# Table of Contents

1. **Implementation Guide** ..................................................... 2–9  
   This descriptive guide will assist you in integrating the DVD science and education content into your instructional program.

2. **National Science Education Standards** .......................... 10-11  
   See the complete *National Science Education Standards (NSES)* correlated for this program.

3. **Episode Guide** .............................................................. 12  
   Step-by-step procedures make it easy to complete the experiments shown in the program.  
   “More Interesting Stuff to Do” gives more experiments that extend student learning.

4. **Lesson Planning Worksheet** ........................................... 13–14  
   This template helps you incorporate all the features of the Bill Nye DVD into your daily lesson plans.

5. **Student “Know / New” Chart** ....................................... 15  
   A “Know-New” T-Chart assesses students’ prior knowledge and what they learned.

6. **Student Recording Sheet** ............................................. 16  
   This handout gives you a standardized format that students can fill out as they conduct an experiment.

7. **Glossary** ................................................................. 17–18  
   Use the terms and definitions found here to assist you in direct vocabulary instruction.  
   The glossary terms are also found on the DVD.

8. **Quiz** ........................................................................... 19  
   This written version of the interactive quiz on the DVD provides a ready-to-go written test. Multiple choice and true-false items address key concepts found in the standards and in the program.

9. **Quiz Answer Key** ......................................................... 20  
   A separate page contains the quiz answer key.

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**Implementation Guide**

*Welcome to Disney’s Bill Nye DVD collection! With the help of this Guide you can bring instructional DVDs into your science curriculum.*

**What’s on the DVD?**

Bill Nye DVDs expand the educational features of *Bill Nye the Science Guy* programs. Each DVD provides students with science content through video clips aligned with *National Science Education Standards* (NSES) and a host of other resources.

Short video clips aligned with the NSES provide a unique opportunity for you to enhance your lessons using DVD technology. Now you can show a video clip, or even short segments of a clip, on command. But there are a host of other features, too! See the chart below for a summary.

### From the **Main** menu, there are three chief sections:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watch Program Menu</td>
<td>From this menu, you can play the program straight through or use the clips to customize your viewing.</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>From this menu, you can access this Teacher’s Guide, the Glossary, Internet Links, and the Quiz.</td>
</tr>
<tr>
<td>Bonus Materials</td>
<td>Use this menu to try a different discussion starter, download a special screen-saver, or check out never-before-seen footage.</td>
</tr>
</tbody>
</table>

### From the **Watch Program** menu, you can:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Play Program</td>
<td>Play the entire program from start to finish.</td>
</tr>
<tr>
<td>Bilingual Mode</td>
<td>View the entire program or clips in English or Spanish.</td>
</tr>
<tr>
<td>Glossary Mode</td>
<td>Make links to Glossary terms appear during the program.</td>
</tr>
<tr>
<td>Program Overview</td>
<td>View the program introduction, in which Bill discusses the topic covered.</td>
</tr>
<tr>
<td>Try This</td>
<td>Show students demonstrating science concepts.</td>
</tr>
<tr>
<td>Way Cool Scientist</td>
<td>Meet a real scientist who talks about his or her area of study.</td>
</tr>
<tr>
<td>Bill’s Demonstration</td>
<td>Look at a science demonstration conducted by Bill Nye.</td>
</tr>
<tr>
<td>Music Video</td>
<td>Enjoy a short music video that summarizes the topic in an age-appropriate and entertaining manner.</td>
</tr>
<tr>
<td>Science Standards</td>
<td>Take advantage of short video clips from the program, which are aligned with National Science Education Standards.</td>
</tr>
</tbody>
</table>
From the **Teacher Support** menu, you can:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Quiz</td>
<td>Give students a quiz to take independently or as a class. Seven to ten quiz items are aligned with the National Science Education Standards. The items are in multiple-choice or true-false format. Each wrong answer links to a standards-aligned video clip. At the end of the quiz, a scoring function reveals the number of correct initial answers.</td>
</tr>
<tr>
<td>Glossary</td>
<td>Check out definitions of key terms and view video clips that reinforce the concepts.</td>
</tr>
<tr>
<td>DVD Features</td>
<td>View a quick overview of the features found on the DVD.</td>
</tr>
<tr>
<td>Teacher’s Guide</td>
<td>Print out or view this comprehensive Teacher’s Guide in PDF format.</td>
</tr>
<tr>
<td>Internet Link</td>
<td>Link to the Bill Nye area of Disney’s Edustation Web site, where you can find links to Internet sites related to the content of each Bill Nye program.</td>
</tr>
</tbody>
</table>

From the **Bonus Materials** menu, you can:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonus Material</td>
<td>Find out what wasn’t in the episode! In most cases, there’s more of the Way Cool Scientist interview, Bill Nye outtakes, and an extra discussion starter.</td>
</tr>
<tr>
<td>Additional Clips</td>
<td>See trailers of related DVDs and videos.</td>
</tr>
<tr>
<td>Screen-Saver</td>
<td>Download this cool screen-saver for your computer.</td>
</tr>
</tbody>
</table>

**The Planning Process**

This Guide provides a Lesson Planning Worksheet (see page 12), which can assist you in setting up your instruction around a topic. The following sections of this Implementation Guide are offered to assist your planning process:

- Determining Objectives and Linking to Standards
- The Learning Cycle
  - Explore
  - Apply
  - Extend
  - Assess
1. The NSES Teaching Standard A states that science teachers must “select science content and adapt and design curricula to meet the interest, knowledge, understanding, abilities, and experience of students.”

The NSES recommends that teachers “integrate . . . a practical structure for the sequence of activities, and the content to be learned.” The primary instructional model recommended by the NSES is inquiry into authentic student-generated questions about natural or designed phenomena. Since most state and local standards documents were derived from the NSES, you will find that your local and state standards match closely with content standards in the Bill Nye DVD.

Each DVD contains a menu of clips that are aligned with the NSES. You can review the standards and their aligned clips in the Science Standards menu under Watch Program. Also, the Standards listed on page 10 of this Guide allow you to look at additional NSES content standards that are addressed on the video. Here’s an example of the content standards and clips aligned with the Bill Nye DVD entitled *Blood and Circulation*:

**Life Science Standards (NSES) Addressed in *Blood and Circulation***

**Life Science:**
Structure and function in living systems

- Living systems at all levels of organization demonstrate the complementary nature of structure and function.
  
  **Aligned clips:**
  - 1 Blood vessels
  - 2 Heart pump and bloodstream
  - 3 Heart valves and blood circulation
  - 4 White blood cells
  - 5 Capillaries

- The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection.
  
  **Aligned clips:**
  - 6 Heart pump
  - 7 Heart muscle
  - 8 Pumping blood to brain
2. Determine your objectives for the lesson and how these objectives address the standards.

**Sample Objectives for Blood and Circulation**

In this activity students will:
- Observe and describe a body system responsible for supply and transport.
- Use this information to define a body system.
- Ask questions about the circulatory system.
- Explain how structure complements function in organs of the circulatory system.
- Cite examples of current research related to this system.

3. Design a learning cycle of instructional experiences and assessments for the students to engage in that will help students meet these standards. Students may be given teacher-planned investigations or may be guided to design their own investigations.

**The Learning Cycle**

The learning cycle is a sequence of activities that involve students in the learning process. The sequence found here is based on research from Lawson, Abraham, and Renner published in 1989. That has been adapted to include: Explore, Apply, Extend and Assess:

- **Explore:** Involves assessing students’ prior knowledge and providing opportunities for students to interact with content from the video.
- **Apply:** Includes having students use the content learned during the Explore section in a new way that is meaningful to future learning.
- **Extend:** Allows students to conduct further research around an area of interest within the topic.
- **Assess:** Provides strategies meant to inform students and teachers about the content and processes that have been learned.

**Explore**

The NSES Teaching Standard B states: “Teachers of science guide and facilitate learning.” This standard addresses the constant need to balance your predetermined goals with allowing students to set and meet their own learning goals.

*Focus and Support Inquiries:* Support student inquiries by making decisions about “when to provide information” and “when to connect students with other sources.” Knowing the best time to intervene is often determined by allowing students to ask questions and to explore concepts openly.
The NSES Teaching Standard C states: “Teachers of science engage in ongoing assessment of their teaching and of student learning.”

Assess in Order to Guide Teaching: The Program Overview or the Discussion Starter on the DVD can be used to gauge students’ prior knowledge. You can use student responses to make decisions about appropriate instruction and adaptations in order to meet the needs of individual students. Assessment can be in the form of student reflections from standards-aligned video clips or answers to questions found on the science quiz. Or, as in the following example, a simple graphic organizer can facilitate a formative assessment.

Example: T-Chart from Blood and Circulation

1. Ask students to fill out the “Know-New” T-Chart (see page 14). Have them list what they already know about the circulatory system (heart, blood vessels, blood, etc.) on the left side of their charts.

2. Show the Program Overview for Blood and Circulation. On the right side of the chart, have students list new things they have learned from watching the clip. Walk around the room and assist students in filling in their T-Charts. Replay the program as necessary to allow students to review sections of interest.

3. Once students have completed their charts, ask them to share what they have listed in the “New” column. Write these on the board. Have students write their own working definitions of the circulatory system. Once students have completed their definitions, collect and review their work to assess prior knowledge.

Conduct direct vocabulary instruction in the Explore phase. Research suggests that:

- Students must encounter words in context more than once to learn them.
- Instruction in new words enhances learning those words in context.
- One of the best ways to learn a new word is to associate an image with it.
- Direct vocabulary instruction on words that are critical to new content produces the most powerful learning.

Use the DVD Glossary with the linked video clips to expose students to new vocabulary words in context, along with associated video images. You can also find a printed version of the glossary terms in this Guide on page 16.
1. Have students begin “Know-New” T-Charts, focusing on what they already know about the structure and function of blood vessels, arteries, and veins.

2. Watch the following chapters from the Bill Nye DVD *Blood and Circulation*:
   - Blood vessels
   - Heart pump and bloodstream
   - Capillaries

3. Complete the “Know-New” T-Charts.

4. Give students copies of the Student Recording Sheet (see page 15) and have them fill the sheets out as they conduct their experiments.

5. Do the experiment entitled “Pump it Up!” from the *Blood and Circulation* Episode Guide, in which students observe the apparent effects of pressure on arteries and veins.

6. Write down any remaining questions about the structure and function of blood vessels, arteries, and veins.
Extend

The NSES Teaching Standard D states: “Teachers of science design and manage learning environments that provide students with the time, space, and resources needed for learning science.” School administrators, parents, and the community can assist teachers in providing local resources that make science lessons pertinent and meaningful.

Identify and Use Resources Outside of the School: “The school science program must extend beyond the walls of the school.” Each Bill Nye DVD contains resources designed to facilitate such understanding, including:

- Way Cool Scientist, found in both Watch Program and Bonus Materials, in which scientists discuss their current areas of study. This real-world connection often results in a deeper student understanding of a particular career.

- Disney’s Edustation Web site, where relevant Internet links provide a starting point for students to further explore science topics.

- Try these video clips, with activities parents and students can do at home. The questions generated by students from these experiences can be used as foundations from which they may conduct their own research.

- Standards-aligned video clips and Bill’s demonstration video clips, which can help generate topics for further research. After viewing the clips, have students list their questions, perhaps about the most current developments in a topic. By conducting online or library research, students will find answers to their questions and will learn about a topic in greater depth.

Example: Conducting Student Research Using Blood and Circulation

Ask students to choose one of the questions they had after completing the activities from Blood and Circulation. An example of a student research question might be, “How has the technology related to artificial hearts advanced in the last ten years?” Explain to students that they will be conducting research to find answers to their questions. Some students may want to complete online or library research, others may want to ask an expert in the field, while others may want to design and conduct a scientific investigation. Encourage students to write a detailed procedure for finding answers to their questions. Ask students to find one or more examples of current research dealing with the circulatory system that is related to their question. Note: Students with similar questions may work together to complete the assignment.
Assess

Once students have conducted the research, you may choose to assess them in a number of different ways:

■ By having students write about what they learned in a journal.

■ By having students submit projects or reports.

■ By having students take the program quiz to gauge their understanding of certain facts in the video. You can either print the quiz (found in this Guide on page 18) and have each student complete it individually or use the DVD screen version and the scoring feature for whole-class assessment.

■ By designing other standards-aligned questions to augment those that are provided.

While the quiz will provide you with information about what the students have learned, it does not assess how students have processed the information. Below you will find assessment ideas that can be used to measure both content and process.

A Sample Assessment for Blood and Circulation

1. Explain to students that an important aspect of scientific inquiry is to communicate findings to others. In this assessment, students will present the following information to their peers:
   ■ The question they investigated.
   ■ The method that was used to find answers to their question.
   ■ Problems or successes during the search.
   ■ Answers to their question.
   ■ Current research related to their question.
   ■ New questions that have arisen.

2. Distribute the rubric found in the Lesson Planning Worksheet (see page 13) to students so they know how they will be assessed. Make sure students understand the criteria found in the rubric. Before you begin, you may want to allow students to make changes to the rubric so that it is clearer or makes more sense from their perspectives.

3. Allow students time to gather information to answer their questions and to prepare for their presentations. As students conduct this work, walk around the room and ask questions to assess their progress and provide input as needed.

4. Take a few minutes to clarify the rules of the presentation with the students. You may want to have multiple copies of the rubric available so that peers can rate the presentations.

5. As presentations are made, assess the quality of the student’s work as thoroughly and as equitably as you possibly can.

Congratulations! You have now completed the steps to set up a lesson plan using the Lesson Planning Worksheet. You have also explored many of the features of the Bill Nye DVD as well as the supplemental information found in this Teacher’s Guide. And most important, you’ve made significant strides toward incorporating DVD technology into your day-to-day instruction.
Science as Inquiry

Abilities necessary to do scientific inquiry

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.

Life Science

Structure and function in living systems

- Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, organs, tissues, organ systems, whole organisms, and ecosystems.

- Cells carry on the many functions needed to sustain life. They grow and divide, thereby producing more cells. This requires that they take in nutrients, which they use to provide energy for the work that cells do and to make the materials that a cell or an organism needs.

- Specialized cells perform specialized functions in multicellular organisms. Groups of specialized cells cooperate to form a tissue, such as a muscle. Different tissues are in turn grouped together to form larger functional units, called organs. Each type of cell, tissue, and organ has a distinct structure and set of functions that serve the organism as a whole.

- The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease. These systems interact with one another.

- 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.

Science in Personal and Social Perspectives

Personal health

- Regular exercise is important to the maintenance and improvement of health. The benefits of physical fitness include maintaining healthy weight, having energy and strength for routine activities, good muscle tone, bone strength, strong heart/lung systems, and improved mental health. Personal exercise, especially developing cardiovascular endurance, is the foundation of physical fitness.
The use of tobacco increases the risk of illness. Students should understand the influence of short-term social and psychological factors that lead to tobacco use, and the possible long-term detrimental effects of smoking and chewing tobacco.

**History and Nature of Science**

**Science as a human endeavor**

- Women and men of various social and ethnic backgrounds—and with diverse interests, talents, qualities, and motivations—are engaged in the activities of science, engineering, and related fields such as the health professions. Some scientists work in teams, and some work alone, but all communicate extensively with others.

- Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity—as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.
Episode Guide
Respiration

Nifty Questions in This Episode

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do our bodies get energy?</td>
<td>Our bodies get energy by combining oxygen with the food we eat.</td>
</tr>
<tr>
<td>How much surface area do your lungs have?</td>
<td>Our lungs have a surface area as big as a tennis court.</td>
</tr>
<tr>
<td>Is your right lung bigger than your left lung?</td>
<td>Yes. The right lung is bigger so that the left lung can fit over the heart.</td>
</tr>
</tbody>
</table>

Experiments shown on the video:

BREATHE DEEP
*Objective: To show how a human lung works.*

- Cut 5 centimeters off the bottom of an empty 2-liter plastic bottle.
- Push a balloon into the top of the bottle and wrap the edge of the balloon over the spout of the bottle.
- Cut a section out of a large balloon to fit the bottom of the bottle and tape it to the bottle.
- Pull on the bottom balloon and watch the top balloon expand and contract like a lung.

More interesting stuff to do:

ALL AIR
*Objective: To record the amount of water that is displaced by exhaling (the volume of air in the lungs).*

- Fill a pan with water to a depth of 5 centimeters.
- Fill a 2-liter bottle to the top with water. Replace the cap.
- Place the bottle upside-down into the pan of water and support it with your hand.
- Remove the cap while the bottle is in the water.
- Place one end of a piece of rubber surgical tubing into the mouth of the bottle underwater.
- Exhale into the other end of the tube.
- On the outside of the bottle, mark the new level of the water inside the bottle after each exhalation.
- Continue exhaling at different rates until the bottle is almost empty.
- Take the bottle out of the pan of water.
- Refill the bottle to each marked level and measure that amount of water into a graduated cylinder. Use this procedure to measure the amount of water displaced by exhaling, which is indicated by the markings on bottle.
- Each measurement equals the volume of air exhaled. (Note: 1,000 milliliters equals one quart)

TAKE A BREATHER
*Objective: To recording your breathing rate after activities.*

- Make a chart to record your findings — at rest, after exercising, etc.
- While resting, record the number of breaths you take in one minute.
- Repeat for two more trials. Average your results.
- Run in place for 30 seconds. Now count the number of breaths you take in one minute.
- Repeat for two more trials. Determine the average.
- The average breathing rate at rest is 16 breaths per minute (but this can vary).
As presentations are made, assess the quality of the student's work as thoroughly and as equitably as you possibly can. The following criteria can be used to assist in your assessment.

Name of Student ________________________

Question Investigated ________________________

<table>
<thead>
<tr>
<th>Initial Question</th>
<th>Methods for Finding Answers</th>
<th>Results</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Question is broad and not well defined</td>
<td>1. Students do not share planned or actual methods.</td>
<td>1. Student results are undefined.</td>
<td>1. Student is not prepared to speak.</td>
</tr>
<tr>
<td>2. Question is defined but limited to single-answer responses.</td>
<td>2. Students share methods but they are unclear or vague.</td>
<td>2. Student results are incomplete and do not adequately answer the question.</td>
<td>2. Presenter has distracting mannerisms and avoids eye contact with the audience.</td>
</tr>
<tr>
<td>3. Question is clear and might elicit multiple responses that may lead to new ideas and additional questions.</td>
<td>3. Students share methods but not the problems or successes of using the methods.</td>
<td>3. Student results are complete, adequately answer the question, and include current research related to the question.</td>
<td>3. Presentation is clean and clear with some eye contact and very few distractions.</td>
</tr>
<tr>
<td>4. Question is engaging and provokes new ways of thinking about an issue.</td>
<td>4. Students share methods and problems or successes in using the methods.</td>
<td>4. Student results are complete, include current research, and have resulted in one or more additional questions.</td>
<td>4. Presentation is exceptional and unique. Presenter uses regular eye contact and avoids distractions.</td>
</tr>
</tbody>
</table>
# Student “Know / New” Chart

**Know**  
Write down what you know about the topic of the video.

**New**  
Write down information from the video that is new to you.
Bill Nye the Science Guy

Student Recording Sheet

Name ___________________________ Date ___________________________

Title of Experiment _______________________________________________________

Question: (What are you testing?) ____________________________________________

Procedure: (Describe the experiment) _______________________________________

Materials: (List what you used) _____________________________________________

Observations: (Record what happened) _______________________________________

Results: (Make your own data table)

Conclusions: (Use your observations and results to describe what you learned)
**Diaphragm**
A sheet of muscles across the lower part of the chest cavity, which is used for breathing.

**Lung**
An organ in most vertebrates that helps oxygen enter the bloodstream and carbon dioxide leave it.

**Alveoli**
Tiny air sacs in the lungs. The site of carbon dioxide and oxygen exchange between blood and air in lungs.

**Respiration**
The process by which oxygen is combined with food to release energy and carbon dioxide. Respiration involves the act of breathing; inhalation and exhalation.
Cellular Respiration
The series of chemical reactions by which a living cell breaks down food molecules and obtains energy from them.

Adenosine Triphosphate (ATP)
A nucleotide that stores energy for a cell and then releases it when the energy is needed.

Mucus
A thick liquid in the air passages of an animal; produced by epithelial tissue; traps dust and pollen from the air.

Gills
Organs through which most aquatic animals obtain oxygen dissolved in water.
**Quiz**  
**Respiration**

**True or False? Circle T or F**

1. Your lungs do not rely on muscles in order to work. T or F
2. Your lungs have as much surface area as the area of a tennis court. T or F
3. Your two lungs are the same size. T or F
4. Each cell uses food to make energy using a simple chemical called adenosine diphosphate (ADP). T or F
5. Food plus energy makes oxygen. T or F
6. Gills help some animals breathe underwater. T or F

**Multiple Choice: Circle the letter of the best answer**

7. Which of the following muscles work with the lungs to help you breathe?  
   A. Biceps  
   B. Heart  
   C. Triceps  
   D. Diaphragm

8. Your lungs are full of air sacs or passages called:  
   A. ATP  
   B. Alveoli  
   C. Mucus  
   D. None of the above

9. Why is it important to exercise everyday?  
   A. To keep your muscles healthy  
   B. To keep your lungs healthy  
   C. To have enough energy  
   D. All of the above

10. How do cigarettes affect your lungs?  
    A. Soot and tar get into your lungs.  
    B. Cigarettes cause your mucus to dry up.  
    C. Cigarettes make your alveoli cleaner.  
    D. Cigarettes do not affect your lungs.
Answer Key
Respiration

2. T  5. F  8. B  10. A
3. F  6. T

Cellular Respiration

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