# Science Benchmark Clarification, Instruction, and Assessment

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 1. All students will apply an understanding of cells to the functioning of multi-cellular organisms, including how cells grow, develop, and reproduce. (Cells)

**Benchmark**
Demonstrate evidence that all parts of living things are made of cells (SCI.III.1.MS.1).

**Benchmark Clarification**
All living things/organisms (*link to Glossary*) are made of cell(s), the simplest unit of life. Each cell, tissue, and organ has a distinct structure and function(s). These help the organism survive. Although students are more familiar with multi-cellular organisms, most organisms are actually single-celled (such as paramecium, amoebae, bacteria).
In some multi-cellular organisms, students will:

- Observe cells in a variety of organisms using microscopes and hand lenses
- Describe cells in a variety of organisms
- Demonstrate that specialized cells cooperate to form a tissue (e.g., muscle)
- Demonstrate that tissues form organs (e.g., heart)
- Demonstrate that organs form organ systems (e.g., circulatory system)

**Living thing/organism:** anything that has the ability to grow, reproduce, take in substances, respond to stimuli, and interact with the environment

**Key Concepts**
Types of living things:

- plants
- animals

See specific functions *SCI.III.1.MS.2*.

Parts of organisms:

- tissues
- organs
- organ systems
- all functions of organisms are carried out by cells

Tools:

- microscope
- hand lens

**Real-World Context**
Common plant or animal cells:
- *Elodea* leaf cells
- onion skin cells
- human cheek cell

Single-celled organisms:
- paramecium
- ameoba

**Instructional Example SCI.III.1.MS.1**

**Benchmark Question:** What are cells?
**Focus Question:** How can we prove cells make up living things?

The class will brainstorm what they already know about cells (KWL, small group, large group discussion). Students will observe a variety of cell samples through the use of printed material, videos, multimedia, and lab explorations. Students will use a variety of scientific tools, such as microscopes and hand lenses. Students will compile a log/journal and illustrate their findings about cells from living things or once living things.

As a class, students will research how scientists have developed an understanding of cells and how they function in living things. Together, students will compile this information to develop a class timeline.

The teacher should make sure that students expand their understanding of scientific contributions to include scientists from diverse populations (cultures, ethnicity, gender). Such scientists might include the following:

<u>Frank Young</u> (*link to Biography*): conducted extensive research in fundamental genetics of bacteria (1931-)

**LIFE SCIENCE: CELLS**
**Frank Edward Young (1931 - )**
**GENETIC RESEARCHER AND AIDS FIGHTER**

Frank Edward Young was born just outside New York City in Mineola, Long Island, on September 1, 1931. Following high school, Young went to Union College and earned his medical degree in 1956 from S.U.N.Y. (State University of New York) Upstate Medical Center in Syracuse. He then took on an internship at the University Hospital of Cleveland, Ohio, and later began work toward a Ph.D. in microbiology at Case Western Reserve University, then known as Western Reserve University. Always ambitious, he received his Ph.D. degree in 1962.

Since then, Dr. Young has held faculty positions and memberships in a number of places. These include the Scripps Clinic and Research Foundation in LaJolla, California; the University of California at San Diego; the School of Medicine and Dentistry at the University of Rochester, New York; and the Strong Memorial Hospital, also located in Rochester.

Dr Frank Young's primary research focused on the fundamental genetics of the bacteria Bacillus *stubtilis* and the regulation of bacteria cell surfaces. He also studied the "How and Why" of DNA (deoxyribonucleic acid) as it relates to bacterial cell transformation. In this process, a bacteria cell called the recipient takes up DNA from its surroundings, and integrates DNA into its own genetic code. The recipient acquires new genes (the DNA) from outside of the cell.

Through his research, Dr. Young also developed some of the first cloning enzymes and vectors (organism carriers). Clones and vectors have become increasingly important to the study of genetics and cell transformation.

In 1984, Dr. Young was appointed Commissioner of the U.S. Food and Drug Administration (FDA) in Washington, D.C. During his time as Commissioner, the FDA approved several drugs and vaccines produced using some of the genetic engineering techniques Dr. Young had helped develop. Most notable of landmarks during his years at the FDA will be the agency's role in approving effective drugs and vaccines to combat the disease AIDS. Although only one drug actually gained FDA approval at the time, AZT, the FDA has made it possible for other promising drugs and treatments to be legally prescribed to those suffering from the disease.

### References

Current Biographic Yearbook. 1989. Charles Moritz (ed.). H.W. Wikson Company, NY. pp. 648-649.

Bacterial Transformation in Microbial Genetics. 1987. David Friefelder (ed.). Jones and Bartlett Publishers, Inc. Portola Valley, CA. pp. 314-329.

Dubnau, D. 1976. "Genetic Transformation of *Bacillus subtilis*: Review With Emphasis on the Recombination Mechanism." in Microbiology (D. Schlessinger, ed.). American Society for Microbiology.

McCarty, M. 1985. The Transforming Principle: Discovering That Genes are Made of DNA. Norton.

## Barbara McClintock (*link to Biography*): Nobel Prize Winner at age eighty-one; did research in genetics and mutations (1902- )

**LIFE SCIENCE: HEREDITY**
**Dr. Barbara McClintock (1902 - )**
**THE NOBEL PRIZE AT AGE 81**

Sometimes professional recognition and respect can be a long time in coming. Dr. Barbara McClintock certainly knows that to be true, having waited more than a quarter of a century for scientists to take her genetic discoveries seriously.

Born in Hartford, Connecticut, in 1902, Barbara attended college at Cornell University in Ithaca, New York, where she received her graduate degree in 1927.

Fascinated by the study of transposition, or moving from place to place, Dr. McClintock single-handedly took on the study of transposable genes decades before anyone else even believed it was possible for genes to change their positions.

She was studying mutations in corn when she noticed that these mutations caused changes in the color and texture of the kernels. Then she noticed that these color changes had definite patterns. This led Dr. McClintock to see whether there was a relationship between developing corn kernels and genetics, and what happened during growth of the corn that affected the genetics of the plant. She learned that mutations were caused by the ability of some of the corn plant's genes to jump.

To understand the concept of jumping genes – or transposition (moving from place to place) – the following example may help. Inside a cell is DNA material. This material is referred to as the chromosome(s) [or genome] of the cell. The DNA is organized in a particular order or sequence. Sometimes, sections of this sequence can be moved to a different place within the overall sequence.

Imagine the DNA sequence is like the letters of the alphabet, lined up side by side in order; A-B-C-, etc. Now, suppose that the letters I-J-K move to a position between B and C. Now the alphabet (DNA sequence) reads: A-B-I-J-K-C-D-. In this example, the clement –I-J -K is like the transposable element or jumping gene.

Dr. McClintock was clearly ahead of her time in terms of scientific thought. And even though Dr. McClintock's genetic work began in the 1940's, it wasn't until the mid 1970's that science gave the theory of jumping genes the serious attention it deserved. Many believe that this is why her discoveries and their importance to science were ignored for so long.

It has been only in the last decade or so that Dr. Barbara McClintock received the recognition to which she is entitled. In 1983, she was awarded the Nobel Prize at the age of 81.

**References**


Breakthrough: Women in Science. Diana C. Gleason. Walker and Co., New York. 1983.

A Feeling for the Organism: The Life and Work of Barbara McClintock. Evelyn Fox Keller. W. H. Freeman. San Francisco. 1983.


## Ernest E. Just (*link to Biography*): studied cell physiology and understanding life itself and evolution through the study of cells (1883-1941)

**LIFE SCIENCE: CELLS**
**Dr. Ernest E. Just (1883 – 1941)**
PIONEERED RESEARCH ON THE LIVING CELL

Despite all the contributions he was to make to science, Dr. Ernest E. Just had to fight to "keep aglow the flame within me," even moving to Europe to escape the racism he encountered in the U.S.

Just was born August 14, 1883 in Charleston, South Carolina. His father, a dockworker, died when Ernest was only four years old. In order to support Ernest and his two siblings, their mother worked two jobs – as a schoolteacher and as a laborer in the phosphate fields outside of town. Young Ernest was forced to work in the crop fields.

At age 17, and with the courage and foresight of his mother, Ernest was sent North to further his education. It is said that he had only $5 to his name when he left home. Upon reaching New York City, he first entered the Kimball Union Academy preparatory school, where he graduated valedictorian in spite of overwhelming racism. Dartmouth College was next. In only three years, he earned degrees in both biology and history, and was the only student to graduate *magna cum laude* (with high honors). And, he was inducted into Phi Beta Kappa, one of the most prestigious academic honor societies in this country.

In 1907, Ernest E. Just became an English teacher at Howard University in Washington, D.C. But, because of the excellence in zoology he displayed at Dartmouth, began teaching biology two years later. He also began work toward his Ph.D. at the Marine Biological Laboratory, located in Maine, in 1909. Summers were spent at the University of Chicago.

Just completed his zoology doctorate in 1916, some seven years later. Even before completing that degree, however, he was widely praised for inspiring young Blacks to excel in school.

Just's scientific endeavors dealt with the study of marine eggs and sperm cells, techniques for their study, the functions of normal verses abnormal cells, and ways they might relate to diseases such as cancer, sickle cell anemia, and leukemia. Just's theory that the cell membrane (surface) is as important to the life of a cell as its nucleus (center) was much ahead of its time.

With the 1930's came recognition of his contributions to knowledge by the American science community. It was during this time that Just was elected vice-president of the American Society of Zoologists, elected a member of the Washington Academy of Sciences, and appointed to the editorial boards of several leading science journals.

But, for all Just's success, he found himself alienated from large research institutions, major (White) universities and scientific organizations because of the color of his skin. He hated being referred to as "Negro scientist" and detested feeling "trapped by color" in a segregated United States of America.

For these reasons, Just found himself attracted to Europe. There, he was free to go to restaurants and the theater. The European scientific community looked to his research, and not to his color, so Just spent much of his career at top laboratories in Germany and France.

Sadly, Ernest E. Just died of cancer in 1941, two years after returning to the United States.

Frank R. Lillie, a well-known scientist and friend of Just, described his life this way: "…despite his achievements, an element of tragedy ran through all Just's scientific career due to the limitations imposed by being a Negro in America…That a man of his ability, scientific devotion, and of such strong personal loyalties as he gave and received, should have been warped in the land of his birth must remain a matter for regret."

Katherine Esau (*link to Biography*): an expert on plant viruses; focused on research on cells and tissues that produce food for plants (1898-)

**LIFE SCIENCE: CELLS**
**Katherine Esau (1898 - )**
**EXPERT PLANT VIRUS RESEARCHER**

Katherine Esau was born and raised in what was formerly known as Russia, or the U.S.S.R. It was here that she was educated through her first year of college. Then the Esau family migrated to Germany where she completed her undergraduate college degree. In 1922, she and her family migrated a second time to the United States of America.

Some time later, Katherine Esau began graduate studies at the University of California (U.C.) in the field of botany. She completed her Ph.D. in 1931 and taught at U.C. Davis until 1963, when she transferred to U.C. Santa Barbara. But, most of Dr. Esau's research, dealing with effects of viral infection of plants, was performed at the Experiment Station of the Agriculture Department on the Davis campus.

In order to conduct these kinds of studies, Dr. Esau had to first study normal plants to understand the kinds of changes which occurred once plants became infected with a virus. Through this work, Dr. Esau became an authority on the structure and development of the phloem (plant tissue responsible for transporting food from the leaves to the rest of the plant).

In researching the effects of viruses on plants, Dr. Esau realized that she had to understand plant cell development – how cells differentiate and become specialized to carry out a particular function or process in the life of the plant.

Differentiation cay be complicated, but it basically means trying to understand why one plant cell will develop to take part in one life process such as water storage, while another will develop to take part in one life process such as water storage, while another will develop to take part in a totally different life process such as transporting foodstuffs. This kind of reasoning and study is called ontology. Dr. Esau's work contributed a great deal to our knowledge of the ontology of plants.

She also realized that, in order to study plant viruses, she had to know a plant's ontology because the first symptoms of a virus infection occurred in plant parts which were still growing or developing. Further study showed that these viruses would infect only certain cells. For instance, a particular virus only infects cells that store water. By knowing how a cell develops (differentiates) in order to become a water-storage cell, we can then accurately study the effects of that virus infection.

Dr. Esau's work led to the discovery of a phloem-limited virus; in other words, a virus which infects only a certain type of complex plant tissue. She also made a significant contribution to the scientific community by showing that the study of the ontology of an organism is important if we are to understand the differences which occur as a result of things such as viral infection.

## References

Modern Men of Science. 1966. McGraw-Hill Book Company. NY. pp. 157-158

**Constructing:** (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.5*).

**Reflecting:** (*link to SCI.II.1.MS.6*).

**Resources/References:**

Webliography
http://mtn.merit.edu/mcf/SCI.III.1.MS.1.html

Cells.
http://www.cellsalive.com

Connecting with Learning: An Equity Toolkit. MDE .
*Family Science.*

"Looking Inside an Onion." *Microworlds.*
http://www.si.edu/nsrc/

*The Lives of Plants.* NEW DIRECTIONS UNIT.
http://www.BCMSC.k12.mi.us

*Magnificent Micro-World Adventures*. AIMS.
http://www.aimsedu.org/aimscatalog/

McCliRuef, Kerry. *The Private Eye*. The Private Eye Project, 1998.
*Skin/Cells*. Bill Nye Video. Disney Educational (800/295-5010)

**Classroom Assessment Example SCI.III.1.MS.1**

Based on all the cell samples they have observed, students will create a product providing evidence that all living things are made of cells. This presentation should also highlight one scientist from the timeline and explain his or her contributions. Students may select from a variety of presentation mediums, including illustrations, multimedia presentations, models, posters, prepared slides, or informational books. Students will present their product to the class and explain characteristics of the different cells.

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI. III.1.MS.1**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Explanation of cells** | Provides a vague explanation. | Provides a brief explanation. | Provides an accurate, detailed explanation. | Provides an extensive, detailed explanation. |
| **Evidence of cells** | Shows an example of a single cell. | Shows one or two examples of cells. | Shows multiple examples of cells. | Shows detailed examples of a variety of cells. |
| **Explanation of scientific contribution** | Selects a scientist, but omits the explanation of his or her contribution. | Selects a scientist and vaguely explains his or her contribution. | Selects a scientist and explains his or her contribution. | Selects more than one scientist and gives a detailed analysis of their contributions. |

**Strand:** Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 1. All students will apply an understanding of cells to the functioning of multi-cellular organisms, including how cells grow, develop, and reproduce. (Cells)

**Benchmark**
Explain why and how selected specialized cells are needed by plants and animals (SCI.III.1.MS.2).

**Benchmark Clarification**
Plants and animals are made of specialized cells that make up different tissues, organs, and organ systems. Each organ or organ system is made of specialized cells that carry out the functions of that organ or system.
Examples of roles that specialized cells play:

- Reproduction: Egg and sperm cells carry instructions for creating a new organism
- Transport: Root and stem cells transport water, minerals, and food
- Disease-fighting: White blood cells fight disease
- Photosynthesis: Occurs in plant cells
- Movement: Muscles and bones are specialized for movement and support

Students will:

- Explain the roles of specialized cells

**Key Concepts**
Specialized functions of cells:

- reproduction
- photosynthesis
- transport
- movement
- disease-fighting

See Systems and processes in cells *SCI.III.2.MS.4*.

**Real-World Context**
Specialized animal cells:

- red blood cells
- white blood cells
- muscle cells
- bone cells
- nerve cells
- egg/sperm cells

Specialized plant cells:

- root cells
- leaf cells
- stem cells

**Instructional Example SCI.III.1.MS.2**

**Benchmark Question:** How are cells adapted to grow, develop, and reproduce?
**Focus Question:** Why are specialized cells needed by plants and animals?

Working in small groups, students will examine a common small plant, such as a marigold. Looking at the plant, students will draw the entire plant and label the three basic organs (leaf, stem, and roots). Next to each organ, the students will:

- Describe the function or purpose of each part
- Predict and draw what the cells might look like in each part

Students will continue investigating plant cells by:

- Collecting actual cell samples
- Examining cell samples to determine their functions
- Analyzing the similarities and differences between their predicted and actual drawings

Students will also use a similar process to expand their knowledge to include animal cells by:

- Researching ways cells are specialized in animals and why animals also have a need for specialized cells
- Selecting one specialized cell and preparing a presentation for the class to explain its structure and function

**Constructing:** (*link to SCI I.1.MS.1*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.5*).

**Reflecting:** (*link to SCI.II.1.MS.1*).

**Resources/References:**

Webliography
http://mtn.merit.edu/mcf/SCI.III.1.MS.2.html

*The Budding Botanist*. AIMS.
http://www.aimsedu.org/aimscatalog/

*GrowLab: Activities for Growing Minds.*
http://www.kidsgardeing.com/

*The Lives of Plants*. NEW DIRECTIONS UNIT.
http://www.BCMSC.k12.mi.us/

“Looking Inside an Onion.” *Microworlds*.
http://www.si.edu/src/

*Magnificent Micro-world Adventures*. AIMS.
http://www.aimsedu.org/aimscatalog/

http://www.fi.edu/tfi/units/life/anatomy/anatomy/html

http://www.utm.edu/departments/ed/cece/fifth/5F2.shtml

Ruef,Kerry .*The Private Eye.* The Private Eye Project, 1998.

**Classroom Assessment Example SCI.III.1.MS.2**

Students will select an organism and one of its specialized cells to research. They will prepare a summary of their research, including information about its structure (visual representation) and function (written summary) that could be used on a class web site.

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.1.MS.2**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Accuracy of visual representation** | Shows a sketchy visual of a cell. | Displays a visual of a cell structure. | Designs an accurate visual of specialized cells. | Designs a detailed, comprehensive visual(s) of several specialized cells. |
| **Completeness of description** | Provides a vague description of cell function. | Describes briefly the cell's function. | Describes the function(s) accurately of the specialized cell. | Describes in detail the function(s) of several specialized cells. |
| **Correctness of format** | Explains with inappropriate vocabulary or grammar. | Explains with partially correct vocabulary and grammar. | Explains with appropriate vocabulary and grammar. | Explains with extended vocabulary and exceptional grammar. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 2. All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions. (Organization of Living Things)

**Benchmark**
Compare and classify organisms into major groups on the basis of their structure (SCI.III.2.MS.1).

**Benchmark Clarification**
Organisms are classified based on related characteristics. Although "species" is the basic unit of classification, students should not be concerned with the formal five-kingdom classification system at this time.
Students will:

- Compare and contrast similar characteristics in structure, such as physical appearance, anatomy, and reproduction
- Use these characteristics to arrange organisms into different groups (e.g., plants: flowering/non-flowering and animals: vertebrate/invertebrate, single-celled/multi-cellular, cold-blooded/warm-blooded)
- Classify organisms into smaller groups (e.g., vertebrates: mammals, fish, birds, amphibians, reptiles)

**Key Concepts**
Characteristics used for classification:

- vertebrates/invertebrates
- cold-blooded/warm-blooded
- single-celled/multi-cellular
- flowering/non-flowering

Groups of vertebrates:

- mammals
- birds
- fish
- reptiles
- amphibians

Observation tools:

- hand lens
- microscope

**Real-World Context**
Representative organisms:

- dog
- worm
- snake
- amoeba
- geranium
- bacteria
- insect
- mold

**Instructional Example SCI.III.2.MS.1**

**Benchmark Question:** How are groups of living things classified?
**Focus Question:** Using a variety of classification systems, how can we classify different groups of organisms?

Students need several experiences classifying organisms in order to understand better the key scientific concepts of diversity and unity of living things. Each student should be given a similar set of 15 to 20 pictures of vertebrate and invertebrate animals. Students should then sort the pictures into different groups, according to their own classification system. Have them repeat this process two more times, using different classification rules each time. Students then will record each sort on paper, give each group a title, and list common characteristics they used to classify these organisms.

Next, students will form pairs and share their data. Each team will use their data to select a system they think will work best. The teacher should continue to combine pairs of students and have them share their method until the entire class agrees upon one system.

Discuss, as a class, the titles for each group and identify characteristics for each group of organisms.

Students should become familiar with the terminology contained in the key concepts. They should also be introduced to more formal classification systems, such as a dichotomous key (a tool used by scientists to classify organisms).

**Constructing:** (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.5*).

**Reflecting:** (*link to SCI.II.1.MS.1*).

**Resources/References:**
Webliography.
http://mtn.merit.edu/mcf/SCI.III.2.MS.1.html

*The Budding Botanist*. AIMS.
http://www.aimsedu.org/aimscatalog/

*Exploring Environments*. AIMS.

http://www.aimsedu.org/aimscatalog/

*Project WILD*.
http://www.projectwild.org/

*Unique U.* AIMS.
http://www.aimsedu.org/aimscatalog/

**Classroom Assessment Example SCI.III.2.MS.1**

Students will classify a variety of organisms into groups according to their structure. Students will use the following categories:

- vertebrate/invertebrate
- categories of vertebrates:
    - mammals
    - birds
    - fish
    - amphibians
    - reptiles
- single-celled/multi-cellular
- flowering/non-flowering

These categories could be used in class games such as Jeopardy or Concentration.

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.2.MS.1**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Correctness of classification** | Classifies with 60%-69% accuracy. | Classifies with 70%-79% accuracy. | Classifies with 80%-99% accuracy. | Classifies with 100% accuracy. |
| **Identification of common characteristics** | Lists one common characteristic for each category. | Lists two common characteristics for each category. | Generalizes several key characteristics for each category. | Compiles a detailed description of common characteristics for each category. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 2. All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions. (Organization of Living Things)

**Benchmark**
Describe the life cycle of a flowering plant (SCI.III.2.MS.2).

**Benchmark Clarification**
Flowering plants, just like animals, have distinct stages in their life cycles. Fertilization, the first stage of a flowering plant, involves the union of egg and sperm. Seeds, which contain the embryos and their food, form in the ovary as a result of the egg/sperm union. As the seeds mature and the fruit ripens, the seeds may be dispersed. If conditions are favorable, the seed coat cracks open and the embryonic plant emerges (the seed germinates) and a mature plant develops with roots, stems, leaves, and flowers. The cycle of the flowering plant is ready to begin again.

Students will:
- Locate the structure where sex cells form in a variety of flowers
- Identify the stages of growth from seed to mature plant

**Key Concepts**
Flowering plant parts and processes:
- roots
- stems
- leaves
- flowers
- fruits
- seeds
- embryo
- pollen
- ovary
- egg cell
- germination
- fertilization

Tools:
- microscope
- hand lens

**Real-World Context**
Common flowering plants:

- bean
- tulip

**Instructional Example SCI.III.2.MS.2**

**Benchmark Question:** What are the life cycles of living things?
**Focus Question:** What are the predictable stages of the life cycle of a flowering plant?

Students will dissect a variety of flowers to observe their structures. Dissection should be done carefully and sequentially, so structural parts are kept together. Students should then place a sheet of black construction paper on a table and gently tap the flower to collect pollen on the paper. They should examine the pollen under the microscope.
Specifically, they should:

1. Remove the petals and sepals to allow for closer observation
2. Examine the pollen-producing structures (stamens) and remove them carefully
3. Observe the remaining ovary structure by carefully slicing the ovary vertically in half. (Because this is a mature flower, fertilization has already taken place, meaning that the egg and sperm have already united and formed the tiny seeds they may see.)

Students should then discuss the role the flower plays in the life cycle of a plant. They should examine a variety of seeds, such as a lima bean, to observe the embryonic plants inside. They should hypothesize which areas will develop into the roots, stem(s), and leaves.

Then the students should design an investigation to determine what effect one variable might have on the life cycle of a flowering plant (e.g., photo-period [amount of sunlight], temperature, soil composition, water, fertilizer, competition [number of plants], acid rain).

**<u>Self-Evaluation Checklist for the Investigation</u>**

1. Problem
   - *Have you clearly stated the problem you investigated?*
   - *What variables did you investigate?*
2. Experiment
   - *Are your instructions for each step written clearly and completely enough so that someone else could easily replicate your investigation?*
3. Results
   - *Are your data organized in a table, chart, or graph?*
   - *Are your tables, charts, or graphs properly labeled?*
4. Conclusions
   - *Are your conclusions fully supported by your data?*
   - *How valid are your conclusions or results?*
   - *In what specific ways could your experiment be improved?*

**Constructing:** (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.2*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.5*).

**Reflecting:** (*link to SCI.II.1.MS.5*).

**Resources/References:**

Webliography.
http://mtn.merit.edu/mcf/SCI.III.2.MS.2.html

"Flower Study," *Budding Botanist*. AIMS.
http://www.aimsedu.org/aimscatalog/

*The Lives of Plants*. NEW DIRECTIONS UNIT.
http://www.BCMSC.k12.mi.us/

"Plants from Seeds." *GrowLab*: *Activities for Growing Minds.*
http://www.kidsgardening.com/

*Plants/Forests.* Bill Nye Video. Disney Educational (800/295-5010).

http://www.argon.iastate.edu.soybean/beangrows.html
http://www.fi.edu/tfi/units/life/living/living.html
http://www.utm.edu.departments/ed/cece/fifth/5F1.shtml

Michigan Soybean Promotion Committee (free classroom kit)
P.O. Box 287
Frankenmuth, MI  48734

*Wisconsin Fast Plants*.
http://www.fastplats.org/

**Classroom Assessment Example SCI.III.2.MS.2**

Students will create a model (PowerPoint presentation, flip-book, flowchart, picture book, song, poem) illustrating the development of a flowering plant (seed→plant→flower [fertilization/fruit development]→ cycling back to seed).

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.2.MS.2**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Correctness of plant development sequence** | Shows inaccurate sequence of developmental stages of a flowering plant. | Illustrates partial sequence of developmental stages of a flowering plant. | Illustrates proper sequence of developmental stages of a flowering plant. | Illustrates detailed examples of numerous flowering plants moving through their developmental stages. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 2. All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions. (Organization of Living Things)

**Benchmark**
Describe the evidence that plants make and store food (SCI.III.2.MS.3).

**Benchmark Clarification**
Students have misconceptions about food energy. Food provides the energy and raw materials needed for cell functions. Plants go through a special "food-making" process called photosynthesis.

Students will:
- Observe chloroplasts in special plant cells
- Determine the location in specialized plant cells where photosynthesis occurs
Explain that during photosynthesis certain raw materials (carbon dioxide and water) are taken in and chemically combined to form new products (sugar and oxygen)
- Recognize that the sun's light energy is converted and stored as chemical energy in food; this food may be used immediately or stored as starch for later use
- Examine various food storage organs (e.g., potatoes, onions, carrots)

**Key Concepts**
Process and products of food production and transport:
- photosynthesis
- starch
- sugar
- oxygen
- carbon dioxide
- water

See Use of food for energy *SCI.III.2.MS.4*.

**Real-World Context**
Plant food storage organs:
- potato
- onion

Starch storage in plants grown under different conditions

**Instructional Example SCI.III.2.MS.3**

**Benchmark Question:** How do living things obtain and use energy?
**Focus Question:** What evidence is there that plants make and store food?

Students will:

- Observe chloroplasts in special plant cells by looking at plant leaves under a microscope. (If needed, prepared slides may be used to help students in locating the chloroplasts.)
- Draw a diagram of what they observe under the microscope.
- Discuss their data and observations with others to determine the location of specialized plant cells where photosynthesis occurs.

The teacher will explain the following:

- During photosynthesis, certain raw materials (carbon dioxide + water) are taken in and chemically combined in the chloroplast to form new products (sugar and oxygen).
- The plant then uses the sugar immediately as food or stores it as starch in a special food storage organ.

In order to develop an understanding of how plants store food, students will examine various food storage organs (e.g., potatoes, onions, carrots). They will conduct a simple iodine/starch test to discover that the storage organ is a vessel that plants use to store food energy.

A simple iodine starch test involves dropping iodine solution on a piece of food. Initially, iodine appears reddish-brown in color. When iodine comes in contact with starch, it turns to a bluish-black indicating the presence of starch.

Then, students will participate in a guided discussion of the food storage organs:

1. What happens to a food storage organ in your cupboard? (Gets smaller, starts to grow sprouts, develops brown spots.)
2. Why is this happening? (It is losing water, growing roots, decomposing [chemical change.])
3. Where is it getting the energy to grow sprouts? (From the food energy stored within the cells of the storage organ.)

Students will design an investigation to test their hypothesis about what is happening to their potato, onion, or carrot.

Follow up with a discussion and presentation of data from the investigations.

End the lesson with a “Did You Know…” i.e., Native Americans in South and Central America first cultivated many tuber plants, like the potato. One of these plants has erroneously been called the Irish potato. Its fried version is called French fries. Ask the students to talk about what observations they can make from this interesting story.

**Constructing:** (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.2*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.6*).

**Reflecting:** (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.5*).

**Resources/References*:***

Webliography.
http://mtn.merit.edu/mcf/SCI.III.2.MS.3.html

"Basic Needs," *GrowLab: Activities for GrowingMinds.*
http://www.kidsgardening.com/

*The Budding Botanist*. AIMS.
http://www.aimsedu.org/aimscatalog/

http://chem.lapeer.org/Bio1Dos/index.html

"The Eyes Have It," *GrowLab: Activities for Growing Minds.*
http://www.kidsgardening.com/

*The Lives of Plants*. NEW DIRECTIONS UNIT.
http://www.BCMSC.k12.mi.us/

"Plants As Food Makers," *GrowLab: Activities for Growing Minds*.
http://www.kidsgrowing.com/

**Classroom Assessment Example SCIIII.2.MS.3**

Students will respond to the following scenario and justify their answers based on their knowledge of the food-making process and food storage organs of plants.

*The agricultural company Potatoes R Us claims that growing potatoes in a high $CO_2$ atmosphere will produce bigger crops. If potatoes are grown under two different concentrations of $CO_2$, then what is the best <u>evidence</u> to determine which potato plants are making and storing more food?*

A. *Amount of $CO_2$ produced by plants*
B. *Size of potatoes*
C. *Amount of oxygen used by plants*
D. *How long it takes for seeds to germinate*

*Select the best answer. Write a letter to the company, Potatoes R US, citing at least two pieces of scientific evidence that would support your answer.*

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.2.MS.3**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Correctness of answer** | Selects correct answer (B, size of potatoes). | Selects correct answer (B, size of potatoes). | Selects correct answer (B, size of potatoes). | Selects correct answer (B, size of potatoes). |
| **Accuracy of justification** | Fails to give an accurate reason for that answer. | Gives only one accurate scientific reason to justify that answer. | Gives two accurate scientific reasons to justify that answer. | Gives several detailed scientific reasons to justify that answer. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 2. All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions. (Organization of Living Things)

**Benchmark**
Explain how selected systems and processes work together in animals (SCI.III.2.MS.4).

**Benchmark Clarification**
All body systems work together for optional functioning of an organism. Examples of body systems working together are as follows:
- The circulatory system transporting food and oxygen to the cells and carrying carbon dioxide and other waste products away from the cells
- The digestive system breaking down food into small particles and enabling them to be absorbed into the bloodstream (part of the circulatory system)
- The skeletal, muscular, circulatory, nervous, and respiratory systems during physical exercise

Students will:
- Explain how selected systems work together to carry out body functions
- Integrate key concepts through illustrations of relationships between systems
- Examine how these functions take place in both complex and simple organisms

**Key Concepts**
Systems/Processes:
- digestion
- circulation
- respiration
- endocrine
- reproduction
- skeletal
- muscular
- nervous
- excretion
- transport
- growth
- repair

**Real-World Context**
Interrelations of body systems during selected activities:
- skeletal
- muscular
- circulatory
- respiratory systems during physical exercise

**Instructional Example SCI.III.2.MS.4**

**Benchmark Question:** How are the parts of living things adapted to carry out specific functions?
**Focus Question:** How do the respiratory, circulatory, and digestive systems work together?

Have students work in small groups to write and perform a play that shows the functions and interactions among the circulatory, respiratory, and digestive systems.

In their groups, students will:
- Select and research a body system
- Assign roles for each group member/organ
- Write a short skit connecting the actor's action with their specific organ(s)
- Perform the skit for the rest of the class

To culminate the activity, the class will create an interactive play that combines the three body systems. After the class play, a discussion could review:
- The function of the body systems
- How systems work together to carry oxygen and nutrients to the cells and remove waste from the cells

**Constructing:** (*link to SCI.I.1.MS.5*).

**Reflecting:** (*link to SCI.II.1.MS.3*).

**Resources/References:**

Webliography.
http://mtn.merit.edu/mcf/SCI.III.2.MS.4.html

Braus, Judy.*Birds, Birds, Birds!* Ranger Rick's Nature Scope Series. National Wildlife Federation, 1991.

*Birds/ Fish/ Insects/ Mammals/ Reptiles.* Bill Nye Videos. Disney Educational (800/295-5010).
http://curry.edschool.virginia.edu/go/frog/menu.html

*Food, Energy & Growth. NEW DIRECTIONS UNIT.*
http://www.BCMSC.k12.mi.us/

*From Head to Toe: Respiratory, Circulatory, and Skeletal Systems*. AIMS.
http://www.aimsedu.org/aimscatalog/

http://www.innerbody.com/text/index.html

http://www-itg.lbl.gov/vfrog/

*Human Body Systems*. MSU Middle School Assessment Project. Michigan State University, 1997.

Stotsky, Sandra. *Diving Into Oceans*. Ranger Rick's Nature Scope Series. National Wildlife Federation, 1998.

**Classroom Assessment Example SCI.III.2.MS.4**

Students will collaborate in small groups to write and produce a play showing the functions of the circulatory, digestive, and respiratory systems. The groups will present their plays to an audience other than their class, such as the PT0, other classes, and civic groups. Each group will submit their script for evaluation.

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.2.MS.4**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Accurate explanation of functions** | Explains functions of one to two systems, but gives sketchy details. | Explains functions of three systems, but gives little detail about how they interrelate. | Explains functions of all three systems and discusses how they work together. | Explains in detail the functions of all three systems and discusses how they work successfully together. |
| **Effectiveness of collaboration** | Participates with some team members in writing, performing, or producing the play. | Participates with most team members in writing, performing, or producing the play. | Participates with all team members in writing, performing, or producing the play. | Participates with all team members equally in writing, performing, or producing the play. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Context

**Content Standard:** 3. All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes. (Heredity)

**Benchmark**
Describe how the characteristics of living things are passed on through generations (SCI.III.3.MS.1).

**Benchmark Clarification**
All living things transfer similar characteristics to their offspring. Hereditary information from two parents occurs when the sperm and the egg unite during sexual reproduction. Sexually produced offspring are never totally identical to either parent. One or more genes can determine an inherited trait of an individual. A single gene can influence more than one trait. Each organism has the ability to pass on its inherited traits to its offspring.

Students will:
- Explain how the traits of an individual offspring are determined when the parents' hereditary information is combined
- Demonstrate that they understand that all hereditary information is carried through genes that are located in the chromosomes of each cell

**Key Concepts**
- reproductive cells
- egg
- sperm
- chromosome
- gene
- hereditary information

**Real-World Context**
Common traits controlled by a single gene pair, such as:
- wrinkled or smooth seeds in a pea plant
- color of horse hair
- human traits such as tongue rolling

**Instructional Example SCI.III.3.MS.1**

**Benchmark Question:** How are characteristics of living things passed on through generations?
**Focus Question:** Which traits of an individual offspring may be determined by the parents' hereditary information?

Students will explore the role of heredity in their lives by examining the following traits:

- Imagine the phone ringing. Pick it up. Put it to your ear. Notice which ear you are using.
- Interlock your fingers. Notice which thumb is placed on top. Pull your hands apart and repeat the process in reverse order. Notice how difficult/awkward it is to have the opposite thumb on top.
- Cross and re-cross your arms. Notice which is the dominant way you cross your arms.
- Examine other physical traits you have inherited from your parents:
  - Handedness (right vs. left)
  - Eye color
  - Rolling your tongue in a "U" shape
  - Free or attached ear lobes
  - Widow's peak ("V" hairline on forehead)
  - Hair on fingers between first and second knuckle
  - Cleft chin
  - Ability to taste PTC paper

Students will record their unique combination of traits/genetic makeup. Students should begin to understand that their unique individual traits are a direct result of the blending of their parents' genetic information.

The class will collect their data and record it in a chart.

| INHERITED TRAIT #1 | | INHERITED TRAIT #2 | | NUMBER OF FEMALES | NUMBER OF MALES |
|---|---|---|---|---|---|
| Free ear lobes | | Attached ear lobes | | | |
| Hair on fingers | | No hair on fingers | | | |
| Widow's peak | | No widow's peak | | | |
| Curly hair | | Straight hair | | | |
| Cleft chin | | Smooth chin | | | |
| Can curl tongue | | Cannot curl tongue | | | |
| Left-handed | | Right-handed | | | |

**Note:** Students will need to further expand their understanding of how hereditary information is passed on from parents to the offspring through the reproduction process.

**Constructing:** (*link to SCI.I.1.MS.1*).

**Reflecting:** (*link to SCI.II.1.MS.2*).

**Resources/References:**

Webliography.
http://mtn.merit.edu/mcf/SCI.III.3.MS.1.html

Aronson, Billy. *They Came From DNA.* W.H.Freeman, 1993.
Balkwill, Fran. *Amazing Schemes Within Your Genes.* Carolrhoda Books, 1993. Murphy, Pat. "Cells and Heredity," *SCIENCE EXPLORER: Family Experiments from the World's Favorite Hands-On Museum. Owlet, 1996.*

*Unique U.* AIMS.
http://www.aimsedu.org/aimscatalog/

**Classroom Assessment Example SCI.III.3.MS.1**

Using the Internet, encyclopedias, books, and magazines, students will select pictures of two dogs. Assuming one dog is female and the other dog is male, students will predict either through illustration and/or written description what traits might appear in the offspring. Possible traits: hair color, hair length, leg length, tail, ears, distinct markings, eye color, nose length.

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.3.MS.1**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Completeness of explanation** | Provides a limited explanation of trait(s). | Provides a minimum of two traits and a reasonable explanation for those traits. | Provides a detailed description of three traits. | Provides a detailed written and visual description of three or more traits. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 3. All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes. (Heredity)

**Benchmark**
Describe how heredity and environment may influence/determine characteristics of an organism (SCI.III.3.MS.2).

**Benchmark Clarification**
Inherited traits are those present in the genetic makeup of an organism that have been passed on from one generation to the next. These may include:

- Eye color
- Left- or right-handedness
- Butterfly wing patterns
- Animal fur color

Acquired traits develop or occur after an organism is born. They occur in response to environmental factors such as stress, overall health, nutritional choices, chemical exposure, and changes in land use and are not a result of the organism's genetic code. These include:

- Straightened teeth from wearing braces
- The loss of a limb in an accident

Students will:

- Distinguish between inherited traits and acquired traits

Key Concepts
Traits:

- inherited
- acquired

**Real-World Context**
Data on heredity, such as:

- identical twin studies
- effects of introduced toxins
- effects of natural selection
- effects of controlled selection and breeding

**Instructional Example SCI.III.3.MS.2**

**Benchmark Question:** In what ways do living things adapt to survive in their environments?
**Focus Question:** How do inherited traits allow organisms to become better adapted to their environments?
The teacher will ask the class to consider the following general questions:

1. What changes can take place in an island ecosystem?
2. How might these changes affect the process of natural selection?
3. Which inherited traits might be passed on from generation to generation?
4. Looking ahead, what other events may cause an organism to adapt over time?

The teacher will present the students with the following scenario:

*Pretend that you are a scientist in the year 2020. You observe that a longer grass has invaded an island. How might a ladybug population living on this island adapt to this change in environment? Consider the following traits: body color, exoskeleton hardness, size of wings, length of legs, etc.*

In small groups, students will write predictions about the adaptations they think might occur in order for the ladybug population to survive. Each student will justify his or her predictions and present his or her reasons in chart form. Use a chart with the headings: ADAPTATION, REASON.

**Constructing:** (*link to SCI.I.1.MS.1*).

**Reflecting:** (*link to SCI.II.1.MS.5*).

**Resources/References:**


Webliography.
http://mtn.merit.edu/mcf/SCI.III.3.MS.2.html

http://home.uleth.ch/bio/sc1000/sc1000genetics.html

Mader, Sylvia. *Inquiry Into Life with ESP CD-ROM and E-text CD-ROM*.
McGraw Hill, 2000.

Murphy, Pat. “Cells and Heredity,” *SCIENCE EXPLORER: Family Experiments from the World’s Favorite Hands-On Museum.* Owlet, 1996.

**Classroom Assessment Example SCI.III.3.MS.2**

Students will construct a model that shows the traits that a futuristic insect might acquire as a result of a current environmental change.

Students will present their models to the class and explain their answers to the following questions:

- Why did the insect acquire those traits?
- What two changes did the insect undergo?
- What factors might have influenced natural selection?
- What traits might be passed on from this insect to its future offspring to ensure reproductive success?

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.3.MS.2**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Accuracy of model** | Develops a model showing inaccurate traits of a futuristic insect. | Develops a model that shows the traits of a futuristic insect. | Develops an accurate model that clearly shows the traits of a futuristic insect. | Develops an in-depth, accurate model that clearly shows the traits of a futuristic insect. |
| **Presentation of model** | Presents information in an incomplete, difficult to understand manner. | Presents information in an easy to understand manner. | Presents information in an interesting, easy to understand, creative manner. | Presents information in an interesting, easy to understand, creative manner with additional visuals. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 4. All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species; compare ways that living organisms are adapted (suited) to survive and reproduce in their environments; and analyze how species change through time. (Evolution)

**Benchmark**
Describe how scientific theory traces possible evolutionary relationships among present and past life forms (SCI.III.4.MS.1).

**Benchmark Clarification**
Remains of organisms and fossils are found in rock layers or uncovered by excavation or erosion. From this physical evidence, scientists have constructed the geologic time scale. By studying remains, examining physiological structures, or conducting chemical tests (carbon dating) and genetic analysis, scientists can infer the relationship between present and past life forms.

Evolutionary trees or diagrams, similarities in bone structure, or embryos of vertebrates may represent common ancestry. Present species may be modified descendants of more primitive ancestors.

Students will:
- Compare and contrast present-day living things and ancient life forms
- Demonstrate the concept of common ancestry

**Key Concepts**
Selected evidence of common ancestry:
- geologic time
- fossil
- bone
- embryo
- limb

**Real-World Context**
Fossils that show evidence of common ancestry, such as:
- similarity of vertebrate limb bones
- similarity of early vertebrate embryos
- similarity of fossil bones to those of contemporary animals (i.e., horse legs)

**Instructional Example SCI.III.4.MS.1**

**Benchmark Question:** How do scientists trace the origin and development of species?
**Focus Question:** How do fossils show evidence of a relationship between past and present animals?

Students will write a journal entry listing ten things they know about the physical characteristics of dinosaurs. Then students will meet in small groups and use their lists to discuss the following questions:

1. Which modern animals have characteristics that are similar to dinosaurs?
2. What changes in the environment might have caused dinosaurs to change?

Small groups will share their hypotheses with the class. Students then will examine several fossils and hypothesize what modern organisms the fossils resemble. They will discuss the use of fossils as scientific evidence. Then small groups will research one of the following pairs of animals to determine similarities and whether fossil evidence exists to support their common ancestry:

- sandhill crane/*Archaeopteryx*
- horse/*Hyracotherium*
- rhinoceros/*Triceratops*
- grizzly bear/*Tyrannosaurus rex*
- elephant/Wooly Mammoth

Students will present their findings to the class.

**Constructing:** (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.5*).

**Reflecting:** (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.3*).

**Resources/References:**
Webliography
http://mtn.merit.edu/mcf/SCI.III.4.MS.1.html

Dinosaurs/Reptiles, Dinosaurs: Those Big Boneheads. Bill Nye Video. Disney Educational (800/295-5010).

*Digging into Dinosaurs.* RANGER RICK'S NATURE SCOPE SERIES. National Wildlife Federation, 1996.

Mader, Sylvia. *Inquiry Into Life with ESP CD_ROM and E-Text CD_ROM*. McGraw Hill, 2000.

Niles, Gregory et al. *The Fossil Factory*. Addison-Wesley, 1989.
http://www.tryrrellmuseum.com/tour/evolution.html
http://www.ucmp.berkley.edu/chromista/bacillariophyta.html
Taylor, Paul. *Fossil.* Alfred A. Knof, 1990.

**Classroom Assessment Example SCI.III.4.MS.1**

Students will research a pair of organisms (possible examples are listed below) to determine their similarities and whether fossil evidence exists to support common ancestry. In small groups or individually, students will compile their findings to write and illustrate a children's story that includes a hypothesis and possible evidence for connecting the two organisms. They will present their stories to a group of elementary students.

Possible examples:

- sandhill crane/*Archaeopteryx*
- horse/*Hyracotherium*
- rhinoceros/*Triceratops*
- grizzly bear/*Tyrannosaurus rex*
- elephant/Wooly Mammoth

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.4.MS.1**

**Scoring of Classroom Assessment Example SCI.III.4.MS.1**

**Content:**

I. Gives supporting evidence for possible ancestral connection between life forms.

| *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|
| *Not Yet* | | *On the Way* | | *Excellent* |

II. Designs illustrations that clearly show both life forms.

| *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|
| *Not Yet* | | *On the Way* | | *Excellent* |

III. Includes comparisons and contrasts of two life forms.

| *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|
| *Not Yet* | | *On the Way* | | *Excellent* |

IV. Summarizes research in a clear, concise manner.

| *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|
| *Not Yet* | | *On the Way* | | *Excellent* |

**Overall presentation:**

I. Writing mechanics

| *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|
| *Not Yet* | | *On the Way* | | *Excellent* |

II. Neatness

| *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|
| *Not Yet* | | *On the Way* | | *Excellent* |

III. Visual appeal

| *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|
| *Not Yet* | | *On the Way* | | *Excellent* |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 4. All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species; compare ways that living organisms are adapted (suited) to survive and reproduce in their environments; and analyze how species change through time. (Evolution)

**Benchmark**
Explain how new traits might become established in a population and how species become extinct (SCI.III.4.MS.2).

**Benchmark Clarification**
The world is constantly changing and species must adapt in order to survive. Natural selection will determine which new traits are successfully passed on to the next generation. A new trait may allow an individual to survive long enough to reproduce and pass on the new trait to its offspring. This adaptation ensures the reproductive success (*link to Glossary*) of the species.
Students will:

- Debate the possible reasons why a given species might become extinct, such as an organism fails to adapt, human impact on the environment, or asteroids
- Hypothesize the possible changes species may undergo, such as behavioral changes (mating rituals, migratory patterns) or physical changes (color, height, structure)

**Reproductive success:** the ability to reproduce offspring from one generation to the next

**Key Concepts**

- environmental change
- variation in populations
- reproductive success

**Real-World Context**
Examples of inheritable and non-inheritable variations, such as:

- white-eyed fruit fly
- scars

Examples of variations due to new gene combinations, such as:

- hybrid organisms

**Instructional Example SCI.III.4.MS.2**

**Benchmark Question:** How do species change through time?
**Focus Question:** How can new traits become established in a population?

Begin by finding out what students know about moths. With a partner, students will brainstorm at least ten questions they have about moths. The partners will share their questions with the class and organize their questions into common categories. Then, the teacher will ask students to think about how moths may adapt to survive. Look at the class list of questions. The teacher will ask students to focus on the questions related to successful moth adaptations.

Next, share the scenario of a real-world occurrence that happened with the peppered moth in England:

*In the early 1800s, the majority of the moths were light-colored, allowing them to blend into the light-colored tree bark. By the late 1800s, the peppered moth population had adapted their coloring to a darker color. With an expansion of local industries, air pollution covered tree bark with dark soot. Moths adapted their coloring to a darker hue in order to survive. As clean-up began and pollution was reduced, the light colored moth population began increasing.*

Students will cut out equal numbers of black, red, white, and newspaper moths and glue them down on a piece of newspaper. Students will review each other's pictures to see which color moths are most easily seen.

Students will create their own models of moth species they think would best survive in this newspaper environment. Students will present their models and explain the traits the moths have acquired.

**Constructing:** (*link to SCI.I.1.MS.1*).

**Reflecting:** (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.2*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

**Resources/References:**

Webliography.
http://mtn.merit.edu/mcf/SCI.III.4.MS.2.html

http://www.biology.com/visitors/ae/voyage/introduction.html

*Critters*. AIMS.
http://www.aimsedu.org/aimscatalog/

Stein, Sara. *The Evolution Book*. Workman Publishing, 1986.

"Where Have All the Condors Gone?" *Breakthroughs: Strategies for Thinking*, Zaner-Bloser, Inc.,1990.

**Classroom Assessment Example SCI.III.4.MS.2**

The teacher will give the students the following imaginary newspaper article:

Scientists Discover New Organisms Living in a Student's Bedroom
*Scientists believe the new organism was first introduced when the student was attending elementary school. Over time, scientists noticed that newer generations of offspring appeared to have developed/adapted several new traits*. It is felt that these traits developed as a result of the changing bedroom environment.*

Students should work in pairs and imagine that they are the student in the scenario. They should select an organism they think might be found in one of their bedrooms after they graduate from 8th grade. They should construct a model of the organism and present it to the class. They should explain which new traits were acquired and the reasons for these adaptations.

* Possible traits: heavier outer layer/coating, changes in coloring, loss of hearing, longer legs, change in diet, change in sleeping pattern.

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.4.MS.2**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Completeness of model** | Develops a model that lacks adaptive traits. | Develops a model that shows one adaptive trait. | Develops an accurate model that clearly shows one to three logical adaptive traits. | Develops an in-depth model that clearly shows numerous logical adaptive traits. |
| **Completeness of explanation** | Proposes a sketchy explanation for the acquisition of new traits. | Proposes a brief explanation for the acquisition of new traits. | Formulates a clear explanation for the acquisition of new traits. | Formulates a detailed explanation for the acquisition of new traits. |
| **Completeness of presentation** | Presents information in an incomplete, difficult to understand manner. | Presents information in a fairly interesting, easy to understand, creative manner. | Presents information in an interesting, easy to understand, creative manner. | Presents information in an interesting, easy to understand, creative manner with additional visuals. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 5. All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)

**Benchmark**
Describe common patterns of relationships among populations (SCI.III.5.MS.1).

**Benchmark Clarification**
Every organism in an ecosystem is directly or indirectly linked with other organisms in the ecosystem. Types of interrelationships may include:

- Parasitism, where one organism benefits and one is harmed
- Mutually beneficial relationships, where both organisms benefit (mutualism)
- Competition, within a species or between different species for food, shelter, etc.
- Predator and prey, where one organism (prey) is consumed by another organism (predator)

Students will:

- Investigate producers, consumers, and decomposers
- Explore the relationships existing organisms within an ecosystem.
- Evaluate examples of relationships to determine the types of interrelationships that exist

**Key Concepts (voc.)**
Participants and relationships:

- predator
- prey
- parasite
- competition
- mutually beneficial

**Real-World Context**
Relationships among plants and animals in an ecosystem that are mutually helpful relationships:

- insects and flowering plants
- birds eating fruit and spreading seeds

Parasitic (harmful) relationships:

- humans and mosquitoes
- trees and mistletoe

Competitive relationships:

- squirrels and seed-eating birds
- weeds and garden plants

**Instructional Example SCI.III.5.MS.1**

**Benchmark Question:** How are parts of an ecosystem related and how do they interact?
**Focus Question:** What types of interrelationships exist among populations in an ecosystem?

Students will write a journal entry listing relationships they have with other people that are helpful to them, harmful to them, or competitive. Students will share their lists with a partner. Students will watch a video about interrelationships and discuss the main concepts as a class. Students will take a walk to an area near the school and observe relationships in an ecosystem. With a partner, students will record their observations. As a class, students will share and compile their data. Students then will evaluate the relationships they have observed (helpful, harmful, competitive). The teacher will introduce key concepts and name the relationships that were identified.

**Constructing:** (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.5*).

**Reflecting:** (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

**Resources/References:**

Webliography.
http://mtn.merit.edu/mcf/SCI.III.5.MS.1.html

*Ecology*. MSU ASSESSMENT PROJECT. Michigan State University, 1997.

*Good Buddy*. PROJECT WILD.
http://www.projectwild.org/

Pollack, Steve. *Ecology*. Dorling Kindersley, 1993.

http://www.pbs.org/edens/denali/mooswolf.htm

**Classroom Assessment Example SCI.III.5.MS.1**

The teacher will present small groups with the following scenario:

*"Survivor II, The Next Generation" is coming out next season. The rules have changed slightly. This season, teams of survivors will be placed on separate islands where they will remain for one month.*

The teacher will select a variety of islands from around the world and write the names of the islands on slips of paper. Each team will draw a slip and then research the island. The winning survivors will be chosen as a result of their fine scientific journaling. To win the one million, you must discover a way to show all of the relationships you see among the different island populations on Earth.

Team journals should include the following information:

- predator/prey relationships
- parasitic relationships (parasite/host)
- competitive relationships
- mutually beneficial relationships

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.5.MS.1**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Description of relationships** | Lists one relationship. | Describes two relationships. | Describes two complete relationships. | Describes three or more complete relationships. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 5. All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)

**Benchmark**
Describe how all organisms acquire energy directly or indirectly from the sunlight (SCI.III.5.MS.2).

**Benchmark Clarification**
Producers, such as green plants and algae, make their own food through the process of photosynthesis. Consumers cannot make their own food. They must consume other organisms to obtain energy. All organisms can serve as energy sources (food) for other organisms.
Students will:

- Demonstrate how energy flows through simple food chains and food webs
- Recognize that sunlight is the direct source of energy for all producers

See Photosynthesis and food use *SCI.III.2.MS.3*

**Key Concepts**

- sunlight
- plants
- food
- photosynthesis
- producers
- consumers
- food webs

**Real-World Context**
Selected food webs, including humans

**Instructional Example SCI.III.5.MS.2**

**Benchmark Question:** How is energy distributed to living things in an ecosystem?
**Focus Question:** How does energy move through a food web?

In small groups, students will draw a picture of a double cheeseburger and list the contents in a table (include all possible items on a typical burger, including condiments). They will identify the contents as coming from a plant or animal. They will draw a food chain showing how the various contents can be traced back to the sun. Each group will present their food chain to the class and discuss similarities and differences. The class will discuss the following questions:

- What is the primary energy source?
- Why is sunlight so important?
- What organisms are the producers?
- What organisms are the consumers?
- How do producers and consumers acquire energy?
- Does the Sun's energy stop at the consumer level?
- What will happen to your leftovers?

**Extension:** Analyze owl pellets to identify members of a food chain.

**Constructing:** (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.6*).

**Reflecting:** (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.2*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

**Resources/References:**

Webliography
http://mtn.merit.edu/mcf/SCI.III.5.MS.2.html

*Ecology*. MSU ASSESSMENT PROJECT. Michigan State University, 1997. *Environment - Block 1 Seventh Grade* – Baylor College of Medicine.

http://ericir.syr.edu/Projects/Newton/9/photosy.html

*Exploring Environments*. AIMS.
http://www.aimsedu.org/aimscatalog/

*Field Detectives*. AIMS.
http://www.aimsedu.org/aimscatalog/

*Food Web/Ocean Life*. Bill Nye Video. Disney Educational (800/295-5010).

*Lobster in a Lunchbox*. PROJECT WILD.
http://www.projectwild.org/

*Owl Pellets*. PROJECT WILD.
http://www.projectwild.org/

**Classroom Assessment Example SCI.III.5.MS.2**

Students will select a presentation format (concept map, poster, or 3-D display) and design a food web to present at a parent open house.

The food web should:

- Use arrows that represent the direction and flow of energy from one organism to another
- Identify the role each organism plays in its food web (producer, consumer, decomposer)

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.5.MS.2**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Completeness of illustration** | Shows none or limited flow of energy through the food web. | Shows most of the energy flow correctly through the food web. | Illustrates the correct flow of energy through the food web. | Extends connections to include other organisms outside of the food web. |
| **Correctness of identification** | Identifies few producers, consumers, and decomposers. | Identifies some producers, consumers, and decomposers. | Identifies all producers, consumers, and decomposers. | Identifies all producers, consumers, and decomposers and extends to include identification of organisms outside of the primary food web. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 5. All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)

**Benchmark**
Predict the effects of changes in one population in a food web on other populations (SCI.III.5.MS.3).

**Benchmark Clarification**
Populations of plants, animals, and other organisms in an ecosystem coexist in a natural balance. As one population fluctuates, the other populations that depend upon it for survival will increase or decrease.
Populations may be affected:

- When natural events, human activities, or introduction of non-native species (*link to Glossary*) change environments
- During natural events such as disease, flood, and drought when this balance is altered, affecting the biodiversity (*link to Glossary*) within the community
- When human activities such as the use of natural resources, pollution, construction, land development, and mining cause populations to change

Students will:

- Predict the effects of changes on populations.

**Non-Native species:** a species that is introduced to an ecosystem either accidentally or intentionally
**Biodiversity:** the number of different species that live within a given area

**Key Concepts**

- natural balance
- population
- dependence
- survival
- community
- biodiversity
- introduction of non-native species

See *SCI.III.5.E.2*.

**Real-World Context**
Plants and animals in an ecosystem dependent upon each other for survival in selected ecosystems

Comparison of animals and plants found in:
- polluted versus non-polluted water
- urban versus rural settings
- rural versus forest settings
- zebra mussels introduced into the Great Lakes
- gypsy moths defoliating trees

**Instructional Example SCI.III.5.MS.3**

**Benchmark Question:** How is energy distributed to living things in an ecosystem?
**Focus Question:** How does a change in one population affect the other organisms in a food web?

Students should envision a Michigan forest and describe the populations living in a natural balance. They should brainstorm a list of the different organisms that live there:
1. Plants: beech trees, maple trees, raspberry bushes, dogwood trees, moss, trillium
2. Animals: robins, white-tailed deer, squirrels, owls, mice, garter snakes, earthworms
3. Other: fungus, bacteria, lichens

Each student will construct a food chain:
1. Write the names of organisms on index cards
2. Punch a hole at the top of each card
3. Use yarn to show how organisms are connected in a food chain
4. Share his or her food chain with the group

In small groups, students will share their food chains to construct a food web and present their webs to the class. As a class, evaluate each group's web to make sure they formed a food web and not just a food chain.
The teacher will present the following scenario to the class:

> *A camper is careless and leaves his or her site with a campfire burning. A spark ignites the dry grass due to drought conditions. This fire is stopped, but not before it wipes out the mouse population. Predict the changes that will occur in the other populations within the forest food web.*

After reading the scenario, each student will remove the "mice" card from their webs. As a class, discuss which populations within the web may increase or decrease after the removal of the mice population from this ecosystem.

**Constructing:** (*link to SCI.I.1.MS.1*).

**Reflecting:** (*link to SCI.II.1.MS.5*).

**Resources/References:**

Webliography.
http://mtn.merit.edu/mcf/SCI.III.5.MS.3.html

"Catch Me If You Can." *Critters*. AIMS.
http://www.aimsedu.org/aimscatalog/

http://www.fi.edu/tfi/units/life/habitat/habact3.html

http://www.globalclassroom.org/antart7.html/
http://www3.umassd.edu/Public/Exhibit/DES300/curmat.html

Merritt, Brett. *Great Lakes Story*. MSTA Journal, Spring 1998.

*The Mysterious Chain*. Flinn Scientific- Biolabs.(800/452-1261).
*Nutrition/Populations*. Bill Nye Video. Disney Educational. (800/295-5010).
*PROJECT WILD.*
http://www.projectwild.org/

*The Tale of the Urban Coyote*. (Leadership Resources.)

Williams, Paul. *Bottle Biology*. Kendall Hunt Publishing, 1993.

**Classroom Assessment Example SCI.III.5.MS.3**

Students will read a news article describing the deer population increase and its effects on other populations within its food web. They will write letters to the editor describing changes in a population. They will include both positive and negative effects on other populations in a food web and create a plan for solving the problems created by these population changes. The students will submit these letters for publication to a newspaper or magazine.

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.5.MS.3**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Identification of population change** | States one possible change in one population. | States clearly the possible changes that occur in two populations. | States clearly the possible changes that occur in three populations. | States clearly numerous changes that occur in four or more populations. |
| **Description of population change** | Describes one effect of the deer increase on other populations. | Describes two effects of the deer increase on other populations. | Describes three effects of the deer increase on other populations. | Describes detailed, numerous effects of the deer increase on other populations. |
| **Correctness of mechanics** | Shows limited use of proper writing mechanics. | Shows some use of proper writing mechanics. | Uses proper writing mechanics. | Uses proper writing mechanics in a highly expressive, creative manner. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 5. All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)

**Benchmark**
Describe the likely succession of a given ecosystem over time (SCI.III.5.MS.4).

**Benchmark Clarification**
Ecosystems change gradually over time. These changes follow a predictable pattern called ecological succession. The pattern begins with a pioneer species (*link to Glossary*) and ends with a climax community (*link to Glossary*). This pattern can be observed in ponds, abandoned fields, barren rocks, sand dunes, and forests.

Students will:

- Describe the pattern of predictable stages that a Given ecosystem undergoes.

**Pioneer species:** the first species to appear and establish life in an ecosystem that has undergone major natural or manmade changes or disturbances (e.g., grasses/plants growing in a newly plowed field; lichens and moss growing on barren rocks)

**Climax community**: the last evolving stage of organisms living in a given ecosystem (e.g., beech/maple forest and the organisms living within)

**Key Concepts**

- succession
- stages
- climax community
- pioneer species

**Real-World Context**
Process of gradual change in ecological systems, such as in ponds or abandoned farm fields

**Instructional Example SCI.III.5.MS.4**

**Benchmark Question:** How do communities of living things change over time?
**Focus Question:** What evidence of succession can you observe in your community?

Using videos, pictures, field trips, or other suitable resources, students will view examples of forests or grasslands showing the stages of succession:

- Areas that have been burned recently
- Areas burned ten or more years ago
- Areas not burned in recorded history

Pairs of students will identify examples of plant communities in different stages of succession. Students should look for the following stages of succession:

- Grasses and non-woody plants only
- Grasses, woody, and non-woody plants
- Grasses and shrubs, with young tree saplings (stem less than 0.5”)
- Ground vegetation and young trees (stem 0.5” - 2”)
- Mature trees (stem 2”) can still be under canopy

Next, each pair of students will draw a flowchart showing the stages of succession that were observed.

(**Extension:** Students can explore other examples of succession:

- Pond succession
- Plowed field left undisturbed
- Barren rock in a lava flow
- Natural disasters such as the Mt. St. Helen’s eruption and controlled burn mishaps in Yellowstone National Park)

**Constructing:** (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.4*), (*link to SCI.I.1.MS.6*).

**Reflecting:** (*link to SCI.II.1.MS.2*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

**Resources/References:**
*Ecosystems.*
http://www.si.edu/nsrc/

“Fire Ecologies.” *PROJECT WILD.*
*http://www.projectwild.org/*

“Forest in a Jar.” *PROJECT WILD.*
*http://www.projectwild.org/*

http://www.educationalimages.com/sx050006.htm
*Magnificent Micro-World Adventures*. AIMS.
http://www.aimsedu.org/aimscatalog/

“Nothing Succeeds Like Succession.” *PROJECT LEARNING TREE*.
http://www.affoundation.org/PLT/

**Classroom Assessment Example SCI.III.5.MS.4**

Each student will work with a partner to draw a storyboard of the stages of succession in a specific ecosystem of their choice. Possible choices may include terrestrial or aquatic ecosystems – farm fields, beaches, sand dunes, fence rows, barren rocks, abandoned wetlands, ponds, or lakes. Students will research this ecosystem. They will illustrate their research using a flow chart, diorama, 3-D display, or multimedia presentation. The project should illustrate the likely stages of succession of a given ecosystem from a pioneer species to a climax community. They will present their project to another class.

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.5.MS.4**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Accuracy of sequence** | Illustrates no successional stages from pioneer to climax communities. | Illustrates a few successional stages from pioneer to climax communities. | Illustrates most successional stages from pioneer to climax communities. | Illustrates detailed successional stages from pioneer to climax communities. |
| **Quality of content** | Includes few details and lists few organisms. | Includes some details and lists different organisms. | Includes important details and lists different organisms. | Includes many additional details and lists a diverse variety of organisms. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 5. All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)

**Benchmark**
Explain how humans use and benefit from plant and animal materials (SCI.III.5.MS.5).

**Benchmark Clarification**

Throughout history, humans in different climates on different continents have used plants and animals in many different ways. Plants and animals provide humans with food, clothing, shelter, building materials, medicine, toys, tools and machines.

Students will:
- Investigate how a specific culture uses/used plants and animals

Key Concepts
Materials from plants, including:
- wood
- paper
- cotton
- linen
- starch
- rubber
- wax
- oils

Materials from animals, including:
- leather
- wool
- fur
- oils
- wax

**Real-World Context**
Human-made objects that incorporate plant and animal materials, including:
- clothing
- building materials
- machines
- medicines

**Instructional Example SCI.III.5.MS.5**

**Benchmark Question:** How do humans interact with the environment?
**Focus Question:** How do people use and benefit from plants and animals?

Each student will list plant and animal products commonly found in their homes. Students will meet in small groups and compile their data. Small groups will present their findings to the class. As a class, students will discuss and evaluate which plants and animals are used for food and other products.

Each small group will select one plant or animal to research. Each group will answer the following questions about their plant or animal:

1. How is the raw material changed into a usable product commonly found in the home?
2. What are the different ways that the product is used?
3. How is the product used by different groups of people?
4. How does growing this plant or raising this animal impact the land, air, and water?

Each group will create a display including the following:

- A written report
- Samples of the products:
    - At least one food item
    - At least two other products
- Technology, such as PowerPoint presentations or videos, as part of their display
- Display at a “Natural Resource Fair” that will be open to the public

**Constructing:** (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.5*).

**Reflecting:** (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.4*), (*link to SCI.II.1.MS.5*).

**Resources/References:**
Webliography.
http://mtn.merit.edu/mcf/SCI.III.5.MS.5.html

“Plants R Us.” *GrowLab: Activities for Growing Minds.*
http://www.kidsgardening.com/

http://www.aea10.k12.ia.us/instruct/sci4-9/Ecology/Ecolo695.html

**Classroom Assessment Example SCI.III.5.MS.5**

Students will read the following scenario:

> *It is the year 2020 and a fabulous new product has hit the market – Food 4 Life. Food 4 Life is an incredible break-through food substitute that you take once a week. It will supply all of your nutritional needs. Just think, no more hassling at the dinner table. Food 4 Life will take us into the new millennium as space colonization becomes a reality. With the problem of food solved, humans will be free to live a healthy, happy, plant-less life.*

Students will debate the claims of Food 4 Life and decide if humans could live in a world without plants.

Each student will write a position statement giving five substantial, scientifically accurate reasons for or against the following idea:

> *I want to live in a world without plants.*

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.5.MS.5**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Accuracy of reasons** | Provides one to five reasons that are incomplete or contain inaccuracies. | Provides one to three accurate reasons. | Provides four to five accurate reasons. | Provides six or more accurate reasons. |
| **Correctness of mechanics** | Shows limited use of proper writing mechanics. | Shows some use of proper writing mechanics. | Uses proper writing mechanics. | Uses proper writing mechanics in a highly expressive, creative manner. |

**Strand:** III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

**Content Standard:** 5. All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)

**Benchmark**
Describe ways in which humans alter the environment (SCI.III.5.MS.6).

**Benchmark Clarification**
Society's actual needs and perceived needs shape decisions about how humans use the environment. Human activities that change the surface of the Earth include surface mining, construction, farming, dams, landfills, restoring natural resources, and land management. Sources of pollution in the hydrosphere include sewage, industrial waste, agricultural run-off, and household dumping. Sources of pollution in the atmosphere include acid rain, car exhaust, and industrial emissions. Health effects of polluted air include irritated eyes and breathing difficulties.

Students will:
- Evaluate the positive and negative effects of human activities on the environment

**Key Concepts**
- agriculture
- land use
- renewable and non-renewable resource development
- resource use
- solid waste
- toxic waste
- biodiversity
-

See *SCI.V.1.MS.5*.
See *SCI.V.2.MS.3*.
See *SCI.V.3.MS.4*.

**Real-World Context**
Human activities, such as:
- farming
- pollution from manufacturing and other sources
- hunting
- habitat destruction
- land development
- reforestation
- species reintroduction

**Instructional Example SCI.III.5.MS.6**

**Benchmark Question:** How do humans alter the environment?
**Focus Question:** What positive and negative effects do humans have on the environment?

The class will brainstorm and identify non-native organisms that have been introduced to the Great Lakes since the St. Lawrence Seaway opened. If necessary, students should be directed to the following:

- sea lamprey
- alewife
- zebra mussel

Using periodicals, newspapers, and the Internet, students will research the following questions about a non-native species introduced into the Great Lakes:

1. How was the organism introduced?
2. What niche did the organism fill and which organism(s) was(were) displaced?
3. What are the stages in the organism's life cycle?
4. What positive effects might this organism have on the ecosystem?
5. What negative effects might this organism have on the ecosystem?
6. How have humans tried to restore the natural balance?

Students will present their findings in a debate of the positive/negative effects of the introduction of the (intentional or accidental) non-native species into the Great Lakes.

**Constructing:** (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.5*).

**Reflecting:** (*link to SCI.II.1.MS.4*), (*link to SCI.II.1.MS.5*).

**Resources/References:**

Webliography.
http://mtn.merit.edu/mcf/SCI.III.5.MS.6.html

Braus, Judy. *Pollution: Problems & Solutions*. RANGER RICK'S NATURESCOPE SERIES. National Wildlife Federation, 1992.

Braus, Judy. *RainForests: Tropical Treasures*. RANGER RICK'S NATURESCOPE SERIES. National Wildlife Federation 1991.

Free classroom kit and information
http://www.handsonplastic.com

http://www.greatlakes.net/teach/pollution

*Research Vessels*. Grand Valley State University, 1998.
Merritt,Brett. *The Great Lakes Story.* MSTA Journal, Spring 1998.

**Classroom Assessment Example SCI.III.5.MS.6**

If possible, have students read *In the Next Three Seconds* by Morgan. This book takes a look at common human activities and their impacts on our world.
Students then should read the following statement:

*In the next three seconds, 93 trees will be cut down to make the liners for disposable diapers.*

Students should brainstorm ways that the use of disposable diapers has impacted our world.

Next, present the following scenario to the students:

*In light of this statement, a new law has been proposed in Lansing banning the use of disposable diapers.*

Students will receive a card from the teacher indicating the role of a community member they will take, such as:

- Aileen, diaper manufacturer
- Samantha, K-Mart manager
- Juan, Peter Pan Nursery School director
- Hitoshi, hospital nurse
- Sam, owner of Sam's Septic Service
- Maria and Jose, parents of newborn triplets
- Jamal, Green Peace member
- Bonnie, XYZ Waste Disposal worker
- Dee-Dee, owner of Dee-Dee's Diaper Delivery Service

Students must prepare a two-minute speech reflecting their character's point of view, either supporting or opposing this law. Students will present their speeches to the legislative body in Lansing (or a social studies class).

**(Give students rubric before activity.)**

**Scoring of Classroom Assessment Example SCI.III.5.MS.6**

| Criteria | Apprentice | Basic | Meets | Exceeds |
|---|---|---|---|---|
| **Accuracy of reasons** | Presents one supportive argument for position. | Presents two supportive arguments for position. | Presents three supportive arguments for position. | Presents four or more supportive arguments for position. |
| **Quality of speech** | Delivers a speech with inaccurate or incomplete thoughts. | Delivers a speech that provides information but is difficult to follow at times. | Delivers a speech in an effective, engaging manner. | Delivers a thorough, well-supported argument that entertains the audience. |
| **Accuracy of visual aid(s)** | Incorporates a visual product that inaccurately displays some aspect of the position. | Incorporates a visual product that ineffectively displays some aspect of the position. | Incorporates a visual product that effectively displays some aspect of the position. | Incorporates multiple visual products that display several aspects of the position. |