BEXLEY CITY SCHOOLS

HONORS BIOLOGY (Molecular) | Curriculum Map and Pacing Guide

COURSE DESCRIPTION: This course focuses on the content of biology at the level or organization of molecules. Molecular biology and the theory of evolution by natural selection tie together chapters as emphasis changes gradually from molecules to cells, to individuals to populations, and finally to the biosphere. Providing insight into molecular biology enables students to understand better the rapid advances in biotechnology and provides them with the knowledge necessary to make informed decisions about the legal, ethical and society issues biotechnology raises.	**Course SCI330** **1 year, 1 credit** **Grades 9-10** **Prerequisite:** Physical Science or comparable course; Geometry or teacher recommendation

QUARTER 1		
Topic: Foundations/Science Skills		
Key Terms: biology, biosphere, controlled experiment, discovery science, eukaryotic cell, ecosystem, genes, hypothesis, natural selection, prokaryotic cell, science, scientific method, theory		
Intellectual Disposition/Measurable Skills: making predictions, problem solving, investigating, collecting, interpreting and recording data, concluding and presenting data in a lab report		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.SIA: Science Inquiry and Application	▪ Identify questions and concepts that guide scientific investigations. ▪ Design and conduct scientific investigations. ▪ Use technology and mathematics to improve investigations and communications. ▪ Formulate and revise explanations and models using logic and evidence (critical thinking). ▪ Recognize and analyze explanations and models. ▪ Communicate and support a scientific argument.	Garbology lab Lasting footprints online activity
B.DI.1: Biodiversity	Describe the biological criteria that needs to be met in order for an organism to be considered alive.	
	Define and provide examples of each level of organization (e.g., biosphere, biome, ecosystem, community, population, multicellular organism, organ system, organ, tissue, cell, organelle, molecule, atom, subatomic particle).	

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Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Design and conduct investigations appropriately using essential processes of inquiry.	Garbology lab
	Use mathematics to enhance the scientific inquiry process.	Garbology lab
B.C.1: Cell Structure and Function	Analyze the similarities and differences among a plant versus animal cell and eukaryotic versus prokaryotic cells.	Microscope or photo comparison
B.E.1: Evolution	Discuss Darwin's principle of survival of the fittest, and explain what Darwin meant by natural selection.	Discussion of examples

QUARTER 1		
Topic: Biochemistry, Molecules of Life		
Key Terms: acid, aqueous solution, base, buffers, chemical reactions, compounds, covalent bond, heat, hydrogen bonds, ions, mass, molecule, pH scale, polar molecule, Radioactive Isotope, reactants, solute, solution, solvent, carbohydrates, dehydration reaction, denaturation, functional groups, glycogen, hydrolysis, hydrophilic, hydrophobic, isomers, lipids, macromolecules, monomers, organic compounds, polymers, polypeptide, saturated, steroids, trans fat, unsaturated		
Intellectual Disposition/ Measurable Skills: model, investigate, analyze, compare/contrast, differentiate, explain, describe		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.C.1: Cell Structure and Function	Explain how a complex network of proteins provides organization and shape to a cell.	Physical science review
	Describe how cells function within a narrow range of temperature and pH.	pH lab
B.C.2: Cellular Processes	Distinguish between the chemical reactions of cells that involve water and carbohydrates, proteins, lipids, and nucleic acids.	pH lab, carbohydrate lab
	Describe how a special group of proteins, enzymes, enables chemical reactions to occur in living systems.	
B.C.2: Cellular Processes	Describe how organisms transform energy (flow of energy) and matter (cycles of matter) as they survive and reproduce.	

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Topic: Biochemistry, Molecules of Life		
Key Terms: acid, aqueous solution, base, buffers, chemical reactions, compounds, covalent bond, heat, hydrogen bonds, ions, mass, molecule, pH scale, polar molecule, Radioactive Isotope, reactants, solute, solution, solvent, carbohydrates, dehydration reaction, denaturation, functional groups, glycogen, hydrolysis, hydrophilic, hydrophobic, isomers, lipids, macromolecules, monomers, organic compounds, polymers, polypeptide, saturated, steroids, trans fat, unsaturated		
Intellectual Disposition/ Measurable Skills: model, investigate, analyze, compare/contrast, differentiate, explain, describe		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Show how chemical reactions (e.g., photosynthesis, fermentation, cellular respiration) can be represented by chemical formulas.	HHMI "Got Lactose"
B.DI.2: Ecosystems	Investigate "the effects of physical and chemical constraints on all biological relationships and systems."	pH lab
B.C.1: Cell Structure and Function	Identify subatomic particles and describe how they are arranged in atoms.	
	Describe the difference between ions and atoms and the importance of ions in biological processes.	
	Compare the types of bonding between atoms to form molecules.	
	Explain the fundamental principles of the pH scale and consequences of having the different concentrations of hydrogen and hydroxide ions.	pH LabQuest/probe lab
B.DI.1: Biodiversity	Define and explain the unique properties of water that are essential to living organisms.	
B.C.1: Cell Structure and Function	Explain the difference between organic and inorganic compounds.	Macromolecules POGIL
	Describe the general structure and function including common functional groups of monosaccharides, disaccharides, polysaccharides, carbohydrates, fatty acids, glycerol, glycerides, lipids, amino acids, dipeptides, polypeptides, protein and nucleic acids.	Trans fat activity Carbohydrate modeling and carb lab

QUARTER 1		
Topic: Cell Structure and Activity		
Key Terms: cell theory, central vacuole, chloroplasts, chromatin, chromosomes, cilia, cytoplasm, cytoskeleton, cytosol, flagella, golgi apparatus, light microscope, lysosome, microtubles, mitochondria, nuclear envelope, nucleiod, nucleous, nucleus, plasma membrane, ribosome, rough ER, scanning electron microscope, smooth ER, transmission electron microscope, transport vesicles, vacuoles		
Intellectual Disposition/Measurable Skills: construct, organize, relate, compare, contrast, describe, explain		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.C.1: Cell structure and function	Distinguish between the specialized parts for transport of materials, energy transformations, protein building, waste disposal, information feedback and movement.	
	Describe the molecular composition of a living cell specifically its elements and complex molecules.	Video: “Magic of Cells”
	Describe the components of the cell membrane, also known as the as the plasma membrane and how it controls what enters and leaves the cell.	Construct plasma membrane model POGIL plasma membrane
B.H.3: Genetic mechanisms and inheritance	Explain how cells in an individual can be very different from one another even though they are descended from a single cell, all having identical instructions.	
B.C.1: Cell structure and function	Describe the functions of all major cell organelles, including nucleus, ER, RER, Golgi apparatus, ribosome, mitochondria, microtubules, microfilaments, lysosomes, centrioles, and cell membrane.	
	Analyze the similarities and differences among a plant versus animal cell and eukaryotic versus prokaryotic cells.	Microscope lab
	Contrast the structure and function of subcellular components of motility (e.g., cilia, flagella, and pseudopoda).	Microscope lab

QUARTER 1		
Topic: Cell Structure and Activity: Working Cell		
Key Terms: active transport, ATP, chemical energy, diffusion, endocytosis, energy, entropy, exocytosis, facilitated diffusion, hypertonic, hypotonic, induced fit, isotonic, kinetic energy, metabolism, osmoregulation, osmosis, passive transport, phagocytosis, potential energy, signal transduction pathway, transport proteins		
Intellectual Disposition/Measurable Skills: Investigate, experiment, examine, interpret, describe, discuss, explain, identify		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.C.1: Cell structure and function	Explain how complex interactions among different kinds of molecules in the cell cause distinct cycles of activities such as growth and division.	
	Describe how cells function within a narrow range of temperature and pH.	Enzyme Lab Quest/probe lab
B.C.2: Cellular processes	Explain how cells make proteins, and how proteins catalyze most chemical reactions in cells.	Jello lab
	Relate DNA sequences to protein structure in cells.	
	Describe how a special group of proteins, enzymes, enables chemical reactions to occur in living systems.	Lactaid/lactose demo
	Describe the function of enzymes, including how enzyme-substrate specificity works, in biochemical reactions.	Jello lab
	Explain how cells store energy temporarily as ATP.	
	Explain how the cell membrane maintains homeostasis.	
	Describe and contrast these types of cell transport: osmosis, diffusion, facilitated diffusion, and active transport.	Diffusion lab osmosis Agar glock lab Diffusion argumentation

QUARTER 2		
Topic: Cell Structure and Activity: Cellular Respiration; Obtaining Energy from Food; Photosynthesis: Using Light to Make Food		
Key Terms: aerobic, anaerobic, autotrophs, cellular respiration, citric acid cycle, consumers, fermentation, heterotrophs, photosynthesis, producers, Calvin Cycle, carbon fixation, chloroplast, C3, C4, CAM plants, light reactions, photon, photosystem		
Intellectual Disposition/Measurable Skills: Design, support, examine experiment, interpret, sketch, discuss, describe, explain, investigate		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.C.2: Cellular processes	Investigate the effects of physical/chemical constraints on all biological relationships and systems.	Cellular respiration lab
	Describe how organisms transform energy (flow of energy) and matter (cycles of matter) as they survive and reproduce.	
	Identify the cellular sites of and follow through the major pathways of anaerobic and aerobic respiration; compare reactants and products for each process, and account for how aerobic respiration produces more ATP per monosaccharide.	POGIL cell respiration
	Explain how photosynthetic organisms use the process of photosynthesis and respiration.	Stomate lab
	Explain the interaction between pigments, absorption of light, and reflection of light.	Chromatography lab
	Describe the light-dependent and light-independent reactions of photosynthesis.	Photosynthesis modeling
	Relate the products of the light-dependent reactions to products of the light-independent reactions.	Photosynthesis modeling and argumentation activity
B.C.2: Cellular processes & Science Inquiry and Application	Design and conduct an experiment demonstrating effects of environmental factors on photosynthesis.	Elodea lab Design a lab photosynthesis

QUARTER 2		
Topic: Genetics: Patterns of Inheritance; Cell Reproduction		
Key Terms: asexual reproduction, autosome, cancer, cell cycle, cell cycle control, cell division, centromere, centrosome, chromatin, chromosome, crossing over, cytokinesis, diploid, fertilization, gamete, genetic recombination, haploid, homologous, chromosome, karyotype, life cycle, meiosis, mitosis, nondisjunction, sex chromosome, sexual reproduction, tumor, zygote		
Intellectual Disposition/Measurable Skills: model, solve, compare, contrast, describe, explain, identify		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.C.2: Cellular processes	Explain how complex interactions among different kinds of molecules in the cell cause distinct cycles of activities such as growth and division.	Video: "Mitosis" Online root tip activity Mitosis microscope lab
	Compare the cellular processes and cellular products of asexual and sexual reproduction, explaining how they are beneficial.	
B.H.3: Genetic mechanisms and inheritance	Explain how sorting and recombination of genes in sexual reproduction and meiosis results in variance in traits of the offspring of any two parents.	Model meiosis
B.C.2: Cellular processes	Describe the basic process of mitosis.	POGIL mitosis
	Describe the process of meiosis.	POGIL meiosis
	Describe how the cell cycle control system normally functions and explain the consequences of errors in the system.	

QUARTER 2		
Topic: Genetics: Patterns of Inheritance; Cells from Cells		
Key Terms: alleles, carrier, inheritance, codominant, dominant allele, genotype, heredity, heterozygous, homozygous, hybrid, Law of independent assortment, Law of Segregation, linkage map, linked genes, locus, phenotype, recessive allele, recombination, rule of multiplication, wild-type traits.		
Intellectual Disposition/Measurable Skills: model, solve, compare, contrast, describe, explain, identify		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.H.3: Genetic mechanisms and inheritance	▪ Explain how Mendel's Laws of Inheritance are interwoven with current knowledge of DNA and chromosome structure and function in modern genetics.	
B.H.5: Modern genetics	▪ Differentiate between incomplete dominance and sex-linked traits, goodness of fit, and dihybrid crosses.	Practice Punnett's squares

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Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.H.3: Genetic mechanisms and inheritance	Apply Chi-square Analysis (goodness of fit) and Punnett's squares to statistically analyze data.	M&M Chi-square Live fruit fly lab
B.H.5: Modern genetics	Differentiate between polygenic inheritance, epistasis and pleiotrophy.	Practice Punnett's squares and genetic problems
B.H.4: Mutations	Explain how different phenotypes result from new combinations of existing genes or from mutations of genes in reproductive cells.	Practice Punnett's squares and genetic problems
B.H.3: Genetic mechanisms and inheritance	Describe the mode of inheritance in commonly inherited disorders (e.g., sickle cell, Down syndrome, Turner's syndrome, PKU).	Practice Punnett's squares and genetic problems
	Identify and explain Mendel's law of segregation and law of independent assortment.	Coin toss lab
	Explain how the process of meiosis reveals the mechanism behind Mendel's conclusions about segregation and independent assortment on a molecular level.	
	Define and provide an example of the following: genotype, phenotype, dominant allele, recessive allele, codominant allele, incompletely dominant alleles, homozygous, heterozygous and, carrier.	Mendel trait activity
B.H.5: Modern genetics	Explain sex-linked patterns of inheritance in terms of some genes being absent from the smaller Y chromosome and thus makes (XY) having a different chance of exhibiting certain traits than do females (XX).	Practice Punnett's squares and genetic problems
B.H.3: Genetic mechanisms and inheritance	Construct and interpret Punnett squares and pedigree charts (e.g., calculate and predict phenotypic and genotypic ratios and probabilities).	Practice Punnett's squares and genetic problems

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Intellectual Disposition/Measurable Skills: model, solve, compare, contrast, describe, explain, identify		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Infer parental genotypes and phenotypes from offspring data presented in pedigree charts from the genotypic and phenotypic ratios of offspring.	Problems Live fruit fly lab

QUARTER 3		
Topic: Genetics: Expressing Genetic Information; Structure and Function of DNA		
Key Terms: bacteriophage, DNA, DNA polymerase, double helix, exons, introns, lysogenic cycle, lytic cycle, messenger RNA, mutagen, mutation, nucleotide, prophage, retrovirus, reverse transcriptase, ribosomal RNA, RNA polymerase, RNA splicing, transcription, transfer RNA, translation		
Intellectual Disposition/Measurable Skills: model, solve, construct, explain, describe, differentiate, compare		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.H.2: Structure and function of DNA in cells	Explain how biological information contained in a genome is encoded in its DNA and divided into discrete units called genes.	DNA replication activity DNA replication modeling and argument
	Explain how the sequence of DNA bases on a chromosome determines the sequence of amino acids in a protein.	Protein synthesis activity
	Explain how inserting, deleting or substituting segments of DNA molecules can alter genes.	Protein synthesis activity
B.H.4: Mutations	Explain how altered genes may be passed to every cell that develops from it, and how mutations in gametes can be passed to offspring.	
B.H.1: Cellular Genetics	Describe how different genes are active in different types of cells influenced by the cell's environment and past history."	
B.H.2: Structure and function of DNA in cells	Describe how the development of the model for DNA structure was the result of the use of technology and the studies and ideas of many scientists.	Video: "Photo 51"

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Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Explain how genes code for protein and the sequence of DNA bases in a chromosome determines the sequence of amino acids in a protein.	Protein synthesis activity
	Explain how the sequence of DNA bases on a chromosome determines the sequence of amino acids in a protein.	Codon coding
B.H.1: Cellular Genetics	Illustrate how all cell organelles work together by describing the step-by-step process of the translation of an mRNA strand into a protein and its subsequent processing by organelles so that the protein is appropriately packaged, labeled and eventually exported by the cell.	Protein synthesis activity
B.H.2: Structure and function of DNA in cells	Describe the basic structure and function of DNA, mRNA, tRNA, amino acids, polypeptides, and proteins (e.g., replication, transcription, and translation).	Protein synthesis activity
	Describe the experiments of major scientists in determining both the structure of DNA and the central dogma.	Video: “Photo 51”
B.H.1: Cellular Genetics	Use mRNA codon charts to determine amino acid sequences of example polypeptides.	Codon coding
B.H.4: Mutations	Use mRNA codon charts to determine the effects of different types of mutations on amino acid sequence and protein structure (e.g., sickle cell).	Codon coding
B.C.1: Cell structure and function	Distinguish between and among viruses, bacteria and protists, and give examples of each.	Protist lab Virus explorer activity

QUARTER 3		
Topic: Genetics: Expressing Genetic Information; How Genes Are Controlled		
Key Terms: adult stem cells, cellular differentiation, embryonic stem cells, gene expression, gene regulation, growth factors, homeotic genes, proto-oncogene, reproductive cloning, signal transduction pathway, therapeutic cloning, tumor-suppressor genes, X chromosome Inactivation		
Intellectual Disposition/Measurable Skills: model, solve, construct, explain, describe, differentiate, compare		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.H.3: Genetic mechanisms and inheritance	Describe how each organism has a genome that contains all of the biological information needed to build and maintain a living example of that organism.	
B.H.1: Cellular Genetics	Explain how cells in an individual can be very different from one another even though they are descended from a single cell, all having identical genetic instructions.	GMO argument and gallery walk
	Describe how gene expression is regulated in organisms such that specific proteins are synthesized only when they are needed by the cell (e.g., allowing cell specialization).	POGIL gene expression and GMO speed dating
	Complete a major project relating to recombinant DNA cloning, or stem cell research.	Video: "Clone" POGIL gene expression

QUARTER 3		
Topic: Genetics and Evolution; How Populations Evolve		
Key Terms: biogeography, bottleneck effect, comparative anatomy, evolution, evolutionary tree, founder effect, gene flow, gene pool, genetic drift, Hardy-Weinberg equilibrium, homology, microevolution, modern synthesis, natural selection, population, relative fitness, sexual selection, sexual dimorphism, vestigial structures		
Intellectual Disposition/Measurable Skills: solve, support, differentiate, describe, explain, demonstrate		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.E.1: Mechanisms of evolution	Explain how once cells with nuclei developed about a billion years ago, increasingly complex multicellular organisms evolved.	
B.E.1: Mechanisms of evolution	Describe how biological evolution explains the natural origins for the diversity of life and how evolution changes the properties of a trait in populations.	Video: "Islands Evolution" Peppered moth activity
B.E.1: Mechanisms of evolution	Explain how modern synthesis is the unification of genetics and evolution and historical perspectives of evolutionary theory."	Darwin HHMI clip

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Intellectual Disposition/Measurable Skills: solve, support, differentiate, describe, explain, demonstrate		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.E.2: Speciation	Distinguish between gene flow, mutation, speciation, natural selection, genetic drift, sexual selection, and Hardy Weinberg's Law.	Hardy-Weinberg problems
	Explain how Natural Selection is used to describe the process by which traits become more or less common in a population due to consistent environmental effects upon the survival or reproduction of the individual with the trait.	Pock pocket mouse activity HHMI Video: "Rock Pocket Mouse"
	Explain how populations evolve over time.	HHMI Video: "Rock Pocket Mouse"
B.E.1: Mechanisms of evolution	Explain the influence of other scientists (e.g., Malthus, Wallace, Lamark, and Lyell) and of Darwin's trip on the HMS Beagle in formulating Darwin's ideas of natural selection. Contrast Lamark and Darwin's ideas about changes in organisms over time.	Darwin HHMI clip
B.E.2: Speciation	Apply the Hardy-Weinberg Law to explain gene frequency patterns in a population.	
B.E.1: Mechanisms of evolution	Explain the biological definition of evolution and how evolution is the decent with modification of different lineages from common ancestors.	HHMI Video: "Rock Pocket Mouse"
	Describe how evolution is the consequence of the interactions of (1) potential for a population to increase its numbers, (2) genetic variability of offspring due to mutation and recombination of genes, (3) finite supply of the resources required for life, and (4) differential survival and reproduction of individuals with the specific phenotype.	Pock pocket mouse activity HHMI Video: "Rock Pocket Mouse"
B.E.1: Mechanisms of evolution	Apply the knowledge of mutation and genetic drift to real-world examples.	Pock pocket mouse activity HHMI Video: "Rock Pocket Mouse"

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Intellectual Disposition/Measurable Skills: solve, support, differentiate, describe, explain, demonstrate		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Explain how heritable characteristics influence how likely an organism is to survive and reproduce in a particular environment.	Pock pocket mouse activity HHMI Video: "Rock Pocket Mouse"
	Provide examples of behaviors that have evolved through natural selection (e.g., migration, courtship rituals).	
	Design, perform and analyze a laboratory simulation of natural selection on a working population.	Rock pocket mouse activity
	Formulate and revise explanations for gene flow and sexual selection based on real-world problems, and describe the basic types of selection, including disruptive, stabilizing and directional.	

QUARTER 3		
Topic: Genetics and Evolution; How Biological Diversity Evolves		
Key Terms: convergent evolution, evo-devo, macroevolution, phylogenetic tree, punctuated equilibria, reproductive barrier, speciation, species, taxonomy, three-domain system		
Intellectual Disposition/Measurable Skills: solve, support, differentiate, describe, explain, demonstrate		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.DI.1: Biodiversity	Describe how both morphological comparisons and molecular evidence must be used to describe biodiversity through cladograms.	
B.E.2: Speciation	Specifically describe the conditions required to be considered a species (e.g., reproductive isolation, geographic isolation).	DVDs: "Islands and Evolutions," "Salamanders: A Step in Speciation"
B.E.1: Mechanisms of evolution	Explain how natural selection and its evolutionary consequences (e.g., adaptation or extinction) provide a scientific explanation for the fossil record of ancient life-forms	

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Intellectual Disposition/Measurable Skills: solve, support, differentiate, describe, explain, demonstrate		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	and the striking molecular similarities observed among the diverse species of living organisms.	
	Discuss evidence from the fields of geology, biochemistry, embryology, comparative anatomy, and comparative physiology that points to shared evolutionary relationships.	
	Explain how Earth's life-forms have evolved from earlier species as a consequence of interaction of (a) the potential of a species to increase its numbers and (b) genetic variability of offspring due to mutation and recombination of DNA.	
B.E.2: Speciation	Distinguish between catastrophism, gradualism and punctuated equilibrium.	HHMI video: "The Day the Mesozoic Died"

QUARTER 3		
Topic: Genetics and Evolution; Evolution of Microbial Life; Evolution of Animals		
Key Terms: archaea, bacteria, binary fission, biofilm, ciliates, endosymbiosis, eukarya, flagellates, prokaryotes, protists, pseudopdia, Symbiosis, bilateral symmetry, body segmentation, chordates, complete digestive tract, dorsal hollow nerve cord, endoskeleton, exoskeleton, gastrovascular cavity, gastrula, Invertebrates, metamorphosis, notochord, pharyngeal slits, radial symmetry, vertebrates		
Intellectual Disposition/Measurable Skills: Investigate, explain, describe, differentiate, organize, compare, classify, state, identify		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
BDI.1: Biodiversity	Explain how the diversity of organisms and ecological niches they occupy result from more than 3.5 billion years of evolution.	HHMI videos: "The Day the Mesozoic Died," "KT Mass Extinction"
B.E.2: Speciation	Explain how classification systems are frameworks developed by scientists for describing the diversity of organisms indicating the degree of relatedness between organisms.	Shark activity
	Explain how Earth's present-day species descended from earlier, common ancestral species.	Salamander lab

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Intellectual Disposition/Measurable Skills: Investigate, explain, describe, differentiate, organize, compare, classify, state, identify		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Describe how evolution provides a natural explanation for the diversity of life on Earth as represented in the fossil record, in the similarities of existing species and in modern molecular evidence.	HHMI Video: "Dinosaurs to Birds"
	Differentiate among chemical evolution, organic evolution, and the evolutionary steps along the way to aerobic heterotrophs and photosynthetic autotrophs.	
	Describe the experiments of Redi, Needham, Spallanzani, and Pasteur to support or falsify the hypothesis of spontaneous generation.	
	Explain how organisms are classified into a hierarchy of groups and subgroups based on similarities that reflect their evolutionary relationships.	Phylogenetic tree activity
	List each of the major levels in the hierarchy of taxa: kingdom, Phylum, class, order, family, genus, and species.	Classification lab
	Explain the binomial nomenclature system.	
	Construct and use a dichotomous key.	Shoe/shark activity
BDI.1: Biodiversity	Explain classification criteria for fungi, plants and animals.	Classification lab
	Compare the major divisions of animals.	Classification lab

QUARTER 4		
Topic: Energy and Ecology; Introduction to Ecology and Biosphere		
Key Terms: abiotic factors, biome, biosphere, biotic factors, community, ecology, ecosystem, population, sustainability		
Intellectual Disposition/Measurable Skills: construct, Interpret, Investigate, explain, describe		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
BDI.1: Biodiversity	Investigate the effects of physical/chemical constraints on all biological relationships and systems.	
B.DI.2: Ecosystems	Define ecology, describing its levels, and explain how ecologists learn about the structures and processes of our natural world.	
	Explain why the biosphere is patchy. List and describe the major abiotic factors affecting the distribution of life in the biosphere, describing ways organisms adapt to their environment.	Reindeer population lab
	Explain how ecosystems tend to have cyclic fluctuations around a state of rough equilibrium.	
	Define and provide examples of biosphere, biome, ecosystem, community, population, species habitat, and niche.	Climatogram activity
	Discuss biotic and abiotic factors that affect land and aquatic biomes.	POGIL biomes
	Explain how organisms cooperate and compete in ecosystems and how interrelationships and interdependencies of organism may generate ecosystems that are stable for thousands of years.	
	Explain why organisms with low genetic diversity and long-life spans might suffer the most in a rapidly changing climate.	POGIL biological magnification

QUARTER 4		
Topic: Energy and Ecology; Population Ecology		
Key Terms: carrying capacity, density-dependent, density-independent, ecological footprint, exponential population, competition, limiting factors, logistic population, population, population density		
Intellectual Disposition/Measurable Skills: construct, interpret, investigate, explain, describe		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.DI.3: Loss of Diversity	Describe the spread and consequences of introduced lionfish in the Atlantic region. Relate this to other invasive species.	
B.DI.2: Ecosystems	Explain through mathematical interpretation the concepts of carrying capacity and homeostasis within biomes.	
	Investigate population changes that occur locally or regionally.	Reindeer population lab
	Explain the concept of carrying capacity. Apply the exponential growth model and logistic growth model to sample populations.	POGIL populations
	Explain how organisms cooperate and compete in ecosystems and how interrelationships and interdependencies of organism may generate ecosystems that are stable for thousands of years.	
	Describe examples of competition, symbiosis and predation.	POGIL biological magnification
	Explain the process of ecological succession, and describe the different communities that result.	POGIL succession
B.DI.3: Loss of Diversity	Describe the growth of the human population over the last 2,000 years, including how age structure diagrams can help to predict changes in a population and in social conditions, and how the ecological footprint of a nation indicates the country's impact on the world's resources.	
	Explain how and why the North American population of mammals has changed in the last 15,000 years.	

QUARTER 4		
Topic: Energy and Ecology; Obtaining Energy from Food		
Key Terms: autotrophs, cellular respiration, consumers, heterotrophs, photosynthesis, producers, biodiversity, biochemical cycles, magnification, biomass, chemical cycling, community, competitive exclusion, consumers, decomposers, detritivores, ecological niche, ecological succession, food chain, food webs, herbivores, competition, mutualism, primary succession, producers, scavenger, secondary succession, trophic structure		
Intellectual Disposition/Measurable Skills: construct, explain, describe, compare, interpret		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.DI.2: Ecosystems	Explain how ecosystems tend to have cyclic fluctuations around a state of rough equilibrium.	
	Differentiate between interspecies and intra-species competition for resources, and what occurs when a species immigrates to or emigrates from ecosystems.	
	Describe how organisms transform energy (flow of energy) and matter (cycles of matter) as they survive and reproduce.	
B.C.2: Cellular Processes	Explain how energy flows through ecosystems in one direction, from photosynthetic organisms to herbivores to carnivores and decomposers.	Disappearing marshlands
B.DI.2: Ecosystems	Discuss the role of beneficial bacteria (e.g., in the recycling of nutrients).	POGIL nitrogen cycle
	Explain how the amount of life any environment can support is limited by the available matter and energy and by the ability of ecosystems to recycle the residue of dead organic materials.	Food energy lab
	Diagram the flow of energy using food webs, food chains, and pyramids (e.g., pyramid of energy, pyramid of biomass and pyramid of numbers).	
B.DI.3: Loss of Diversity	Read and describe current journal articles relating to environmental concerns.	Diversity argumentation
	Discuss and evaluate the significance of human interference with major ecosystems.	Diversity argumentation

QUARTER 4		
Topic: Living Organisms; Unifying Concepts of Animal Structure and Function; Working Plant		
Key Terms: anatomy, ectotherms, endotherms, tissue, homeostasis, negative feedback, organ, organ systems, physiology, positive feedback, organ, organ systems, physiology, positive feedback, tissue, atypical dominance, asexual reproduction, blade, carpel, cotyledons, dermal tissue system, dicot, fertilization, flower, fruit, ground tissue system, monocot, ovary, ovules, petals, phloem, secondary growth, Seed, sepals, shoot system, stamen, stigma, vascular tissue system, wood, xylem		
Intellectual Disposition/Measurable Skills: investigate, identify, describe, explain, locate, recognize, examine		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.C.1: Cell structure and function	Describe the molecular composition of a living cell specifically its elements and complex molecules.	
	Explain how complex interactions among different kinds of molecules in the cell cause distinct cycles of activities such as growth and division.	
	Identify major types of animal cells and tissues.	Frog dissection
B.C.2: Cellular processes	Describe the major components and functions of physiological systems, including skeletal, muscle, circulatory, respiratory, digestive, urinary, endocrine, nervous, reproductive and immune.	Frog dissection
	Describe the basic mechanisms of plant processes especially movement of materials and plant reproduction.	
	Explain the functions of unique plant structures, including the cell wall, chloroplasts, and critical parts of the flower and seed.	

District Instructional Resource:

Biology Concepts and Applications Level 1 (2018) / Cengage (6-year online subscription: 2019-2020 to 2024-2025)

Standards Alignment:

Ohio Learning Standards (2018) – retrieved Jan. 2, 2019
http://education.ohio.gov/getattachment/Topics/Learning-in-Ohio/Science/Ohios-Learning-Standards-and-MC/SciFinalStandards121018.pdf.aspx?lang=en-US