Proposal but not required: On the first day of school all Biology classes conduct an inquiry / Observation lab that introduces the scientific process. Suggested activities include:

**Mystery Box**

**Living vs Nonliving**

**Academic and Behavior Expectations**

**Class Safety including evacuation procedures**

**Activities to develop data literacy skills**

---

**Time: 4 days**

8 Characteristics of Living Things
* Summer Reading Quizzes

**Important Vocabulary:**

<table>
<thead>
<tr>
<th>Cell</th>
<th>Biology</th>
<th>Unicellular</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td>Characteristics</td>
<td>Reproduction</td>
<td>Obtain</td>
</tr>
<tr>
<td>Function</td>
<td>Homeostasis</td>
<td>Asexual</td>
<td>Internal</td>
</tr>
<tr>
<td>Genetic Code</td>
<td>Multicellular</td>
<td>Sexual</td>
<td></td>
</tr>
</tbody>
</table>

**Possible Labs/Activities:**
- Characteristics of Living things Graphic Organizer
- Structural Hierarchy / Levels of Organization Posters / Mobiles
- Greek and Latin Roots / Scranimals activity
Time: 7.5 days

MA Standards:
- 1.1 Recognize that biological organisms are composed primarily of very few elements. The six most common are C, H, N, O, P, S.
- 1.2 Describe the basic molecular structures and primary functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids).

Essential Questions:

Chapters / Pages: The Chemistry of Life: 2.1/35-39, 2.3/44-48

Need To Know:
- Recognize C, H, N, O, P, S
- Definition of organic
- Four Organic compounds / macromolecules (carbohydrates, proteins, lipids, nucleic acids) → identify, structure, function, compare & contrast

Important Vocabulary:

<table>
<thead>
<tr>
<th>Carbohydrates</th>
<th>Compounds</th>
<th>Molecules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrons</td>
<td>Hydrogen bonds</td>
<td>Nucleus</td>
</tr>
<tr>
<td>Lipids</td>
<td>Macromolecules</td>
<td>Proteins</td>
</tr>
<tr>
<td>Organic</td>
<td>Nucleic acids</td>
<td>Nitrogenous Base</td>
</tr>
<tr>
<td>Monomer</td>
<td>Polymer</td>
<td>Monosaccharide</td>
</tr>
<tr>
<td>Polysaccharide</td>
<td>Nucleotide</td>
<td>Ribonucleic Acid</td>
</tr>
<tr>
<td>Deoxyribonucleic acid</td>
<td>Amino Acid</td>
<td>Amino Group</td>
</tr>
<tr>
<td>Carboxyl Group</td>
<td>Phosphate Group</td>
<td></td>
</tr>
</tbody>
</table>

Possible Activities:
- Identifying Organic Compounds (Lab Manual A)
- Discovering Where Proteins are Found (Lab Manual B)
- McMush Lab
- Alphabet Cereal / Pasta graphing exercise
- Practice MCAS Open Response Questions
- Organic Compounds Graphic Organizer
- CHNOPS Body
- Organic Compound Group Presentations
Biology Benchmarks

Time: 7 days

MA Standards:
- 1.3 Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, which have an effect on enzymes.

Essential Questions:

Chapters / Pages: Chemical Reactions and Enzymes 2.4 / 49-53

Need To Know:
- The shape of an enzyme determines the function
- Substrates bind with specific active sites on enzyme
- Enzymes lower the energy needed for a chemical reaction to take place
- Effects of pH and Temperature on enzymes (pg. 51)

Important Vocabulary:

<table>
<thead>
<tr>
<th>Acid</th>
<th>Activation Energy</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemical Reaction</td>
<td>Catalyst</td>
<td>Reaction</td>
</tr>
<tr>
<td>Enzyme</td>
<td>pH</td>
<td>Active Site</td>
</tr>
<tr>
<td>Products</td>
<td>Reactants</td>
<td></td>
</tr>
<tr>
<td>Reaction Rate</td>
<td>Yield</td>
<td></td>
</tr>
<tr>
<td>Substrate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Possible Activities:
- pg. 54 catalase using potato
- Catalase Demonstration
- Toothpickase
- Practice MCAS Open Response Questions
- Reinforce graphing skills including interpreting graphs
**MA Standards:**
- 2.1 Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, facilitated diffusion, and active transport). (pp. 174-189)
- 2.2 Compare and contrast, at the cellular level, prokaryotes and eukaryotes (general structures and degrees of complexity). (pp 172-173)

**Note: 2.3 to be addressed with Standard 5.2**

**Essential Questions:**

**Chapters / Pages:** Life is Cellular 7.1-7.3 / 169-189

**Need To Know:**
- Plant & Animal Cells → identify, describe, structure, function, compare & contrast
- Plasma Membrane → identify, describe, structure, function
- Active Transport vs. Diffusion vs. Facilitated Diffusion vs. Osmosis → describe, compare & contrast
- Prokaryotes vs. Eukaryotes → structure, locomotion, compare & contrast

**Important Vocabulary:**

<table>
<thead>
<tr>
<th>Active Transport</th>
<th>Cell Wall</th>
<th>Centriole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloroplast</td>
<td>Chromosome</td>
<td>Cilia</td>
</tr>
<tr>
<td>Concentration</td>
<td>Cytoplasm</td>
<td>Cytoskeleton</td>
</tr>
<tr>
<td>Diffusion</td>
<td>Endoplasmic Reticulum</td>
<td>Plasma Membrane</td>
</tr>
<tr>
<td>Facilitated Diffusion</td>
<td>Flagellum</td>
<td>Vacuole</td>
</tr>
<tr>
<td>Golgi Apparatus</td>
<td>Gradient</td>
<td>Homeostasis</td>
</tr>
<tr>
<td>Hypertonic</td>
<td>Hypotonic</td>
<td>Isotonic</td>
</tr>
<tr>
<td>Lysosome</td>
<td>Mitochondrion</td>
<td>Nuclear Envelope</td>
</tr>
<tr>
<td>Nucleolus</td>
<td>Nucleus</td>
<td>Osmosis</td>
</tr>
<tr>
<td>Osmotic Pressure</td>
<td>Prokaryotic</td>
<td>Equilibrium</td>
</tr>
<tr>
<td>Pseudopod</td>
<td>Sodium Potassium Pump</td>
<td>Eukaryotic</td>
</tr>
<tr>
<td>Ribosome</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Possible Activities:**
- Potato Diffusion / Osmosis Lab (modify to increase inquiry for honors)
- Jigsaw Organelles / Cell “Cocktail Party” – “Hello, My Name is … “
- Starch bags and iodine indicator / Dialysis Tubing
- Analyzing Data (pg. 188)
- Introduce Microscope / Onion Cell Lab
- Venn Diagram (comparing prokaryotic, eukaryotic plant and animal)
**Biology Benchmarks**

**Time:** 12 days

**MA Standards:**
- 2.4 Identify the reactants, products, and basic purposes of photosynthesis and cellular respiration. Explain the interrelated nature of photosynthesis and cellular respiration in the cells of photosynthetic organisms.
- 2.5 Explain the important role that ATP serves in metabolism.

**Essential Questions:**

**Chapters / Pages:** Photosynthesis 8 / 201-214, Cellular Respiration 9 / 221-232

**Need To Know:**
- Photosynthesis: Overall equation $6CO_2 + 6H_2O +$ Sun’s Energy $\rightarrow C_6H_12O_6 + 6O_2$
- Cellular Respiration: Overall Equation $C_6H_12O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O +$ Energy
- Factors affecting photosynthesis and cellular respiration
- Compare & Contrast Photosynthesis and Cellular Respiration
- Relationships between Photosynthesis and Cellular Respiration

**Important Vocabulary:**

- Aerobic
- Anaerobic
- Adenosine Triphosphate (ATP)
- Chlorophyll
- Chloroplast
- Cristae
- Mitochondrion
- Thylakoid
- Adenosine Diphosphate (ADP)
- Pigment
- Chloroplast

**Possible Activities:**
- Battery & light bulb activity
- What waste material is produced during photosynthesis? Quick lab p 206 Substitute for Elodea
- Investigating Photosynthesis (pg. 215)
- Investigating the Effects of Light Intensity on Photosynthesis pg. 231 Quick lab
- Investigating Fermentation by Making Kimchi (pg. 234)
- Cellular Respiration and Photosynthesis Plays
- Photosynthesis and Cellular Respiration Responsive Readings
- Spinach Paper Chromatography
- Photosynthesis and Cellular Respiration Concept Maps

**Approximate End of Quarter 1**
MA Standards:
- 2.6 Describe the cell cycle and the process of mitosis. Explain the role of mitosis in the formation of new cells, and its importance in maintaining chromosome number during asexual reproduction.
- 2.7 Describe how the process of meiosis results in the formation of haploid cells. Explain the importance of this process in sexual reproduction, and how gametes form diploid zygotes in the process of fertilization.

Essential Questions:

Chapters / Pages: Cell Growth and Division 10 / 241-249, Meiosis 11.4 / 275-278

Need To Know:
- Mitosis → steps, describe, results
- Meiosis → steps, describe, results
- Mitosis/Meiosis → compare & contrast
- sexual vs. asexual reproduction → similarities & differences, advantages & disadvantages
- Chromosomes → basic structure and Function
- Regulation of Cell Growth → normal function vs. dysfunction

Important Vocabulary:

<table>
<thead>
<tr>
<th>Anaphase</th>
<th>Cancer</th>
<th>Centrioles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centromere</td>
<td>Chromatids</td>
<td>Crossing Over</td>
</tr>
<tr>
<td>Cyclin</td>
<td>Cytokinesis</td>
<td>Diploid</td>
</tr>
<tr>
<td>Fertilization</td>
<td>Gamete</td>
<td>Haploid</td>
</tr>
<tr>
<td>Homologous</td>
<td>Interphase</td>
<td>Meiosis</td>
</tr>
<tr>
<td>Metaphase</td>
<td>Mitosis</td>
<td>Telophase</td>
</tr>
<tr>
<td>Prophase</td>
<td>Spindle Fibers</td>
<td></td>
</tr>
<tr>
<td>Zygote</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Possible Activities:
- Modeling the Cell Cycle (pg. 254)
- Mitosis Wheel
- Mitosis/Meiosis Flipbook
- Observing Mitosis (Onion and Whitefish) Slides with Microscope
- Selected parts of “Life’s Greatest Miracle”
- Process of Fertilization (Handwerker pg.59)
**MA Standards:**

3.4 Distinguished among observed inheritance patterns caused be several types of genetic traits (dominant, recessive, incomplete dominance, codominant, sex-linked, polygenic, and multiple alleles).

3.5 Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance (such as dihybrid crosses).

3.6 Use a Punnett Square to determine the probabilities for genotype and phenotype combinations in monohybrid crosses.

**Essential Questions:**

**Chapters / Pages:** Introduction to Genetics 11.1-11.3 / 263-274

**Need To Know:**
- Genotypes: what they are, how to interpret
- Phenotypes: what they are, determining possible genotypes
- Types of Genetic Traits: dominant, recessive, codominant, sex-linked, polygenic incomplete dominance, multiple alleles
- Medelian Genetics: Basic Crosses, Interpreting Crosses, Independent Assortment, Segregation
- Punnet Squares: How to complete a cross (monohybrid & dihybrid), how to interpret genotypes, phenotypes, common ratios (1:2:1, 9:3:3:1)
- Pedigree Charts: Reading & Interpreting, working backwards

**Important Vocabulary:**

<table>
<thead>
<tr>
<th>Acquired Trait</th>
<th>Allele</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codominant</td>
<td>Dihybrid</td>
<td>Dominant</td>
</tr>
<tr>
<td>F1</td>
<td>F2</td>
<td>Gene</td>
</tr>
<tr>
<td>Genetics</td>
<td>Genotype</td>
<td>Heterozygous</td>
</tr>
<tr>
<td>Homologous</td>
<td>Homozygous</td>
<td>Hybrid</td>
</tr>
<tr>
<td>Incomplete Dominance</td>
<td>Independent Assortment</td>
<td>Inherited Traits</td>
</tr>
<tr>
<td>Multiple Alleles</td>
<td>Offspring</td>
<td>Trisomy</td>
</tr>
<tr>
<td>Pedigree</td>
<td>Phenotype</td>
<td>Polygenic</td>
</tr>
<tr>
<td>Probability</td>
<td>Segregation</td>
<td>Recessive</td>
</tr>
<tr>
<td>Sex-Linked</td>
<td>Trait</td>
<td></td>
</tr>
</tbody>
</table>

**Possible Activities/Labs:**
- Pennies and Beans and Mendel’s Genes
- Survey of Human Traits (PTC tasters, Tongue rollers, Widows peak, etc)
MA Standards:
3.4 Distinguished among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, incomplete dominance, codominant, sex-linked, polygenic, and multiple alleles).
3.5 Describe how Mendel’s laws of segregation and independent assortment can be observed through patterns of inheritance (such as dihybrid crosses).
3.6 Use a Punnett Square to determine the probabilities for genotype and phenotype combinations in monohybrid crosses.

Essential Questions:

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- Genotypes: what they are, how to interpret
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<td>Gene</td>
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<tr>
<td>Genetics</td>
<td>Genotype</td>
<td>Heterozygous</td>
</tr>
<tr>
<td>Homologous</td>
<td>Homozygous</td>
<td>Hybrid</td>
</tr>
<tr>
<td>Incomplete Dominance</td>
<td>Independent Assortment</td>
<td>Inherited Traits</td>
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<tr>
<td>Probability</td>
<td>Segregation</td>
<td>Recessive</td>
</tr>
<tr>
<td>Sex-Linked</td>
<td>Trait</td>
<td></td>
</tr>
</tbody>
</table>

Possible Activities/Labs:
- Pennies and Beans and Mendel’s Genes
- Survey of Human Traits (PTC tasters, Tongue rollers, Widows peak, etc)
4.6 Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father and that sexually produced offspring resemble, but are not identical to, either of their parents.

Essential Questions:

Chapters / Pages:

Need To Know:

Important Vocabulary:

For MA Standard 4.5

For MA Standard 4.6
Meiosis Gametes Haploid Diploid
Sperm Ovum Zygote Implantation
Fertilization

Possible Activities:
- Frog Embryology Quick Lab (PH p1022)

Approximately the end of Quarter II, Semester I (Suggestion: take two days for Semester Review; We usually three days of exams)
Time: 15 days

MA Standards:
- 3.1 Describe the basic structure (double helix, sugar/phosphate backbone, linked by complimentary nucleotide pairs) of DNA, and describe its function in genetic inheritance.
- 3.2 Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic code. Explain the basic processes of transcription and translation, and how they result in the expression of genes. Distinguish among the end products of replication, transcription, and translation.
- 3.3 Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic changes in offspring.

Essential Questions:

Chapters / Pages: DNA and RNA 12 (except 12.5)/ 287-308

Need To Know:
- DNA: structure, function, location
- Replication: process, intermediates, end products, conservation of genetic code
- Transcription: process, concept of codons, base pairs, function, locations
- Translation: process, base pairs, location, functions, anticodons
- Proteins/Amino Acids
- RNA: structure, function, location
- Mutations: genotype vs. phenotype, types of mutations
- Phenotype vs. Genotype relationships, similarities, differences

Important Vocabulary:

<table>
<thead>
<tr>
<th>Term</th>
<th>Term</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenine</td>
<td>Anticodon</td>
<td>Uracil</td>
</tr>
<tr>
<td>Base Pairs</td>
<td>Chromatin</td>
<td>Codon</td>
</tr>
<tr>
<td>Cytosine</td>
<td>DNA Polymerase</td>
<td>Double Helix</td>
</tr>
<tr>
<td>tRNA</td>
<td>Gene</td>
<td>Transcription</td>
</tr>
<tr>
<td>Genetic Code</td>
<td>Genotype</td>
<td>Guanine</td>
</tr>
<tr>
<td>Inheritance</td>
<td>Replication</td>
<td>Thymine</td>
</tr>
<tr>
<td>mRNA</td>
<td>Mutation</td>
<td>Phenotype</td>
</tr>
<tr>
<td>Insertions, Deletions</td>
<td>Nucleotide</td>
<td>Translation</td>
</tr>
<tr>
<td>Substitutions</td>
<td>RNA Polymerase</td>
<td>rRNA</td>
</tr>
</tbody>
</table>

Possible Activities:
- Protein/Amino Acid Wheel (p. 303)
- Modeling DNA Replication (p. 313)
- DNA Bingo
- Disney©DNA/ Build DNA
Biology Benchmarks

- Chargaff’s DNA Data (Martin Shields p.121)
- DNA from the Beginning
- Dragon/Gummy Bear Genetics
- Predicting Your Offspring Activity
- Reebop Lab
- Spongebob Genetics
- Modeling DNA Probes (p. 361)
MA Standards:
- 2.3 Use cellular evidence (e.g. cell structure, cell number, cell reproduction) and modes of nutrition to describe the six kingdoms (Archaebacteria, Eubacteria, Protista, Fungi, Plantae, and Animalia)
- 2.8 Compare and contrast a virus and a cell in terms of genetic material and reproduction.

Essential Questions:

Chapters / Pages: Viruses 19.2 / 478-483

Need To Know:
- Viruses \( \rightarrow \) structure, function, nutrition
- Viruses vs. Cells \( \rightarrow \) compare & contrast chart (pg. 483)
- Living vs. Non-Living – What are viruses?

Important Vocabulary:

<table>
<thead>
<tr>
<th>Bacteriophage</th>
<th>Capsid</th>
<th>Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNA</td>
<td>RNA</td>
<td></td>
</tr>
<tr>
<td>Particle</td>
<td></td>
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</tr>
</tbody>
</table>

Possible Activities:
- How Do Viruses Differ in Structure? (pg. 482) Quick lab
- Viral Diseases Research Project
- Videos “Ebola (Nova)” Outbreak
- Viruses vs. Cells (Handwerker p.11)
MA Standards:
5.1 Explain how evolution is demonstrated by evidence from the fossil record, comparative anatomy, genetics, molecular biology (p454-455), and examples of natural selection.

Essential Questions:

Chapters / Pages:
- Ch. 15 “Darwin’s theory of Evolution” p368 – 386
- Ch 17 “The History of Life” p417-420, 435-438
- Ch 18 “Classification” p454-455

Need To Know:
- The major elements (ie. Overpopulation, Competition, Variation,) of Darwin’s Theory of Natural Selection
- How to use various forms of evidence to support the theory of natural selection

Important Vocabulary:
- Geographic Distribution
- Homologous Structures
- Fitness
- Artificial Selection
- Natural Selection
- Extinction (p151 & 417)
- Convergent Evolution
- Radiative Dating (p420)
- Fossil
- Descent with Modification
- Charles Darwin
- Adaptation
- Embryology
- Relative Dating (p419)
- Adaptive Radiation (p436)
- Theory
- Population
- Survival of the Fittest
- Vestigial Organ
- Evolution
- Index Fossils
- Coevolution

Possible Activities:
- Mix and Match Embryos
- Evolution Modeling Activities (eg. Peppered Moth, Survivor: Galapagos Island)
- Modeling Adaptation (p389)
- Comparing Amino Acids
- Role Playing Scientists
- Evidence of Evolution: Fossil Records
- DNA
- Homologous Body Structures
- Similarities in Embryology
Time: 12 days

MA Standards:
- 5.3 Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity from a population.
- 5.2 Describe species as reproductively distinct groups of organisms. Recognize that species are further classified into a hierarchical taxonomic systems (kingdom, phylum, class, order, family, genus, species) based on morphological, behavioral, and molecular similarities. Describe the role that geographic isolation can play in speciation.

Essential Questions:

Chapters / Pages:  
- Ch 16 “Evolution of Populations” (p392-400, 404-405)  
- Ch 18 “Classification” (p447-453, 457-461)

Need To Know:
- Sources for genetic variation in a population / offspring
- How natural selection changes the frequency of phenotypic expression of polygenic traits in a population
- The conditions under which speciation may occur
- How to interpret graphic representations of evolution such as phylogenic trees
- How organisms are classified from most inclusive taxa (domain, kingdom) to least inclusive (species)
- Major similarities and differences between organisms classified in the 6 kingdoms

Important Vocabulary:

<table>
<thead>
<tr>
<th>Term</th>
<th>Term</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allele</td>
<td>Heredity</td>
<td>Heterozygous</td>
</tr>
<tr>
<td>Homozygous</td>
<td>Phenotype</td>
<td>Genotype</td>
</tr>
<tr>
<td>Gene</td>
<td>Gene Pool</td>
<td>Relative Frequency</td>
</tr>
<tr>
<td>Mutations</td>
<td>Single-gene trait</td>
<td>Polygenic trait</td>
</tr>
<tr>
<td>Directional Selection</td>
<td>Stabilizing Selection</td>
<td>Disruptive Selection</td>
</tr>
<tr>
<td>Genetic Drift</td>
<td>Founder Effect</td>
<td>Speciation</td>
</tr>
<tr>
<td>Species (p64)</td>
<td>Population (p64)</td>
<td>Reproductive Isolation</td>
</tr>
<tr>
<td>Behavioral isolation</td>
<td>Temporal Isolation</td>
<td>Geographic Isolation</td>
</tr>
<tr>
<td>Taxonomy</td>
<td>Classification</td>
<td>Binomial Nomenclature</td>
</tr>
<tr>
<td>Domain</td>
<td>Kingdom</td>
<td>Phylum</td>
</tr>
<tr>
<td>Class</td>
<td>Order</td>
<td>Family</td>
</tr>
<tr>
<td>Genus</td>
<td>Bacteria</td>
<td>Eukarya</td>
</tr>
<tr>
<td>Prokaryotic</td>
<td>Eubacteria</td>
<td>Plantae</td>
</tr>
<tr>
<td>Archaeabacteria</td>
<td>Eukaryotic</td>
<td>Animalia</td>
</tr>
<tr>
<td>Protista</td>
<td>Fungi</td>
<td></td>
</tr>
</tbody>
</table>

Possible Activities:
- Candy Dichotomous Key – Kingdom Dichotomous key
- Kingdom “Who am I?”
- Camanincules
Approximate End of Quarter 3
Time: 6 days

MA Standards:
6.3 Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels. Describe how relationships among organisms (predation, parasitism, competition, commensalism, and mutualism) add to the complexity of biological communities.

Essential Questions:

Chapters / Pages: The Biosphere 3.1-3.2 / 63-73

Need To Know:
- create and interpret food chains and food webs
- identify correct trophic level for a member of a food web
- relationship between organisms in an ecosystem
- explain energy relationships in a food web or chain
- create and explain energy pyramids

Important Vocabulary:
- food web
- community
- trophic level
- food chain
- predation
- producer
- predator
- consumer
- prey
- decomposer
- parasitism
- competition
- mutualism
- commensalisms
- autotrophs
- heterotrophs
- photosynthesis
- carnivore
- omnivore
- herbivore
- niche

Possible Activities:
- Wellar and Vroom Dr. Seuss Food Web
- Finding Nemo
Time: 5 days

MA Standards:
6.4 Explain how water, carbon, and nitrogen cycle between abiotic resources and organic matter in an ecosystem and how oxygen cycles through photosynthesis and respiration.

Essential Questions:

Chapters / Pages: Cycles of Matter 3.3 / 74-80

Need To Know:
- describe nutrient cycles
- identify missing components of a nutrient cycle
- biotic vs. abiotic processes and how they regulate nutrient cycles
- explain how all nutrient cycles are related to each other

Important Vocabulary:
- nutrient
- photosynthesis
- oxygen
- organic
- CO
- NO₂⁻
- precipitation
- cycle
- respiration
- transpiration
- condensation
- N₂
- bacteria
- ecosystem
- carbon
- abiotic
- biogeochemical
- NH₃
- fixation
- water
- nitrogen
- evaporation
- CO₂
- NO₃⁻
- denitrification

Possible Activities:
- Bottle Biology
**Biology Benchmarks**

**Time:** 8 days

**MA Standards:**
6.1 Explain how birth, death, immigration, and emigration influence population size.
6.2 Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.

**Essential Questions:**

**Chapters / Pages:** Populations 5.1-5.2 / 118-127

**Need To Know:**
- identify which factors increase/decrease population size and biodiversity
- describe how events and conditions in the community affect population size and biodiversity
- explain how many interactions between organisms in the community affect population size and biodiversity
- interpret and analyze graphs of population growth/decay
- identify factors that result in speciation and extinction
- explain how natural causes, changes in climate, human activity, and the introduction of invasive and non-native species affect population and biodiversity
- predict changes in population and biodiversity based on only a few conditions given

**Important Vocabulary:**

<table>
<thead>
<tr>
<th>Populations</th>
<th>Biodiversity</th>
<th>Birth</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy pyramids</td>
<td>Predator</td>
<td>Prey</td>
<td>Immigration</td>
</tr>
<tr>
<td>Emigration</td>
<td>Exponential growth</td>
<td>Biomass pyramid</td>
<td>Pyramid of numbers</td>
</tr>
<tr>
<td>Weather</td>
<td>Climate</td>
<td>Greenhouse effect</td>
<td>Speciation</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Extinction</td>
<td>Temperature</td>
<td>Natural causes</td>
</tr>
<tr>
<td>Biosphere</td>
<td>Climate zone</td>
<td>Human activities</td>
<td>Invasive</td>
</tr>
<tr>
<td>Non-native species</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Possible Activities:**
- Predator / Prey modeling activity
Biology Benchmarks

**Time:** 5 days

**MA Standards:**
Central Concept: There is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism. Homeostasis allows the body to perform its normal functions.

4.8 Recognize that the body’s systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.

4.1 Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy and for repair and growth.

**Essential Questions:**

**Chapters / Pages:**
- Ch. 35 p891-896
- Ch. 38 p978-984

**Need To Know:**
- How multicellular organisms are organized into a structural hierarchy, levels of organization.
- Examples of specialized cells and the functions they perform.
- The 4 major categories of tissues (epithelial, connective, muscle, and nerve) and general functions.
- How organisms maintain a relatively constant internal condition (feedback loops, feedback inhibition) and provide specific examples (body temp, carbon dioxide, nitrogenous waste, water).
- How humans obtain nutrition from the food they eat.
- What are the organs of the digestive system?

**Important Vocabulary:**

<table>
<thead>
<tr>
<th>Cells</th>
<th>Tissue</th>
<th>Organs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organ Systems</td>
<td>Homeostasis</td>
<td>Anatomy</td>
</tr>
<tr>
<td>Physiology</td>
<td>Epithelial tissue</td>
<td>Connective tissue</td>
</tr>
<tr>
<td>Muscle tissue</td>
<td>Nervous tissue</td>
<td>Feedback loops</td>
</tr>
<tr>
<td>Feedback inhibition</td>
<td>Stimulus</td>
<td>Mouth</td>
</tr>
<tr>
<td>Pharynx</td>
<td>Esophagus</td>
<td>Stomach</td>
</tr>
<tr>
<td>Small intestines</td>
<td>Large intestines</td>
<td>Rectum</td>
</tr>
<tr>
<td>Liver</td>
<td>Gall Bladder</td>
<td>Pancreas</td>
</tr>
<tr>
<td>Macromolecules</td>
<td>Villi (sing. Villus)</td>
<td>Bile</td>
</tr>
<tr>
<td>Enzymes</td>
<td>Amylase</td>
<td>Peristalsis</td>
</tr>
</tbody>
</table>

**Possible Activities:**

- Observe different types of tissues with compound microscope
- Feedback Loop Concept maps
Time: 4 days

MA Standards:
4.2 Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. Describe how the kidneys and the liver are closely associated with the circulatory system as they perform the excretory function of removing waste from the blood. Recognize that kidneys remove nitrogenous wastes, and the liver removes many toxic compounds from the blood.
4.3 Explain how the respiratory system (nose, pharynx, larynx, trachea, lungs, alveoli) provides exchange of oxygen and carbon dioxide.

Essential Questions:

Chapters / Pages: Miller/Levine  Circulation 37-1, 37-2 Kidney 38.3
  Respiration 37-3 P. 956 References Fig. 37-13 & 37-14 in text

Need To Know:
- Students should be able to diagram and describe the movement of blood through a generalized (mammalian?) circulatory system.
- Students should be able to diagram and describe the structure of a mammalian heart.
- Students should be able to describe the relationship between the circulatory system and the kidneys.
- Describe how the kidneys remove nitrogenous waste, excess salt and excess water from blood.
- Students should be able to describe the how oxygen and carbon dioxide are exchanged between the blood, air, and tissues in the human respiratory system.
- Students will be able to explain and define the basic functions of the: Nose, Pharynx, Larynx, Lungs, and Alveoli (Air Sacs)
- Students should understand that the alveoli in lungs provides an huge surface area for gas exchange.
- Students should know that the respiratory system works with the circulatory esp. hemoglobin on red blood cells to carry oxygen to cells for cellular aerobic respiration.

Important Vocabulary:

<table>
<thead>
<tr>
<th>Blood</th>
<th>Red Blood Cells</th>
<th>White Blood Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platelets</td>
<td>Plasma</td>
<td>Hemoglobin</td>
</tr>
<tr>
<td>Heart</td>
<td>Atria (atrium)</td>
<td>Ventricles</td>
</tr>
<tr>
<td>Blood Vessels</td>
<td>Artery (Arteries)</td>
<td>Capillary</td>
</tr>
<tr>
<td>Vein (s)</td>
<td>Kidney</td>
<td>Nephron</td>
</tr>
<tr>
<td>Filtration</td>
<td>Reabsorption</td>
<td>Diffusion</td>
</tr>
<tr>
<td>Nose</td>
<td>Pharynx</td>
<td>Larynx</td>
</tr>
<tr>
<td>Lungs</td>
<td>Alveoli</td>
<td></td>
</tr>
</tbody>
</table>
Possible Activities:
- Kidney Dissection
- Circulation Flipbook
- Human Physiology Pulse and BP lab
- Observe lung tissue with light microscope
- KWL Chart
### MA Standards: Consider addressing some of 4.4 and 4.7 with 2.1
- 4.4 Explain how the nervous system (brain, spinal cord, sensory neurons, motor neurons) mediates communication between different parts of the body and the body’s interactions with the environment. Identify the basic unit of the nervous system, the neuron, and explain generally how it works.
- 4.7 Recognize that communication between cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells.

### Essential Questions:

### Chapters / Pages:
- Nervous System Ch 35 p897-905
- Endocrine and Reproductive Systems Ch 39 p997-999

### Need To Know:
- Gross composition of the nervous system (diagram p. 891) brain, spinal cords, nerves (35-1)
- The main function of the nervous system (p897 – Sec 35-2)
- That the nervous system sends electrical messages back and forth between the brain, spinal cord, and body
- Neurons move messages in one direction: Sensory neurons: Organs $\rightarrow$ Brain  Motor neurons: Brain $\rightarrow$ Organs
- How the endocrine system (glands) coordinates and communicates with different body systems and target cells

### Important Vocabulary / Terms:

<table>
<thead>
<tr>
<th>Nervous system</th>
<th>Sensory Neurons</th>
<th>Brain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nerve Impulses</td>
<td>Spinal Cord</td>
<td>Dendrite</td>
</tr>
<tr>
<td>Action Potential</td>
<td>Resting Potential</td>
<td>Threshold</td>
</tr>
<tr>
<td>Cell Body</td>
<td>Motor Neurons</td>
<td>Neurotransmitter</td>
</tr>
<tr>
<td>Stimulus</td>
<td>Axon</td>
<td>Hypothalamus</td>
</tr>
<tr>
<td>Endocrine System</td>
<td>Endocrine glands</td>
<td>Target Cells</td>
</tr>
<tr>
<td>Hormone</td>
<td>Thyroid</td>
<td>Pituitary Gland</td>
</tr>
</tbody>
</table>

### Possible Activities:
- Stroop Effect Activity
- Observing Nervous Responses PH Bio Lab Manual A Ch 35 p249-253
- Observing Nervous Responses PH Bio Lab Manual B Ch 35 p227-231
Time: 4 days

MA Standards: Consider addressing 4.6 with 2.7
4.5 Explain how the muscular/skeletal system (skeletal, smooth and cardiac muscle, bones, cartilage, ligaments, tendons) works with other systems to support and allow for movement. Recognize that bones produce both red and white blood cells.
4.6 Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father and that sexually produced offspring resemble, but are not identical to, either of their parents.

Essential Questions:

Chapters / Pages: Skeletal system and Muscular system 36.1-36.2 / 920-931

Need To Know:
- State the functions of the skeletal system (36-1)
- Identify three types of joints: immovable (synarthrotic), slightly moveable (amphiarthrotic) or freely moveable (synovial or diarthrotic) (36-1)
  - Red marrow found in bone is where red and white blood cells are produced
  - Describe three types of muscle tissues (36-2)
  - Describe the functions of muscle tissues
  - Explain how muscles contract (36-2)

Important Vocabulary:
For MA Standard 4.5
Bone marrow Cartilage Joint Ligament
Tendon Skeletal Muscle Smooth Muscle Cardiac Muscle
Myosin Actin Neuromuscular Junction Acetylcholine

For MA Standard 4.6
Meiosis Gametes Haploid Diploid
Sperm Ovum Zygote Implantation
Fertilization

Possible Activities:
- Bone classification activity
- Muscle Tissue Slides / Overheads
- Frog Embryology Quick Lab (PH p1022)
Biology Benchmarks

**Time:** 4 days

**Review for MCAS Exam**

MCAS first week of June

**Time:** 7 days before end of Quarter IV, Semester II (suggest 2 days for review; finals are usually 3 days)

**Possible Activities:**
- Biome Zoo Project
- GATTACA
- Disease Research Project
- Body Systems Children’s Book