

Catching a Cold

Teacher Notes



Purpose

The purpose of this assessment probe is to elicit students' ideas about infectious disease. The probe is designed to find out whether students use the germ theory to explain what causes an infectious disease like the common cold.

Related Concepts

common cold, germ theory, infectious disease

Explanation

The best answer is “germs.” The common cold is an infectious disease caused by a virus and transmitted between two people—one who is contagious and one who picks up the contagion (virus). The *cause* is the virus (germs), *transmission* is how it is spread, and other factors contribute to a weakened immune system that is less effective in fighting off the virus

in the human body. The virus is transmitted through respiratory secretions. The virus can be picked up by breathing in the virus when it is spread in an aerosol form generated by the sick person's coughing or sneezing. It can also be picked up from direct contact with saliva or nasal secretions containing the virus as well as indirectly from surfaces that have been contaminated by a person's saliva, respiratory aerosols, or nasal secretions. This is why hand washing is so important. Most cold germs are picked up by touching contaminated surfaces and transferring the virus from an object to the mouth. In all of these cases of transmission, what causes the cold is the virus.

A fever is a physiological response to the virus, not a cause. Feeling cold and chilled, being wet, being wet and cold, and not getting enough sleep or exercise are all factors that can

contribute to a weakened immune system that is less effective in fighting off the virus as it multiplies inside the body's cells. These factors that lower resistance are not the actual cause of a cold. For example, one does not catch a cold merely by being wet and cold. A virus must enter the body in order to cause a cold. Food spoils as a result of bacterial growth and results in a bacterial infection that causes gastrointestinal problems, not a common cold.

Although colds occur more often in the winter months, the cold weather itself does not cause the common cold. During cold weather months, people spend more time inside in close proximity to each other, thus spreading the virus more easily. Also the hot, dry air that results from heating during the wintertime dries out the mucus membranes of the throat and nose and makes them less effective barriers against infection by the common cold virus.

Curricular and Instructional Considerations

Elementary Students

In the elementary grades, students should have a variety of experiences that provide initial understandings of various science-related personal and societal health challenges (NRC 1996). Children at this age use the word *germs* for all microbes, as they may not yet be ready to distinguish between bacteria and viruses. They develop an understanding of good health factors, such as nutrition, exercise, keeping warm and dry, and sleep, but they have difficulty distinguishing between the factors that

promote good health in general and the causes of infectious diseases. At this stage they should be taught how communicable diseases such as colds are transmitted, and the reason for hand washing should be explained, reinforced, and practiced in school and at home. Later in the elementary grades, students begin to learn about some of the body's defense mechanisms that prevent or overcome infectious diseases such as colds.

Middle School Students

In the middle grades, students build upon their K–4 understandings of health and disease to recognize the role of microorganisms in causing illness. This is a good time to introduce the germ theory of diseases from the historical perspective of Louis Pasteur's discovery and to discuss how technology (microscopes) has made germs visible.

High School Students

By high school, students have a fairly solid foundation in understanding human body systems such as the digestive, circulatory, and respiratory systems and recognize viruses as agents of infection. However, they may not have as clear an understanding of the immune system and thus have difficulty with understanding mechanisms and processes associated with infectious diseases.

Administering the Probe

This probe is appropriate at all grade levels. The last distracter on the list—"imbalance of body fluids"—comes from a predominant historical

belief that subsequently led people to treat illness by inducing vomiting, bleeding, or purging in order to adjust body fluids. As this phrase may be unfamiliar to younger students, consider eliminating it from the list when used with younger children. For older students who can distinguish between different types of microbes, you might consider deleting “germs” and adding two responses—“viruses” and “bacteria.”

Related Ideas in *National Science Education Standards (NRC 1996)*

K–4 Personal Health

- ★ Individuals have some responsibility for their own health. Students should engage in personal habits—dental hygiene, cleanliness, and exercise—that will maintain and improve their health. At this level, children should come to understand how communicable diseases, such as colds, are transmitted and that some of the body’s defense mechanisms prevent or overcome transmission.

5–8 Structure and Function in Living Systems

- ★ Disease is a breakdown in structures or functions of an organism. Some diseases are the result of intrinsic failures of the system. Others are the result of damage by infection by other organisms.

9–12 Personal and Community Health

- The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of disease-producing organisms. Many diseases can be prevented, controlled, or cured.

Related Ideas in *Benchmarks for Science Literacy (AAAS 1993 and 2008)*

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 Note: Benchmarks revised in 2008 are indicated by (R). New benchmarks added in 2008 are indicated by (N).

K–2 Physical Health

- Eating a variety of healthful foods and getting enough exercise and rest help people to stay healthy.
- ★ Some diseases are caused by germs, and some are not. Diseases caused by germs may be spread by people who have them. Washing one’s hands with soap and water reduces the number of germs that can get into the body or that can be passed on to other people.

3–5 Physical Health

- Some germs may keep the body from working properly. For defense against germs, the human body has tears, saliva, and skin to prevent many germs from getting into the body and special cells to fight germs that do get into the body.

★ Indicates a strong match between the ideas elicited by the probe and a national standard’s learning goal.

6–8 Physical Health

- ★ Viruses, bacteria, fungi, and parasites may infect the human body and interfere with normal body functions. A person can catch a cold many times because there are many varieties of cold viruses that cause similar symptoms.
- Specific kinds of germs cause specific diseases. (N)

6–8 Discovering Germs

- ★ Throughout history, people have created explanations for disease. Some have held that disease has spiritual causes, but the most persistent biological theory over the centuries was that illness resulted from an imbalance in the body fluids. The introduction of germ theory by Louis Pasteur and others in the 19th century led to the modern belief that many diseases are caused by microorganisms—bacteria, viruses, yeasts, and parasites.

Related Research

- The folklore about how an individual “catches” a common cold is very tenacious. The condition is not regarded as a disease, and the word *cold* reinforces the connection with environmental causes (Driver et al. 1994, p. 56).
- In a study by Brumby, Garrard, and Auman (1985), some students saw health and illness as two different concepts with different causes rather than as a continuum. Another sample of students saw illness as the negative end of a health continuum

of “lifestyle diseases” with no mention of infectious diseases (Driver et al. 1994).

- Exposure to TV and publicity on AIDS might influence modern children’s ideas about infectious disease and predispose them more toward the germ theory of disease (Driver et al. 1994).
- Students have been known to hold conflicting ideas concurrently—at the same time, for example, believing that “all diseases are caused by germs” and that you can “catch a cold by getting cold and wet” (Driver et al. 1994).
- Research suggests that children often think of disease and decay as properties of the objects affected. They do not appear to hold a concept of microbes as agents of change (Driver et al. 1994, p. 55).

Suggestions for Instruction and Assessment

- When teaching about infectious diseases, distinguish among cause, transmission, and factors that lower resistance to disease.
- Engage older students in a debate regarding the many myths of the common cold. Encourage students to use their knowledge of cells, the immune system, and personal health to back up their claims with evidence.
- Use the story of Louis Pasteur and his contribution to the development of the germ theory. This historical episode is particularly relevant at the middle school level. In addition to tracing the development of ideas related to infectious diseases, it pro-

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vides an excellent opportunity to highlight the nature of science.

Related NSTA Science Store Publications, NSTA Journal Articles, NSTA SciGuides, NSTA SciPacks, and NSTA Science Objects

American Association for the Advancement of Science (AAAS). 2001. *Atlas of science literacy*. Vol. 1. (See “Diseases,” pp. 86–87.) Washington, DC: AAAS.

American Association for the Advancement of Science (AAAS). 2007. *Atlas of science literacy*. Vol. 2. (See “Discovering Germs,” pp. 86–87.) Washington, DC: AAAS.

Pea, C., and D. Sterling. 2002. Cold facts about viruses. *Science Scope* (Nov./Dec.): 12–17.

Roy, K. 2003. Handwashing: A powerful preventative practice. *Science Scope* (Oct.): 12–14.

Sullivan, M. 2004. Career of the month: An interview with microbiologist Dale B. Emeagwali. *The Science Teacher* (Mar.): 76.

Related Curriculum Topic Study Guides

(Keeley 2005)

“Infectious Disease”

“Health and Disease”

“Personal and Community Health”

References

American Association for the Advancement of Science (AAAS). 1993. *Benchmarks for science literacy*. New York: Oxford University Press.

American Association for the Advancement of Science (AAAS). 2008. Benchmarks for science literacy online. www.project2061.org/publications/bsl/online

Brumby, M., J. Garrard, and J. Auman. 1985. Students’ perceptions of the concept of health. *European Journal of Science Education* 7(3): 307–323.

Driver, R., A. Squires, P. Rushworth, and V. Wood-Robinson. 1994. *Making sense of secondary science: Research into children’s ideas*. London: RoutledgeFalmer.

Keeley, P. 2005. *Science curriculum topic study: Bridging the gap between standards and practice*. Thousand Oaks, CA: Corwin Press.

National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academy Press.