CELL WARS

STUDY GUIDE

by

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11 Minutes — 16mm film — videocassette
Produced by Idelle Musiek
SYNOPSIS

No so long ago in a body not so far away . . .

The battle of CELL WARS marks a time when germ armies march toward their target for infection, an open wound. Andi, our hero, journeys into the bloodstream to join the blood cells that fight infection. Andi, now an antibody, encounters Franci, the princess of phagocytes, who aids him in his quest against disease germs.

DISEASE GERMS: evil warriors

VIRUS

In CELL WARS, Macho Virus is a villainous germ who punches out cell tissue. When virus germs enter the bloodstream, they destroy cells by attacking cell tissue ‘directly’ and spread infection throughout the body.

BACTERIA

Ms. Bacteria, the princess of poison, divides as she spreads all over the body. Rather than use her hands to punch out cells directly, she secretes poison. When bacteria germs secrete poison, their method of infecting and destroying cells is ‘indirect.’

CELLS AND ANTIBODIES

LYMPHOCYTE

Andi journeys into the bloodstream and discovers that he is inside a white blood cell called a lymphocyte. Lymphocytes produce antibodies to fight invading germs. Andi turns into an antibody.

ANTIBODY

Ready for battle, Andi the antibody, recognizes Macho Virus entering the bloodstream. An antibody can recognize only one specific type of virus or bacteria germ. Each antibody, shaped like a ‘Y’, is made to specifically interlock with its target germ. Imagine a lock and key. As Andi the antibody wrestles Macho Virus, he locks the germ into an immobile position which renders the germ harmless.

PHAGOCYTE

In CELL WARS, Franci the phagocyte wines and dines on bacteria. The phagocyte, a type of white blood cell, destroys germs by consuming them. Phagocytes can consume either bacteria or virus germs.
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BEFORE SCREENING

INTRODUCTION

Ask students how they would like to take a journey inside their bloodstream and visit a microscopic universe composed of millions of tiny red and white blood cells. There they could observe how certain types of white blood cells defend the body against disease germs that can infect and make us ill. Show pictures of cells and germs if available. Inform students that they are about to journey into a bloodstream where live performers act out roles of cells and germs. Introduce terms in this glossary.

GLOSSARY

Bacteria (bacterium) - any of numerous microscopic plants that are single cells and are important to people because of their chemical activities and as causes of disease.

Germ - something from which something else develops; microbe; micro-organism.

Virus - a disease-causing agent too tiny to be seen by the ordinary microscope that may be a living organism or may be a very special kind of protein molecule.

Phagocyte - a cell such as a leukocyte that engulfs and digests cells, microorganisms, or other foreign bodies in the bloodstream and tissues.

Lymphocyte - a white blood cell formed in lymphoid tissue, as in lymph nodes, spleen, thymus, and tonsils, and constituting between 22 to 28 percent of all leukocytes in the normal adult human's blood. Also called "lymph cell."
Antibody - any of various proteins in the blood that are generated in reaction to foreign proteins that neutralize them, and thus produce immunity against certain microorganisms or their toxins (poisons).

Cell - the smallest structural unit of an organism that is capable of independent functioning.

Leukocyte - any of the white or colorless nucleated cells occurring in blood. Also called “white blood cell.”

Immunity power to resist infection either natural or acquired (as by vaccination).

Vaccine - a suspension of microorganisms or viruses (or some part or product of them) that will produce immunity when it is injected into a person.

Immunization - a process that produces immunity through the use of vaccines.

AFTER SCREENING

REVIEW QUESTIONS

1. How do the disease germs plan to invade Doreen’s knee? When they ‘enter her bloodstream,’ what will they do to it? Can ‘infection’ cause disease? (yes)

2. What type of blood cell does Andi fall into? What is the function of a ‘lymphocyte?’ What type of body does it produce? Clue: Virus asks “Is _______ home?” (antibody)

3. Ask students to shape themselves like antibodies. (‘Y’ shape) Can Andi the antibody, recognize and fight any type of germ that invades the bloodstream? Is each antibody made to ‘recognize and destroy one specific germ only?’ During the wrestling match, Andi the antibody wraps his arms around the germ. Why? When they attach to each other, is ‘the germ made inactive?’ Discuss how they interconnect like a lock and key. The germ is ‘locked into an inactive position.’

4. What type of germ does the antibody battle with? How do ‘virus’ germs destroy cell tissue? Is the method of ‘attacking cell tissue’ a direct or indirect method of destroying cells? (direct)
5. What type of germ calls herself princess of poison? What happens when Ms. 'Bacteria' divides? As bacteria 'spread throughout the body,' how do they destroy cells? Is 'secreting poison' a direct or indirect method of destroying cells? (indirect)

6. Franci is the princess of what type of white blood cell? How do 'phagocytes' destroy germs? Clue: Franci says, "As soon as I finish 'eating these germs,' I go on a diet."

**DISCUSSION QUESTIONS**

1. Suggest that students take their own voyage into the bloodstream: Ask students to imagine themselves shrinking into the smallest building blocks of life called cells; suggest that half the class pretend they are cells and the other half pretend they are germs and have them act out concepts of CELL WARS.

2. Ask students what they hate most about getting sores, catching colds, etc. Explain how germs can enter any body openings such as the ears, nose, mouth or open wounds. And although the body provides us with a defense (immunity) against disease germs, there are ways we can prevent disease and infection; i.e. cleanliness, nutrition, vaccines, etc. [See Additional Discussion Questions: Childhood Immunization]

3. If appropriate, introduce basic concepts of immune deficiency diseases such as AIDS and methods of prevention. [See Additional Discussion Questions: The immune system as related to AIDS]

**ADDITIONAL DISCUSSION IDEAS**

**Childhood Immunizations**

Why do children starting school have to have a series of immunizations before they are allowed to enter school?

Immunizations are given to children to help protect them from getting the diseases that they might normally get without receiving the immunizations.

Most school children must have immunizations to protect them from: Diptheria, Pertussis, Tetanus, Polio, Measles, Mumps and Rubella.
Do these immunizations give life-long immunity?

The duration of immunity is not known for the Measles, Mumps and Rubella immunizations.

It is recommended that adults get a booster shot for Diphtheria and Tetanus every 10 years.

A booster shot for Pertussis and Polio is only recommended for high risk adults such as those working with patients who might get Pertussis or Polio.

ADDITIONAL DISCUSSION IDEAS
The immune system as related to AIDS

What disease have you heard about that breaks down the body’s immune system? AIDS

What does AIDS mean? Acquired Immune Deficiency Syndrome.

What does AIDS do to the body? AIDS breaks down the body’s immune system, or its ability to fight disease. Secondary unrelated diseases produce the symptoms that result in death. Among the secondary diseases are a type of pneumonia and a form of cancer.

What causes AIDS? AIDS is caused by the HIV (Human Immunodeficiency) virus. This virus infects and damages cells of the immune system. The HIV virus may also infect cells of the nervous system, causing mental and emotional problems.

How many children in the United States have AIDS? As of 1986, fewer than 300 of the estimated 20,000 AIDS cases in the U.S. were children under 13 years old.

How do children get AIDS? Children with AIDS can acquire it during the birth process from infected mothers. In some cases, children have been infected through blood transfusions that they may have needed in surgery. Blood and its products are screened now for the AIDS virus, so blood transfusions are relatively safe.

Why should children with AIDS be allowed to continue to go to school? To date, not one case of AIDS is thought to have been transmitted in a school or day care setting. AIDS is not spread through the kind of casual contact that children have in school. AIDS is not spread by touching, hugging, eating together or using the same bathroom. This information is based on the fact that family
members of patients with AIDS have not gotten the AIDS virus just by living in the same household.

**FOR THE TEACHER**

**MORE INFORMATION FOR THE TEACHER ON THE STRUCTURE OF ANTIBODIES**

**Antigen**—a foreign substance that causes the body to produce highly specific immune response in the form of antibodies or specially sensitized cells.

The body's defense system does not usually produce antibodies against its own body tissues.

Some examples of nonmicrobial antigens are pollen, egg white, blood cells from other persons or species, and transplanted tissues and organs.

Antibodies are not usually formed against the whole antigen, but only against certain parts of it. On the antigen's surface, there are spots where the antigen and antibody react which are called antigen determinant sites. Every antibody molecule has at least two sites designed for a particular kind of determinant of the antigen where it can bind.

**Antibody**—a serum protein that B lymphocytes produce in reaction to the presence of an antigen.

Like most antigens, antibodies have more than one antigen-antibody combining site. Antibodies belong to a group of proteins called globulins, so they are also called immunoglobulins.

The antibody molecule is composed of two light chains and two heavy chains linked together in a flexible Y shape.

**BASIC STRUCTURE OF A TYPICAL ANTIBODY**

1. Light chain
2. Heavy chain
3. Hinge area
4. Fc region
5. Antigen-combining site
The Y shaped antibody molecule can also assume a T shape due to the disulfide hinge area. The Fc (crystallizable fragment) region allows the antibody to find to the surface of a certain host cell.

Most antibodies have two combining sites, and they are called monomers. A pentamer is made up of 5 monomers and a dimer is made up of 2 monomers.

**Functions of the five human immunoglobulins:**
- IgG—protection from bacteria and viruses in the blood.
- IgM—it is the first antibody on the scene after exposure to an antigen.
- IgA—prevents attachment of pathogens.
- IgD—it is thought that it might initiate the immune system in newborns.
- IgE—it works with allergic reactions.

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**BASIC STRUCTURE OF THE FIVE HUMAN IMMUNOGLOBULINS**

On October 12, 1987, it was announced that Susumu Tonegawa, a Japanese researcher working in the United States, won the Nobel Prize in medicine. His discovery of how the body makes millions of kinds of antibodies to fight disease could help improve vaccines and make organ transplants safer. He said that his finding that genes can change during the life cycle of a person is contrary to what many people have thought.

Tonegawa’s research also helped explain how the immune system can produce faulty antibodies that may cause allergies in some individuals.