



**Correlations to Colorado State and National Education Standards
Adherence:**

What Sticks Can Make You Sick

This classroom activity addresses in part or in whole the following identified sections taken from Colorado State and National Science Education Standards.

Colorado State Standard 1. Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.

As students in grades 9-12 extend their knowledge, what they know and are able to do includes

- asking questions and stating hypotheses, using prior scientific knowledge to help guide their development;
- creating and defending a written plan of action for a scientific investigation;
- selecting and using appropriate technologies to gather, process, and analyze data and to report information related to an investigation;
- identifying major sources of error or uncertainty within an investigation;
- constructing and revising scientific explanations and models, using evidence, logic, and experiments that include identifying and controlling variables;
- communicating and evaluating scientific thinking that leads to particular conclusions;
- recognizing and analyzing alternative explanations and models.

For students continuing their science education beyond the standards, what they know and are able to do **may** include

- continuing to practice and apply inquiry skills as they extend their understanding of science content through further study

Colorado State Standard 3. Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment.

3.1 Students know and understand the characteristics of living things, the diversity of life, and how living things interact with each other and with their environment.

As students in grades 9-12 extend their knowledge, what they know and are able to do includes

- explaining how adaptations of an organism determine its niche (role) in the environment;

3.3 Students know and understand how the human body functions, factors that influence its structures and functions, and how these structures and functions compare with those of other organisms.

As students in grades 9-12 extend their knowledge, what they know and are able to do includes

- describing cellular organelles and their function);
- using examples to explain the relationship of structure and function in organisms.

3.4 Students know and understand how organisms change over time in terms of biological evolution and genetics.

For students continuing their science education beyond the standards, what they know and are able to do **may** include

- explaining specializations that allow different types of cells to perform different functions;

Colorado State Standard 5. Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.

As students in grades 9-12 extend their knowledge, what they know and are able to do includes

- demonstrating the interrelationships between science and technology;
- explaining the use of technology in an occupation.

For students continuing their science education beyond the standards, what they know and are able to do **may** include

- applying their knowledge and understanding of chemical and physical interactions to explain present and anticipated technologies;
- exploring the scientific and technological aspects of contemporary problems.

Colorado State Standard 6. Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.

As students in grades 9-12 extend their knowledge, what they know and are able to do includes

- explaining that the scientific way of knowing uses a critique and consensus process;
- identifying and predicting cause-effect relationships within a system;
- identifying and describing the dynamics of natural systems;
- identifying and testing a model to analyze systems involving change and constancy;

NATIONAL CONTENT STANDARD A: As a result of activities in grades 9-12, all students should develop

- **Abilities necessary to do scientific inquiry**
 - Students should formulate a testable hypothesis and demonstrate the logical connections between the scientific concepts guiding a hypothesis and the design of an experiment. They should demonstrate appropriate procedures, a knowledge base, and conceptual understanding of scientific investigations.

- Designing and conducting a scientific investigation requires introduction to the major concepts in the area being investigated, proper equipment, safety precautions, assistance with methodological problems, recommendations for use of technologies, clarification of ideas that guide the inquiry, and scientific knowledge obtained from sources other than the actual investigation. The investigation may also require student clarification of the question, method, controls, and variables; student organization and display of data; student revision of methods and explanations; and a public presentation of the results with a critical response from peers. Regardless of the scientific investigation performed, students must use evidence, apply logic, and construct an argument for their proposed explanations.
- This aspect of the standard emphasizes the critical abilities of analyzing an argument by reviewing current scientific understanding, weighing the evidence, and examining the logic so as to decide which explanations and models are best. In other words, although there may be several plausible explanations, they do not all have equal weight. Students should be able to use scientific criteria to find the preferred explanations.
- Students in school science programs should develop the abilities associated with accurate and effective communication. These include writing and following procedures, expressing concepts, reviewing information, summarizing data, using language appropriately, developing diagrams and charts, explaining statistical analysis, speaking clearly and logically, constructing a reasoned argument, and responding appropriately to critical comments.
- **Understandings about scientific inquiry**
 - Historical and current scientific knowledge influence the design and interpretation of investigations and the evaluation of proposed explanations made by other scientists.
 - Scientists conduct investigations for a wide variety of reasons.
 - Scientific explanations must adhere to criteria such as: a proposed explanation must be logically consistent; it must abide by the rules of evidence; it must be open to questions and possible modification; and it must be based on historical and current scientific knowledge.
 - Results of scientific inquiry--new knowledge and methods--emerge from different types of investigations and public communication among scientists. In communicating and defending the results of scientific inquiry, arguments must be logical and demonstrate connections between natural phenomena, investigations, and the historical body of scientific knowledge. In addition, the methods and procedures that scientists used to obtain evidence must be clearly reported to enhance opportunities for further investigation.

NATIONAL CONTENT STANDARD C: As a result of their activities in grades 9-12, all students should develop understanding of

- **The cell**
 - Cells have particular structures that underlie their functions.

NATIONAL CONTENT STANDARD E: As a result of activities in grades 9-12, all students should develop

- **Abilities of technological design**
 - Students should demonstrate thoughtful planning for a piece of technology or technique. Students should be introduced to the roles of models and simulations in these processes.
 - Students should present their results to students, teachers, and others in a variety of ways, such as orally, in writing, and in other forms--including models, diagrams, and demonstrations.
- **Understandings about science and technology**
 - Scientists in different disciplines ask different questions, use different methods of investigation, and accept different types of evidence to support their explanations.

NATIONAL CONTENT STANDARD F: As a result of activities in grades 9-12, all students should develop understanding of

- **Personal and community health**
 - The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of the disease-producing organism. Many diseases can be prevented, controlled, or cured. Some diseases, such as cancer, result from specific body dysfunctions and cannot be transmitted.
- **Natural resources**
 - Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.

NATIONAL CONTENT STANDARD G: As a result of activities in grades 9-12, all students should develop understanding of

- **Science as a human endeavor**
 - Individuals and teams have contributed and will continue to contribute to the scientific enterprise. Doing science or engineering can be as simple as an individual conducting field studies or as complex as hundreds of people working on a major scientific question or technological problem. Pursuing science as a career or as a hobby can be both fascinating and intellectually rewarding.
 - Scientists have ethical traditions. Scientists value peer review, truthful reporting about the methods and outcomes of investigations, and making public the results of work. Violations of such norms do occur, but scientists responsible for such violations are censured by their peers.
- **Nature of scientific knowledge**
 - Science distinguishes itself from other ways of knowing and from other bodies of knowledge through the use of empirical standards, logical arguments, and skepticism, as scientists strive for the best possible explanations about the natural world.
 - Scientific explanations must meet certain criteria. First and foremost, they must be consistent with experimental and observational evidence about nature, and must make accurate predictions, when appropriate, about systems being studied. They should also be logical, respect the rules of evidence, be open to criticism, report methods and procedures, and make knowledge public.
 - Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. In areas where data or understanding are incomplete, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest.
- **Historical perspectives**
 - Usually, changes in science occur as small modifications in extant knowledge. The daily work of science and engineering results in incremental advances in our understanding of the world and our ability to meet human needs and aspirations.
 - Occasionally, there are advances in science and technology that have important and long-lasting effects on science and society. Examples of such advances include the following

Germ theory

Molecular biology

Medical and health technology

- The historical perspective of scientific explanations demonstrates how scientific knowledge changes by evolving over time, almost always building on earlier knowledge.

References

National Science Education Standards, 1996. National Academic Press, Washington, D.C. <http://www.nap.edu/readingroom/books/nses/html/6e.html#csc912>

Colorado Model Content Standards, Science, 1995. Colorado Department of Education. Denver, CO. <http://www.cde.state.co.us/download/pdf/science.pdf>