BEXLEY CITY SCHOOLS

BIOLOGY (Ecological) | Curriculum Map and Pacing Guide

COURSE DESCRIPTION:	**Course SCI320** **1 year, 1 credit** **Grades 10** **Prerequisite:** Preferred Physical Science and teacher recommendation
Course concentrates on the whole organism – its community and contribution to and dependence upon life. Course emphasis is on the interrelationship of all living things and includes themes: living things changes through time; diversity of type and unit of pattern; genetic continuity; relationship between organism and environment; biological roots of behavior; relationship between structure and function; maintenance of life while changing; and intellectual history of biological concepts. A vertebrate specimen is dissected, and laboratory investigations are integral to course.	

QUARTER 1

Topics: Study of Life: Introduction to Biology; Nature of Science; Methods of Science

Key Terms: Organisms, Biology/BiologistSpecies, Homeostasis, Adaptation, Science, Theory, Law, Observation, Inference, Scientific Method, Hypothesis, Control Group, experimental Group, Independent Variable, Dependent Variable, constant, SI unit

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
SS: Science Inquiry and Application	Identify questions and concepts that guide scientific investigations: - Design and conduct scientific investigation. - 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; and - Communicate and support a scientific argument.	Fermentation Lab Part I

QUARTER 1

Topic: Chemistry of Biology; Cellular Structure and Function; Cellular Reproduction; Energy

Key Terms: Chemistry of Biology: Atom, nucleus, proton, neutron, electron, element, Isotope, compound, covalent bond, molecule, ion, ionic bond, van der walls forces, chemical reaction, reactant, product, activation energy, catalyst, enzyme, Substrate, active site, polar molecule, hydrogen bond, mixture, solution, solvent, Solute, acid, base, pH, buffer, macromolecules, polymer, carbohydrate, lipid, protein, amino acid, Nucleic acid, nucleotides peptide bond, polypeptide, ATP, RNA, DNA, Monosaccharide, disaccharide, polysaccharide, glycogen, starch
Cellular Structure and Function: Cell Theory, Anton van Leeuwenhoek, Robert Hooke, Matthias Schleiden/Theodor Schwann, Louis Pasteur, compound microscope, Electron microscope, Cell, prokaryotic cell, eukaryotic cell, nucleus, organelle, Selective permeability, Phospholipid bilayer, transport protein, fluid mosaic model, concentration gradient, cytoplasm/cytosol, cytoskeleton, microtubules, microfilaments, Chromosomes, Chromatin, Micrometer (µm), nucleolus, cell/plasma membrane, cell wall, lysosome, centrioles, Chloroplast, thylakoids, cell wall, Vacuole, cilia, flagella, DNA/RNA, Nuclear envelope, ribosomes, Chlorophyll, Golgi complex/apparatus, endoplasmic reticulum, mitochondria, diffusion, dynamic equilibrium, facilitated diffusion, carrier protein, osmosis, hypertonic, hypotonic, isotonic, Passive transport, active transport, endocytosis, exocytosis
Cellular Reproduction (Mitosis): Cell cycle, Interphase, G_1 Phase, S phase, G_2 Phase, M phase, mitosis, cytokinesis, Chromosomes, Chromatin, Prophase, Sister Chromatids, Centromere, Spindle apparatus, metaphase, anaphase, telophase, Cell Plate, Cyclin/cyclin-dependent kinases (CDKs), Cancer, Carcinogens, Oncogene (not in book), apoptosis,
Stem Cells (Embryonic vs. Adult)
Energy (Photosynthesis and Cellular Respiration); Plant Structure and Function: Energy, Thermodynamics, metabolism, photosynthesis, cellular respiration, adenosine triphosphate (ATP), Thylakoid, Granum/Grana, Stroma, pigment, NADP+, Calvin Cycle, Rubisco, PSI/II, C-3/C-4/CAM plants, Anaerobic process, aerobic respiration, aerobic process, glycolysis, Krebs cycle, fermentation, electron transport system, Mitochondria matrix, FADH+, NAD+, Lactic Acid

Measurable Skills: model, investigate, analyze, compare/contrast, differentiate, explain, and describe

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Cells • B.C.1 : Cell structure and function • Structure, function and interrelatedness of cell organelles • Eukaryotic cells and prokaryotic cells • B.C.2 : Cellular processes • Characteristics of life regulated by cellular processes • Photosynthesis,		

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chemosynthesis, cellular respiration, biosynthesis of macromolecule s		
SS: Cells /B.C.1 C: 6	Identify subatomic particles and describe how they are arranged in atoms.	
SS: Cells /B.C.1 QC: A.5.f C: 6	Explain the fundamental principles of the pH scale and consequences of having the different concentrations of hydrogen and hydroxide ions.	pH LabQuest/probe lab
SS: Cells /B.C.1 C: 6	Define and explain the unique properties of water that are essential to living organisms.	

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Measurable Skills: model, investigate, analyze, compare/contrast, differentiate, explain, and describe

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SS: Cells /B.C.1 C: 6 (and 1)	Explain the difference between organic and inorganic compounds.	
SS: Cells /B.C.1 C: 6	Describe how cells “function within a narrow range of temperature and pH.”	Enzyme Labquest/ probe lab
SS: Cells /B.C.2 C: 6	Describe how “a special group of proteins, enzymes, enables chemical reactions to occur in living systems.”	Lactaid/Lactose demo HHMI “Got Lactose”
SS: Cells /B.C.2 C: 6	Describe the function of enzymes, including how enzyme-substrate specificity works, in biochemical reactions.	Jello Lab
SS: Cells /B.C.2 C: 6	Explain how cells store energy temporarily as ATP.	

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SS: Cells /B.C.1 C: 6	Compare the types of bonding between atoms to form molecules.	
SS: Cells /B.C.1 C: 6	Describe the molecular composition of a living cell specifically its “elements and complex molecules.”	Macromolecule Pogil
SS: Cells /B.C.1 C: 6	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.	Carbohydrate Lab

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Cells /B.C.1 C: 6	Describe the difference between ions and atoms and the importance of ions in biological processes.	
SS: Cells /B.C.2 C: 7	Explain how “a complex network of proteins provides organization and shape” to a cell.	Cell Membrane Model Pogil Plasma Membrane
SS: Cells /B.C.1 C: 7	Describe the functions of all major cell organelles, including nucleus, ER, RER, Golgi apparatus, ribosome, mitochondria, microtubules, microfilaments, lysosomes, centrioles, and cell membrane.	Cell Diagram Handout Cell Organelle Handout
SS: Cells /B.C.2 C: 7	Contrast the structure and function of subcellular components of motility (e.g. cilia, flagella, pseudopods)	

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SS: Cells /B.C.1 C: 7	Explain how "a complex network of proteins provides organization and shape" to a cell.	Cell Membrane Model
SS: Cells /B.C.2 C: 7	Describe how cells "function within a narrow range of temperature and pH."	pH Lab
SS: Cells /B.C.2 C: 7	Distinguish between "the chemical reactions of cells that involve water and carbohydrates, proteins, lipids, and nucleic acids."	Organic Compound cutouts
SS: Cells /B.C.2 C: 7	Describe how "a special group of proteins, enzymes, enables chemical reactions to occur in living systems."	Jello/detergent lab Enzyme Lab (Catalase)

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SS: Cells /B.C.1 C: 7	Analyze the similarities and differences among a plant versus animal cell and eukaryotic versus prokaryotic cells.	Cell Observation Lab (plant and animal) - microscope
SS: Cells /B.C.1 C: 7	Describe the basic process of mitosis.	POGIL Mitosis
SS: Cells /B.C.2 C: 7	Describe and contrast these types of cell transport: osmosis, diffusion, facilitated diffusion, and active transport.	Diffusion lab osmosis Agar block lab
SS: Cells /B.C.2 C: 7	Explain how the cell membrane maintains homeostasis.	

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SS: Cells C: 7 (17)	Describe the experiments Pasteur to support or falsify the hypothesis of spontaneous generation.	
SS: Cells B.C.2 C: 7	Distinguish between the “specialized parts for transport of materials, energy transformations, protein building, waste disposal, information feedback and movement.”	Cell Membrane Model Lab Dialysis Tube Lab Cell Size and Diffusion Lab
SS: Cells C: 7	Describe the molecular composition of a living cell specifically its “elements and complex molecules.”	Video “Magic of Cells”
SS: Cells C: 7	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

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SS: Cells C: 9	Explain how "complex interactions among different kinds of molecules in the cell cause distinct cycles of activities such as growth and division."	Mitosis Activity Mitosis Slides with Microscope Mitosis video Online root tip activity Model mitosis
SS: Cells C: 9	Explain how "complex interactions among different kinds of molecules in the cell cause distinct cycles of activities such as growth and division."	Leaf Observation Lab Chromatography Lab
SS: Diversity and Interdependence of Life	Investigate "the effects of physical/chemical constraints on all biological relationships and systems."	Cellular Respiration Lab

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
B.DI.2: Ecosystems • Equilibrium and disequilibrium C: 8		
SS: Diversity and Interdependence of Life B.DI.2: Ecosystems • Equilibrium and disequilibrium C: 8	Describe how "organisms transform energy (flow of energy) and matter (cycles of matter) as they survive and reproduce."	Photosynthesis Pogil Packet
SS: Cells /B.C.2	Identify the cellular sites of and follow through the major pathways of anaerobic and aerobic respiration; compare	POGIL Cell Respiration. Cellular respiration lab

QUARTER 1

Topic: Chemistry of Biology; Cellular Structure and Function; Cellular Reproduction; Energy

Key Terms: Chemistry of Biology: Atom, nucleus, proton, neutron, electron, element, Isotope, compound, covalent bond, molecule, ion, ionic bond, van der walls forces, chemical reaction, reactant, product, activation energy, catalyst, enzyme, Substrate, active site, polar molecule, hydrogen bond, mixture, solution, solvent, Solute, acid, base, pH, buffer, macromolecules, polymer, carbohydrate, lipid, protein, amino acid, Nucleic acid, nucleotides peptide bond, polypeptide, ATP, RNA, DNA, Monosaccharide, disaccharide, polysaccharide, glycogen, starch
Cellular Structure and Function: Cell Theory, Anton van Leeuwenhoek, Robert Hooke, Matthias Schleiden/Theodor Schwann, Louis Pasteur, compound microscope, Electron microscope, Cell, prokaryotic cell, eukaryotic cell, nucleus, organelle, Selective permeability, Phospholipid bilayer, transport protein, fluid mosaic model, concentration gradient, cytoplasm/cytosol, cytoskeleton, microtubules, microfilaments, Chromosomes, Chromatin, Micrometer (µm), nucleolus, cell/plasma membrane, cell wall, lysosome, centrioles, Chloroplast, thylakoids, cell wall, Vacuole, cilia, flagella, DNA/RNA, Nuclear envelope, ribosomes, Chlorophyll, Golgi complex/apparatus, endoplasmic reticulum, mitochondria, diffusion, dynamic equilibrium, facilitated diffusion, carrier protein, osmosis, hypertonic, hypotonic, isotonic, Passive transport, active transport, endocytosis, exocytosis
Cellular Reproduction (Mitosis): Cell cycle, Interphase, G_1 Phase, S phase, G_2 Phase, M phase, mitosis, cytokinesis, Chromosomes, Chromatin, Prophase, Sister Chromatids, Centromere, Spindle apparatus, metaphase, anaphase, telophase, Cell Plate, Cyclin/cyclin-dependent kinases (CDKs), Cancer, Carcinogens, Oncogene (not in book), apoptosis,
Stem Cells (Embryonic vs. Adult)
Energy (Photosynthesis and Cellular Respiration); Plant Structure and Function: Energy, Thermodynamics, metabolism, photosynthesis, cellular respiration, adenosine triphosphate (ATP), Thylakoid, Granum/Grana, Stroma, pigment, NADP+, Calvin Cycle, Rubisco, PSI/II, C-3/C-4/CAM plants, Anaerobic process, aerobic respiration, aerobic process, glycolysis, Krebs cycle, fermentation, electron transport system, Mitochondria matrix, FADH+, NAD+, Lactic Acid

Measurable Skills: model, investigate, analyze, compare/contrast, differentiate, explain, and describe

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
C: 8	reactants and products for each process, and account for how aerobic respiration produces more ATP per monosaccharide.	
SS: Cells /B.C.2 C: 8	Explain how photosynthetic organisms use the process of photosynthesis and respiration.	Stomata Lab
SS: Cells /B.C.2 C: 8	Explain the interaction between pigments, absorption of light, and reflection of light.	Chromatography lab
SS: Cells /B.C.2 C: 8	Describe the light-dependent and light-independent reactions of photosynthesis.	Video on Photosynthesis

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Cells /B.C.2 C: 8	Relate the products of the light-dependent reactions to products of the light-independent reactions.	Elodea Lab
SS: Cells /B.C.2 C: 8	Design and conduct an experiment demonstrating effects of environmental factors on photosynthesis.	*Elodea* lab Design a lab photosynthesis
SS: Cells /B.C.2 C: 8 (10) (22: Plant Structure and Function)	Describe the basic mechanisms of plant processes especially movement of materials and plant reproduction.	
SS: Cells /B.C.1 C: 8 (10) (22: Plant Structure and Function)	Explain the functions of unique plant structures, including the cell wall, chloroplasts, and critical parts of the flower and seed.	

QUARTER 1

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Cells /B.C.2 C: 8	Show how chemical reactions (e.g., photosynthesis, fermentation, cellular respiration) can be represented by chemical formulas.	HHMI video: “Got Lactose” Yeast Lab Corn Lab (Fermentation) Part II-redesign

QUARTER 2

Topic: Sexual Reproduction and Genetics; Complex Inheritance and Human Heredity; Molecular Genetics; Genetics and Biotechnology

Key Terms:

Sexual Reproduction and Genetics: Gene, homologous chromosomes, gamete, haploid, fertilization, diploid, meiosis, crossing over, Sexual reproduction, asexual reproduction, zygote, synapsis, Genetics, heredity, allele, dominant, recessive, homozygous, heterozygous ,genotype, phenotype, Law of segregation, hybrid, law of independent assortment, true breeding, purebred, First Filial generation, Second filial generation, parent generation, Gregor Mendel, Punnett square, monohybrid, dihybrid, carrier, Genetic recombination, polyploidy

Complex Inheritance and Human Heredity: Carrier, Hybrid, Purebred, pedigree, Huntington's disease, cystic fibrosis, Incomplete Dominance, codominance, multiple alleles, epistasis, sex chromosomes, autosome, Sex-linked trait, polygenic trait, Karyotype, telomere, nondisjunction

Molecular Genetics: Double Helix, nucleosome, Nucleic Acid, Bacteriophage, Nucleotides, Chargaff's rule, Semiconservative Replication, DNA polymerase, Okazaki fragment, RNA, messenger RNA, ribosomal RNA, transfer RNA, transcription, RNA polymerase, intron, exon, Codon, translation, ribosome, anti-codon, One gene-one enzyme hypothesis, Gene Regulation, operon, mutation, mutagen

Genetics and Biotechnology

Intellectual Disposition/Measurable Skills: model, solve, compare, contrast, describe, explain, identify, differentiate

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Cells B.C.2 C: 10 (7)	Explain how complex interactions among different kinds of molecules in the cell cause distinct cycles of activities such as growth and division."	Online root tip activity Meiosis Modeling
SS: Heredity B.H.1: Cellular genetics C: 10-11	Explain how Mendel's Laws of Inheritance are interwoven with current knowledge of DNA and chromosome structure and function in modern genetics."	Face Lab
SS: Heredity B.H.3: Genetic mechanisms and inheritance C: 10-11	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
SS: Heredity B.H.1, B.H.3 C: 10-11	Differentiate between incomplete dominance and sex-linked traits, goodness of fit, and dihybrid crosses.	Practice Punnett's squares
SS: Heredity B.H.1 C: 10-11	Apply Chi-square Analysis (goodness of fit) and Punnett's squares to statistically analyze data.	M&M Chi-square Live Fruit Fly Lab
SS: Heredity B.H.3 C: 10-11	Differentiate between polygenic inheritance, epistasis, and pleiotropy.	
SS: Heredity B.H.4 C: 10-11	Explain how different phenotypes result from new combinations of existing genes or from mutations of genes in reproductive cells.	

QUARTER 2

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Heredity B.H.1 C: 10	Describe the process of meiosis.	POGIL Meiosis
SS: Heredity B.H.3 C: 11	Describe the mode of inheritance in commonly inherited disorders (e.g. sickle cell, Down syndrome, Turner's syndrome, PKU).	
SS: Heredity B.H.1 C: 10	Identify and explain Mendel's law of segregation and law of independent assortment.	Coin Toss Lab
SS: Heredity B.H.1 C: 10	Explain how the process of meiosis reveals the mechanism behind Mendel's conclusions about segregation and independent assortment on a molecular level.	
SS: Heredity B.H.3 C: 10	Define and provide an example of the following: genotype, phenotype, dominant allele, recessive allele, codominant allele, incompletely dominant alleles, homozygous, heterozygous and, carrier.	Human Trait Activity
SS: Heredity B.H.3 C: 10-11	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).	Genetic Problems

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SS :Heredity B.H.3 C: 10-11	Construct and interpret Punnett squares and pedigree charts (e.g., calculate and predict phenotypic and genotypic ratios and probabilities).	Genetic Problems Penny Lab
SS: Heredity B.H.1 C: 10-11	Infer parental genotypes and phenotypes from offspring data presented in pedigree charts from the genotypic and phenotypic ratios of offspring.	Pedigree Problems Live Fruit Fly Lab
SS: Cells:B.C.2 SS: Heredity : B.H.2 C: 12	Explain how cells make proteins, and how proteins catalyze most chemical reactions in cells.	Protein Synthesis Activity Codon Bingo
SS: Cells:B.C.2 SS: Heredity: B.H.2 C: 12	Relate DNA sequences to protein structure in cells.	
SS: Heredity B.H.2 C: 12	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.	DNA extraction Lab
SS: Heredity B.H.2 C: 12	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

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
		DNA animation
SS: Heredity B.H.2 C: 12	Explain how the sequence of DNA bases on a chromosome determines the sequence of amino acids in a protein.	
SS: Heredity B.H.2 C: 12	Explain how inserting, deleting or substituting segments of DNA molecules can alter genes.	GMO argument/packet
SS: Heredity B.H.3 C: 12	Explain how altered genes may be passed to every cell that develops from it, and how mutations in gametes can be passed to offspring.	
SS: Heredity B.H.5 C: 12	Describe how different genes are active in different types of cells influenced by the cell's environment and past history.	
SS: Heredity B.H.1 C: 12	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.	
SS: Heredity B.H.2 C: 12	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"
SS: Heredity B.H.2 C: 12	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

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SS: Cells B.H.2 C: 12	Explain how the sequence of DNA bases on a chromosome determines the sequence of amino acids in a protein.	Codon Coding Codon Bingo
SS:Heredity B.H.2 C: 12 (7)	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 package, labeled, and eventually exported by the cell.	
SS: Heredity B.H.2 C: 12	Describe the basic structure and function of DNA, mRNA, tRNA, amino acids, polypeptides, and proteins (e.g. replication, transcription, and translation).	
SS: Heredity B.H.2 C: 12	Describe the experiments of major scientists in determining both the structure of DNA and the central dogma.	
SS: Heredity B.H.2 C: 12	Use mRNA codon charts to determine amino acid sequences of example polypeptides.	Codon Coding
SS: Heredity B.H.2 C: 12	Use mRNA codon charts to determine the effects of different types of mutations on amino acid sequence and protein structure (e.g., sickle cell).	

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SS: Cells B.C.2 C: 12	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
SS: Heredity B.H.5 C: 12-13	Complete a major project relating to recombinant DNA cloning, or stem cell research.	Video: "Clone"

QUARTER 3

Topic: Evolution: Organizing Life's Diversity

Key Terms:
Fossil Evidence of Change: Fossil K-T Boundary
Evolution: Artificial Selection, Natural Selection, Evolution, *The Origin of Specie,* Derived trait, ancestral trait, homologous structure, vestigial structure, analogous structure, embryo, Biogeography, fitness, camouflage, mimicry, fossil, adaptation, Hardy-Weinberg Principle, genetic drift, founder effect, bottleneck, gene flow, stabilizing natural selection, Directional natural selection, disruptive selection, sexual selection, prezygotic isolationg mechanism, postzygotic isolating mechanism, Allopatric speciation, sympatric speciation, adaptive radiation, gradualism, punctuated equilibrium
Organizing Life's Diversity: Classification, Taxonomy, Binomial nomenclature, *Scientific name*, Carolus Linnaeus, taxon, Domain, Phylogeny, morphological characters, biochemical characters, Cladogram, phylogenic tree, Archaea, Peptidoglycan, Eukarya, Protista, Fungus, Plantae, Animalia, Virus

Measurable Skills: solve, support, differentiate, describe, explain, demonstrate, investigate, organize, compare, classify, state, identify

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Diversity and Interdependence of Life B.DI.1 SS: Evolution B.E.2 C: 14/15	Describe how both morphological comparisons and molecular evidence must be used to describe biodiversity through cladograms.	Salamander Lab
SS: Cells B.C.1 SS: Evolution B.E.2 C: 14/15	Explain how once cells with nuclei developed about a billion years ago, increasingly complex multicellular organisms evolved.	
SS: Evolution B.E.2 C: 14/15	Describe how biological evolution explains the natural origins for the diversity of life.	Video: "Islands Evolution"
SS: Evolution B.E.1 C: 14/15	Explain how evolution changes the properties of a trait in populations.	Peppered Moth Activity
SS: Heredity B.H.5 C: 14/15	Explain how modern synthesis is the unification of genetics and evolution and historical perspectives of evolutionary theory.	
SS: Evolution B.E.1 C: 14/15	Distinguish between gene flow, mutation, speciation, natural selection, genetic drift, sexual selection, and Hardy Weinberg's law.	Hardy-Weinberg Problems
SS: Evolution B.E.2 C: 14/15	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	Pock Pocket Mouse Activity HHMI Video: "Rock Pocket Mouse"

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
	the survival or reproduction of the individual with the trait.	
SS: Evolution B.E.2 C: 15	Apply the Hardy-Weinberg law to explain gene frequency patterns in a population.	
SS: Evolution B.E.1 C: 15	Explain how evolution is the decent with modification of different lineages from common ancestors.	
SS: Evolution B.E.1 C: 15	Explain how populations evolve over time.	
SS: Evolution B.E.1 C: 15	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.	
SS: Evolution B.E.1 C: 15	Apply the knowledge of mutation and genetic drift to real-world examples.	
SS: Evolution B.E.1 C: 15	Explain how heritable characteristics influence how likely an organism is to survive and reproduce in a particular environment.	

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SS: Evolution B.E.1 C: 15	Formulate and revise explanations for gene flow and sexual selection based on real-world problems.	
C: 15	Explain the biological definition of evolution.	
SS: Evolution B.E.2 C: 15	Explain the influence of other scientists (e.g., Malthus, Wallace, Lamarck, and Lyell) and of Darwin's trip on the HMS Beagle in formulating Darwin's ideas of natural selection.	
SS: Evolution B.E.2 C: 15	Contrast Lamark and Darwin's ideas about changes in organisms over time.	
SS: Evolution B.E.1 C: 15	Explain how evolution is the decent with modification of different lineages from common ancestors.	
SS: Evolution B.E.1 C: 15	Explain how populations evolve over time.	
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Key Terms:
Fossil Evidence of Change: Fossil K-T Boundary
Evolution: Artificial Selection, Natural Selection, Evolution, *The Origin of Specie,* Derived trait, ancestral trait, homologous structure, vestigial structure, analogous structure, embryo, Biogeography, fitness, camouflage, mimicry, fossil, adaptation, Hardy-Weinberg Principle, genetic drift, founder effect, bottleneck, gene flow, stabilizing natural selection, Directional natural selection, disruptive selection, sexual selection, prezygotic isolationg mechanism, postzygotic isolating mechanism, Allopatric speciation, sympatric speciation, adaptive radiation, gradualism, punctuated equilibrium
Organizing Life's Diversity: Classification, Taxonomy, Binomial nomenclature, *Scientific name*, Carolus Linnaeus, taxon, Domain, Phylogeny, morphological characters, biochemical characters, Cladogram, phylogenic tree, Archaea, Peptidoglycan, Eukarya, Protista, Fungus, Plantae, Animalia, Virus

Measurable Skills: solve, support, differentiate, describe, explain, demonstrate, investigate, organize, compare, classify, state, identify

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Evolution B.E.1 C: 15	Provide examples of behaviors that have evolved through natural selection (e.g., migration and courtship rituals).	
SS: Evolution B.E.2 C: 15	Design, perform and analyze a laboratory simulation of natural selection on a working population.	Rock Pocket Mouse Activity
SS: Evolution B.E.1 C: 15	Describe the basic types of selection, including disruptive, stabilizing, and directional.	
SS: Evolution B.E.2 C: 15	Specifically describe the conditions required to be considered a species (e.g., reproductive isolation and geographic isolation).	
SS: Evolution B.E.1 C: 15	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 and the striking molecular similarities observed among the diverse species of living organisms.	
SS: Diversity and Independence of Life B.DI.1 C: 15	Discuss evidence from the fields of geology, biochemistry, embryology, comparative anatomy, and comparative physiology that points to shared evolutionary relationships.	

QUARTER 3

Topic: Evolution: Organizing Life's Diversity

Key Terms:
Fossil Evidence of Change: Fossil K-T Boundary
Evolution: Artificial Selection, Natural Selection, Evolution, *The Origin of Specie,* Derived trait, ancestral trait, homologous structure, vestigial structure, analogous structure, embryo, Biogeography, fitness, camouflage, mimicry, fossil, adaptation, Hardy-Weinberg Principle, genetic drift, founder effect, bottleneck, gene flow, stabilizing natural selection, Directional natural selection, disruptive selection, sexual selection, prezygotic isolationg mechanism, postzygotic isolating mechanism, Allopatric speciation, sympatric speciation, adaptive radiation, gradualism, punctuated equilibrium
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Measurable Skills: solve, support, differentiate, describe, explain, demonstrate, investigate, organize, compare, classify, state, identify

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Diversity and Independence of Life B.DI.1 C: 15, 17	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.	
SS: Diversity and Independence of Life B.DI.1 C: 15	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.	
SS: Diversity and Independence of Life B.DI.1 C: 15	Distinguish between catastrophism, gradualism, and punctuated equilibrium.	
SS: Evolution B.E.1 C: 15	Discuss Darwin's principle of survival of the fittest and explain what Darwin meant by natural selection.	Pocket Mouse Activity
SS: Evolution B.E.2 SS: Diversity and Interdependence of Life C: 17	Explain how the diversity of organisms and ecological niches they occupy result from more than 3.5 billion years of evolution.	Galapagos Video
SS: Diversity and Interdependence of Life B.DI.1 SS: Evolution B.E.2	Explain how classification systems are frameworks developed by scientists for describing the	Shark Activity

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Measurable Skills: solve, support, differentiate, describe, explain, demonstrate, investigate, organize, compare, classify, state, identify

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
C: 17	diversity of organisms indicating the degree of relatedness between organisms.	
SS: Evolution B.E.2 C: 15, 17	Explain how Earth's present-day species descended from earlier, common ancestral species.	Salamander Lab
SS: Evolution B.E.1 C: 15,17	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"
SS: Evolution B.E.2 C: 15,17	Differentiate among chemical evolution and organic evolution and the evolutionary steps along the way to aerobic heterotrophs and photosynthetic autotrophs.	Time Line
SS: Diversity and Independence of Life B.DI.1 C: 17	Explain how organisms are classified into a hierarchy of groups and subgroups based on similarities that reflect their evolutionary relationships.	Phylogenetic Tree Activity Classification Conundrum
SS: Diversity and Independence of Life B.DI.1 C: 17	List each of the major levels in the hierarchy of taxa: kingdom, Phylum, class, order, family, genus, and species.	Classification Lab
SS: Diversity and Independence of Life B.DI.1 C: 17	Explain the binomial nomenclature system.	

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Diversity and Independence of Life B.DI.1 C: 17	Construct and use a dichotomous key.	Shark Key
SS: Diversity and Independence of Life B.DI.1 C: 17	Explain classification criteria for fungi, plants, and animals.	
SS: Diversity and Independence of Life B.DI.1 C: 17	Compare the major divisions of animals.	Classification Lab
SS: Diversity and Independence of Life B.DI.1 C: 15, 17 (2)	Explain how the diversity of organisms and ecological niches they occupy result from more than 3.5 billion years of evolution.	

QUARTER 4

Topic: Principles of Ecology; Communities, Biomes and Ecosystems; Population Ecology

Key Terms:

Principles of Ecology

Ecology, Biosphere, Biotic, Abiotic, population, community, ecosystem, biome, Habitat, niche, predation, symbiosis, mutualism, commensalism, parasitism, Autotroph, heterotroph, herbivore, carnivore, omnivore, detritivore, Trophic level, Food chain, food web, biomass, matter, biogeochemical cycle, nitrogen fixation, denitrification

Communities, Biomes, and Ecosystems (Succession)

Community, Limiting Factor, Range of tolerance, ecological succession, primary succession, Climax community, secondary succession, Lichen, pioneer species, Ecosystem, Biome, Weather, latitude, climate, Arctic/Alpine Tundra, Taiga, desert, Mid-latitude/Temperate Deciduous Forest, Chaparral/scrubland, grassland, savanna, Tropical rain forest, Tropical, ozone layer, Greenhouse effect, polar Climatogram, Deciduous, Arboreal, Permafrost, arid

Population Ecology

Population Density, Dispersion/Dispersal, Density-independent factor, density- dependent factor, Population growth rate, emigration, immigration, death/mortality rate, Birth/natality rate, exponential growth, Logistic growth, carrying capacity, r-strategist, k-strategist, demography/demographics, demographic transition, zero population growth, age structure/population pyramid

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.DI: DIVERSITY AND INDEPENDENCE OF LIFE B.DI.1: Biodiversity • Genetic diversity • Species diversity B.DI.2: Ecosystems • Equilibrium and disequilibrium • Carrying capacity B.DI.3: Loss of Diversity • Climate change • Anthropocene effects • Extinction • Invasive species		
SS: Cells C: 1	Describe the biological criteria that needs to be met in order for an organism to be considered alive.	
SS: Diversity and Independence of Life B.DI.3 C: 2	Read and describe current journal articles relating to environmental concerns.	DDT/Eutrophication

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Diversity and Independence of Life B.DI.1 C: 1-4	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, and subatomic particle).	
SS: Diversity and Independence of Life B.DI.2 C: 1-4	Design and conduct investigations appropriately using essential processes of inquiry.	Salinization Lab Yeast Lab
SS: Diversity and Independence of Life B.DI.2 C: 3-4	Use mathematics to enhance the scientific inquiry process.	Population Sampling Lab Population Pyramids
SS: Diversity and Interdependence of Life B.DI.3 C: 3	Investigate the effects of physical/chemical constraints on all biological relationships and systems.	Food Web Lab (DDT)

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Diversity and Interdependence of Life B.DI.2 C: 1-4	Explain through mathematical interpretation the concepts of carrying capacity and homeostasis within biomes.	
SS: Diversity and Interdependence of Life B.DI.3 C: 1-4	Investigate population changes that occur locally or regionally.	Reindeer Population Lab Yellowstone Video Population Sampling Lab https://www.census.gov/population/international/data/idb/informationGateway.php
SS: Diversity and Interdependence of Life B.DI.2 C: 4	Apply the exponential growth model and logistic growth model to sample populations.	POGIL Populations
SS: Diversity and Interdependence of Life B.DI.2	Explain how ecosystems tend to have cyclic fluctuations around a state of rough equilibrium.	Yellowstone Video

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Diversity and Independence of Life B.DI.2 QC: F.1.a C: 1-4	Define and provide examples of biosphere, biome, ecosystem, community, population, species habitat, and niche.	Climatogram Activity
SS: Diversity and Independence of Life B.DI.2 C: 3	Discuss biotic and abiotic factors that affect land and aquatic biomes.	Biome Map Pogil Biomes
SS: Diversity and Independence of Life B.DI.2 C: 1-2	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.	Food Web Concept Map Ecological Footprint Activity
SS: Diversity and Interdependence of Life B.DI.2 C: 2	Explain how ecosystems tend to have cyclic fluctuations around a state of rough equilibrium.	

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Diversity and Interdependence of Life B.DI.2 C: 2	Differentiate between interspecies and intra-species competition for resources, and what occurs when a species immigrates to or emigrates from ecosystems.	Reindeer Lab
SS: Diversity and Interdependence of Life B.DI.3 C: 3	Investigate the effects of physical and chemical constraints on all biological relationships and systems.	Seed Germination Lab (Salinization)
SS: Diversity and Independence of Life B.DI.1 C: 2-3	Describe examples of competition, symbiosis, and predation.	Video Clips
SS: Diversity and Independence of Life B.DI.2 C: 3	Explain the process of ecological succession, and describe the different communities that result.	Video Clip (Nova)
SS: Diversity and Interdependence of Life B.DI.2 C: 2-3	Describe how organisms transform energy (flow of energy) and matter (cycles of matter) as they survive and reproduce.	Biogeochemical Cycle Handout

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Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
SS: Diversity and Independence of Life B.DI.2 C: 4	Explain the concept of carrying capacity.	Reindeer/Human Population Lab
SS: Diversity and Independence of Life B.DI.2 C: 4	Describe the growth of populations, including exponential and logistic growth.	Reindeer/Human Population Lab
SS: Diversity and Independence of Life B.DI.1 C: 2	Explain how energy flows through ecosystems in one direction, from photosynthetic organisms to herbivores to carnivores and decomposers.	Food Web
SS: Diversity and Independence of Life B.DI.1 C: 2	Discuss the role of beneficial bacteria (e.g., in the recycling of nutrients).	Food Web Nutrient Cycle Handout/Animation Pogil Nutrient cycles
SS: Diversity and Independence of Life B.DI. 2 C: 2	Explain how the amount of life any environment can support is limited by the available matter and energy and	Yeast Activity Lab

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	by the ability of ecosystems to recycle the residue of dead organic materials.	
SS: Diversity and Independence of Life B.DI.2 C: 2	Diagram the flow of energy using food webs, food chains, and pyramids (e.g., pyramid of energy, pyramid of biomass and pyramid of numbers).	Food Web Lab
SS: Diversity and Independence of Life B.DI.3	Discuss and evaluate the significance of human interference with major ecosystems.	

QUARTER 4		
Topic: Bacteria and Viruses; Protists; Animals		
Key Terms: Bacteria and Viruses Bacteria, nucleoid, Capsule, pilus, binary fission, conjugation, endospore, Archaea, flagella, Photoautotroph, Chemoautotroph, Nitrogen Fixation, *Legumes, Plasmid, Virus, capsid, lytic cycle, lysogenic cycle, retrovirus, prion, smallpox Protista Animals		
Measurable Skills: investigate, identify, describe, explain, locate, recognize, examine		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
B.DI: DIVERSITY AND INDEPENDENCE OF LIFE B.DI.1: Biodiversity • Genetic diversity • Species diversity B.DI.2: Ecosystems • Equilibrium and disequilibrium • Carrying capacity B.DI.3: Loss of Diversity • Climate change • Anthropocene effects • Extinction • Invasive species B.C: CELLS B.C.1 : Cell structure and function • Structure, function and interrelatedness of cell organelles • Eukaryotic cells and prokaryotic cells B.C.2 : Cellular processes • Characteristics of life regulated by cellular processes • Photosynthesis, chemosynthesis, cellular respiration, biosynthesis of macromolecules		

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Measurable Skills: investigate, identify, describe, explain, locate, recognize, examine		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
SS: B.DI: DIVERSITY AND INDEPENDENCE OF LIFE B.DI.1 C: 18,19	Distinguish between and among viruses, bacteria, and protista, and give examples of each.	Protist Lab Antiobiotic Lab Bacteria Slice Lab with Microscope Bacteria Video Virus Video Epidemiology Study
SS: CELLS B.C.1 C: 24-37	Identify major types of animal cells and tissues.	Frog Dissection Squid Dissection
SS: Cells B.C.1 C: 24-37	Describe the major components and functions of physiological systems, including skeletal, muscle, circulatory, respiratory, digestive, urinary, endocrine, nervous, reproductive, and immune.	Frog Dissection Squid Dissection

District Instructional Resource:

Miller Levine Biology (2019) / Pearson (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