Subareas/Courses	BIOL 2131	BIOL 2111	BIOL3132	BIOL3112	BIOL3133	BIOL3240	BIOL3113
CELL STRUCTURE AND PROCESSES							
Understand cell structure and function							
•demonstrating knowledge of the components of cells	X						
•comparing the characteristics of prokaryotic and eukaryotic cells	X		X	X		X	
•analyzing the interactions among cell organelles	X						
•demonstrating knowledge of the structure and function of different types of cells	X						
Understand the basic chemical components and reactions of cells							
•recognizing the chemical elements necessary for life	X						
•analyzing the differences between anaerobic and aerobic respiration and their products	X	X					
•recognizing the role of enzymes as catalysts in cellular reactions and factors that affect enzyme function	X	X					
•identifying the structure and function of different biomolecules	X	X					
Understand the physiological processes of cells							
• demonstrating knowledge of how cells maintain homeostasis (e.g., the effect of concentration gradients, rate of movement, and surface area/volume ratio)	X						
• analyzing the processes of photosynthesis and cellular respiration and the relationships between the two processes	X	X					
• analyzing transport mechanisms across the cell membrane (e.g., active and passive transport, facilitated diffusion)	X	X					
• recognizing the role of electron transport systems and ATP in respiration and photosynthesis	X	X					
Understand the processes of cell division, growth, and differentiation							
• comparing the processes of mitosis, meiosis, and binary fission	X	X			X	X	
• demonstrating knowledge of the phases of the cell cycle and the effects of unregulated cell growth	X	X					
• analyzing the role of cell differentiation in the development of tissues	X	X					
• analyzing factors (e.g., genetics, disease, nutrition, exposure to toxic substances) that affect cell division and differentiation	X	X				X	
HEREDITY AND EVOLUTION							
Understand the principles of heredity.							
• applying knowledge of the laws of probability to determine genotypic and phenotypic frequencies in Mendelian inheritance					X		
• demonstrating knowledge of the relationship of the behavior of chromosomes during meiosis and fertilization to inheritance patterns	X	X			X		
• recognizing factors influencing the transmission of genes from one generation to the next (e.g., linkage, position of gene on a chromosome, crossing over, independent assortment)					X		X
• recognizing how the genotype of an organism influences the expression of traits in its phenotype (e.g., dominant and recessive traits, polygenic inheritance, genetic disorders)					X		X
• analyzing effects of environmental factors (e.g., light, nutrition, moisture, temperature) on the expression of traits in the phenotype of an organism					X		X
Understand the molecular basis of genetics and genetic engineering.							
• identifying the structures and functions of DNA and RNA in organisms	X	X			X	X	X
• analyzing the mechanisms of replication, transcription, and translation	X	X					
• demonstrating knowledge of the characteristics of the genetic code	X				X		
• analyzing types of mutations and their consequences	X				X	X	X
• demonstrating knowledge of extranuclear inheritance (e.g., mitochondrial DNA)	X				X		
• recognizing techniques used in the isolation, manipulation, and expression of genetic material (e.g., electrophoresis, DNA forensics, recombinant DNA technology)	X	X					
• recognizing applications of genetic engineering in medicine (e.g., gene therapy) and agriculture (e.g., transgenic organisms)	X	X			X	X	
• demonstrating knowledge of ethical issues related to research in genetics and genetic engineering							
Understand principles of taxonomy and classification in biology.							
• demonstrating knowledge of characteristics of biological classification (i.e., hierarchy of taxonomic levels, importance of heritable characteristics in classifying organisms)			X	X			
• recognizing the procedures and criteria used to classify organisms			X	X			
• demonstrating knowledge of the taxonomic relationships among organisms			X	X			
• identifying distinguishing characteristics of taxonomic groups at the domain and kingdom levels			X	X			
• demonstrating knowledge of the relationship between taxonomic classification and evolutionary history and identifying taxonomically useful traits (e.g., homologous traits) and those that are not (e.g., analogous traits)			X	X	X		
Understand the theory, evidence, and mechanisms of evolution.							
• recognizing the historical development and mechanisms of Darwinian evolutionary theory			X		X		
• identifying sources of variation in a population on which natural selection can act (e.g., mutations, genetic drift)					X	X	X
• analyzing the role of natural selection in leading to genotypic and phenotypic changes in a population over time			X		X	X	X
• demonstrating knowledge of population genetics, including factors that contribute to changing allele frequencies in a population (e.g., genetic drift, founder effect)					X		X
• demonstrating knowledge of factors that contribute to speciation (e.g., geographic isolation, reproductive isolation)			X		X		X
• analyzing evidence that species change over time (e.g., fossil record, molecular genetics)			X		X		X
CHARACTERISTICS OF ORGANISMS							
Understand reproduction, development, and life cycles of living organisms.							
• demonstrating knowledge of the characteristics of sexual and asexual reproduction, including advantages and disadvantages of each			X	X			
• recognizing processes related to developing embryos (e.g., cleavage, gastrulation, organogenesis)			X	X			
• analyzing factors (e.g., genetics, nutrition, disease) that affect the growth and development of organisms			X	X		X	
• demonstrating knowledge of the life cycles of prokaryotes, plants, animals, and fungi			X	X			
Understand the structures, organization, and functions of systems in organisms.							
• demonstrating knowledge of the anatomical structures, organ systems, and physiological processes (e.g., digestion, excretion, transpiration) that allow organisms to carry out specific life functions			X	X			
• recognizing levels of biological organization (i.e., tissues, organs, and organ systems) in			X	X			

multicellular organisms							
• analyzing characteristics, functions, and relationships of systems in animals			X	X			
• analyzing characteristics, functions, and relationships of systems in plants			X	X			
Understand how organisms obtain, store, and use matter and energy.							
• demonstrating knowledge of processes used by organisms (i.e., heterotrophs and autotrophs) to obtain energy	X		X			X	
• demonstrating knowledge of ways in which animals obtain food and water			X	X			
• demonstrating knowledge of ways in which plants obtain nutrients and water			X	X			
• demonstrating knowledge of strategies used by organisms to store nutrients	X		X			X	
• analyzing processes by which nutrients are obtained and distributed to all parts of an organism			X	X			
Understand the structure and function of the human body.							
• demonstrating knowledge of the structures and processes of the human body							
• analyzing systems involved in the regulation of physiological processes (e.g., nervous system, endocrine system)							
• demonstrating knowledge of the tissues, organs, and systems that support and facilitate body movement (e.g., muscles, connective tissues, skeletal system)							
• analyzing the role of human body systems in supplying nutrition and oxygen to cells							
• recognizing the characteristics of common diseases and disorders of the human body							
ECOSYSTEMS							
Understand populations and communities.							
• identifying the basic requirements of organisms for life (e.g., nutrition, space, habitat)					X		X
• demonstrating knowledge of the concept of an ecological niche					X		
• analyzing basic characteristics of populations (e.g., distribution, density) and interpreting population growth curves					X		
• demonstrating knowledge of factors that affect population size and growth rates (e.g., carrying capacity, limiting factors)					X		
• analyzing the relationships among organisms in a community (e.g., predator/prey, symbiosis, parasitism)					X		
Understand the flow of matter and energy through ecosystems.							
• recognizing the characteristics of biogeochemical cycles in ecosystems and biomes (e.g., carbon, water, oxygen, nitrogen, phosphorus)					X		X
• analyzing the roles of organisms in biogeochemical cycles and the flow of matter through different types of ecosystems					X		X
• analyzing the types, sources, and flow of energy through different trophic levels (e.g., producers, consumers, and decomposers) and between organisms and the physical environment in aquatic and terrestrial ecosystems					X		X
Understand types and characteristics of ecosystems and biomes and factors affecting their change over time.							
• recognizing common patterns of interdependence and interrelationships among species in an ecosystem (e.g., the role of producers, consumers, and decomposers)					X		X
• identifying the biotic and abiotic factors that affect an ecosystem					X		X
• recognizing types and characteristics of aquatic and terrestrial biomes and the types of flora and fauna in those biomes							
• analyzing human effects on ecosystems					X		X
• recognizing processes and patterns of ecological succession							
• recognizing the concept of limiting factors (e.g., light intensity, temperature, mineral availability) and the effects that they have on the productivity and complexity of different ecosystems (e.g., tropical forest versus taiga, continental shelf versus deep ocean)							
CHARACTERISTICS OF SCIENCE							
Understand the characteristics of scientific knowledge and the process of scientific inquiry.							
• demonstrating knowledge of the nature, purpose, and characteristics of science (e.g., reliance on verifiable evidence) and the limitations of science in terms of the kinds of questions that can be answered	X	X	X	X	X	X	X
• recognizing the difference between a scientific hypothesis and a scientific theory	X	X	X	X	X	X	X
• recognizing the dynamic nature of scientific knowledge through the continual testing and revision of hypotheses	X	X	X	X	X	X	X
• determining an appropriate scientific hypothesis or investigative design for addressing a given problem		X		X	X	X	X
• demonstrating knowledge of the principles and procedures for designing and carrying out scientific investigations (e.g., changing one variable at a time)		X		X			X
• recognizing the importance of and strategies for avoiding bias in scientific investigations	X	X	X	X	X	X	X
• demonstrating knowledge of the unifying concepts (e.g., system, model, change, scale) of science	X	X	X	X	X	X	X
Understand scientific tools, instruments, materials, and safety practices.							
• recognizing procedures for the safe and proper use of scientific tools, instruments, chemicals, and other materials in investigations		X		X		X	X
• identifying appropriate units for measuring objects or substances		X		X		X	X
• identifying potential safety hazards associated with scientific equipment, materials, procedures, and settings		X		X		X	X
• recognizing appropriate protocols for maintaining safety and for responding to emergencies during classroom laboratory activities		X		X		X	X
• demonstrating knowledge of the role of models in science	X	X	X	X	X	X	X
Understand the skills and procedures for analyzing and communicating scientific data.							
• recognizing the concepts of precision, accuracy, and error and identifying potential sources of error in gathering and recording data		X		X			X
• applying appropriate mathematical concepts and computational skills to analyze data (e.g., using ratios; determining mean, median, and mode)		X					X
• identifying methods (e.g., tables, graphs) and criteria for organizing data to aid in the analysis of data (e.g., detecting patterns)		X		X			X
• demonstrating knowledge of the use of data (e.g., tables, graphs) to support or challenge scientific arguments and claims	X	X	X	X	X	X	X
• identifying appropriate methods for communicating the outcomes of scientific investigations (e.g., presentations at science fairs, publication in peer-reviewed journals)	X	X	X	X	X	X	X
• demonstrating familiarity with effective resources and strategies for reading to gain information about science-related topics and developing subject-area vocabulary		X		X			X