General Science II
The Study of Life
2007

COURSE DESCRIPTION:

Biology, the study of life, is extremely broad in its scope. In General Biology this discipline is broken into four categories: Energy - Organization of Living Things, Diversity - Biological Evolution, Reproduction/Heredity and Environmental Studies. To cover this diversity we look at many subdisciplines of biology that include microbiology, cytology, genetics, evolution, ecology and classification.

This course of study can be approached in many different ways. Some teachers like to begin with the cell and build up while others like to begin with the Ecology and break down the big picture into its smaller components. I prefer the later approach because it grabs the student's attention and gets them involved in the learning process immediately. Using this approach, the study of biology is started with classification and followed by ecology, the cell, genetics/disease and DNA. The year is ended with a unit on Evolution.

During the year many different strategies should be used to approach the different topics that are covered. Hands-on activities and labs along with discussion and research are an integral part of the general biology learning process. Students should be encouraged to question and find answers to their questions using the scientific method. The development of critical thinking skills should be encouraged and a major focus throughout the year. Assignments should also be cross curricular in nature and planned to require students to use their reading, writing and math skills. Technology should be integrated when appropriate to ensure that students are well versed in the use of the computer and the World Wide Web.

The General Biology course should be varied in not only the topics discussed but in the way it is approached. Students should come away from the class with not only an understanding of biology, but with the understanding of how science is process and how this process is used. Throughout the year students should be given ample opportunity to use this process as a means of discovery in the general biology classroom.

CORE CURRICULUM CONTENT STANDARD 5.5: (Characteristics of Life) All students will gain an understanding of the structure, characteristics, and basic needs of organisms and will investigate the diversity of life.

STRAND 5.5.12 A. - MATTER, ENERGY, AND ORGANIZATION IN LIVING SYSTEMS

Cumulative Progress Indicators

1. Relate the structure of molecules to their function in cellular structure and metabolism.

Students should understand that:

- All organisms are composed of cells, from just one cell to many cells. About two-thirds of the weight of cells is accounted for by water, which gives cells many of their properties. In multicellular organisms, specialized cells perform specialized functions. Organs and organ systems are composed of cells and function to serve the needs of the cells for food, air, waste removal. The way in which cells function is similar in all living organisms.
- Cells carry out the many functions needed to sustain life. They grow and divide, thereby producing more cells. Food is used to provide energy for the work that cells do and is a source of molecular building blocks from which needed materials are assembled.
- Living systems are made of complex molecules (including carbohydrates, fats, proteins and nucleic acids) that consist mostly of a few elements, especially carbon, hydrogen, oxygen nitrogen and phosphorous.
- Cellular processes are carried out by many different types of molecules, mostly proteins. The function of each protein molecule depends on its specific sequence of amino acids and the shape of the molecule.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

- Model important molecules found in living systems using molecule kit.
  - Differentiate between important macromolecules in terms of their structure and their function.
- Differentiate between plant and animal cells by observing them using a light microscope.
- Draw contrasting plant and animal cells labeling each organelle and specifying their functions.
- Create an edible cell using candy.
  - Students will then be required to identify each organelle and state the function of a number of organelles before eating their cell.
- Compare the organelles of a cell to the different departments/people found in a factory.

- Working in pairs, students to write a help wanted ad to fill the "position" of an organelle in their factory.
- Students to present their ad to the class and the remaining students guess what "position "is being advertised for.

- Observe single-celled organisms from the kingdom Protista.
  - Observe the change in the Euglena after changing its environment.
- Prepare a report or power point presentation on an organ/organ system. This research should enable the student to discuss its structure and function.
  - Students may present to class if power point is created.
- View mitosis using video from http://www.cellsalive.com.
- Model mitosis using chromosome bead set.
- Observe cells in various stages of mitosis using prepared onion root tip slides.
- Differentiate between osmosis, diffusion, active transport, passive transport, endocytosis and exocytosis.
  - Using an egg as a cell, observe osmosis across a semi-permeable membrane.
  - Using dialysis tubing, observe diffusion across a semi-permeable membrane.
  - Observe endocytosis by watching paramecium feed on Congo red-stained yeast. (http://www.accessexcellence.org/)
  - The "Jelly Bean Problem", (http://www.accessexcellence.org)
- Students will "build" a protein by using the DNA triplet code to identify the appropriate amino acids that make up the protein.
- Observe the affect of enzymes on the rate of chemical reactions using hydrogen peroxide and liver.
- Protein Structure lab (http://education.sdsc.edu/teachertech/downloads/molbio.pdf)
  - Protein folding activity with four foot tuber
- Students to build a model of DNA.
- Elephant-sized Amoebas Lab – Page 694, textbook.
- "Why are Cells so Small?" Lab – Carolina Biological
- Fat Lab
- Sugar/Starch Lab
- "Using Bubbles to Explore Membranes" http://www.accessexcellence.org/AE/AEC/AEF/1995/wardell_membranes.html
  - Model phospholipid bilayer using wooden clothespins, etc.
- Watch video/video segments, "Cells: The Basic Unit of Life", www.unitedstreaming.com
- "Put an Enzyme to Work!", http://learn.genetics.utah,edu/units/activities/proteins/

INSTRUCTIONAL STRATEGIES:
Discussion, labs, demonstration, drawing, research, writing, presenting, model building, cooperative learning and viewing.

EVALUATION/ASSESSMENT OF STUDENTS:

Possible evaluations might include: labs, quizzes, lab practicum, student presentations, drawings and tests.

EVALUATION/ASSESSMENT OF CURRICULUM:
This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:
- Life Science. Holt, Rinehart & Winston: Austin, Texas, 2001.
- As noted above.

STRAND: 5.5.12 A. - MATTER, ENERGY, AND ORGANIZATION IN LIVING SYSTEMS

Cumulative Progress Indicators
2. Explain how plants convert light energy to chemical energy.
3. Describe how plants produce substances high in energy content that become the primary source of energy for life.

Students should understand that:
- Plants have the capability (through photosynthesis) to take energy from light, using carbon dioxide and water, to form sugar molecules. These sugar molecules can be used to make amino acids and other carbon-containing (organic) molecules and assembled into larger molecules with biological activity (including proteins, DNA, carbohydrates and fats).

- The chemical elements that make up the molecules of living things pass through food webs and are combined and recombined in different ways. At each link in an ecosystem, some energy is stored in newly made structures, but much is dissipated into the environment as heat. Continual input of energy from sunlight keeps the process going. Matter and energy are conserved in each change.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:
- Lab – "Food Factory Waste", page 728 in textbook.
- Lab – "Cells in Action", page 83 in textbook
- "Who Eats Whom?" activity, page 433 in textbook.
- Study food web on page 440 in textbook and determine producers, consumers (herbivores, 1° consumers, and 2° consumers)
- Using food web on page 440 determine the possible affects on other organisms in the food web if populations of some of the organisms increase or decrease.
- Differentiate between the pyramid of mass, pyramid of numbers and pyramid of energy.

- Do Math Break on page 441 in textbook.

- Draw a food web that depicts how the organisms interact in the classroom "fish bowl" ecosystem.
  - Observe the water and carbon cycles
  - Observe changes in "ecosystem" throughout the year and determine why these changes have occurred.
- Do Conservation of Energy lab.
  - Determine conservation of energy using the chemical equation for photosynthesis by "counting" the atoms.
- The Energy Cycle Lab (http://www.fi.edu/tfi/units/life/habitat/habact4.html)
- Photosynthesis Lab (http://chem.lapeer.org/Bio1Docs/PhotoLab.html)
- Photosynthesis Pigment Lab (http://www.zcs.k12.in.us/zcs/gknollman/sites/IntroductiontoLifeScience/WrittenLabs/Photosynthesis%20Lab.pdf)
- Snail and Elodea Lab
- "Is Yeast Alive?" (http://serendip.brynmawr.edu/sci_edu/waldron/pdf/)
- "Carbon Dioxide Breath" Lab, page 767, textbook.
- View video/video segments, "Biology: The Science of Life. Ecology: Organisms in their Environment." www.unitedstreaming.com

INSTRUCTIONAL STRATEGIES:
Discussion, viewing, cooperative learning and labs.

EVALUATION/ASSESSMENT OF STUDENTS:
Lab reports, quizzes and tests.

EVALUATION/ASSESSMENT OF CURRICULUM:
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STRAND 5.5.12 A. - MATTER, ENERGY, AND ORGANIZATION IN LIVING SYSTEMS

Cumulative Progress Indicators:
4. Relate disease in humans and other organisms to infections or intrinsic failures of the system.

Students should understand that:
- Mutated genes can cause body parts or systems to work poorly.
- Pathogens enter the human body and multiply to create infection

- Some viral diseases destroy critical cells of the immune system, leaving the body unable to deal with multiple infections agents and cancerous cells.
- Advances in technology give today's human beings a better chance of staying healthier than their ancestors.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

- After "building" a protein (see 5.5.12.A.1), cause a mutation to see how the protein changes.
- Identify different types of mutations (deletions, substitutions and insertions) and understand how these mutations may affect the DNA triplet code.
  - Complete Mutation Worksheet
- Watch Lorenzo's oil to understand sex-linked inheritance and how a sex-linked disease can have devastating effects on the individual.
  - Discuss the mechanism of the disease.
- Swab plates containing nutrient agar with q-tip that has touched various surfaces and watch bacterial colonies form.
- "Antibiotics – What are they?" (http://serendip.brynmawr.edu/sci_edu/waldron/)
- Quick lab, page 641 in textbook.
- "How does an infectious disease spread?" (http://serendip.brynmawr.edu/sci_edu/waldron/)
- Research a disease to understand its cause and understand the technology used to identify and treat the disease.
  - Can be done as a power point and presented by student to the class.
  - Students can research disease in their family (make a family pedigree) to identify a disease to research.
- Understand the role of nutrition in the development of disease.
  - View movie Super Size Me
  - Student to calculate their basal metabolic rate (BMR) and their body mass index (BMI).
- Watch video segment, "Life Science: Cells - Cancer Cells", www.unitedstreaming.com
- Debate whether viruses are living or non-living.
- Watch video segments from "Understanding Viruses", www.unitedstreaming.com
- Watch video segment, "How do HIV and AIDS Affect the Human Body?", from "HIV and AIDS: Staying Safe", www.unitedstreaming.com

INSTRUCTIONAL STRATEGIES:

Discussion, labs, debate, research, presenting, cooperative learning and viewing.

EVALUATION/ASSESSMENT OF STUDENTS:

Labs, quizzes, research, presentations and tests.

EVALUATION/ASSESSMENT OF CURRICULUM:

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STRAND 5.5.12 B. – DIVERSITY AND BIOLOGICAL EVOLUTION

Cumulative Progress Indicators:

1. Explain that through evolution the Earth's present species developed from earlier distinctly different species.
2. Explain how the theory of natural selection accounts for extinction as well as an increase in the proportion of individuals with advantageous characteristics within a species.

Students should understand that:

- Scientists consider a variety of evidence in order to classify organisms into three domains and six kingdoms.
- Molecular evidence substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descent branched.
- Modern ideas about evolution (natural selection and common descent) provide a scientific explanation for the history of life on earth.
- Evolution is the consequence of the interaction of:
    1. the potential for a species to increase its numbers.
    2. the genetic variability of offspring due to mutation and recombination of genes.
    3. a finite supply of resources required for life.
    4. the ensuing selection from environmental pressure of those organisms better able to survive and leave offspring.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

- Create and use dichotomous keys to develop observation skills and differentiate between organisms.
    - Create a dichotomous key to “classify” students in class.
    - Create a dichotomous key to “classify” sneakers of students in class.
    - Create and use a dichotomous key to identify leaves collected.
    - Use a dichotomous key to identify algae.
- Knives, Forks and Spoons lab to determine how different characteristics affect the survival of an organism.
- Complete Peppered Moth Survey lab to see “evolution in action”.
- Observe the formation of microspheres.
- Analyze and answer questions regarding the geologic time scale to determine when various types of organisms appeared.

- ♦ Observe the redundancy of the DNA triplet code and use this code to make a protein (see 5.5.12.A.1).
  - o Discuss the universality of the DNA code.
- ♦ View "Life Science: Evolution". http://unitedstreaming.com
- ♦ Timeline of Earth's History activity, page 175, textbook.
- ♦ Dating the Fossil Record Lab, page 712, textbook.
- ♦ Observe similarities between organisms in terms of embryonic development, homologous structure and the triplet DNA code. (powerpoint)
- ♦ View "Life Science: Evolution". http://unitedstreaming.com

INSTRUCTIONAL STRATEGIES:
Discussion, labs, cooperative learning and viewing.

EVALUATION/ASSESSMENT OF STUDENTS:
Labs, quizzes and unit test.

EVALUATION/ASSESSMENT OF CURRICULUM:
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STRAND 5.5.12 C. – REPRODUCTION AND HEREDITY

Cumulative Progress Indicators:
1. Describe how information is encoded and transmitted in genetic material.
2. Explain how genetic material can be altered by natural and /or artificial means: mutations and new gene combinations may have positive, negative or no effect on organisms or species.
3. Assess the impact of current and emerging technologies on our understanding of inherited human characteristics.

Students should understand that:
- ♦ Hereditary information is contained in genes, located in the chromosomes of most cells. A human cell contains many thousands of different genes. One or many genes can determine an inherited trait of an individual and a single gene can influence more than one trait.
- ♦ Genes are segments of DNA molecules. Inserting, deleting or substituting DNA segments can alter genes. An altered gene may be passed on to every cell that develops from it.
- ♦ Sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations from the offspring of any two parents.

- The passing of traits from one generation to the next follows predictable patterns of inheritance. The patterns can be analyzed through the use of statistical models.
- Biotechnology allows for the screening and possible treatment of genetic disorders.
- Biotechnology allows for determining the degree of relatedness among individuals.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

- Discuss the experiments of Gregor Mendel.
  - View "Biologix: Introduction to Modern Genetics and Monohybrid Crosses" http://unitedstreaming.com
  - Use a lily flower to show how Mendel cross-bred his flowers.
- Use the punnett square to determine how traits are passed from one generation to another.
  - Determine ratios of dominant to recessive traits for certain crosses for both monohybrid and dihybrid crosses.
  - Determine genotypes and phenotypes for certain crosses.
- Differentiate between incomplete dominance, polygenic inheritance and co-dominance.
  - Analyze blood types (co-dominance) to determine parents of an infant.
  - Be able to identify incomplete dominance when doing genetics problems.
- Complete Create-a-Face lab to ensure student's understanding of genetic terminology (dominant, recessive, genotype, phenotype, homozygous, heterozygous)
- Differentiate between substitutions, deletions and insertions and understand how each type of mutation affects DNA's triplet code.
  - Complete Mutation Worksheet.
  - Analyze the DNA triplet code to see the redundancy in it.
  - Understand what "wobble" is.
- Students will "build" a protein by using the DNA triplet code to identify the appropriate amino acids that make up the protein.
  - Students to make a point mutation to their "protein" to see how it affects the protein.
- Observe genetic recombination by using chromosome bead set to model meoisis.
- Complete online karyotype lab (www.biology.arizona.edu/).
  - Students will research three diseases caused by meiotic errors that are identified in the lab.
- Students to research and debate the use of biotechnology and its affects on society and to the individual. Topics discussed may include prenatal testing, genetic testing and genetic engineering of food.
  - Students may be given situations to determine the pros and cons of the technology to both the individual and society.
- Analyze electrophoresis gel to determine paternity.
- Watch Lorenzo's oil to understand sex-linked inheritance.
- Activity 4 – "Should Teenagers be tested for the HD gene?"

(http://education.sdsc.edu/teachertech/downloads/genetics.pdf)

- Extract DNA from a strawberry.
- http://www.unitedstreaming.com - View video segment “Mutations”.
- Student to create a pedigree of their family and follow a particular trait or to help identify disease pattern within their family.
  - If disease is followed to make pedigree, students should research disease
- View meiosis using video from http://www.cellsalive.com
- Read various pedigrees and determine individual’s phenotypes and genotypes.

INSTRUCTIONAL STRATEGIES:

Discussion/notes, labs, viewing, research, debate and problem solving.

EVALUATION/ASSESSMENT OF STUDENTS:

Labs, quizzes, unit tests.

EVALUATION/ASSESSMENT OF CURRICULUM:

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RESOURCES/BIBLIOGRAPHY:

- As noted above.

STANDARD 5.10 (Environmental Studies) All students will develop an understanding of the environment as a system of interdependent components affected by human activity and natural phenomena.

Strand 5.10.12 A– Natural Systems and Interactions
Strand 5.10.12 B – Human Interactions and Impact

Cumulative Progress Indicators (5.10.12 A):

1. Distinguish naturally occurring process from those believed to have been modified by human interaction or activity.
    - climate change
    - ozone production
    - erosion and deposition
    - threatened and endangered species

Cumulative Progress Indicators (5.10.12 B):

1. Assess the impact of human activities on the cycling of matter and the flow of energy through ecosystems.
2. Use scientific, economic and other data to assess environmental risks and benefits associated with societal activity.

Student Should Understand that:

- Human activities and decisions can lead to species becoming threatened or endangered.
- Although the interrelationships and interdependence of organisms may generate biological communities in ecosystems that are stable for hundreds or thousands of years, ecosystems may change when climate changes or when one or more new species appear as a result of migration or local evolution.
- All organisms cause changes in the environment where they live. Some of these changes are detrimental to the organisms or other organisms whereas others are beneficial.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

- View the change in the ozone hole and discuss how it was formed and its impact on the earth and organisms living on the earth. (http://ozonewatch.gsfc.nasa.gov/)
    - Analyze data: Is the size of the ozone hole changing?
- Create an ecosystem showing relationships between organisms and their environment. Teacher to disrupt the ecosystem and students will determine the effect on the organisms in their ecosystem. Students to determine whether any organisms become threatened, endangered or whether any will go extinct.

- Research an ecosystem and draw a food web depicting the relationships between the individual organisms within that ecosystem.
- Hold a town meeting to determine the impact of human activity on a pristine forest. Students to have different parts and write a persuasive essay and speak in front of the class to try and persuade the other students to vote in their favor. A vote will be taken to determine the fate of the forest in question.
  - Students to analyze the impact of their decision in regards to the animals known to live in the "forest". They will determine whether any of the animals/plants may become threatened, endangered or extinct?
- Students to read and answer questions regarding an article on the invasive species, purple loosestrife, to see how it has affected Sussex County's wetlands.
- Go for a nature walk to see first hand how abiotic and biotic factors interplay. Discuss how a change in one organism (in this instance, the felling of a tree) changes the immediate area within that ecosystem.
- Take a field trip to Tillman's Ravine in Stokes State Forest. Discuss how the hemlock trees have changed the environment of the forest limiting the number of species that can live there. Discuss the disturbance (fungus) that is presently occurring in the forest and how that will affect the forest in the future.
- Observe lichen (nature walk) and discuss its role in regard to soil formation in an ecosystem.
  - Discuss its role in primary succession as a result of retreating glaciers due to global warming.
- Nitrogen Needs Lab – Page 750 in textbook.
- Too Much of a Good Thing? Lab – Page 756 in textbook.
- View video/video segments from "Elements of Biology: Ecosystems: Organisms and their Environment." http://www.unitedstreaming.com
- Discuss the impact of the human population on the deer and bear populations in New Jersey
  - Determine the carrying capacity of a bear population in a "forest".
  - Determine how the changes in these populations are affecting our forests.
    - Debate natural carrying capacity vs. cultural carrying capacity. (Reference: wildlifesciences.org/downloads/Fate_of_NJ_**Bear**s_v4.pdf)
- Test the pH of snow and rain water collected on the school grounds to determine whether acid rain is a problem in our immediate area.
  - Research the impact of acid rain on terrestrial and aquatic ecosystems.
- Students to research a biome or type of ecosystem to learn the impact of man's activities on this type of natural system.
  - Student to prepare a "mini" power point presentation to be presented to the class.
- View "Planet Earth" movies.
- Make observations of "fish bowl ecosystem" throughout the year notating changes in the system and how those changes affect the other organisms in the "ecosystem".
- Watch the movie, "An Inconvenient Truth".

- ♦ Design an experiment to compare the decay rate of man made materials, such as, paper, cardboard, styrofoam and plastic.

NOTE: As part of a unit on the earth's atmosphere during General Earth Science, Mrs. Burns' class goes into great detail regarding climate change. A research project is done regarding the greenhouse effect and global warming, real time data is plotted and analyzed by the students regarding the ozone hole and acid rain is discussed and a reading assignment is completed by the students.

INSTRUCTIONAL STRATEGIES:
Discussion/notes, labs, writing, speaking, nature walks, field trip and viewing.

EVALUATION/ASSESSMENT OF STUDENTS:
Labs, individual presentations, persuasive essays, quizzes and tests.

EVALUATION/ASSESSMENT OF CURRICULUM:
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STANDARD 5.1 (Scientific Processes) All students will develop problem-solving, decision-making and inquiry skills, reflected by formulating usable questions and hypotheses, planning experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions, and communicating results.

STRAND 5.1.12 A – Habits of Mind

Cumulative Progress Indicators:

1. When making decisions, evaluate conclusions, weigh evidence and recognize that arguments may not have equal merit.
2. Assess the risks and benefits associated with alternative solutions.
3. Engage in collaboration, peer review and accurate reporting of findings.
4. Explore cases that demonstrate the interdisciplinary nature of scientific enterprise.

Students Should Understand that:

- Scientific explanations must meet certain criteria (e.g., they must be consistent with experimental and observational evidence about nature, make accurate predictions about systems being studied, be logical, respect the rules of evidence, be open to criticism, report methods and procedures, make a commitment to making knowledge public) to be considered valid.
- Conceptual principles and knowledge guide scientific inquiries.
- Historical and current scientific knowledge influence the design and interpretation of investigations and the evaluation of proposed explanations made by other scientists.
- All scientific knowledge is subject to change as new evidence becomes available.
- Some scientific ideas are incomplete and opportunity exists in these areas for new advances: theories are continually tested, revised and occasionally discarded.
- From time to time, major shifts occur in the scientific view of how the world works but usually the changes that take place in the body of scientific knowledge are small modifications of prior knowledge.
- Scientists conduct investigations for a variety of reasons (e.g., to discover new aspects of the natural world, to explain recently observed phenomena, to test the conclusions of prior investigations, to test the predictions of current theories).
- Science involves different types of work in many different disciplines (e.g., scientists in different disciplines ask different questions, use different methods of investigation, and accept different types of evidence to support their explanations; many scientific investigations require the contributions of individuals from different disciplines, new disciplines of science, such as geophysics, biochemistry, often emerge at the interface of older disciplines).

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

- In running experiments throughout the year (see previous standards), students will make predictions, design experiments, collect and organize data and make conclusions based on data collected.
  - Data can be organized into graphs/charts using Excel software.
  - Students to practice peer review by reviewing/discussing each other's work/experimental results.
  - Students to collaborate as a class or in small groups and be given an opportunity to design their own experiments throughout the year.
- Students to identify an everyday problem and use the steps of the scientific to solve their problem.
- Students to research a scientist and make a power point presentation regarding his/her contribution to science.
- Discuss/research how technology is changing our understanding of genetics, disease, etc.
- View video/video segments, "Emerging Careers: Biotechnology Occupations", www.unitedstreaming.com
- View video/video segments, "Scientific Method and Measurement", www.unitedstreaming.com

INSTRUCTIONAL STRATEGIES:
Research, presentation, experimentation, data collection, and data reporting.

EVALUATION/ASSESSMENT OF STUDENTS:
Labs, quizzes, tests and research

EVALUATION/ASSESSMENT OF CURRICULUM:
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RESOURCES/BIBLIOGRAPHY:

- As noted above.

STRAND 5.1.12 B - Inquiry and Problem Solving

Cumulative Progress Indicators:

1. Select and use appropriate instrumentation to design and conduct investigations.
2. Show that experimental results can lead to new questions and further investigations.

Students will be able to:

- Learn quickly the proper use of new instruments by following instructions in manuals or by taking instructions from an experienced user.
- Use computers for producing tables and graphs an for making spreadsheet calculations.
- Design and conduct scientific investigations (e.g., formulates testable hypotheses; identifies and clarifies the method, controls, and variables; analyzes, organizes and displays data; revises methods and explanations; presents results; receives critical response for others).
- When conditions of an investigations cannot be controlled, it may be necessary to discern patterns by observing a wide range of natural occurrences.
- Technology (e.g., hand tools, measuring instruments, calculators, computers) and mathematics (e.g., measurement, formulas, charts, graphs) are integral in the performance of accurate scientific investigations and communications.
- Investigations and public communication among scientists must meet certain criteria in order to result in new knowledge and methods (e.g., arguments must be logical and demonstrate connections between natural phenomena, investigations and the historical body of scientific knowledge; the methods and procedures used to obtain evidence must be clearly reported to enhance opportunities for further investigation).

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

- Review and use the following tools/instruments necessary in scientific investigation including but not limited to:
  - Ruler/meter stick
  - Graduated cylinder
  - Thermometers
  - Microscopes (light and stereoscopic)
- The following labs/activities can be done to review the use of the tools/instruments mentioned above:
  - "Does it All Add Up?", Page 686, textbook
  - Graphing Data, Page 688, textbook.
  - Observe microorganisms, plant cells, animal cells and trout eggs under the light microscope.
  - The letter "E" lab.
  - Students to measure various items in the room to review use of a ruler/meter stick.
  - Students to measure each other's height using a meter stick and graph the data collected.
- View video/video segments, "Scientific Method and Measurement", www.unitedstreaming.com
- Review and use the scientific method to solve problems or answer questions. To do this, **previously suggested experiments may be run**. The following experiments may also be used when reviewing the scientific method early in the year:
  - How does temperature affect the hatch rate of capsule critters?

- What affects the germination rate of a string bean seed?

- Allow students the opportunity to develop an experiment by providing materials and a problem to solve.
- Write formal lab reports throughout the year.
  - Conclusions should include possible sources of error and further questions that should/could be addressed.
- Present data collected while doing experiments in tables and graphs.
  - Use Excel or other computer software to make tables and graphs.
- View video/video segments, "Scientific Method and Measurement", www.unitedstreaming.com

INSTRUCTIONAL STRATEGIES:
Discussion, labs, graphing, writing, and cooperative learning.

EVALUATION/ASSESSMENT OF STUDENTS:
Labs, quizzes and tests

EVALUATION/ASSESSMENT OF CURRICULUM:
This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:
- Life Science. Holt, Rinehart & Winston: Austin, Texas, 2001.
- As noted above.

STRAND – 5.1.12.C Safety

Cumulative Progress Indicators:
3. Understand, evaluate and practice safe procedures for conducting science investigations.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:
- **This CPI should be practiced on an ongoing basis throughout the year.**
- Students to act out unsafe lab procedures and remaining students will identify what they are doing wrong.
- Students to sign a lab safety agreement.
- As a class, students will determine the "safety rules" in the classroom.
- Students to determine what safety procedures must be followed before doing any experiments.

INSTRUCTIONAL STRATEGIES:
Discussion, cooperative learning and labs

EVALUATION/ASSESSMENT OF STUDENTS:

Labs and quizzes.

EVALUATION/ASSESSMENT OF CURRICULUM:
This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:

STANDARD 5.2 (Science and Society) All students will develop an understanding of how people of various cultures have contributed to the advancement of science and technology, and how major discoveries and events have advanced science and technology.

Strand 5.2.12 A - Cultural Contributions

Cumulative Progress Indicators:

1. Recognize the role of the scientific community in responding to changing social and political conditions and how scientific and technological achievement affect historical events.

Students Should Understand that:

- Ethical traditions are associated with the scientific enterprise (e.g., commitment to peer review, truthful reporting about the methods and outcomes of investigations, publication of the results of work) and that scientists who violate these traditions are censored by their peers.
- Science and technology are essential social enterprises, but alone they can only indicate what can happen, not what should happen.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

- Review and use the scientific method throughout the year.
- Write formal lab reports to report findings of experiments done in class.
- Students to engage in peer review of each other's results.
- Discuss claim by All Huang in regard to human cloning.
- Research/debate ethical issues in science, such as, human cloning, prenatal testing, genetic engineering of crops, etc.
- View "Biologix: Manipulating DNA", http://unitedstreaming.com

INSTRUCTIONAL STRATEGIES:

Conduct experiments, lab report writing, discussion and debate.

EVALUATION/ASSESSMENT OF STUDENTS:

Lab reports, oral presentation and quizzes.

EVALUATION/ASSESSMENT OF CURRICULUM:

This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:

As noted above.

Strand 5.2.12 B - Historical Perspectives

Cumulative Progress Indicators:

1. Examine the lives and contributions of important scientists who affected major breakthroughs in our understanding of the natural and designed world.
2. Discuss significant technological achievements in which science has played an important part as well as technological advances that have contributed directly to the advancement of scientific knowledge.
3. Describe the historical origin of important scientific developments such as atomic theory, genetics, plate tectonics, etc., showing how scientific theories develop, are tested, and can be replaced or modified in light of new information and improved investigative techniques.

Students Should Understand that:

- Throughout history, diverse cultures have developed scientific ideas and solved human problems through technology.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

- Research and prepare a presentation or report on a scientist detailing his contributions to science.
  - You may require the scientist to have the same ethnic background as the student.
- Research/discuss the importance of science and technology in the field of medicine.
- Observe the differences between the effectiveness of the light microscope, scanning electron microscope and transmission electron microscope.
  - Discuss how this new technology has changed biology and related fields.
- View "World History: The Modern Era, Galileo's Telescope" http://unitedstreaming.com

INSTRUCTIONAL STRATEGIES:

Research, presentation, writing and viewing**.**

EVALUATION/ASSESSMENT OF STUDENTS:

Presentation, report, quizzes and test.

EVALUATION/ASSESSMENT OF CURRICULUM:

This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:

- As noted above

STANDARD 5.3 (Mathematical Applications) All students will integrate mathematics as a tool for problem-solving in science, and as a means of expressing and/or modeling scientific theories.

STRAND 5.3.12 A – Numerical Operations

Cumulative Progress Indicators:
1. Reinforce indicators from previous grade level

Students will be able to:
- Use common prefixes such as milli, centi- and kilo-
- Convert within a unit (e.g., centimeters to meters)
- Determine the correct number of significant figures
- Solve simple algebraic expressions.
- Use ratio and proportion to solve problems.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:
- Use dimensional analysis to convert metric units.
- Determine ratios, percents/decimals when determining probability of genotypes and phenotypes when doing genetics problems.
- Calculate the surface to volume ratio of a cell. "Elephant Sized Amoebas" Lab, page 694, textbook.
- Determine hatch rate of trout eggs.
- Students to calculate their basal metabolic rate (BMR) and body mass index (BMI).

INSTRUCTIONAL STRATEGIES:
Discussion/notes, lab and problem solving.

EVALUATION/ASSESSMENT OF STUDENTS:
Quizzes/tests.

EVALUATION/ASSESSMENT OF CURRICULUM:
This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:

- Life Science. Holt, Rinehart & Winston: Austin, Texas, 2001.

STANDARD 5.4 (Nature and Process of Technology) All students will understand the interrelationships between science and technology and develop a conceptual understanding of the nature and process of technology.

STRAND 5.4.12 A – Science and Technology

Cumulative Progress Indicators:

1. Know that scientific inquiry is driven by the desire to understand the natural world and seeks to answer questions that may or may not directly influence humans, while technology is driven by the need to meet human needs and solve human problems.

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Students Should Understand that:

- Scientific inquiry is driven by the desire to understand the natural world and seeks to answer questions that may or may not directly influence humans.
- Technology is driven by the need to meet human needs and solve human problems.
- Biotechnology is used in a variety of areas (e.g., agriculture, pharmaceuticals, food and beverage, fuels and energy, the environment, genetic engineering) and requires specific scientific knowledge about the natural system being modified.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO: (Arrange by standard)
INSTRUCTIONAL STRATEGIES:

- Students to research an area in which biotechnology is used and present to class.
- Make an "oil spill" and have students figure out how to clean up the "spill" as an introduction to bioremediation.
- Have students identify how technology affects their lives.
    - Have the students write an essay depicting what their life might be like without certain technology that they have come to rely on.

EVALUATION/ASSESSMENT OF STUDENTS:
Discussion, cooperative learning and writing.

EVALUATION/ASSESSMENT OF CURRICULUM:
This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:

STRAND 5.4.12 B – Nature of Technology

Cumulative Progress Indicators:

1. Assess the impacts of introducing a new technology in terms of alternative solutions, costs, tradeoffs, risks, benefits and environmental impact.

Students Should Understand that:

- Alternatives, risks, costs, and benefits must be considered when deciding on proposals to introduce new technologies or to curtail existing ones (e.g., Are there alternative ways to achieve the same ends? Who benefits and who suffers? What are the financial and social costs and who bears them? How serious are the risks and who is in jeopardy? What resources will be need and where will they come from?)

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO: (Arrange by standard)

- Research new technologies such as, prenatal testing, genetically modified food, genetic testing, stem cell research, etc.
  - Students can present research to class and technology can be debated if desired.
  - Research can be presented in a power point.
- Give students situations regarding new scientific technologies. Working cooperatively, students will determine the affect of this technology on the individual and on society.
  - Students can present situation to class along with their ideas. Situation/technology can be debated if desired.
- Activity 4 – "Should Teenagers be tested for the HD gene?" (http://education.sdsc.edu/teachertech/downloads/genetics.pdf

INSTRUCTIONAL STRATEGIES:

Research, writing, presenting, speaking and cooperative learning.

EVALUATION/ASSESSMENT OF STUDENTS:

Presentation and/or research paper.

EVALUATION/ASSESSMENT OF CURRICULUM:

This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:

- As noted above.

STRAND 5.4.12 C – Technological Design

Cumulative Progress Indicators:

1. Plan, develop, and implement a proposal to solve an authentic, technological problem.

Students Should Understand that:

- A design involves different design factors (e.g., ergonomics, maintenance and repair, environmental concerns).
- A design involves design principles (e.g., flexibility, proportion, function).
- Since there is no such thing as a perfect design, trade-offs of one criterion for another must occur to find an optimized solution.
- The scientific principles of energy, work, and power are integral to technological design (e.g., the second law of thermodynamics means that a system cannot be designed which is 100% efficient).
- An optimal solution to a design problem is more likely to be found when the process followed is systematic and repetitive.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

- Design a method to keep trout tank cool and out of UV radiation before eggs are delivered.
- Students to design various experiments (see previous standards) throughout the year.
    - Students to engage in peer review.

INSTRUCTIONAL STRATEGIES:

Discussion, cooperative learning and problem solving.

EVALUATION/ASSESSMENT OF STUDENTS:

Labs and design outcome.

EVALUATION/ASSESSMENT OF CURRICULUM:

This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:

STANDARD 8.1 (Computer and information literacy) All students will use computer applications to gather and organize information and to solve problems.

A. Basic Computer Skills and Tools

1. Create a multi-page document with citations using word processing software in conjunction with other tools that demonstrates the ability to format, edit, and print.
2. Create documents including a resume and a business letter using professional format.
3. Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.
4. Given a database, define fields, input data from multiple records, produce a report using sort and query, and interpret the data.
5. Produce a multimedia project using text, graphics, moving images, and sound.
6. Produce and edit page layouts in different formats using desktop publishing and graphics software.
7. Develop a document or file for inclusion into a website or web page.
8. Discuss and/or demonstrate the capability of emerging technologies and software in the creation of documents or files.
9. Merge information from one document to another.

B. Application of Productivity Tools

Social Aspects

1. Describe the potential and implications of contemporary and emerging computer applications for personal, social, lifelong learning, and workplace needs.
2. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse.
3. Make informed choices among technology systems, resources, and services in a variety of contexts.
4. Use appropriate language when communicating with diverse audiences using computer and information literacy.

Information Access and Research

5. Select and use specialized databases for advanced research to solve real world problems.
6. Identify new technologies and other organizational tools to use in personal, home, and/or work environments for information retrieval, entry, and presentation.
7. Evaluate information sources for accuracy, relevance, and appropriateness.
8. Compose, send, and organize e-mail messages with and without attachments.

Problem Solving and Decision Making

9. Create and manipulate information, independently and/or collaboratively, to solve problems and design and develop products.
10. Identify, diagnose, and suggest solutions for non-functioning technology systems.
11. Identify a problem in a content area and formulate a strategy to solve the problem using brainstorming, flowcharting, and appropriate resources.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO: (Arrange by standard)

- Research a scientist and **develop a resume** for that scientist stating his accomplishments in the field of science.
- Students to write a formal research paper. Possible topics might include: disease, biome, scientist, etc.
- Students to differentiate between appropriate and inappropriate sources when doing scientific research.
- Use Excel or other software to organize data into graphs and charts.
- Produce power point presentations. Possible topics might include: organ/organ system, biome, disease, scientist, man's affect on ecosystems, etc.
- Use the scientific method to solve problems that are presented to the class by the teacher either in small groups or as a class.
- Evaluate the accuracy of measurement tools used in class. (accuracy vs. precision.)

INSTRUCTIONAL STRATEGIES:

Discussion, research, writing and cooperative learning.

EVALUATION/ASSESSMENT OF STUDENTS:

Presentations, research papers and tests/quizzes.

EVALUATION/ASSESSMENT OF CURRICULUM:

This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:

STANDARD 8.2 (Technology Education) All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and the environment.

Strands and Cumulative Progress Indicators

A. Nature and Impact of Technology

1. Use appropriate data to discuss the full costs, benefits and trade-offs, and risks related to the use of technologies.
2. Explain how technological development is affected by competition through a variety of management activities associated with planning, organizing, and controlling the enterprise.
3. Provide various examples of how technological developments have shaped human history.

B. Design Process and Impact Assessment

1. Analyze a given technological product, system, or environment to understand how the engineering design process and design specification limitations influenced the final solution.
2. Evaluate the function, value, and appearance of technological products, systems, and environments from the perspective of the user and the producer.
3. Develop methods for creating possible solutions, modeling and testing solutions, and modifying proposed design in the solution of a technological problem using hands-on activities.
4. Use a computer assisted design (CAD) system in the development of an appropriate design solution.
5. Diagnose a malfunctioning product and system using appropriate critical thinking methods.
6. Create a technological product, system, or environment using given design specifications and constraints by applying design and engineering principles.

C. Systems in the Designed World

1. Explain the life cycle of a product from initial design to reuse, recycling, remanufacture, or final disposal, and its relationship to people, society, and the environment, including conservation and sustainability principles.
2. Analyze the factors that influence design of products, systems, and environments.
3. Compare and contrast the effectiveness of various products, systems, and environments associated with technological activities in energy, transportation, manufacturing, and information and communication.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO: (Arrange by standard)

- Discuss/research/debate the impact of medical technologies on the human population and their affect on the individual and society.
- Discuss/research the carbon cycle and how man's activities are changing this natural cycle by the over reliance of fossil fuels.
  - Research/debate methods proposed to sequester carbon in order to remove it from the atmosphere.
- Design an experiment to compare the decay rate of man made materials, such as, paper, cardboard, styrofoam and plastic.
- Create an artificial environment to sustain a trout population.
  - Test for pH, ammonia and nitrates.
  - Students to propose a method to stabilize any fluctuations in these measurements.

INSTRUCTIONAL STRATEGIES:
Labs, cooperative learning, problem solving, research and debate.

EVALUATION/ASSESSMENT OF STUDENTS:
Labs, tests and quizzes.

EVALUATION/ASSESSMENT OF CURRICULUM:
This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY: