* There needs to be an emphasis on the connections between the macro- and the micro- systems in biological systems (e.g. the effect of a single mutation on ecosystem dynamics, and/or the effect of climate change on cellular processes) .
* To the extent possible, the historical context of content should be integrated into content and the bioethical implications of research and development of biological knowledge and technology should be explored.
* For each cross cutting concept, the cross-cutting concepts that most closely approximate the standard is listed.
* A road map for integration between content and practice can be found on page 261 of the NGSS Standard spiral book.
* Teachers should pay particular attention to the boundaries of each standard to adequately teach the depth and breadth of each standard.
* Models are not limited to physical models, but can also include illustrations, mathematical representations, simulations, etc.
* Asking questions can refer to a way of obtaining, evaluating, and communicating information (students’ show their thinking process) as a means of deriving a response.
* Applying concepts of statistics and probability is a skill that can be utilized in numerous standards, not just those standards where explicitly stated.

| NGSS PE | ORSS | Content | Practice | CCC | Notes on Alignment |
| --- | --- | --- | --- | --- | --- |
| HS-LS1 From Molecules to Organisms: Structures and Processes | | | | | |
| 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. | H.1.L.2  H.1.L.3  H.3.S.3 | S  P | P | S  S  P | These ORSS combined cover this standard as long as the practices and CCC are included.  CCC-Structure and Function |
| HS-LS1-2.  Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. | 5.1.L.1  6.1.L.1  6.2.L.1  H.1 | P  P  P | N | N  P | Not addressed in standards at grade level.  These ORSS combined (5.1.L.1., 6.1.L.1., and 6.2.L.1.) result in a strong alignment. It is not adequate to merely create a model, the student must use the model to demonstrate the relationships between systems and system components.  CCC – Systems and System Models |
| HS-LS1-3.  Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. | H.1.L.4  H.3.S.2 | P | S | N  S | These ORSS combined result in a strong alignment.  CCC – Stability and Change |
| HS-LS1-4.  Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. | H.1.L.4  H.2.L.3 | P  P | N | N | These ORSS combined result in a strong alignment.  CCC – Systems and System Models  It is not adequate to merely create a model, the student must use the model to demonstrate the relationships between systems and system components. |
| HS-LS1-5.  Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. | 8.2.P.2  H.2.L.1 | P  P | N | N  P | CCC – Energy and Matter  It is not adequate to merely create a model, the student must use the model to demonstrate the relationships between systems and system components. |
| HS-LS1-6.  Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. | H.1.L.1  H.2.L.1  H.3.S.3 | P  P | P | N  P | CCC – Energy and Matter |
| HS-LS1-7.  Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. | H.1.L.1  H.1.P.2  H.2.P.1 | P  P  P | N | N | CCC – Energy and Matter  It is not adequate to merely create a model, the student must use the model to demonstrate the relationships between systems and system components. |
| HS-LS2 Ecosystems: Interactions, Energy, and Dynamics | | | | | |
| HS-LS2-1.  Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. | 6.2.L.2  H.2.L.2 | P  P | N | N | See Performance Expectations (pg 108 of NGSS standards) HS-LS2-1.  CCC – Scale, Proportion, and Quantity |
| HS-LS2-2.  Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. | H.2.L.2  H.3.S.3 | P | N  P | N | CCC – Scale, Proportion, and Quantity |
| HS-LS2-3.  Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. | H.2.L.1  H.1.L.4  H.3.S.3 | P  P | P | N  P | OR Standards are nearly identical to NGSS. NGSS includes the addition of aerobic/anaerobic conditions.  CCC – Energy and Matter |
| HS-LS2-4.  Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. | H.2.L.1  H.2.P.3 | P  P | N | N | CCC – Energy and Matter  Mathematical representations should focus on proportions, not on real numbers. |
| HS-LS2-5.  Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. | H.2.L.1  7.2.L.2 | P  P | N | N | CCC – Systems and System Models |
| HS-LS2-6.  Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. | H.2.L.2  H.2.E.4  H.3.S.3 | P  P | P | P  P | CCC – Stability and Change  The “reasoning” component of this standard is new. |
| HS-LS2-7.  Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. | H.2.E.4  H.3  H.4.D.1-4 | P | P  S | S | CCC – Stability and Change  CCC - Cause and Effect  Biodiversity is a new component and must be included. |
| HS-LS2-8.  Evaluate the evidence for the role of group behavior on individual and species’ chances to survive and reproduce. | H.3.S.3 | N | P | N | CCC – Cause and Effect |
| HS-LS3 Heredity: Inheritance and Variation of Traits | | | | | |
| 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. | H.1.L.2  H.1.L.3  H.3.S.1 | P  S | P | P | CCC – Cause and Effect, Structure and Function  Obtaining, evaluating, and communicating information (students’ show their thinking process) as a means of deriving a response. |
| 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. | H.2.L.3  H.2.L.4  H.3.S.1  H.3.S.3 | P  P | P  P  N | P | CCC – Cause and Effect  Standard is taught by engaging in argument from evidence. |
| HS-LS3-3.  Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. | H.1.L.3  H.3.S.3 | N  P | P | N | CCC – Scale Proportion and Quantity |
| HS-LS4 Biological Evolution: Unity and Diversity | | | | | |
| HS-LS4-1.  Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. | H.2.L.5  H.3.S.4 | S  P | N | N | CCC – Patterns |
| 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. | H.2.L.4  H.2.L.3  H.3.S.3  H.1.L.4  H.2.L.2 | P  P  P  P | P | N | CCC – Cause and effect |
| 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. |  | N | N | N | CCC – Patterns  Practice - Mathematics and Computational Practice  Practice – Argumentation from Evidence |
| HS-LS4-4.  Construct an explanation based on evidence for how natural selection leads to adaptation of populations. | H.2.L.4  H.3.S.3  H.2.L.2 | P  P | P | N | H.2.L.2 – environmental disturbances lead to evolution  CCC – Cause and effect |
| 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. | H.2.L.2  H.2.L.4  H.3.S.3 | P  P | P | N | CCC – Cause and effect  CCC – Stability and Change  This standard offers a strong example of an opportunity to include H.3.S.4 as a historical background to the content. |
| HS-LS4-6.  Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. | H.4.D.1 - 4 | N | S | N | CCC – Cause and effect |
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| The following ORSS are not aligned to any NGSS: | | | | | |
| H.4.D.5 Describe how new technologies enable new lines of scientific inquiry and are largely responsible for changes in how people live and work. | | | | | |
| H.4.D.6 Evaluate ways that ethics, public opinion, and government policy influence the work of engineers and scientists, and how the results of their work impact human society and the environment. | | | | | |
| H.3.S.5. Explain how technological problems and advances create a demand for new scientific knowledge and how new knowledge enables the creation of new technologies. | | | | | |