California Science Content Standards Correlation

Science Snoops—Life Science Investigations

Focus on Life Science, Grade 7	All examples of student activities are from the **monarch butterfly mystery case**
Cell Biology All living organisms are composed of cells, from just one to many trillions, whose details usually are visible only through a microscope.	Students use a virtual microscope to determine the infection rate by a single-celled protozoan parasite of monarch butterflies.
Genetics A typical cell of any organism contains genetic instructions that specify its traits. Those traits may be modified by environmental influences. As a basis for understanding this concept: *Students know* the differences between the life cycles and reproduction methods of sexual and asexual organisms. *Students know* DNA (deoxyribonucleic acid) is the genetic material of living organisms and is located in the chromosomes of each cell.	Students study the monarch butterfly's life cycle. Students learn about the genetic basis of Bt corn biotechnology and herbicide tolerant plants.
Evolution Biological evolution accounts for the diversity of species developed through gradual processes over many generations. As a basis for understanding this concept: *Students know* both genetic variation and environmental factors are causes of evolution and diversity of organisms. *Students know* that extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient for its survival.	Students study monarch butterfly population dynamics in relation to habitat, predation, milkweed distribution, nectar sources, migration, weather data, herbicide use, etc.
Structure and Function in Living Systems The anatomy and physiology of plants and	Students are given the opportunity to study the structure and function of

animals illustrate the complementary nature of structure and function. As a basis for understanding this concept: *Students know* plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism. *Students know* organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.	monarch butterflies. Examples: Monarchs rely on nectar sources to build up fats in their bodies for the survival during migration and the winter months. The caterpillars use their true legs to grasp milkweed plant parts during feeding. Insects have an exoskeleton to support their bodies. Etc.
Physical Principles in Living Systems (Physical Sciences) Physical principles underlie biological structures and functions. As a basis for understanding this concept: *Students know* that for an object to be seen, light emitted by or scattered from it must be detected by the eye. *Students know* how simple lenses are used in a magnifying glass, the eye, a camera, a telescope, and a microscope.	Students use a virtual microscope to see things that can not be seen with the naked human eye (e.g. corn pollen on milkweed leaves and protozoan parasites among butterfly scales).
Investigation and Experimentation Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other strands, students should develop their own questions and perform investigations. Students will: Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data. Use a variety of print and electronic resources (including the World Wide Web) to collect information and evidence as part of a research project. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the	Students have the opportunity within the software curriculum to: ● gather information to develop hypotheses, explanations, predictions and models about the monarch's population dynamics ● collect data with a virtual balance, microscope, and caliper (masses of caterpillars, butterflies, and forewing lengths of butterflies, presence or absence of corn pollen on milkweed leaves, presence or absence of parasites) ● collect data with a mark and recapture simulation of a virtual butterfly population ● interpret charts and graphs and use

scientific evidence. Construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge (e.g., motion of Earth's plates and cell structure). Communicate the steps and results from an investigation in written reports and oral presentations.	formulas to estimate monarch populations • use reference materials to acquire subject matter knowledge about monarch butterflies (for example the software contains videos on the migration and life cycle of the monarchs, and text explanations of the monarch's interactions with other organisms etc. in the virtual media library of the Science Snoops Institute where students are "employed".) • communicate their findings to virtual co-workers in the software program by email, via work plans and data collections plans as well as a final report.
Biology/Life Sciences - Grades Nine - Twelve	All examples of student activities are from the monarch butterfly mystery case
Genetics The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept: *Students know* how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.	Students research the information provided, how Bt corn is created by inserting a Cry protein gene from *Bacillus thuringiensis* into the corn plant's own genetic material, or DNA. Students consider the effects of Bt corn pollen on monarch caterpillars. Students compare crop plants that have been genetically engineered to be resistant to herbicides to wildflowers such as milkweed plants that are not herbicide resistant.
Ecology Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept: *Students know* biodiversity is the sum total of different kinds of organisms and is affected by	Students evaluate how changes in the environment affect monarch butterfly populations and diminish biodiversity. Students learn how to estimate population sizes of monarch caterpillars

alterations of habitats. *Students know* how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size. *Students know* how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death. *Students know* a vital part of an ecosystem is the stability of its producers and decomposers.	and butterflies both in the summer range, during migration and while overwintering. Students recognize that monarch larvae depend on milkweed plants and monarch butterflies depend on nectar from wildflowers to survive the winter months.
Evolution Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept: *Students know* how natural selection determines the differential survival of groups of organisms. *Students know* a great diversity of species increases the chance that at least some organisms survive major changes in the environment.	Students investigate the various hazards (predators, parasitoids, weather, human-made hazards etc.) that threaten the survival of monarchs during the different stages of their life cycle by analyzing population data from the current year and comparing them to data from previous years.

Investigation & Experimentation Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will: Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data. Identify and communicate sources of unavoidable experimental error. Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions. Formulate explanations by using logic and evidence. Distinguish between hypothesis and theory as scientific terms. Recognize the usefulness and limitations of models and theories as scientific representations of reality. Recognize the issues of statistical variability and the need for controlled tests. Recognize the cumulative nature of scientific evidence. Analyze situations and solve problems that require combining and applying concepts from more than one area of science. Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California. Know that when an observation does not agree with an accepted scientific theory, the	Students collect data with virtual instruments such as a balance, a caliper, and a microscope. They analyze data to find a relationship between census data and changes in the environment (weather, agricultural practices) and numbers of predators, and parasites. Students evaluate different methods to estimate wildlife populations and sources of errors in these estimates. Students formulate hypotheses about monarch butterfly population numbers in the current year as compared to previous years. They gather evidence for possible explanations for the decline in the monarch numbers. (Weather data analysis, evidence of Bt corn pollen on milkweed leaves, changes in masses of caterpillars and butterflies, changes in forewing lengths, numbers of milkweed plants, use of herbicides etc.) Students investigate a science–based issue when they investigate the effect of Bt corn pollen and herbicides on the monarch's survival. They recognize that even though the ecological role of monarchs is minor in terms of ecosystem function and the world of biology would not be much different if monarchs were to become extinct, the monarch may be the "canary in the cornfield" telling us that human activities are diminishing and degrading the natural environment.

observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets).	