Biological Science

Course Learning Outcomes are measurable statements that are used to identify the specific knowledge and skills that a student should have at the end of a course.

BIOL 1100
L1- Examine the processes by which scientific knowledge is gained.
L2- Demonstrate a working knowledge of the basic concepts and terminology of the biological sciences.
L3- Explore how scientific knowledge influences human society.

BIOL 1101
L1- Explain the basic concepts of cells as the fundamental unit of life.
L2- Understand and apply the basic concepts of cell energetics.
L3- Demonstrate a working knowledge of the processes of cell division, heredity, and molecular biology.
L4- Discuss and evaluate the basic concepts of ecology and evolution.
L5- Understand how the biological sciences explain the natural world and begin the process of developing critical thinking skills.
L6- Understand basic concepts and develop critical thinking skills that will serve as a foundation for more advanced biology courses.

BIOL 1101L
L1- Explain the basic concepts of cells as the fundamental unit of life.
L2- Understand and apply the basic concepts of cell energetics.
L3- Demonstrate a working knowledge of the processes of cell division, heredity, and molecular biology.
L4- Discuss and evaluate the basic concepts of ecology and evolution.
L5- Understand how the biological sciences explain the natural world and begin the process of developing critical thinking skills.
L6- Understand basic concepts and develop critical thinking skills that will serve as a foundation for more advanced biology courses.

BIOL 1102
L1- To explain how phylogenetic methods are used to study diversity and reconstruct evolutionary history.
L2- To investigate the development of diversity of all organisms.
L3- To investigate the relationship between plant form & function.
L4- To investigate the relationship between animal form & function.

BIOL 1102L
L1- To learn to recognize and classify living organisms.
L2- To investigate the relationship between plant form & function.
L3- To investigate the relationship between animal form & function.
L4- To practice the scientific method on one or more concepts relevant to topics in objectives 2 – 3.
L5- To apply critical reading and writing skills in the biological sciences.

BIOL 1192
L1- Expose students to career paths, challenges, and background needed to pursue a career in Ecology, Conservation Biology or related fields.
L2- Develop an understanding of the primary fields of study in Ecology and Conservation Biology by presenting a peer-reviewed study from a sub-discipline of interest.
L3- Understand the importance of documenting personal employment experience to present to potential employers.

BIOL 2206
L1- Definition of the macromolecules composing a cell and their role in cellular physiology and metabolism.
L2- Recognition of the metabolic pathways composing the chemistry common to all cells.
L3- Comprehension of the inter-connection of the individual pathways composing cellular signaling and the role these play in the integrity of a macromolecular organism.

BIOL 2207
L1- Gain an appreciation for the diversity of cellular form and function.
L2- Gain skills necessary for cellular manipulations and visualization.
L3- Gain skills necessary for macromolecular manipulations and visualizations.
L4- Learn scientific communication.

BIOL 2209
L1- Learn about a coarse classification of the biosphere (earth) based on biomes.
L2- Further student learning in evolution and population genetics beyond the BIOL 1101 level.
L3- Learn about the adaptations and constraints of organisms to abiotic environmental factors (physiological ecology).
L4- Learn about behavioral adaptations and constraints of organisms to conspecific interactions (behavioral ecology).
L5- Learn about methods and issues for description of population distributions, demographics, growth patterns, and life histories (population ecology).
L6- Learn about methods and issues for describing population interactions.
L7- Learn about methods and issues for describing ecological communities (community ecology).
L8- Learn about methods and issues for description of ecosystem and global systems (ecosystem and global ecology).

BIOL 2209L
L1- Gain experience in using field techniques common to ecological research.
L2- Learn to use computer tools to present and analyze ecological data.
L3- Explore real world applications of ecological research.
L4- Learn about creating a scientific paper.

BIOL 2213
L1- Learn common and scientific names of plants.
L2- Gain knowledge and appreciation of local plants, plant communities, and their uses by man and other organisms.
L3- Learn about some native plants with culinary, medicinal and survival uses.
L4- Learn the basic skills and terminology to identify plants.
L5- Develop the knowledge to collect and preserve plant specimens.
L6- Learn about the publications and resources available for plant identification and study.

BIOL 2214
L1- Learn common and scientific names of plants.
L2- Gain knowledge and appreciation of local plants, plant communities, and their uses by man and other organisms.
L3- Learn about some native plants with culinary, medicinal and survival uses.
L4- Learn the basic skills and terminology to identify plants.
L5- Develop the knowledge to collect and preserve plant specimens.
L6- Learn about the publications and resources available for plant identification and study.

BIOL 3301
L1- Demonstrate a working knowledge of the structures of the primary anatomical systems.
L2- Demonstrate a working knowledge of normal and abnormal physiological processes.

L3- Demonstrate a working knowledge of how the different body systems integrate to sustain life, health, and function.

BIOL 3301L
L1- Demonstrate a working knowledge of the structures of the primary anatomical systems.
L2- Demonstrate a working knowledge of normal and abnormal physiological processes.
L3- Demonstrate a working knowledge of how the different body systems integrate to sustain life, health, and function.

BIOL 3302
L1- Demonstrate a working knowledge of the structures of the primary anatomical systems.
L2- Demonstrate a working knowledge of normal and abnormal physiological processes.
L3- Demonstrate a working knowledge of how the different body systems integrate to sustain life, health, and function.

BIOL 3302L
L1- Demonstrate a working knowledge of the structures of the primary anatomical systems.
L2- Demonstrate a working knowledge of normal and abnormal physiological processes.
L3- Demonstrate a working knowledge of how the different body systems integrate to sustain life, health, and function.

BIOL 3307
L1- Develop a basic understanding of the effect of radiation on biological entities.
L2- Understand the effect of cellular response to radiation on the progression of human disease.

BIOL 3310
L1- Knowledge of the diversity of invertebrate animals.
L2- Knowledge of how the different phyla are related evolutionarily.
L3- Professional Practice in Biology.

BIOL 3310L
L1- Knowledge of the diversity of invertebrate animals.
L2- Knowledge of how the different phyla are related evolutionarily.
L3- Professional Practice in Biology.

BIOL 3316
L1- Gain facility in Excel, Minitab and R.
L2- Gain understanding of probability.
L3- Gain understanding of basic concepts in mathematical statistics.
L4- Learn and apply basic null hypothesis testing procedures.

BIOL 3324
L1- Understand the developmental basis of anatomical structure and organization in plants and animals.
L2- Understand the cellular and molecular mechanisms underlying developmental processes.
L3- Read and understand current developmental biology literature.

BIOL 3324L
L1- Obtain first-hand knowledge of living embryos and developmental processes.
L2- Practice writing in a standard scientific format.

BIOL 3337
L1- Understand the primary factors that lead to conservation threats.
L2- Understand proposed solutions to conservation threats.
L3- Understand how scientific studies test conservation hypotheses.
L4- Provide a review and synthesis of a research topic in Conservation Biology.

BIOL 3358
L1- Apply concepts of inheritance of genetic traits.
L2- Apply principles of DNA metabolism to gene expression.
L3- Recognize the role of genetic variability and natural selection in evolution.
L4- Apply principles of genetic manipulation in recombinant DNA technology.

BIOL 4400
L1- Understand development and function of cells, tissues, and organs.
L2- Understand principles of embryogenesis with focus on oral structures.
L3- Describe histologic characteristics of oral tissues in health and disease.

BIOL 4400L
L1- Understand development and function of cells, tissues, and organs.
L2- Understand principles of embryogenesis with focus on oral structures.
L3- Describe histologic characteristics of oral tissues in health and disease.

BIOL 4404
L1- Explain how mass and energy flow through plants.
L2- Explain how growth and development are regulated in plants.
L3- Appreciate the functional diversity among land plants.

BIOL 4404L
L1- Explain how mass and energy flow through plants.
L2- Explain how growth and development are regulated in plants.
L3- Appreciate the functional diversity among land plants.

BIOL 4405
L1- To describe salient anatomical features of vascular land plants relevant for scientific investigations of plant function.
L2-To describe salient physiological functions in plants that influence their performance in natural and-or experimentally controlled environments.
L3- To apply process of science skills to answer questions in plant biology that integrate knowledge of plant anatomy and plant physiology.

BIOL 4405L
L1- Describe salient anatomical features of vascular land plants.
L2- Describe physiological functions influencing plant performance.
L3- Develop oral communication skills in plant biology.
L4- Apply process of science skills to plant biology research.

BIOL 4406
L1- Describe and interpret the evolutionary history of plants.
L2- Comprehend the theory of organic evolution as it applies to plant diversity.
L3- Apply process of science skills to the study of plant diversity and evolution.

BIOL 4406L
L1- Identify major lineages of terrestrial plants.
L2- Develop oral communication skills in plant biology.
L3- Apply process of science skills to plant biology research.

BIOL 4408
L1- Learn about a coarse classification of the biosphere based on biomes.
L2- Learn about the physiological adaptations of plants to abiotic environmental factors.
L3- Learn about soil minerals and below ground interactions.
L4- Learn about population distributions, demographics, growth patterns, and life histories.
L5- Learn about methods and issues for describing population interactions.
L6- Learn about methods and issues for describing ecological communities.
L7- Learn about methods and issues for ecosystem and global ecological systems.

BIOL 4408L
L1- Learn about a coarse classification of the biosphere based on biomes.
L2- Learn about the physiological adaptations of plants to abiotic environmental factors.
L3- Learn about soil minerals and below ground interactions.
L4- Learn about population distributions, demographics, growth patterns, and life histories.
L5- Learn about methods and issues for describing population interactions.
L6- Learn about methods and issues for describing ecological communities.
L7- Learn about methods and issues for ecosystem and global ecological systems.

BIOL 4413
L1- Become aware of strengths and weaknesses in biology content and teaching skills.
L2- Understand and confidently use various teaching methods such as inquiry, discussion, and demonstration.
L3- Effectively use resources and technology to improve teaching.
L4- Create, critique, and implement science lessons.
L5- Demonstrate mastery of major biology concepts and themes.
L6- Use resources that promote professional development.
L7- Reflect on teaching and professional development.
L8- Design and implement assessment strategies that improve biology teaching.

BIOL 4415L
L1- Understand the divisions of the nervous system and neural imaging techniques.
L2- Understand neuron and glia function, membrane potentials, neurotransmission, and neural development.
L3- Understand the relationship between meninges, CSF, and the blood-brain barrier.
L4- Identify and describe anatomy of spinal cord, brainstem, diencephalon, telencephalon, and cranial nerves.
L5- Understand transduction and processing in sensory systems: somatosensory, visual, auditory, olfactory, gustatory.
L6- Understand motor control pathways and central modulation of movement.
L7- Understand brain regions involved in speech, learning, and memory.

BIOL 4417
L1- Comprehend processes of evolutionary change: drift, selection, recombination, mutation.
L2- Understand evolutionary impacts on diversification, adaptation, and complexity.
L3- Explain evolution’s role in other biological fields and history of evolutionary biology.
L4- Interpret phylogenetic trees and Hardy-Weinberg deviations.
L5- Read and understand contemporary literature in evolutionary biology.

BIOL 4419
L1- Understand cellular and extracellular organization into tissues, organs, and organ systems.

BIOL 4419L
L1- Reinforce tissue and organ knowledge via microscope work.
L2- Gain practical histology skills, including slide preparation and tissue identification.

BIOL 4423
L1- Examine protozoan diversity and diseases they cause.
L2- Examine diversity and disease impact of trematodes, cestodes, and nematodes.
L3- Understand parasitic arthropods as vectors and parasites.

BIOL 4427
L1- Understand fish taxonomy and phylogeny.
L2- Explain morphological, behavioral, and physiological adaptations in fish.
L3- Design studies testing hypotheses about fish biology and interpret resulting data.

BIOL 4427L
L1- Design and execute studies testing taxonomic hypotheses.
L2- Understand scientific writing structure and prepare a manuscript.
L3- Identify fish using dichotomous keys to family and species level.

BIOL 4431
L1- Describe insect diversity and anatomical features.
L2- Describe insect life cycles and field identification.
L3- Understand ecological, economic, and medical importance of insects.
L4- Demonstrate professional biology practices including scientific communication.

BIOL 4431L
L1- Identify insects using dichotomous keys and collections.
L2- Demonstrate professional practices in biological fieldwork and lab documentation.

BIOL 4433
L1- Understand prokaryotic structure and function.
L2- Explore unusual microbial metabolism and research integration.
L3- Interpret and critically engage with microbiology literature.

BIOL 4433L
L1- Practice core biochemistry and microbiology lab skills.
L2- Complete research tasks and final reports.

BIOL 4435
L1- Describe vertebrate evolutionary history and phylogeny.
L2- Read and explain vertebrate paleontology literature.
L3- Conduct supervised paleontological research projects.

BIOL 4437
L1- Maintain scientific notebooks and write formal reports.
L2- Prepare and measure biochemical solutions.
L3- Apply advanced biochemical concepts through calculations and inquiry.
L4- Use standard lab techniques including electrophoresis and spectroscopy.

BIOL 4438
L1- Understand origin, evolution, adaptations, and conservation of birds.
L2- Identify avian morphology and taxonomy.

BIOL 4439
L1- Identify physical, chemical, and biological preservation agents.
L2- Use the scientific method in geological, biological, and archeological taphonomic problems.

BIOL 4441
L1- Understand mammalian evolution, classification, and adaptive strategies.
L2- Identify North American mammals and their anatomical/ecological traits.
L3- Apply mammalogy field and laboratory techniques.

BIOL 4441L
L1- Understand mammalian evolution, classification, and adaptive strategies.
L2- Identify North American mammals and their anatomical/ecological traits.
L3- Apply mammalogy field and laboratory techniques.

BIOL 4442
L1- Describe and discuss major areas of plant-animal interactions in terms of ecology, evolution, genetics, behavior, and coevolution.

L2- Apply concepts and principles to interpret and discuss primary literature on plant-animal interactions.
L3- Summarize, synthesize, and interpret a topic in plant-animal interactions based on primary literature.

BIOL 4444
L1- Understand mechanisms driving cellular function: DNA/RNA/protein roles, cytoskeleton, energy cycles, and disease relevance.
L2- Learn in vitro/in vivo techniques and their applications in molecular biology and medicine.
L3- Understand science as a process: data interpretation, model creation, and experimental design.

BIOL 4444L
L1- Learn and apply in vitro/in vivo techniques used in molecular biology analysis of cellular functions.
L2- Apply techniques in a directed experimental protocol.
L3- Present findings in the format of a peer-reviewed, discipline-specific journal.

BIOL 4445
L1- Introduction to basic biochemical systems and terminology.
L2- Recognize chemical and physical properties of biomolecules and metabolic pathways.
L3- Understand enzyme function and kinetics.
L4- Grasp biochemical equilibria, buffers, and thermodynamics.
L5-Understand core metabolic pathways and dysfunctions.

BIOL 4447
L1- Understand metabolism and biosynthesis of lipids, amino acids, and nucleotides.
L2- Comprehend mechanisms and diseases related to cell signaling.
L3- Understand replication, transcription, translation, and protein synthesis problems.
L4- Gain understanding of nucleic acid chemistry and metabolism.

BIOL 4450
L1- Understand structures, functions, and interrelationships of the head and neck within systemic anatomy.
L2- Acquire comprehensive knowledge of skeletal, muscular, nervous, and circulatory systems for dental application.
L3- Apply anatomical knowledge to intraoral injection techniques in lab settings.

BIOL 4451
L1- Describe antigen-antibody interactions in immune responses.
L2- Explain immunological diseases, immunization methods, and infectious disease immunobiology.
L3- Comprehend clinical immunodiagnosis and immunological assays.

BIOL 4451L
L1- Describe and perform immunological assays including agglutination, precipitation, ELISA, electrophoresis, and immunoblotting.
L2- Conduct antibody production in animal models and write a scientific research paper on results.

BIOL 4454
L1- Perform literature review on fungal immunodiagnosis.
L2- Design and conduct immunological experiments.
L3- Analyze experimental data and present findings.
L4- Collaborate in research groups and write research reports.

BIOL 4455
L1- Describe attributes of pathogens and their roles in disease.
L2- Explain organ-system-based bacterial diseases and defenses.
L3- Comprehend viral pathogenesis by system and immune responses.
L4- Understand fungal, chlamydial, and rickettsial diseases and defenses.

BIOL 4455L
L1- Master fundamental microbiology lab techniques.
L2- Identify bacterial unknowns using learned methods.

BIOL 4459
L1- Explain ecological factors influencing fish distribution and abundance.
L2- Describe study designs and interpret ecological data.

BIOL 4459L
L1- Design, execute, and analyze a study on fish abundance.
L2- Understand and apply scientific writing in ecology.

BIOL 4460
L1- Understand neurobiology, neural development, and signal transmission.
L2- Comprehend brain anatomy, CSF, and neurovascular systems.
L3- Explain sensory and motor systems and brain integration functions.

BIOL 4461
L1- Understand microbial DNA replication, repair, and recombinant applications.
L2- Explain transcription and translation regulation in microbes.
L3- Comprehend phage life cycles and genetic transfer roles.

BIOL 4462
L1- Describe physical, biological, and ecological traits of freshwater systems.
L2- Explain organismal interactions and material/energy flow in ecosystems.
L3- Apply scientific processes in independent freshwater ecology research.

BIOL 4462L
L1- Identify aquatic organisms and explain their ecological roles.
L2- Analyze physical properties and their influence on freshwater habitats.
L3- Evaluate species interactions and ecosystem processes in the field.

BIOL 4463
L1- Explain cell injury, inflammation, and tissue repair mechanisms.
L2- Understand genetic, immune, and neoplastic disorders.
3- Describe cardiovascular and respiratory system diseases.
L4- Comprehend endocrine, renal, musculoskeletal, and neural disorders.

BIOL 4463L
L1- Explain cell injury, inflammation, and tissue repair mechanisms.
L2- Understand genetic, immune, and neoplastic disorders.
3- Describe cardiovascular and respiratory system diseases.
L4- Comprehend endocrine, renal, musculoskeletal, and neural disorders.

BIOL 4466
L1- Classify medically important fungi by morphology and taxonomy.
L2- Define diagnostic techniques and antifungal treatments.
L3- Explain fungal pathogenesis and research appreciation.

BIOL 4469
L1- Search and critically read current microbiology literature.
L2- Develop field and observational skills in microbial ecology.

BIOL 4473
L1- Design and execute research in applied microbiology.
L2- Develop lab skills and discover-driven research capabilities.
L3- Analyze microbial roles in environmental systems.

BIOL 4473L
L1- Design and execute research in applied microbiology.
L2- Develop lab skills and discover-driven research capabilities.
L3- Analyze microbial roles in environmental systems.

BIOL 4475
L1- Identify major groups of animal, plant, and bacterial viruses.
L2- Describe viral molecular biology by genome type.
L3-Explain mechanisms of virus-induced disease.

BIOL 4486
L1- Understand physiological concepts and human body systems.
L2- Solve clinical problems and discuss case studies.
L3- Conduct lab research and present clinical applications.

BIOL 4486L
L1- Understand physiological concepts and human body systems.
L2- Solve clinical problems and discuss case studies.
L3- Conduct lab research and present clinical applications.

BIOL 4488
L1- Understand radiation effects at cellular and organism levels.
L2- Explore literature and communicate scientific findings clearly.

BIOL 4489
L1- Plan, conduct, and report ecological field investigations.
L2- Critically evaluate empirical evidence and peer feedback.

BIOL 4491
L1- Analyze a biological book and expand biological understanding.

BIOL 4492
L1- Analyze a biological book and expand biological understanding.

BIOL 4495
L1- Understand principles of animal behavior and analysis.
L2- Conduct original behavioral studies and communicate results.