

Science Standards in *Backyard Bugs*

The National Science Education Standards (NSES) provide the underpinning for the standards used in *Backyard Bugs*. These Standards focus on key concepts and foundational principles of science education. The content portion of the Standards is divided into grade level categories (K-4, 5-8, and 9-12), and includes eight major Standards.

To learn more about NSES, go to their web site at: <http://www.nsta.org/standards>

Many state and local school districts have their own science education standards. In most cases, these standards are based on the NSES.

Backyard Bugs focuses primarily on the life science content Standards, but also includes universal science ideas and key processes including inquiry methodology, investigation skills, and the historical aspects of nature and science. *Backyard Bugs* is designed for grades K-5. Because the NSES Standards are divided into K-4 and 5-8 levels, most of the Standards incorporated into *Backyard Bugs* come from the K-4 level. Some lesson plans are augmented using the 5-8 Standards as a guide.

Unifying Concepts and Processes: This Standard is presented for grades K-12, because these concepts need to be developed over time. They form foundation for a student's learning experience in science, and function as a framework for students to learn about science and scientific processes. In the elementary grades, instruction should focus on the meaning and use of these Standards. Unifying concepts and processes include:

- Systems, order, and organization – introduces the concepts that related objects or organisms can form an organized group and that all aspects of the universe are understandable, and exhibit predictable behavior. For example, communities of bees function as structured systems within their colonies.
- Evidence, models, and explanation – includes the concept that through observation, data collection and the development of logical ideas, one can propose an explanation of how nature functions. For example, models of a bees' hive help explain the role and behavior of the bees.
- Change, constancy and measurement – focuses on the idea that some aspects of the universe stay the same while others change. Measurement is a means to quantify some aspects of the natural world. For example, a Celsius thermometer can measure the changeable temperature of the air.
- Evolution and equilibrium – introduces the idea that the current form and function of natural objects is due to gradual and occasional changes that have occurred over time. Frequently, these changes offset earlier changes to maintain a balance known as equilibrium. Populations of organisms can evolve and reach a new equilibrium when faced with environmental changes. For example, using a pesticide to control a pest kills those members of a population that are most susceptible and leaves the

members who are naturally resistant. The resistant population will increase and reach a new equilibrium.

- Form and function – conveys the relationship between the shape or appearance of an object or system and its use. For example, the shape and coloring of stick insects allows them to blend in with their surroundings to hide from predators.

Content Standard A: Science as Inquiry: This content Standard focuses on developing the abilities and understanding necessary for scientific inquiry. Children in the elementary grades can conduct basic experiments with concrete results. They are able to use simple instruments of measurement and observation (rulers, scales, and magnifying glasses). They can plan an investigation and communicate their results. Students will be able to:

- Ask a question about their environment – students develop questions that may be answered with scientific knowledge and observations. For example, students may consider the question, “How do antlions get food?”
- Plan and conduct a simple investigation – students can develop investigations to answer specific questions. For example, students may develop an experiment in which they observe antlions in their pits to help answer the question, “How do antlions capture prey?”
- Gather data – students use measuring instruments such as rulers, thermometers, balances, microscopes, and magnifiers to help them investigate a problem. For example, a student may use a virtual magnifying glass to examine parts of an insect.
- Use this data to construct an explanation – students must evaluate their data and information to develop an explanation. For example, students may gather data that shows that animals tend to resemble their parents.
- Communicate their investigation and explanations – students should be able to critique and analyze their work and then present it, either in written, verbal, or pictorial form. For example, students studying the life cycle of a butterfly could draw the relationship between the stages of development.

Content Standard C: Life Science: The Life Science content Standard builds understanding of living things, their life cycles, and their habitats. Students will study:

- Characteristics of organisms – each organism has different structures that serve different functions. For example, insects have many different types of sense organs, wings, mouthparts, and legs. These characteristic body parts help the insects interact and survive in their specific environment.
- Life cycles of organisms – different organisms have different life cycles. These life cycles include being born, becoming adults, reproducing, and eventually dying. Plants and animals typically resemble their parents. Some characteristics, such as number of legs, are inherited from an

organism's parents. Other characteristics, like having the ability to roller-skate, are learned behaviors that cannot be passed on to the next generation.

- Organisms and their environments – an organism's behavior is determined by their environment. Factors such as the amount of food and resources, the numbers of other organisms, and physical characteristics like the weather and pollution clearly affect an organism's behavior. In addition, all organisms cause change in their environment. For example, humans construct buildings in ways that alter the physical landscape of a location.

Content Standard G: History and Nature of Science: The content strand emphasizes the contributions of significant scientists from the past. Through scientific inquiry, these men and women provided the foundation on which new science and technology ideas are being built. Science is on-going, and it is clear that there is still much to be understood and explained.