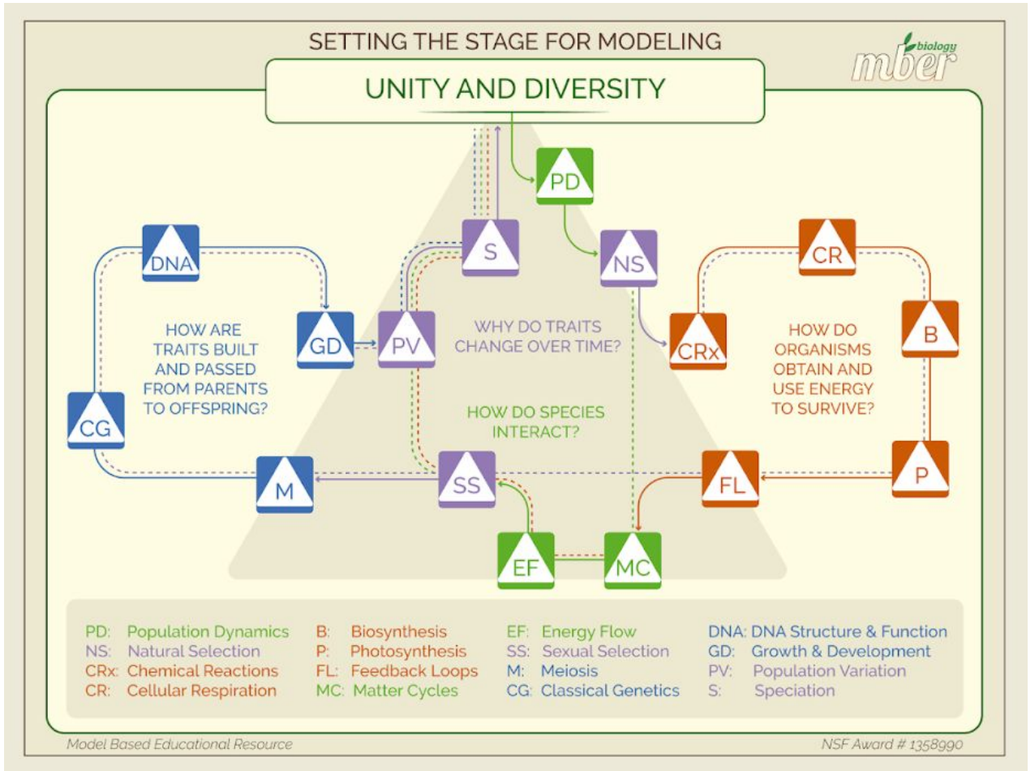
Year at a Glance - BCPS Biology 19-20

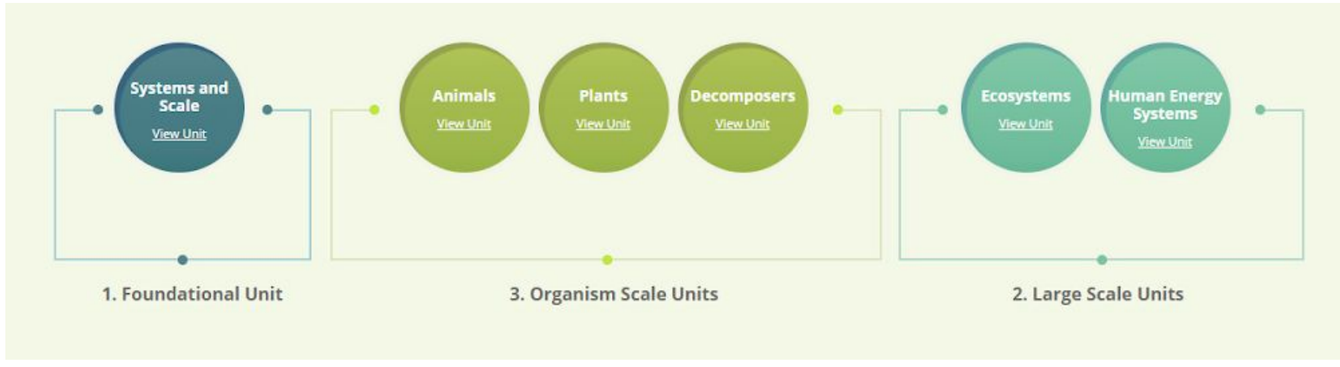
Semester 1 Options									
MBERS Unity & Diversity Unit	Carbon Time Units	Systems & Scale		Animals		Plants	Ecosystems		
	MBERS Units	Population Dynamics PD	Chemical Reactions CRx	Cellular Respiration CR	Biosynthesis B	Photosynthesis P	Feedback Loops FL	Matter Cycles MC	Energy Flow EF
Semester 2 Options									
Carbon Time Units	Genetics				Evolution				Human Energy Systems Carbon Time Unit
MBERS Units	Natural Selection NS	Sexual Selection SS	Meiosis M	Classical Genetics CG	DNA Structure & Function DNA	Growth & Development GD	Population Variation PV	Speciation S	

MBER Pacing



Carbon Time Pacing

*Genetics & Evolution under development



Biology 2nd Semester Expectations 2019-2020 *(Common Resources: Carbon Time & MBERS)*

<table>
<tr><th>Carbon Time Unit</th><th>MBERS Unit</th><th colspan="3">Standards addressed in that Unit</th><th>Learning Objectives</th><th>Pacing</th></tr>
<tr>
<td>Genetics</td>
<td>Natural Selection

Sexual Selection

Meiosis

Growth & Development

Classical Genetics

DNA Structure & Function</td>
<td colspan="3">HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.</td>
<td>CT Genetics Unit
Unit at a Glance, and links

Variation of Traits
-Individuals within a species have different traits.
-Acquired traits do not get passed on to their offspring. Inherited traits can get passed on. Individuals inherit albinism.
-If the shape of the protein changes, it can stop an enzyme from functioning.
-There are different versions of a gene (alleles). Different versions of a gene can lead to different proteins and therefore different traits.
-Changes at the DNA level can cause the change in the tyrosinase protein. Environment can also determine whether a trait is harmful, helpful, or neither.
-Environmental factors can cause mutations in genes, and viable mutations are inherited.
-Environmental cues or hormones can turn genes on and off. Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population.

Growth & Development
- In sexual reproduction, a specialized type of cell division called meiosis occurs and results in the production of sex cells, such as gametes (sperm and eggs) or spores, which contain only one member from each chromosome pair in the parent cell.
-Chromosomes can sometimes swap sections (crossing over) during the process of meiosis, thereby creating new genetic combinations and thus more genetic variation. Variation increases the chance that at least some organisms will survive if the environment changes.

Inherited Traits
- When crossing two individuals of opposite traits, In the first generation only one trait shows up. In the second generation we see ¾ of this "dominant" trait and ¼ of the other "recessive" trait.</td>
<td>7.5 Weeks</td>
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<td><u>Asking Questions and Defining Problems</u>
*Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1)

<u>Developing and Using Models</u>
*Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS -LS1-4)

<u>Analyzing and Interpreting Data</u>
*Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS -LS3-3)

<u>Engaging in Argument from Evidence</u>
Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence. (HS-LS3-2, 2-8)

<u>Constructing Explanations & Designing Solutions</u>
Construct an explanation based on valid and reliable evidence obtained from a Variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS -LS1-1)</td>
<td><u>LS1.B: Growth and Development of Organisms</u>
*In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)

<u>LS3.A : Inheritance of Traits</u>
*Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA The instructions for forming species' characteristics are carried in DNA . All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different way s. Not all DNA codes for a protein; some segments of DNA are inv olv ed in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)
<u>LS3.B: Variation of Traits</u>
*In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)
* Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3)
<u>LS2.D: Social Interactions and Group Behavior</u>
*Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HS-LS2-8)
<u>LS4.C: Adaptation</u>
*Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-5), (HS-LS4-6)
*Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (HS-LS4-5)</td>
<td><u>Cause and Effect</u>
Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS3-1),(HS-LS3-2)

<u>Scale, Proportion, and Quantity</u>
Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). (HS-LS3-3)

<u>Systems and System Models</u> Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy , matter, and information flows—within and between systems at different scales. (HS-LS1-4)</td>
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<tr><th>Carbon Time Unit</th><th>MBERS Unit</th><th colspan="3">Standards addressed in that Unit</th><th>Learning Objectives</th><th>Pacing</th></tr>
<tr><td rowspan="2">Evolution</td><td rowspan="2">Natural Selection

Population Variation

Speciation</td><td colspan="3">HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment .

HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.</td><td rowspan="2">CT Evolution Unit
Unit at a Glance and links

<u>Changing Populations</u>
-Kinds of bacteria
Within the kinds there are different types (varieties) antibiotic resistant or not.

-Build a mathematical model to explain why we need to take multiple doses of antibiotics to kill bacteria.

<u>Natural Selection</u>
-Students learn that differences in DNA matter more than external differences.
- Students learn that changing environments can lead to the expansion of some species,
the emergence of new species as populations diverge under different conditions, and the decline—and sometimes the extinction—of some species.

<u>Evidence of Common Ancestry and Diversity</u>
-If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.</td><td rowspan="2">6.5 Weeks</td></tr>
<tr><td><u>Analyzing and Interpreting Data</u>
Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS-LS4-3)

<u>Constructing Explanations and Designing Solutions</u>
Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS4-2),(HS-LS4-4)

<u>Obtaining, Evaluating, and Communicating Information</u>
Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally , graphically , textually , and mathematically). (HS-LS4-1)</td><td><u>LS4.A : Evidence of Common Ancestry and Diversity</u>
*Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1)

<u>LS4.B: Natural Selection</u>
*Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2),(HS-LS4-3)
*The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)

<u>LS4.C: Adaptation</u>
*Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment’s limited supply of the resources that individuals need in order to surv iv e and reproduce, and (4) the ensuing proliferation of those organisms that are better able to surv iv e and reproduce in that environment. (HS-LS4-2)
*Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically , behaviorally , and physiologically well suited to surv iv e and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3),(HS-LS4-4)
*Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)</td><td><u>Patterns</u>
Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-LS4-1),(HS-LS4-3)

<u>Cause and Effect</u>
Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS4-2),(HS-LS4-4)</td></tr>
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<tr><th>Carbon Time Unit</th><th>Standards addressed in that Unit</th><th>Learning Objectives</th><th>Pacing</th></tr>
<tr><td rowspan="2">Human Energy Systems</td><td>*HS-PS1-7*
HS-LS2-5
HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth’s surface can create feedbacks that cause changes to other Earth systems.
HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate.
HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.</td><td>Explain how data are sampled and represented in different representations of large-scale data sets (e.g., graphs, maps, videos).

Use large-scale data sets related to climate change (sea level rise, global temperature, atmospheric CO2, long-term trend, and atmospheric CO2 short term variability) to make predictions about the future.

Distinguish between short-term variability and long-term trends in large-scale data sets.

Locate organic and inorganic carbon pools near the Earth’s surface (atmosphere, biomass, soil, fossil fuels, and ocean).

Describe pools as changing in size over time.

Explain changes in atmospheric CO2 in terms of fluxes and associated with carbon-transforming processes: combustion, photosynthesis, cellular respiration.

Describe carbon cycling within Earth and Human systems.

Identify carbon fluxes associated with human economic activities.

Identify energy transformations involved in carbon fluxes.

Trace energy associated with human lifestyles to its sources, particularly combustion of fossil fuels.

Describe energy as flowing through Earth systems, from sunlight to chemical energy to heat that is radiated into space.

Explain the consequences of lifestyle and energy system choices for changes in atmospheric CO2 concentration.</td><td>CT Human Energy Systems Unit
Unit at a Glance

Lesson 1 – Pretest and Expressing Ideas about Arctic Sea Ice (2hr 25min)
5 Activities

Lesson 2 – Describing Patterns in Large Scale Data (2hr 40min)
4 Activities

Lesson 3 – Explaining Connections between Patterns
(1hr 25 min)
3 Activities

Lesson 4 – Fossil Fuels and Carbon Pools (3hr 15 min)
5 Activities

Lesson 5 – Consequences of Our Lifestyles (2hr 40min)
4 Activities

Lesson 6 – Global Implications and Posttest (2hr 10min)
4 Activities

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3 Weeks</td></tr>
<tr><td><u>Constructing Explanations and Designing Solutions</u>
*Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7)
*Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

<u>Analyzing and Interpreting Data</u>
*Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)
* Analyze data using tools, technologies, and/or models</td><td><u>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</u>
* Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)

<u>LS4.D: Biodiversity and Humans</u>
* Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (secondary to HS-LS2-7)

<u>ESS2.A: Earth Materials and Systems</u>
* Earth’s systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-2)
*The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun’s energy output or Earth’s orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash</td><td><u>Stability and Change</u>
*Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-7)
* Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-5)
*Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)

<u>Cause and Effect</u>
* Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS2-2), (HS-ESS2-4)

<u>Systems and System Models</u>
*When investigating or describing a</td></tr>
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	(e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HS-ESS2-2) **Using Mathematical and Computational Thinking** *Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6) **Developing and Using Models** * Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-6) *Use a model to provide mechanistic accounts of phenomena. (HS-ESS2-4)	clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4) **ESS2.D: Weather and Climate** * The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. (HS-ESS2-2), (HS-ESS2-4) * Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen.(HS-ESS2-6) *Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2-6),(HS-ESS2-4) **ESS3.C: Human Impacts on Earth Systems** * Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4) **ESS3.D: Global Climate Change** *Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (HS-ESS3-5) *Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HS-ESS3-6)	system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6) **Energy and Matter** * The total amount of energy and matter in closed systems is conserved. (HS-ESS2-6) **Influence of Engineering, Technology, and Science on Society and the Natural World** * New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS2-2)		
	Semester 1 Exams **(0.5 Weeks)**				**Total ~** **18 Weeks**