enzymatic action of the digestive system; basic urinalysis determinations.

BYS 219 - GENETICS AND EVOLUTION

Semester Hours: 3

Hereditary basis of organisms; genes as the discrete units of inheritance, and genes in organisms and populations. Mendelian principles and evolutionary processes. Replication, transcription, and translation of DNA, RNA, and proteins. Prerequisite w/concurrency: BYS 221. Prerequisites: BYS 119, BYS 120 and (CH 101 or CH 121) and (MA 107 or MA 112).

BYS 221 - LABORATORY

Semester Hour: 1

Laboratory activities include experiments to further students understanding in Mendelian genetics, molecular biology, and human genetic diseases. Prerequisite w/concurrency: BYS 219.

BYS 292 - INTRO TO BIOLOGICAL RESEARCH

Semester Hours: 3

Introduction to the principles and practices of biological research. Covers experimental design, statistical analysis, critical review of journal articles, responsible conduct of research, and writing for the biological sciences. Recommended for students planning to do undergraduate research.

Prerequisites: BYS 119, MA 112, EH 101.

BYS 300 - CELL & DEVELOPMENTAL BIOLOGY

Semester Hours: 4

Lecture/Lab. One lab per week. Introduces the student to topics in cell and developmental biology. Subjects include cell structure, organelles, cytoskeleton, secretory pathway, cell division, cell cycle, cell interaction and control of differentiation. Prerequisites: BYS 219 (C- or better) and either CH 123 or 201.

BYS 300L - CELL & DEVELOPMENT BIO LAB

Semester Hours: 0

BYS 301 - ELEMENTARY BIOCHEMISTRY

Semester Hours: 3

Biochemistry and energetics of living cells, metabolism, structure and function of carbohydrates, lipids, proteins, and nucleic acid. Enzymes, coenzymes, vitamins, blood, endocrine glands, DNA synthesis, and gene expression. Same as CH 301. Prerequisites: BYS 119, BYS 120 and CH 201 or CH 331.

BYS 302 - PEOPLE, PLANTS & ENVIRONMENT

Semester Hours: 3

This course is designed to introduce students from multiple departments to the vital roles that plants have in our ecosystems through the study of basic plant and soil science. Special attention is placed on the impact that plants have on our technology-based society.

BYS 311 - INTRO MOLECULAR UNDSST BIO SYST

Semester Hours: 3

Introduction to a molecular understanding of genes, gene expression, and genetic engineering in selected prokaryotic and eukaryotic systems. Includes examples of biotechnology applications. Prerequisite: CH 331.

BYS 312 - PRINCIPLES OF ECOLOGY

Semester Hours: 4

Lecture/Lab. One lab a week. Population structure and growth, competition, predation, symbiosis, biogeochemical cycling and energy flow, disturbance and community dynamics, biodiversity and conservation. Field trips required. Prerequisite: BYS 120.

BYS 313 - ANATOMY & PHYSIOLOGY I

Semester Hours: 4

Lecture/Lab. One lab a week. Structure and function of the human body. Anatomy of the skeletal and muscular systems, physiology of membranes, cellular and epithelial transport and nervous system function. Appropriate preparation for professional schools/graduate study in biological sciences. Prerequisite: BYS 119. Prerequisites with concurrency: BYS 300, and either CH 201 or CH 331.

BYS 313L - LABORATORY

Semester Hours: 0

Laboratory activities on the basic concept of system physiology including a rat dissection. Focuses on membrane transport and histology, and include gross anatomy and a study of the muscles and bones of the human body. Capstone student research project on electromyography of muscles.

BYS 314 - ANATOMY & PHYSIOLOGY II

Semester Hours: 4

Lecture and one lab a week. Continuation of BYS 313 stressing structural and functional relationships of major organ systems, focusing on heart, brain, lungs, kidney, and the gastrointestinal tract. Appropriate for students preparing for professional schools or graduate study in biological sciences. Prerequisite: BYS 313 (C- or better).

BYS 314L - ANATOMY & PHYSIOLOGY II LAB

Semester Hours: 0

Research-intensive system-based laboratory course. Includes brain dissection, a student EEG project, heart dissection, and a cardiovascular physiology project. This is followed by a pulmonary function lab and a renal function lab where students calculate their own glomerular filtration rate.

BYS 315 - ICHTHYOLOGY

Semester Hours: 4

Classification, anatomy, physiology, and ecology of freshwater and marine fishes. Emphasizes fishes of north Alabama. Laboratory and field trips required. Prerequisites: BYS 120 and BYS 219. Prerequisite with concurrency: BYS 300.

BYS 317 - VERTEBRATE ZOOLOGY

Semester Hours: 5

Lecture/Lab. Two three-hour labs a week. Morphology of vertebrate animals. Relationship of organs and systems and their phylogenetic significance. Prerequisites: BYS 120 and BYS 219. Prerequisite with concurrency: BYS 300.

BYS 318 - VERTEBRATE REPRODUCTION

Semester Hours: 3

General treatment of the major concepts and controversial areas of comparative vertebrate reproduction: ecological and evolutionary aspects, development of reproductive functions and sexual behavior, seasonal breeding and other topics of current interest. Prerequisites: BYS 120 and BYS 219. Prerequisite with concurrency: BYS 300.

BYS 320 - MEDICAL TERMINOLOGY

Semester Hours: 3

The meaning, spelling, etymology and pronunciation of major medical terms related to anatomy, pathology, medical professions, procedures and pharmaceuticals; body systems, their associated diseases and disorders. Correct usage of terms and interpretation of documents containing these terms. Hybrid course with online and in-class portions. Prerequisites: BYS 300 or BYS 215 and BYS 216.

BYS 321 - GENERAL MICROBIOLOGY I

Semester Hours: 4

Structure, biochemistry, and genetics of microorganisms, control of microbial growth, and microorganisms as pathogens. Lab covers basic and diagnostic methods in microbiology, environmental factors controlling microbial growth and survival, and characteristics of medically important microorganisms. Prerequisites: BYS 120, BYS 219. Prerequisite with concurrency: BYS 300.

BYS 321L - LABORATORY

Semester Hours: 0

BYS 347 - BIOPHYSICAL CHEMISTRY I

Semester Hours: 3

First and second laws of thermodynamics. Free energy and equilibrium. Colligative properties of solutions. Ionic equilibria. Electrochemistry. Reaction kinetics. Enzyme catalysis. Adsorption and surface tension. Same as CH 347. Prerequisites: CH 332, PH 112, PH 115 and MA 172.

BYS 348 - BIOPHYSICAL CHEMISTRY II

Semester Hours: 3

Viscosity, diffusion, sedimentation, electrophoresis, determination of molecular weight by osmotic pressure. Light scattering and photochemistry. Elementary IR, UV-VIS, ESR, NMR spectroscopy. Fluorescence. Optical rotation. Same as CH 348. Prerequisites: BYS 347 or CH 347.

BYS 361 - GENERAL BIOCHEMISTRY

Semester Hours: 3

Biochemical structure and function of amino acids, proteins, carbohydrates, lipids, and nucleic acids; Enzyme catalysis and kinetics; major catabolic pathways, their integration and control mechanisms: Glycolysis, Citric Acid Cycle, Fatty Acid Oxidation and Oxidative Phosphorylation. Same as CH 361. Prerequisites: (BYS 119, BYS 120, CH 332 and CH 335) or (BYS 311, CH 332 and CH 335).

BYS 362 - GENERAL BIOCHEMISTRY LAB

Semester Hour: 1

One 3-hour lab a week. Practical experience in isolation, qualitative identification, and quantitative estimation of biomolecules. Same as CH 362. Prerequisites: CH 335 and CH 336. Prerequisite with concurrency: CH 361.

BYS 363 - GENERAL BIOCHEMISTRY II

Semester Hours: 3

A continuation of BYS 361 to include amino acid oxidation, biosynthesis of biomolecules, integration of metabolism, DNA and RNA metabolism, protein biosynthesis, and gene structure. Same as CH 363. Prerequisites: BYS 361 (C- or better).

BYS 364 - BIOGEOGRAPHY

Semester Hours: 3

Why plants and animals live where they do. Principles governing plant and animal distribution and dispersal, using the communities of North America as prime examples. Strongly recommended: BYS 312. Prerequisites: BYS 120, BYS 219. Prerequisite with concurrency: BYS 300.

BYS 365 - GENERAL BIOCHEMISTRY LAB II

Semester Hour: 1

Experimental course illustrating the topics in BYS 363. Prerequisites: BYS 361 and BYS 362. Prerequisite with concurrency: BYS 363.

BYS 403 - ADV EXERCISE PHYSIOLOGY

Semester Hours: 4

Lecture/Lab. One lab per week. Human physiology, addressing the effects of environmental variables such as altitude, thermal stress, and terrain on the major physiological systems of the body; in-depth analysis of resistance training, aerobic and anaerobic training; integration of multiple systems. Prerequisites: BYS 401, and (BYS 301 or CH 301) or (BYS 361 or CH 361).

BYS 405 - PSYCHOPHARMACOLOGY

Semester Hours: 3

Introduction to drug classification and action with emphasis on physiological and psychological interactions.

BYS 417 - PRINCIPLES OF PLANT PHYSIOLOGY

Semester Hours: 4

The objectives in the development of this course is to provide students with an opportunity to: (1) study the principles of plant physiology (2) to gain an understanding of the complexity of plant genetics and stress response pathways (hormones) as well as (3) to appreciate how dependent we are on plants from those in our forests and environment to those in agricultural production and beyond. Laboratory experiments will provide an additional opportunity for students to take the lecture material and gain actual experience in the growth, nutritional requirements, and maintenance of a wide variety of plants through the semester via work on campus as well as in the UAH Greenhouse. Prerequisites: BYS 120 and BYS 219.

BYS 419 - MICROBIAL GENETICS

Semester Hours: 3

Transmission, expression, and evolution of genes in microorganisms. Studies of chromosomes, plasmids, transposons, bacteriophages, and other genetic elements. Prerequisites: BYS 219, BYS 300 and BYS 321.

BYS 420 - MICROBIAL BIOTECHNOLOGY

Semester Hours: 4

Microbial Biotechnology is an advanced Graduate/Undergraduate course that provides insight of how bacteria, viruses, and fungi are manipulated and used to solve human problems. This course is designed based on topics recommended by American Society of Microbiology. Prerequisites: BYS 419.

BYS 430 - IMMUNOLOGY

Semester Hours: 4

Lecture/Lab. One 3-hour lab per week. Innate, humoral, and cell-mediated immunity. Immune deficiencies and hypersensitivities. Autoimmunity, transplantation, and tumor immunology. Prerequisites: BYS 219, BYS 300 and BYS 321. Prerequisite with concurrency: CH 361.

BYS 431 - BIOLOGICAL DATA SKILLS

Semester Hours: 3

This course covers a range of computational skills needed specifically for biologists who do not have any training in computer science. The course focuses on command line tools, basic programming in Python, and various aspects of data handling including, data curation, organization, storage, querying, and archiving. The course will include a project that ties together skills that are useful for individual students.

BYS 432 - PRINC OF SIGNAL TRANSDUCTION

Semester Hours: 2

This course will introduce the broad principles of intracellular signal transduction. More detail lectures on specific intracellular signaling pathways will be given where students will learn both the basic and the most recent and cutting edge concepts of intracellular signaling. Appropriate for undergraduate and graduate studies in biological sciences, researchers new to the field and those actively working in the general area.

BYS 433 - RESEARCH SEMINAR ATTENDANCE

Semester Hour: 1

This course gives upper level biology majors a chance to gain exposure to research in biology. Students will attend seminars and learn about how research projects are planned and interpreted. Additionally they will learn how scientists present their research. Prerequisite: BYS 300.

BYS 436 - BIOLOGICAL PSYCHOLOGY

Semester Hours: 3

Functional analysis of neural and endocrine systems underlying behavior. Same as PY 436. Prerequisites: 15 hours of PY or approval of instructor, and BYS 120 or BYS 313, and 6 hours of PY.

BYS 437 - PSYCHOBIOLOGY STRESS & ILLNESS

Semester Hours: 3

Overview of psychological stress responses and their influence on health, behavior, and illness. Same as PY 437. Prerequisites: approval of instructor.

BYS 461 - HERPETOLOGY

Semester Hours: 4

Classification, diversity, anatomy function, ecology, behavior, and evolution of amphibians and reptiles. Laboratory and field trips devoted to anatomy and identification, with an emphasis on Alabama and southeastern U.S. species. Prerequisites: BYS 120 and BYS 219.

BYS 464 - EVOLUTION

Semester Hours: 3

Principles of evolution and speciation. Nature of species, selection and adaptation, divergence and cladogenesis, isolation, hybridization, and phylogeny. Prerequisites: BYS 120, 219. Prerequisites with concurrency: BYS 300.

BYS 466 - ORNITHOLOGY

Semester Hours: 4

An examination of birds, including classification, diversity, anatomy, function, ecology, behavior, and evolution. Laboratory and field trips devoted to anatomy and identification, with an emphasis on Alabama and southeastern U. S. species. Prerequisites: BYS 120, BYS 219 and BYS 312 w/ concurrency.

BYS 467 - ANIMAL BEHAVIOR

Semester Hours: 3

This course examines the role of animal behavior in survival and reproduction. It emphasizes the genetic, morphological, and physiological basis of behavior. Particular emphasis is placed on the mechanisms underlying behavior and their evolutionary significance.

BYS 490 - SENIOR CAPSTONE

Semester Hours: 2

Discussions, readings, and presentations of topical biological subjects using scientific literature. Capstone course emphasizing refinement of oral and written communication skills and critical thinking. All students will take ETS Major Field Test in Biology as part of the course grade. Prerequisites: BYS 119, 120, 219, and 300. Senior standing.

BYS 491 - SPECIAL TOPICS BIOLOGICAL SCI

Semester Hours: 1-4

Directed readings and/or written reports on topics of interest to individual students carried out under supervision of an instructor. Prerequisites: Permission of instructor required before registration.

BYS 492 - UNDERGRADUATE RESEARCH

Semester Hours: 2-4

For advanced-level biological sciences students with biological sciences GPA of 3.5 or above. Individual investigations into biological problems under direct supervision of instructor. May also be taken at the Marine Environmental Sciences Consortium, Dauphin Island, Alabama. Prerequisites: Permission of instructor required before registration.

BYS 499 - UNGRAD HONORS RES & THESIS

Semester Hours: 2-4

Individual investigations into biological problems under direct supervision of instructor. For honors students majoring in the biological sciences. Prerequisites: Approval of instructor, chair, and director of honors program; senior standing.

Marine Sciences

Select courses in marine sciences, available through the Marine Sciences Consortium at The Dauphin Island Sea Lab (<http://www.disl.org/>), may be taken for credit at UAH toward a biological sciences major or minor, a minor in marine sciences, or a Master of Science degree in biological sciences. Marine sciences coursework must be approved by the Marine Sciences Consortium UAH liaison officer in the Biological Sciences Department prior to enrollment in the courses.

MS 202 - MARINE BIOLOGY

Semester Hours: 4

Survey of invertebrates, vertebrates, and marine plants as communities with local examples. Examination of marshland, estuarine, beach, dune, inlet and neritic habitats, and niches. Lecture/Lab/field work. Offered only at the Marine Environmental Sciences Consortium Sea Lab at Dauphin Island, AL.

Prerequisites: BYS 119 and BYS 120.

MS 204 - COM MARINE FISHERIES/ALA

Semester Hours: 2

Biology, harvesting technology, and processing of commercially valuable fish and shellfish species of Alabama. Offered only at the Marine Environmental Sciences Consortium Sea Lab at Dauphin Island, Alabama. No credit for biological sciences major or minor; can be used for marine science minor.

MS 301 - MARINE TECH METHODS I

Semester Hours: 2

Marine science research equipment, methods, and techniques. Operation and field maintenance of major sampling gear. Only at the Marine Environmental Sciences Consortium Sea Lab at Dauphin Island, Alabama. No credit for biological sciences major or minor; can be used for a marine science minor. Prerequisites: BYS 119 and BYS 120.

MS 303 - COASTAL CLIMATOLOGY

Semester Hours: 2

Physical factors resulting in climatic conditions in and near coastal region. Emphasis on northern Gulf of Mexico. Only at the Marine Environmental Sciences Consortium Sea Lab at Dauphin Island, Alabama. No credit toward a biological sciences major or minor; can be used for a marine science minor.

MS 304 - COASTAL ZONE MANAGEMENT

Semester Hours: 2

Examination of ecological features and physical management policies design for coastal communities and a review of the federal and state programs that impinge upon coastal ecological communities. Only at the Marine Environmental Sciences Consortium Sea Lab at Dauphin Island, Alabama.

MS 491 - SPECIAL TOPICS IN MARINE SCIEN

Semester Hours: 1-4