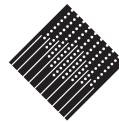
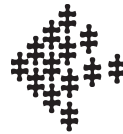


# The Science of Healthy Behaviors

under a contract from the  
National Institutes of Health

National Institute of Nursing Research  
Office of Behavioral and Social Sciences Research



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# Foreword

This curriculum supplement, from *The NIH Curriculum Supplements Series*, brings cutting-edge medical science and basic research discoveries from the laboratories of the National Institutes of Health (NIH) into classrooms. As the largest medical research institution in the United States, NIH plays a vital role in the health of all Americans and seeks to foster interest in research, science, and medicine-related careers for future generations. NIH's Office of Science Education (OSE) is dedicated to promoting science education and scientific literacy.

We designed this curriculum supplement to complement existing life science curricula at both the state and local levels and to be consistent with *National Science Education Standards*.<sup>1</sup> It was developed and tested by a team composed of teachers, scientists, medical experts, and other professionals with relevant subject-area expertise from institutes and medical schools from across the country; representatives from the National Institute of Nursing Research and the Office of Behavioral and Social Sciences Research; and curriculum-design experts from Biological Sciences Curriculum Study (BSCS) and SAIC. The authors incorporated real scientific data and actual case studies into classroom activities. A three-year development process included geographically dispersed field tests by teachers and students.

The structure of this module enables teachers to effectively facilitate learning and stimulate student interest by applying scientific concepts to real-life scenarios. Design elements include a conceptual flow of activities based on the BSCS 5E Instructional Model, multisubject integration emphasizing cutting-edge science content, and built-in assessment tools. Activities promote active and collaborative

learning and are inquiry-based to help students develop problem-solving strategies and critical thinking.

Each curriculum supplement comes with a complete set of materials for both teachers and students, including printed materials, extensive background and resource information, and a Web site with interactive activities. The supplements are distributed at no cost to teachers across the United States. All materials may be copied for classroom use but may not be sold. We welcome your feedback. For a complete list of curriculum supplements, updates, and availability and ordering information, or to submit feedback, please visit our Web site at <http://science.education.nih.gov> or write to

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We appreciate the valuable contributions of the talented staff at BSCS and SAIC. We are also grateful to the NIH scientists, advisors, and all other participating professionals for their work and dedication. Finally, we thank the teachers and students who participated in focus groups and field tests to ensure that these supplements are both engaging and effective.

I hope you find our series a valuable addition to your classroom and wish you a productive school year.

Bruce A. Fuchs, Ph.D.  
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<sup>1</sup> In 1996, the National Academy of Sciences released the *National Science Education Standards*, which outlines what everyone should understand about science by the time they graduate from high school. The *Standards* encourages teachers to select major science concepts that empower students to use information to solve problems rather than stressing memorization of unrelated information.



# About the National Institutes of Health

Begun as the one-room Laboratory of Hygiene in 1887, the National Institutes of Health (NIH) today is one of the world's foremost biomedical and behavioral research centers and the federal focal point for health research in the United States.

## Mission and Goals

The NIH mission is science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability.

The goals of the agency are to

- foster fundamental creative discoveries and innovative research strategies and their applications as a basis for advancing significantly the nation's capacity to protect and improve health;
- develop, maintain, and renew scientific resources—both human and physical—that will ensure the nation's ability to prevent disease;
- expand the knowledge base in medical and associated sciences in order to enhance the nation's economic well-being and ensure a continued high return on the public investment in research; and
- exemplify and promote the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science.

NIH works toward meeting those goals by providing leadership, direction, and grant support to programs designed to improve the health of the nation through research in the

- causes, diagnosis, prevention, and cure of human diseases;
- processes of human growth and development;
- biological effects of environmental contaminants;

- understanding of mental, addictive, and physical disorders; and
- collection, dissemination, and exchange of information in medicine and health, including the development and support of medical libraries and the training of medical librarians and other health information specialists.

## Organization

Composed of 27 separate institutes and centers, NIH is one of eight health agencies of the Public Health Service within the U.S. Department of Health and Human Services. NIH encompasses 75 buildings on more than 300 acres in Bethesda, Md., as well as facilities at several other sites in the United States. The NIH budget has grown from about \$300 million in 1887 to more than \$28 billion in 2005.

## Research Programs

One of NIH's principal concerns is to invest wisely the tax dollars entrusted to it for the support and conduct of this research. Approximately 82 percent of the investment is made through grants and contracts supporting research and training in more than 2,000 research institutions throughout the United States and abroad. In fact, NIH grantees are located in every state in the country. These grants and contracts make up the NIH Extramural Research Program.

Approximately 10 percent of the budget goes to NIH's Intramural Research Programs, the more than 2,000 projects conducted mainly in its own laboratories. These projects are central to the NIH scientific effort. First-rate intramural scientists collaborate with one another regardless of institute affiliation or scientific discipline and have the intellectual freedom to pursue their research leads in NIH's own laboratories. These explorations range from

basic biology to behavioral research, to studies on treatment of major diseases.

### **Grant-Making Process**

The grant-making process begins with an idea that an individual scientist describes in a written application for a research grant. The project might be small, or it might involve millions of dollars. The project might become useful immediately as a diagnostic test or new treatment, or it might involve studies of basic biological or behavioral processes whose clinical value may not be apparent for many years.

Each research grant application undergoes peer review. A panel of scientific experts, primarily from outside the government, who are active and productive researchers in the health sciences, first evaluates the scientific merit of the application. Then, a national advisory council or board, composed of eminent scientists as well as members of the public who are interested in health issues or the biomedical or behavioral sciences, determines the project's overall merit and priority in advancing the research agenda of the particular NIH funding institutes and centers.

About 38,500 research and training applications are reviewed annually through the NIH peer-review system. At any given time, NIH supports 35,000 grants in universities, medical schools, and other research and research training institutions, both nationally and internationally.

### **NIH Nobelists**

The roster of people who have conducted NIH research or who have received NIH support over the years includes some of the world's most illustrious scientists and physicians. Among them are 115 winners of Nobel Prizes for achievements as diverse as deciphering the genetic code and identifying the causes of hepatitis. You can learn more about Nobelists who have received NIH support at <http://www.nih.gov/about/almanac/nobel/index.htm>.

### **Impact on the Nation's Health**

Through its research, NIH has played a major role in making possible many achievements over the past few decades, including these:

- Mortality from heart disease, the number one killer in the United States, dropped by 36 percent between 1977 and 1999.
- Improved treatments and detection methods increased the relative five-year survival rate for people with cancer to 60 percent.
- With effective medications and psychotherapy, the 19 million Americans who suffer from depression can now look forward to a better, more productive future.
- Vaccines are now available that protect against infectious diseases that once killed and disabled millions of children and adults.
- In 1990, NIH researchers performed the first trial of gene therapy in humans. Scientists are increasingly able to locate, identify, and describe the functions of many of the genes in the human genome. The ultimate goal is to develop screening tools and gene therapies for the general population for cancer and many other diseases.

### **Science Education**

Science education by NIH and its institutes and centers contributes to ensuring the continued supply of well-trained basic research and clinical investigators, as well as the myriad professionals in the many allied disciplines who support the research enterprise. These efforts also help educate people about scientific results so that they can make informed decisions about their own—and the public's—health.

This curriculum supplement is one such science education effort, a collaboration among four partners: the NIH National Institute for Nursing Research, the NIH Office of Behavioral and Social Sciences Research, the NIH Office of Science Education, and Biological Sciences Curriculum Study.

For more about NIH, visit its Web site at <http://www.nih.gov>.



# About the National Institute of Nursing Research

There are more than two and a half million nurses in the United States, making nursing the largest healthcare profession. People consistently rate nurses highly for being trustworthy. You can find nurses in a variety of settings. While most work in hospitals, others work in schools, community centers, clinics, government offices, and businesses, and many provide home care for people outside the hospital.

The National Institute of Nursing Research (NINR), a part of the National Institutes of Health (NIH), is a government agency that supports the work of nurse researchers. Nurse researchers are nurses who have received advanced education in science. They study questions that arise from the daily experiences of nurses. Many of these questions involve finding ways for nurses to help people of all ages stay healthy, prevent diseases, or manage symptoms such as pain, nausea, and fatigue, and to care for the ill or injured.

To promote health or provide care for patients, nurses need to know what methods work best. That is the role of research. For example, nurse researchers have explored ways to help children start healthy habits that can bring lifelong benefits, or overcome a variety of health problems. Here are some of the results from NINR research studies:

- a school exercise program, along with classes on nutrition, smoking, and fitness, helped children lower their body fat and blood pressure;
- a community awareness program decreased the exposure to lead for children in a low-income neighborhood;
- a coping-skills program taught teenagers with diabetes how to improve control of their disease, which also improved their quality of life;
- an educational program helped asthmatic children reduce the severity of their breathing problems; and
- use of relaxation and imagery decreased pain for children after a tonsillectomy.

The work of nurse researchers advances our understanding of health and illness. This allows nurses, doctors, and other healthcare professionals to promote good health and deal with a wide range of health conditions and diseases. The nursing research supported by NINR can and does make a difference in the lives of many people.

For more about NINR, contact the NINR Office of Science Policy and Public Liaison at [info@ninr.nih.gov](mailto:info@ninr.nih.gov) or visit this Web site: <http://ninr.nih.gov/ninr>.



# About the Office of Behavioral and Social Sciences Research

The National Institutes of Health (NIH) Office of Behavioral and Social Sciences Research (OBSSR) opened officially July 1, 1995. The U.S. Congress established the OBSSR in NIH's Office of the Director in recognition of the key role that behavioral and social factors often play in illness and health. The OBSSR mission is to stimulate behavioral and social sciences research throughout NIH and to integrate these areas of research more fully into others of the NIH health research enterprise, thereby improving our understanding, treatment, and prevention of disease.

The major responsibilities of the OBSSR and its director, set forth in its formal mission statement, are

- to develop initiatives designed to stimulate research in the behavioral and social sciences arena, integrate a bio-behavioral perspective across the research areas of NIH, and encourage the study of behavioral and social sciences across NIH's institutes and centers;
- to initiate and promote studies to evaluate the contributions of behavioral, social, and lifestyle determinants in the development, course, treatment, and prevention of illness and related public health problems;
- to inform and advise the NIH director and other key officials of trends and developments having significant bearing on the missions of NIH, the U.S. Department of Health and Human Services, and other federal agencies;
- to serve as the principal NIH spokesperson regarding research on the importance of behavioral, social, and lifestyle factors in the causation, treatment, and prevention of diseases and to advise and consult on these topics with NIH scientists and others within and outside the federal government;
- to provide leadership in ensuring that findings from behavioral and social sciences research are disseminated to the public; and
- to sponsor seminars, symposia, workshops, and conferences at NIH and at national and international scientific meetings on state-of-the-art behavioral and social sciences research.

Additional information about the OBSSR, including its activities and accomplishments, can be found at this Web site: <http://obssr.od.nih.gov>.



# Introduction to *The Science of Healthy Behaviors*

In the past 100 years, chronic diseases, such as heart disease, stroke, diabetes, and cancer, have become the most prevalent, most costly, and, ironically, most preventable health problems that Americans face. Surprisingly, 7 out of 10 Americans who die each year succumb to a chronic disease.<sup>6</sup> The statistics, including the costs associated with chronic diseases, are staggering. Consider the following:

- more than 90 million Americans live with a chronic disease;
- medical care costs for people with chronic diseases account for more than 75 percent of the United States' \$1 trillion total medical care costs;
- the direct and indirect costs of diabetes are nearly \$100 billion annually;
- the estimated direct and indirect costs associated with smoking are more than \$68 billion annually;
- in 2001, approximately \$300 billion was spent on all cardiovascular diseases;
- in 2000, the direct medical costs associated with physical inactivity was almost \$76 billion; and
- chronic diseases account for one-third of the years of potential life lost before age 65.<sup>6</sup>

Although it may seem that chronic diseases are strictly an issue for adults, such a view is shortsighted. The health of adults is linked to the health of the young people they were, which in turn is linked to decisions made to choose and adopt healthy behaviors. Middle school students need to understand how decisions are made and that decisions made during adolescence can have both long-term and short-term health consequences. Understanding the influence of behavioral and

social factors on health will inform students' choices of health-promoting and disease-preventing behaviors.

## **What Are the Objectives of the Module?**

*The Science of Healthy Behaviors* has several objectives. One is to introduce students to the scientific study of behavior. Through inquiry-based activities, students investigate what behavior is and how it can be studied. They investigate influences on behaviors and examine the health outcomes of behaviors. As behavioral therapists in role-playing activities, students develop their understanding of the module's concepts and prepare to apply them in their own lives.

A second objective is to have students reach the understanding that behaviors have both short-term and long-term consequences to health and that behaviors are influenced in complex ways by a variety of factors. The lessons in this module help students sharpen their skills in observation, critical thinking, experimental design, and data analysis. They also make connections to other disciplines, including English, mathematics, and social science.

A third objective is to convey to students the purpose of scientific research. Ongoing research affects how we understand the world around us and gives us the foundation for improving choices about our personal health and the health of our community. In this module, students experience how science provides evidence that can be used to understand and treat human disease.

The lessons in this module encourage students to think about the relationships among

knowledge, choice, behavior, and human health in this way:

**Knowledge (what is known and not known)  
+ Choice = Power**

**Power + Behavior = Enhanced Human Health**

The final objective of this module is to encourage students to think in terms of these relationships now and as they grow older.

### Why Teach the Module?

Middle school life science classes offer an ideal setting for integrating many areas of student interest. In this module, students participate in activities that integrate inquiry, science, human health, mathematics, and science-technology-society relationships. The real-life context of the module's classroom lessons is engaging for students, and students can apply the knowledge they gain immediately to their lives.

*“The adolescent survey was highly motivating for students. The inquiry-based activity about the survey was excellent. The simulation was excellent—it made students feel important, and they were more motivated to learn.”*

—Field-Test Teacher

*“I liked analyzing things, not just being told them and memorizing them; it wasn't boring. I liked working in a different area of science; it made it more interesting. I liked learning something that can actually apply to the outside world. It made the learning feel more purposeful.”*

—Field-Test Student

### What's in It for the Teacher?

The Science of Healthy Behaviors meets many of the criteria by which teachers and their programs are assessed:

- The module is **standards based** and meets science content, teaching, and assessment standards as expressed in the *National*

*Science Education Standards*.<sup>19</sup> It pays particular attention to the standards that describe what students should know and be able to do with respect to **scientific inquiry**.

- As described above, it is an **integrated** module, drawing most heavily from the subjects of behavioral and social science, mathematics, and health.
- The module has a Web-based **technology component** that includes an interactive database and simulations.
- Finally, the module includes built-in **assessment tools**, which are noted in each of the lessons with an assessment icon.

In addition, the module provides a means for **professional development**. Teachers can engage in new and different teaching practices like those described in this module without completely overhauling their entire program. In *Designing Professional Development for Teachers of Science and Mathematics*, Susan Loucks-Horsley et al.<sup>15</sup> write that replacement modules such as this one can “offer a window through which teachers can get a glimpse of what new teaching strategies look like in action.” By experiencing a short-term unit like this one, teachers can “change how they think about teaching and embrace new approaches that stimulate students to problem solve, reason, investigate, and construct their own meaning for the content.” The use of supplements like this one can encourage reflection and discussion and stimulate teachers to improve their practices by focusing on student learning through inquiry.

The following table correlates topics often included in the middle school life science curriculum with the major concepts presented in this module. This information is presented to help teachers make decisions about incorporating this material into the curriculum.

## Correlation of *The Science of Healthy Behaviors* to Common Middle School Life Science Topics

Topic	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Behavior	✓	✓	✓	✓	✓
Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models.	✓		✓	✓	
Evaluation includes reviewing the experimental procedures, examining the evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations.	✓		✓	✓	
Human health and medicine			✓	✓	✓
Risk assessment and management			✓	✓	✓
Identify questions that can be answered through scientific investigations.			✓		
Relationships among science, technology, and society	✓		✓	✓	✓
Use appropriate tools and techniques to gather, analyze, and interpret data.	✓		✓	✓	✓
Communicating procedures and evaluations	✓	✓	✓	✓	✓
Mathematics is important in all aspects of scientific inquiry.			✓		





# Implementing the Module

The five lessons in this module are designed to be taught in sequence for approximately eight days as a replacement for a part of the standard curriculum in middle school life science. The following pages offer general suggestions about using these materials in the classroom; you will find specific suggestions in the procedures provided for each lesson.

## What Are the Goals of the Module?

*The Science of Healthy Behaviors* is designed to help students reach these major goals associated with scientific literacy:

- to understand a set of basic scientific principles related to the study of behavior and the relationships of behavior to human health;
- to experience the process of scientific inquiry and develop an enhanced understanding of the nature and methods of science; and
- to recognize the role of science in society and the relationship between basic science and human health.

## What Are the Science Concepts and How Are They Connected?

The lessons are organized into a conceptual framework that allows students to move from what they already know about behavior, some of which may be incorrect, to a scientific perspective on behavior and its importance to science and to their lives. Students begin by developing their own definition of behavior through observations of human and animal behavior (*Defining Behavior*). Students then explore the relationship between influences on behavior and reasons for behavior (*Influences on Behavior*).

An investigation of factors influencing physical activity introduces students to the survey as a tool of behavioral scientists (*Tools of Social and Behavioral Science: The Survey*). In *Behavioral Specialists at Work: The Healthcare*

*Setting*, Students role-play behavioral scientists in a hospital scenario to investigate the relationships between behavior and health. They also develop a behavioral modification plan to help a fictitious character lower his risk of heart disease.

The final lesson, *Behavior Specialists in the Healthcare Setting ... Again*, allows students to consider what they have learned in previous lessons. They investigate in detail the many influences on a person's behavior and relate this to the reasons underlying behaviors. The following two tables illustrate the science content and conceptual flow of the classroom lessons and activities.

## Science Content of the Lessons

Lesson	Science Content
Lesson 1	What is behavior?; observation as a scientific tool
Lesson 2	Influences on behavior
Lesson 3	Using a survey as a scientific tool
Lesson 4	Relationship of behavior to health; changing behaviors
Lesson 5	Pulling it together: changing behavior as it relates to influences on and reasons for behavior

## How Does the Module Correlate with the National Science Education Standards?

*The Science of Healthy Behaviors* supports teachers in their efforts to reform science education in the spirit of the National Research Council's 1996 *National Science Education Standards (NSES)*.<sup>19</sup> The content of the module is explicitly standards based. The chart on pages 7–9 lists the specific content standards that this module addresses.

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