Microscopic Marvels (grades 6 – 12)

Next Generation Science Standards Alignment

"Within the Next Generation Science Standards (NGSS), there are three distinct and equally important dimensions to learning science. These dimensions are combined to form each standard – or performance expectation – and each dimension works with the other two to help students build a cohesive understanding of science over time."

1. **Disciplinary Core Ideas (DCI):** "DCIs are the key ideas in science that have broad importance within or across multiple science or engineering disciplines. These core ideas are grouped into the following domains."
    - Physical Science (PS), Life Science (LS), Earth and Space Science (ESS), Engineering Technology and Applications of Science (ETS)

2. **Crosscutting Concepts (CC):** "CCs help students explore connections across the four domains of science.
    - Patterns; Cause and Effect; Scale, Proportion, and Quantity; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change

3. **Science and Engineering Practices (SEP):** "Science and Engineering Practices describe what scientists do to investigate the natural world and what engineers do to design and build systems."

Source: www.nextgenscience.org

Microscopic Marvels School Program

The following pages explain the alignment of Microscopic Marvels with NGSS Performance Expectations and the more general three dimensions of science. If interested in more detail, please don't hesitate to contact the Program Coordinator, Caryn Beiter, via phone or email. 207-646-1555x110, caryn@wellsnerr.org

Relevant Performance Expectations

***MS = middle school HS = high school**

MS-L2-3: Develop a model to describe the cycling of matter and flow of energy among living and non-living parts of an ecosystem.

MS-LS2.4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Disciplinary Core Ideas (DCI)

LS2.A: Independent Relationships in Systems

MS: Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving factors. Growth of organisms and population increases are limited by access to resources. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.

HS: Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
HS: Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. Plants or algae form the lowest level of the food web.

LS2.C: Ecosystem Dynamics, Functioning, Resilience
MS: Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all of its populations.
HS: 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.

LS4.D: Biodiversity and Humans
MS: Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.
HS: Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change.

ESS1.B: Earth and the Solar System
MS: This model of the solar system can explain tides, eclipses of the sun and the moon, and the motion of the planets in the sky relative to the stars.

ETS1.B: Developing Possible Solutions
MS: A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.

Crosscutting Concepts (CC)

CC6: Structure and Function
MS: Students model complex and microscopic structures and systems and visualize how their function depends on the shapes, composition, and relationships among its parts. They design structures to serve particular functions by taking into account properties of different materials and how materials can be shaped and used.
HS: Students infer the functions and properties of natural and designed objects and systems from their overall structure, the way their components are shaped and used.

Science and Engineering Practices (SEP)

Estuary observations, data collection, plankton design & testing

SEP2: Developing and Using Models
A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations.

SEP3: Planning and Carrying Out Investigations
Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters.