THE BODY’S DEFENSES AGAINST DISEASE

1 videocassette. ............... 24 minutes

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**Introduction**

In the last fifty years, medical science has made enormous progress in the prevention and treatment of infectious diseases. The list of successes is formidable. Smallpox has been eradicated. Polio no longer terrifies every parent. Diseases like bacterial pneumonia can be controlled by antibiotics. As a consequence of such progress, the attention of most medical researchers turned toward noninfectious diseases like cancer and heart disease.

The optimism was premature. Many kinds of bacteria have developed resistance to antibiotics so that diseases that were easily treatable are once again becoming a threat. HIV and the Ebola virus have shown how vulnerable we are to pathogens unknown only twenty years ago.

Perhaps more than ever, we appreciate how the body is our most important defender against disease. The body has a remarkably complex system of different types of defenses, ranging from the simple barrier of skin cells to pathogen-eating phagocytes and protective antibodies. Medical science can augment these defenses but not replace them.

*The Body's Defenses Against Disease* gives students an overview of how their own bodies protect them from harm. It examines different kinds of bacteria and viruses. It looks at how good hygiene, vaccinations,
and antibiotics can help the body protect itself. It
describes the effects of allergies and auto-immune
diseases such as rheumatoid arthritis. Finally, it examines
how HIV infection weakens the body's defenses,
enabling opportunistic diseases to do their damage.

The video is designed for grades 5 through 8. Younger
and older audiences may find it useful as well.

**Objectives**

After viewing the video, students will be able to:

1. describe different types of pathogens, particularly
   bacteria and viruses.

2. explain how pathogens such as bacteria and viruses
   cause disease.

3. describe different health behaviors that protect
   them and others from infectious diseases.

4. describe the essential components of the body's
   defenses against pathogens, including:
   - skin
   - mucous membranes
   - cilia
   - phagocytes
   - antibodies
5. explain how antibiotics, vaccinations and other medical advances help the body fight disease.

6. explain how the immune system sometimes attacks the body itself, causing allergies and auto-immune diseases like rheumatoid arthritis.

7. describe how HIV attacks the immune system.

**Summary**

The opening shows battle scenes. The narration accompanying these images says that there is a war being waged that affects the health and well-being of every person. This war isn't being waged between countries but, instead, by our own bodies against disease.

After the title the video focuses on the microscopic enemies that threaten our health. The program points out that there are invisible and dangerous enemies all around us. Microscopic images of bacteria show how quickly bacteria can multiply. A doctor is shown taking a sample of mucus from a student's mouth and examining the petri dish a day later. The program describes how some bacteria cause harm by producing substances that are toxic, and briefly describes different types of bacterial infections.

The video next shows how viruses are different from bacteria. Viruses are not living cells and depend on
cells to reproduce. They cause disease by invading and eventually destroying cells in the body.

The program briefly describes how, for most of history, doctors and others had little understanding about the causes of disease. It was only late in the last century that doctors began to understand the role of pathogens in spreading disease. Up until that time, it was common for surgeons not to wash their hands before performing an operation, and doctors frequently infected their patients, causing more harm than good.

Using student models, the program then describes the importance of good health behaviors in preventing infection, including good sanitation, covering up when sneezing and coughing, and staying away from others they might infect when they are contagious.

The program then details how the body is our strongest defender against disease. It describes several lines of defense. Skin is like the wall of a fort that provides a protective barrier against invaders. A cut, however, provides a way for pathogens to get through this barrier and pathogens can enter the mouth and nose. Mucous membranes in the nose, throat, and bronchial tubes trap pathogens before they reach the lungs. Cilia in bronchial tubes and trachea sweep pathogens to the throat where they can be exhaled by coughing. Tears wash pathogens from the eyes and kill others. Gastric juice in the stomach kills many pathogens.
The program next looks at what happens when pathogens get beyond these first lines of defense, for example through a cut in the skin. This part details how certain kinds of white blood cells, called phagocytes, attack pathogens and engulf them. Other kinds of white blood cells, called lymphocytes, manufacture antibodies that are custom-tailored to attack specific kinds of pathogens.

The video next describes how antibodies that have been manufactured as a result of an invasion by a specific pathogen remain in the blood. If the same kind of pathogen enters the blood again later, they are ready to destroy it. The body is also primed to make the right kind of antibodies very quickly. In this way antibodies prevent the getting of the same kind of disease a second time.

The program then describes various weapons that modern medicine uses to help the body combat disease. It discusses how vaccines work to prime the production of antibodies so that the body reacts quickly to attacks by bacteria and viruses. It also describes how antibiotics work to destroy bacteria. However, the video also notes how bacteria can develop resistance to antibiotics.

Finally, the program looks at failures of the immune system. It describes how hay fever and other allergic reactions are a result of an overly aggressive immune response to pollen and other foreign particles. It shows
a person suffering from rheumatoid arthritis and describes how this is an auto-immune disease where the body attacks its own cells.

The most attention is given to AIDS, a disease in which HIV attacks white blood cells called T-cells, weakening the immune system so that the body can't protect itself from other kinds of infections.

A brief summary concludes the program.

**Review Questions**

1) What is a pathogen?
   
   *It is something that, once inside the body, causes disease.*

2) Describe bacteria.
   
   *Bacteria are microscopic, one-cell forms of life.*

3) How do bacteria reproduce?
   
   *Bacteria reproduce by dividing into halves. Under the right conditions, some bacteria divide as often as once every twenty minutes.*

4) How are viruses different from bacteria?
   
   *Viruses are much smaller than bacteria. They cannot reproduce by themselves. Instead, they take over cells, using them as factories to make more viruses.*
5) How do viruses and bacteria cause damage?

Bacteria can produce toxins, or poisons, that harm the body's cells. Viruses can weaken or destroy cells when they invade them.

6) How are communicable diseases like the flu different from diseases like cancer and heart disease?

Communicable diseases can be passed on from one person to another. Diseases like cancer cannot be spread by contact with other people.

7) What are some steps that people can take to avoid catching a disease from someone else or transmitting a disease?

Wash frequently especially after using the toilet and before eating or preparing food, cover up when sneezing or coughing, avoid getting close to others when sick.

8) What are several defenses that keep pathogens from getting inside the body? Examples in the program include skin cells that act as a barrier, mucus that traps pathogens, cilia that sweep them up and out of respiratory tract, tears that wash pathogen away from eyes, and gastric juices that kill pathogens that get into the stomach.

9) Name two different kinds of white blood cells and describe what they do.
Phagocytes destroy pathogens by engulfing them. Lymphocytes produce antibodies.

10) Describe how getting a disease provides immunity to the same disease.
When a disease strikes for the first time, antibodies are produced that are specific to the virus or bacteria that cause the sickness. When such pathogens enter the body a second time, some of these antibodies are already present to attack them, and other antibodies can be manufactured quickly.

11) Describe how vaccinations provide immunity. A vaccine injects dead or weakened pathogens into the body. These pathogens have the same antigen markers as a strong, live pathogen. They cause the body to manufacture antibodies that are effective against a strong pathogen later.

12) How do antibiotics work?
Antibiotics kill bacteria by destroying their cell walls.

13) What are some limitations of antibiotics?
They don't work against viruses. Also, bacteria can change so that an antibiotic is no longer effective.
14) What causes an allergic reaction?
   The immune system overreacts to a harmless agent, like a pollen grain.

15) What is an auto-immune disease?
   It's a disease that results when the immune system attacks the body's own cells. The example in the program is rheumatoid arthritis.

16) How does HIV weaken the immune system? It weakens or destroys T-cells.

17) How is HIV transmitted?
   The ways described in the program include sharing needles or "works", through intimate sexual contact where body fluids are exchanged, and through blood, although blood transfusions are now considered safe.

18) Can you be infected with HIV through casual contact? No.

19) What are some ways in which you cannot get HIV?
   You can't get HIV by touching, hugging, or kissing. Drinking from the same glass or being in the same class as someone with HIV also won't cause you to get the virus.
Activities

1) There are many different kinds of bacteria and not all are pathogens. Explain to students that bacteria are friends as well as foes. Among other things, bacteria decompose waste and dead organisms; are used in making yogurt and cheese; and are instruments in genetic engineering, where they act as factories to make products important to humans, such as human growth hormones.

Bacteria come in a variety of shapes. For example, cocci are sphere-shaped, bacilli are rod-shaped, and spirochetes have a spiral shape.

Bacteria can live in a surprising range of places, from ice to hot springs. One type of bacteria has been found at the bottom of the sea at hydrothermal vents. These bacteria consume the hydrogen sulfide and they themselves are food for tube worms. The bacteria and the tube worms that feed on them are highly unusual because unlike other forms of life, they don't depend on photosynthesis for energy, either directly or indirectly.

Ask students to research and report on different types of bacteria. Among the questions they should consider are:

- What shape do they have?
- Where are they likely to be found?
- Are they harmful or helpful to humans? Why?
2) The program states that under the right conditions certain kinds of bacteria can divide at the rate of once every twenty minutes. Students are often astounded at how many bacteria can result from a single ancestor in a matter of a few hours.

A simple mathematical exercise can make the point. Have them imagine that a single bacterium starts to divide at 12 midnight and calculate how many bacteria exist after each 20-minute period until noon. After 20 minutes, for example, there will be 2 bacteria. After 40 minutes there will be four.

The results for six hours and twelve hours are:

- 6 hours: 262,144 bacteria
- 12 hours: 69,719,476,736 bacteria

3) Viruses have been in the news a great deal, particularly because of HIV, the virus that causes AIDS. Also, books like The Hot Zone have focused attention on the deadly Ebola virus and Marburg virus.

Ask students to research and report on different types of viruses. Examples include the following:

- polio
- measles
- smallpox
- HIV
- flu
- Ebola
4) Ask students to research and report on some of the key people who have made discoveries that have advanced our understanding and/or treatment of disease. Examples include:

Edward Jenner: developed vaccines for smallpox

Louis Pasteur: founded the science of microbiology and proved the germ theory of disease

Alexander Fleming: discovered penicillin

Jonas Salk: developed the first polio vaccine

Ignatz Philipp Semmelweiss: first to stress the importance of doctors' washing their hands before examining patients.

5) Students often don't understand the importance of taking the full prescription of antibiotics even after they no longer feel sick. Tell them that the early doses kill the weakest bacteria but not necessarily the strongest. If a patient stops taking an antibiotic too soon, these stronger bacteria will reproduce quickly and will be harder to knock out because they are more resistant.

6) Invite a doctor or health professional to talk about AIDS and answer students' questions. He or she could alleviate fears about getting the disease from casual contact while stressing the importance of avoiding risky behaviors.
7) Students may wonder why it is necessary to get a new flu vaccine each year. Explain that viruses, like bacteria, can change or mutate. The flu virus mutates very quickly so that a vaccine that works one year may not work the next.

8) Ask students to research and report in greater detail on the role of specific kinds of white blood cells such as phagocytes, lymphocytes and T-cells.

Glossary

**AIDS (Acquired Immune Deficiency Syndrome):**
a severe immunological disorder caused by HIV. As a result of a weakened immune system a person is susceptible to opportunistic infections and to certain cancers

**antibody:** a protein molecule produced in response to a specific antigen, such as a bacterium or a virus. Antibodies destroy or weaken pathogens

**antibiotic:** a substance, such as penicillin or streptomycin, that can destroy or inhibit the growth of bacteria

**antigen:** something that when introduced into the body promotes the production of antibodies

**bacteria:** single-cell organisms that have no nucleus
cilia: hairlike extensions from the surface of cells

communicable disease: disease that can be transmitted between people, a contagious disease

contagious disease: disease that is transmittable by direct or indirect contact

gastric juice: acidic digestive fluid secreted by glands in the stomach

HIV (human immunodeficiency virus): virus that causes AIDS

immune system: system of organs, tissues, cells, and antibodies that neutralizes potentially harmful agents like bacteria and viruses that get into the body

lymph: clear fluid that contains white blood cells and circulates throughout the lymphatic system, and removes bacteria from the tissues and supplies mature lymphocytes to the blood

lymphatic system: system in which lymph circulates throughout the body

lymph nodes: small round structures in the lymphatic system that remove bacteria and other pathogens from the lymph and supply the blood with lymphocytes

lymphocyte: type of white blood cell
mucus: thick fluid secreted by glands of the mucous membranes and which provide a protective coating

**pathogen:** agent such as a bacterium or virus that causes disease

**penicillin:** type of antibiotic

**phagocyte:** type of white blood cell that engulfs harmful foreign bodies in the bloodstream and/or tissues of the body

**rheumatoid arthritis:** auto-immune disease that affects joints

**smallpox:** highly infectious viral disease characterized by high fever and aches followed by the eruption of pimples that blister and produce pus

**streptococcus:** type of bacteria that can cause a sore throat among other things

**T-cell:** type of white blood cell

**vaccination:** inoculation with a vaccine that provides immunity to a disease

**virus:** organic particle consisting mainly of genetic material surrounded by a protective coat, by itself lifeless, but inside a living cell it can commandeer the cell to manufacture more viruses while at the same time harming the cell
Bibliography


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*Breath of Life: Our Respiratory System*
*Cell Division*
*Food into Fuel: Our Digestive System*
*In Control: Our Brain and Nervous System*
*Introducing the Cell*
*Our Flexible Frame: The Muscular and Skeletal Systems*
*Pumping Life: The Heart and Circulatory System*
Script

Female Narrator:

Wars have been a sad part of world history. They have divided nations and people for as long as we can remember.

But even as these very conspicuous conflicts have been taking place, other less visible battles have also been waged and are being fought at this very moment.

These battles don't involve guns or bombs. There are no airplanes, tanks or destroyers.

But these battles affect the health and even the survival of every person, because they are waged by our bodies against disease.

Title: The Body's Defenses Against Disease

Male Narrator:

We are surrounded by enemies. Even when we are most relaxed, there may be hidden agents attacking us. These enemies may be in the air we suck into our bodies with every breath, or in the food we eat and the water we drink.

On the surface of our skin there can be millions of these agents, too small to be seen.
Female Narrator:

But with the help of a microscope, we can see some of these creatures. These are bacteria. Bacteria are simple one-cell forms of life. There are many different kinds of bacteria, and not all are bad.

But some, like streptococci, can make us seriously ill. Bacteria and other things that cause disease are called pathogens. We also just call them germs.

Bacteria can reproduce very quickly by dividing in two. Under the right circumstances, some divide as rapidly as once every twenty minutes. In this way, millions of bacteria are produced.

Bacteria that are harmful release poisonous substances called toxins that damage cells in the body. Salmonella bacteria attack cells in the digestive tract. Tuberculosis bacteria attack cells in the lungs, and streptococci harm cells in the throat. One common result is a sore throat.

Male Narrator:

When a doctor checks to see if you have been infected, or invaded, with streptococci, she takes a throat culture. She takes a sample of mucus from your throat, and then puts it in a dish that provides food for any bacteria that may in the mucus. If there are any streptococci, they will rapidly divide and multiply.
In little over a day a doctor can look at the culture and tell by its color whether any bacteria are present.

**Female Narrator:**

Even smaller than bacteria are viruses. In this photograph, taken with an electron microscope, the round-shaped object is a bacterium. The red colored objects attached to it are viruses.

Viruses are so small that if we were the size of a typical virus, over 200 million of us could fit on the head of a pin.

Viruses are not cells, and they can't reproduce by themselves. Instead, they take over cells, using them as a kind of factory to make other viruses. Ungrateful guests, they destroy their host cells as the new viruses burst out, looking for other cells to invade.

Like bacteria, there are different kinds of viruses. These are measles viruses. They attack skin cells, causing a rash.

Flu viruses attack cells in the throat and respiratory system.

**Male Narrator:**

Bacterial and viral diseases are called communicable or infectious diseases. They are different from noninfectious diseases like cancer and heart disease because
infectious diseases can be passed on from one person to another.

For example, drinking from the same glass as someone with flu can expose you to the virus. Even getting too close can be risky because the air he exhales may contain thousands of viruses that can then be inhaled by you.

Female Narrator:

For most of human history people didn't know that viruses and bacteria exist, much less understand how these pathogens spread disease. In the 1800s, sanitary conditions in most cities were terrible. Streets overflowed with garbage that provided perfect homes for germs. Food frequently contained bacteria that caused diseases like dysentery.

Up until the late 1800s, even doctors had little comprehension of how diseases are transmitted. Many surgeons, for example, didn't bother to wash their hands before an operation. As a consequence, doctors who were supposed to cure their patients often infected them with deadly pathogens instead.

Male Narrator:

Today, doctors know more about how germs cause disease. They routinely wash their hands before and after examining a patient, and they use surgical instru-
ments that have been sterilized, or made free of bacteria and other pathogens.

Most people also take simple common-sense steps to avoid being infected with germs or infecting others. For example, they wash their hands before handling food or after using the bathroom, and cover themselves when they sneeze or cough.

And if they're sick, they try to stay away from other people to whom they could pass germs. But these precautions, while important, are not enough to totally protect us. No matter what we do, we are still surrounded by an environment full of pathogens.

Yet, most of the time we remain healthy. How do we protect ourselves from these attackers that should make us sick?

**Female Narrator:**

The answer is that we all have defenders that ward off some of these attackers and destroy others.

These defenders are our own bodies. The body contains several lines of defense against pathogens.

The first line of defense is our skin. The cells that make up our skin fit together tightly so tiny bacteria and even smaller viruses can't get through.
An apple's skin serves a similar purpose. As long as it is intact, it can keep out things that would rot the apple. But even a small puncture or cut provides a way for pathogens to get inside the apple and harm it.

In the same way a cut or wound can break the barrier of our skin. This is why it is important to put a band aid or bandage on it. A band-aid provides a substitute barrier that prevents germs from getting in.

**Male Narrator:**

But germs can enter in other ways. With each breath, for example, pathogens can enter our bodies through nose and mouth.

But there is a second line of defense. Mucous membranes in the nose, throat, and bronchial tubes can trap pathogens before they reach the lungs. And hairlike cilia in the bronchial tubes and trachea can sweep them upwards so that we can then cough them out.

Tears also provide a defense by flooding and washing away pathogens that get in our eyes.

And if we should eat something contaminated with bacteria, gastric juice, a powerful acid in the stomach, can kill them.
Female Narrator:

In many cases these defenses are enough to protect us from harm, but not always. There are still other defenses, different tissues and cells in the body that together are called the immune system.

Many of the weapons of the immune system are found in the blood that flows through the circulatory system and reaches almost every part of the body. Besides the billions of red blood cells that flow through our blood vessels, there are other kinds of blood cells, different kinds of white blood cells that are essential soldiers in defending against disease.

Male Narrator:

Suppose there's a cut in the skin, through which bacteria enter the bloodstream. These bacteria let off chemical signals that alert certain kinds of white blood cells called phagocytes, which means "cells that eat".

And that's exactly what they do. A phagocyte surrounds pathogens by sending out extensions of its cell body, called pseudopods, that envelope the invaders. Once inside the phagocyte, the pathogens are dissolved by chemicals.

One kind of phagocyte is called a macrophage, which means "big eater". Here a macrophage has sent out its
pseudopods to capture a single bacterium before drawing it into its cell body.

**Female Narrator:**

White blood cells are present not only in the blood but also in lymph, a clear liquid that circulates throughout the body in the lymphatic system. Lymph provides nourishment for cells and also removes poisons and destroyed germs.

At certain points in the lymphatic system are clumps of tissue called lymph nodes. Here, dead pathogens and other waste are collected before being disposed of. Inside lymph nodes something else important happens.

But before seeing what this is, let's first look at a characteristic of every pathogen as well as every cell in the body. Every cell in the body and every pathogen that invades the body has special markers on its surface called antigens. Antigens are markers that tell the immune system whether or not something is part of the body.

The first time a particular kind of pathogen invades the body, its antigen markers alert the immune system that it doesn't belong.

Inside lymph nodes, special white blood cells called lymphocytes respond by manufacturing antibodies.
Antibodies are Y-shaped molecules that are custom-designed so that their ends will fit on the antigen markers of an invading bacterium or other germ. Like pieces of a jigsaw puzzle, each kind of antibody fits with only a particular kind of antigen.

After they are manufactured by lymphocytes, antibodies rush to the site of an infection and latch onto the invading pathogens and make them harmless. In some instances, antibodies clump the pathogens together and make it easier for phagocytes to eat them. Antibodies also enable chemicals in the blood to destroy pathogens.

**Male Narrator:**

But the first time a pathogen invades the body, it takes time for antibodies to be manufactured and do their job. In the meantime, the pathogens may have had time to do damage, and the person becomes sick.

However, once attacked by a particular kind of pathogen, some antibodies remain in the bloodstream and are ready to respond if the same kind of pathogen attacks again.

Also, lymphocytes remember the germ's antigen markers and are ready to make the right kinds of antibodies quickly...so quickly that this time the pathogen doesn't have time to do any damage.
Antibodies make a person immune to a disease. Immunity means that once a person becomes sick with a disease like mumps, chicken pox or measles, she can't become sick again with the same disease.

**Female Narrator:**

Becoming sick with a disease isn't the only way to get immunity.

Vaccinations also can provide protection. A vaccine contains weakened or dead forms of a germ. These germs can't cause any harm. But even though they're harmless, they have the same antigen markers on their surface as a strong, living pathogen.

The body's immune system reacts as if they're dangerous by producing antibodies. The body also remembers for the future what the markers are. This means that if we are exposed to the live and powerful germs later, there will already be some protective antibodies ready to attack, and the body will be able to produce more antibodies quickly.

**Male Narrator:**

Today, we take many vaccines against pathogens for granted, but this wasn't always true. Take the polio virus. The polio virus attacks the nervous system.

Fifty years ago, there was no vaccine against this virus.
In some cases, the victim's legs were seriously weakened or paralyzed. In other cases, the paralysis was more serious and affected a person's ability to breathe.

Thousands of patients depended on cumbersome iron lungs to stay alive. Many people died from polio. The disease was all the more terrible because children were particularly at risk. Parents worldwide were terrified that their children would be stricken.

But in 1955, Dr. Jonas Salk developed an effective vaccine. A newsreel from that time gives a sense of the joy this news brought.

**Newsreel:**

1955, a year of anxiety and triumphs. A major medical hurdle was crossed with the discovery by Dr. Jonas Salk of the antipolio vaccine, which was to spread a mantle of protection over millions of American children. And the scientist entered the ranks of the medical immortals. Leading drug firms shifted into high gear to meet a nation's demand which spread to every crossroads, despite early controversy. Each hastily setup center became a mecca for anxious parents, shepherding little Johnny and little Jill to their inoculations. They're protected, and it didn't hurt a bit.

**Female Narrator:**

Today, we have effective vaccines for many diseases, including tetanus, diphtheria, small pox, and some
types of flu. Being vaccinated for these diseases is one of the most important steps a person can take to safeguard his health.

Modern medicine has other weapons against pathogens, including certain drugs. Since the 1940s, antibiotics, such as penicillin and tetracycline, have proved effective in killing bacteria. Antibiotics work by attacking the walls of bacteria, causing the bacteria to explode.

Before antibiotics, bacterial infections like pneumonia were among the major causes of death. Today, such diseases are no longer such a threat.

But antibiotics work only with bacteria. They have no effect on viruses, such as those that cause the flu or the common cold.

Also, bacteria have developed that are resistant to many kinds of antibiotics. When an antibiotic is used against bacteria that have infected the body, there may be one or several bacteria that are slightly different and are not affected by the drug. Most of the bacteria die, but a resistant bacterium survives and can rapidly reproduce. All the bacteria that descend from this original resistant bacterium will also be resistant to the antibiotic. For this reason penicillin and other early kinds of antibiotics are no longer effective against many kinds of bacteria. Indeed, scientists are con-
stantly struggling to develop new antibiotics as bacteria become resistant to ones that already exist.

**Female Narrator:**

While vaccinations and antibiotics aid the body in fighting disease, the body itself remains the most important defense.

But sometimes the body's immune system fails to do its job correctly. Robert suffers from allergies. His eyes get red, his nose itches, and he sneezes uncontrollably. Robert is allergic to certain kinds of pollen.

When pollen gets into anybody's nose, the immune system recognizes the pollen as something that doesn't belong in the body. However, for people who are allergic to pollen, the immune system overreacts.

As part of the overactive immune response chemicals are released that cause membranes in the nose to swell and the eyes to water.

**Male Narrator:**

Lottie has a different kind of problem with her immune system. She suffers from rheumatoid arthritis. Rheumatoid arthritis is one of a number of diseases known as auto-immune diseases. The immune system mistakes certain cells in her own body as enemy invaders and attacks them.
In rheumatoid arthritis the immune system attacks cells around the finger joints, knees and other joints. This makes it difficult for a person suffering from rheumatoid arthritis to do simple tasks, like unscrewing a top.

**Female Narrator:**

The most serious threat related to the immune system comes when the immune system itself is attacked and weakened. Ileana has AIDS. She was infected with the virus called HIV, or Human Immunodeficiency virus.

HIV doesn't attack the liver or the heart or the respiratory system. HIV attacks the immune system itself by infecting white blood cells called T-cells. When HIV invades T-cells, it reproduces and weakens these cells, often destroying them.

This doesn't happen quickly and someone can be infected with HIV for years and not feel sick. But after a while, often more than ten years after being infected, so many T-cells are destroyed that the immune system is seriously weakened. Because the immune system is weakened, the body is no longer able to fight off infections and cancers that it used to be able to handle. At this point the person has AIDS. It is diseases like cancer and pneumonia that—taking advantage of the weakened immune system—eventually cause death.
At the moment, there is no cure for AIDS, and there is no vaccine that can prevent it.

**Male Narrator:**

Fortunately, HIV cannot be passed from one person to the next by casual contact. It is not like a flu virus, for example.

You can't get HIV from being in the same class as someone who has it. You can't get it by drinking from the same glass. You can't get it from touching or hugging or even kissing a person with AIDS or who is infected with HIV.

There are only three ways that you can get the HIV virus, as Dr. Marjorie Serotoff explains.

**Marjorie Serotoff:**

HIV can be transmitted in three different ways: through sharing needles or "works" where people use intravenous methods of injecting drugs; through intimate sexual contact where bodily fluids are exchanged; and through blood. Blood transfusions at this point in time are safe, although in the past there were some problems with them.

**Female Narrator:**

In this program we have seen that we are all engaged in a war against different kinds of enemies, including tiny bacteria, and even smaller viruses.
**Male Narrator:**

Against these enemies we have a variety of defenses, including our skin, mucus and cilia in our respiratory passages, and gastric juice in our stomachs.

**Female Narrator:**

And backing up these defenders is the body's immune system, which includes special white blood cells called phagocytes that eat invaders, and other white blood cells called lymphocytes that manufacture protective antibodies that latch onto germs and make them harmless.

**Male Narrator:**

We've seen how medical science can work with the immune system. Because of vaccines, diseases like polio are no longer the serious threat they once were. Because of antibiotics, many bacterial infections can now be controlled.

**Female Narrator:**

We've also seen how allergies result when the immune system overreacts to something like pollen that gets inside our bodies,

and how sometimes the immune system attacks the cells of its own body.
And finally, we saw how AIDS has become a deadly threat by weakening the immune system itself, making a victim more susceptible to other diseases.

Male Narrator:

But AIDS is an exception, for most of the time, the body succeeds in protecting us and keeping us healthy. Most of the time, the body is victorious in its battles against disease.
CLOZE EVALUATION QUESTIONS

THE BODY’S DEFENSES AGAINST DISEASE

DIRECTIONS: Select the answer, from the four choices given, by circling the correct letter.

1. The world in which we live is full of germs which may make us sick. One type of organism which can make us sick is the _______. These are simple one celled forms of living material found everywhere in our environment. There are different varieties of them and they can only be seen with a microscope.

2. Certain types of bacteria cause different types of diseases. Those bacteria that make us sick are generally called ____. Bacteria can spread quickly as they reproduce themselves. For example, one bacteria divides into two bacteria, two divide into four and four divide into eight. They can easily move throughout the body and affect different areas.

3. There are other microscopic threats to our body beside bacteria. These organisms are even smaller and are called __________. They are so small that over 200 million of them could fit on the head of a pin. They cannot reproduce by themselves, but must first take over a cell to begin their replication. Some of these organisms can be quite harmful to our body.

4. Bacteria and viruses are different than other types of diseases. They are called communicable or _______ diseases because they can be passed from one person to another. For example, if someone has a cold and you drink from his or her glass you might also get a cold. Therefore, diseases caused by some types of bacteria and viruses can be spread quite easily.

5. Although we are exposed to many diseases, our bodies have defense mechanisms to protect us. The first line of defense is our _______. The cells of this part of our body fit so tightly that even the very tiny bacteria and viruses cannot penetrate. However, when this area of our body is broken into by a cut or wound, then pathogens can enter.

6. As we breathe, germs can enter our bodies through our nose and throat. In order to stop them we have ______ located in our nose, throat and bronchial tubes. This feature of our immune system traps these pathogens and prevents them from entering our bodies.

7. The _______ system is composed of different tissues and cells that work to defend the body. Besides these tissues and cells, the circulatory system, specifically the blood, is another important defense system. For example, the white blood cells are very important in the fight against disease.

8. White blood cells act like soldiers in an army. One specific type of white blood cell, called a(n) _______ will surround the invading bacteria, dissolve and eliminate it. The white blood cells are also present in another body defense system called the lymphatic system.

9. The lymph system provides nourishment for cells, removes poisons and destroyed bacteria. When a pathogen or germ enters the cell, the lymph system reacts by having specialized white blood cells produce _______. These bodies rush to the site of the infection and latch onto the invading pathogen and allow other specialized substances to consume the invader.

10. Antibodies help a person become immune to a disease. Another way we can become immune to a disease is by getting a _______. This is actually a weakened form of the disease itself. The body reacts to this small amount of the germ by producing antibodies. A good example of this was an injection which stopped the spread of the dreaded disease known as polio.

NAME

1. A. algae B. fungi C. bacteria D. liverwort
2. A. pathogens B. viruses C. illnesses D. germs
3. A. rod bacteria B. viruses C. pathogens D. antigens
4. A. noninfectious B. harmless C. infectious D. harmful
5. A. hair B. skin C. muscle D. bone
6. A. liquids B. coverings C. thick skin cells D. mucous membranes
7. A. nervous B. respiratory C. immune D. digestive
8. A. phagocyte B. antigen C. pathogen D. pseudopod
9. A. phagocytes B. antibodies C. antigens D. liquids
10. A. pathogen B. medicine C. vaccination D. reaction