SC.6.L.14.5 AA Identify and investigate the general functions of the major systems of the human body (digestive, respiratory, circulatory, reproductive, excretory, immune, nervous, and musculoskeletal) and describe ways these systems interact with each other to maintain homeostasis. (Also assesses SC.6.L.14.6)

SC.6.L.14.6 Compare and contrast types of infectious agents that may infect the human body, including viruses, bacteria, fungi, and parasites.

Your Immune System

You and a friend step into a crowded elevator and immediately notice two people coughing and sneezing up a storm.

Within a couple of days you come down with a bad cold and blame it on that elevator ride. Yet your friend exposed to the same germs at the same time remains perfectly healthy.

What made the difference? The power of your immune system makes a difference in an individual’s ability to fight off disease. Your own special genetic makeup can give you an advantage or a disadvantage against specific diseases. The immune system is a network that can help us avoid illness or sometimes become the underlying reason we get sick.
How does the immune system work?

The immune system is on constant alert. It is searching for anything that enters the body that will interfere with the body’s normal functions. The job of the immune system is to recognize, seek out and destroy foreign invaders before they harm the body. It is also on the lookout for internal errors the body causes to itself. Cancer cells are an example of internal errors that occur in cells during the everyday process of metabolism. It is very difficult for the immune system to spot internal errors.

The immune system is the body’s second line of defense against microbes. An imbalance in this system initiates almost all illnesses, especially chronic infection, fatigue, cancer, autoimmune conditions, and chronic allergies. A damaged immune function is a combination of our genetic susceptibility (the body’s own ability to do the job of the immune system as determined by its own genetic makeup contained in its DNA) and environmental factors.

Infectious Diseases

Infectious diseases are caused by microbes that people pick up from their environment. Microbes that cause disease are called germs. Diseases that are carried from one person to another are called infectious diseases. A few infectious diseases are caused by larger organisms such as worms. Some examples of bacterial diseases are diphtheria, strep throat, tetanus, typhoid fever, whooping cough, and venereal diseases (gonorrhea and syphilis).

Bacteria are one group of microbes. Most bacteria are harmless or beneficial to people. The body’s defenses are constantly on the lookout for the disease causing bacteria that will cause illness if they get beyond the body’s defenses. Bacteria that cause disease create poisons called toxins in the body. It is the toxins that cause the symptoms of the disease. The most common symptoms are pain and fever.

Examples of Bacteria that cause infectious diseases:
**How Bacteria Cause Disease**

Most bacteria enter the body through the mouth, nose, a cut or wound in the skin. They do not need to enter a cell to reproduce. If they enter the blood stream they can be carried to any part of the body. Wherever they settle in they begin to multiply. As they multiply the waste from their cells’ metabolic functions is expelled. The waste is toxic to most body cells. The toxins kill the body’s cells.

**What kind of defenses does the body have to keep bacteria out?**

Your body’s first line of defense is the skin. The skin blocks many kinds of bacteria and secretes compounds that inhibit (slow down) the growth of bacteria. The cilia and mucus in the windpipe are part of the body’s defense system. The cilia sweep the bacteria into the mucus which can eliminate many kinds of bacteria.

The stomach protects itself with a strong acid that most bacteria cannot survive in. The intestines already have a large population of bacteria living there and the new bacteria need to compete with the residents for food. The resident bacteria (normal flora) also produce antibiotic chemicals that inhibit the invaders.

**Viruses**

Another group of microbes that cause disease are called viruses. Some examples of viral diseases are cold, flu, chicken pox, mumps, measles, polio, rabies and herpes.

**How does a virus infect a cell?**

Viruses unlike bacteria need to enter a living cell to survive and reproduce. They use the cell’s DNA to reproduce. See Diagram below.
Protozoans and Parasitic Worms

Disease can also be caused by protozoans and fungi. Malaria and amebic dysentery (commonly called diarrhea) are caused by protozoans. Common fungal diseases are ringworm (not caused by a worm) and athlete’s foot (not caused by participating in sports).

Examples of Protozoans and Parasitic worms (not to scale):

- Protozoan (malaria)
- Porkworm (parasitic)
- Tapeworm (parasitic)
The Second Line of Defense

The second line of defense is in the blood system. There are two kinds of white blood cells in the second line of defense. Both kinds come from cells made in the bone marrow. Normal bone marrow makes one kind of white blood cell that can eat bacteria and other germs. Another kind of white blood cell can make chemicals that attack germs.

Some white blood cells can move out of the blood stream into the spaces between cells. There they can flow around microbes and engulf them like an ameba. In this way, the blood cells destroy the invaders by “eating” them.

Another kind of white blood cell makes chemicals called antibodies. For every type of microbe that invades the body, a special type of antibody is produced. The first time a germ gets into your body it may make you sick. Your body will detect the invader and produce antibodies for that specific type of germ. The germs are destroyed and you get well. The next time that same kind of germ enters your body; your body remembers and makes the antibodies quickly. The germ is eliminated before you get sick. You have now acquired immunity to that specific germ and the disease it carries.

You can get immunity to some diseases in two ways. One way is to have the disease. You could, for example, have the disease chicken pox, which is caused by a virus. After you get well, some of the antibodies against chicken pox virus stay in your blood.

Another way you can become immune is by having a shot called a vaccination. The vaccine is made from a weakened or dead virus or bacteria. The vaccine does not usually make you sick but the white blood cells still react by making antibodies. After that, if you are attacked by living germs from the disease you have been vaccinated against, your white blood cells will react by making antibodies. You may not get sick at all or have a much milder reaction to the disease.
Elaborate (learn more):

The picture below shows the main types of cells you would find in your bloodstream. Turn the paper to read the names of the cells.

The picture below shows a sample of blood with the Lyme virus, red and white blood cells in it. Can you identify each of the different types of cells?

If you have access to a computer and Mom or Dad give permission, you can find out more about your immune system by playing a game (Immune system defense forces) at the following website: http://www.nobelprize.org/educational/medicine/immunity/game/index.html
Questions

Fill in each blank with the word (or words) that fits best. Choose from the words below:

vaccine white blood cells defense cilia antibody mucus bone marrow immunity

1. The body has two main lines of ____________ against infectious disease. Coughing forces out germs caught in sticky _________ found in your windpipe. Germ eating _______________________ destroy some microbes. For every type of invading germ a special kind of ________________ is produced by your immune system. Having antibodies in the blood against a germ give you _______________. A ______________________ is a kind of shot that makes you immune to a certain disease.

2. If the statement is true, write T on the line. If the statement is false, write F on the line and correct the underlined word.
   A. _______ the acid in your stomach is part of your second line of defense.
   B. _______ Antibodies against measles can make you immune to measles.
   C. _______ Cilia that help get rid of germs are found in the bone marrow.
   D. _______ White blood cells that eat bacteria are part of your first line of defense.

3. Explain why the bone marrow’s job is so important.

4. Explain how bacteria create symptoms of the disease they cause.

5. Explain what an antibody is and how it helps you remain healthy.