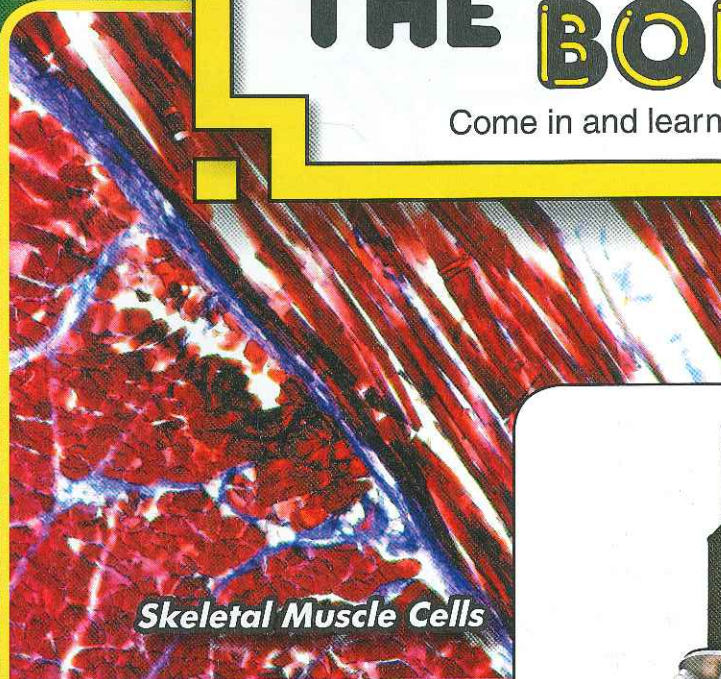


GREAT THE BODY SHOP

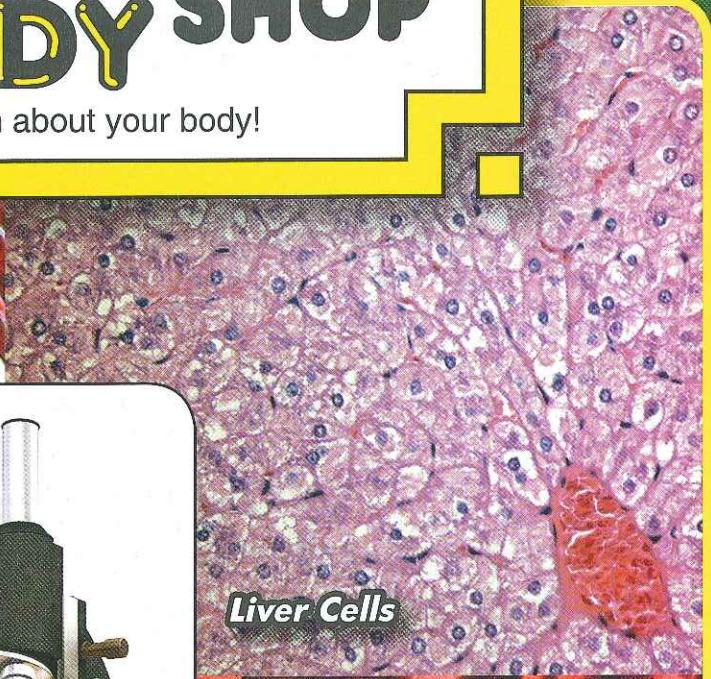
Come in and learn about your body!



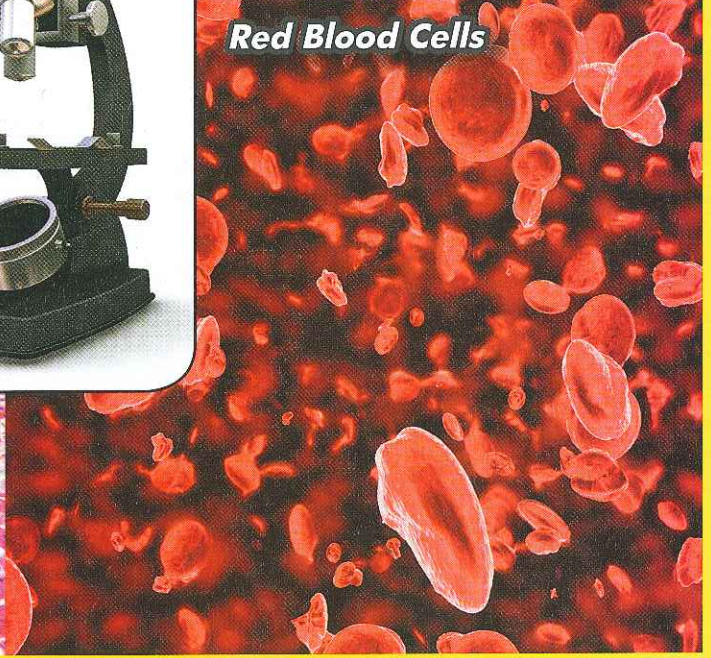
Skeletal Muscle Cells



Skin Cells



Liver Cells



Red Blood Cells



Cells

A **cell** is the basic unit of life, yet it is so small that it can only be seen with a powerful microscope. Every part of every living thing is made of cells. Some have more cells and some have less. There are approximately 37 trillion cells in the human body. Each type of cell has a special function. That's why each one looks so different!

Name: _____

MASTER KEY

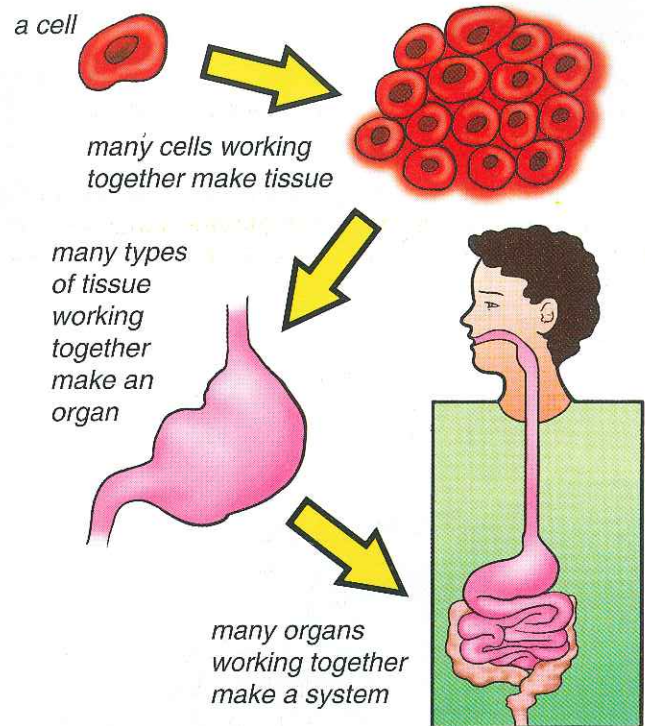


From Cells to Systems

As interesting as it is, a tiny cell is not much good all by itself. That's why **cells of the same type group together**. Each of these cell groups is called **tissue**. Fat cells, for example, gather together to form fat tissue. Bone cells group together to form bone tissue, etc.

Often, **different kinds of tissue join up to perform a single job**. When they do this, they make an **organ**. Your stomach, for example, is an organ made of muscle tissue that allows it to squeeze in and out. It's lined with another kind of tissue that protects it from its own digestive juices.

When **different organs work together**, they form a **system**. Your stomach is an organ in your digestive system. So are your liver and intestines. Your heart, arteries, and veins are the organs that form your circulatory system. Your brain and spinal cord are different organs in your nervous system, etc.



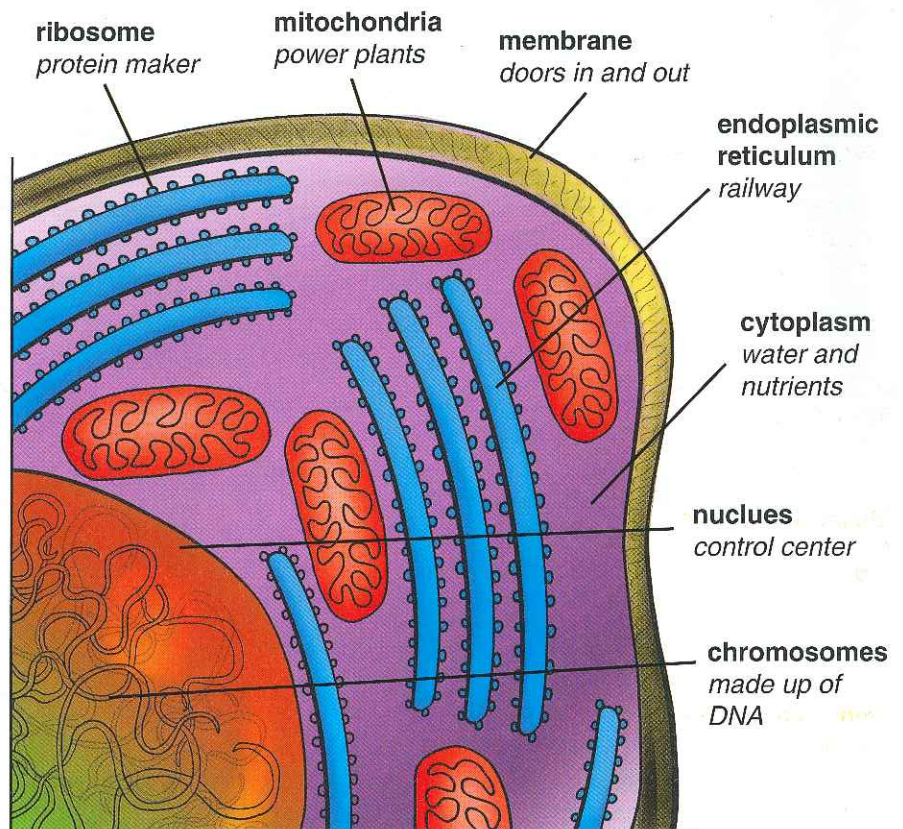
Cell Structure

The wall around each cell is called the **membrane**. The cell membrane is not solid; it is quite thin, and allows nutrients from your food, oxygen, and water to pass into the cell. The membrane also allows waste, like carbon dioxide, to pass back out.

Inside the cell is the jelly-like **cytoplasm** (sigh-toe-plaz-um). Cytoplasm is made of water, fat, vitamins, and minerals. These nutrients are burned for energy by the cell's **mitochondria** (might-o-kon-dree-uh). Think of the mitochondria as the **cell's power plants**. By burning nutrients and oxygen, the mitochondria supply the cell with the energy it needs to live and work.

Notice the channels inside the cell. They're called the **endoplasmic reticulum** (end-o-plaz-mick re-tick-u-lum). They act as miniature railways, transporting materials (like nutrients) from one part of the cell to the other.

The cell's control center is the **nucleus**. In it are all the chemicals that will tell the cell how to grow, how to carry on its function, and how and when to reproduce. These **chemicals** are called **DNA**.

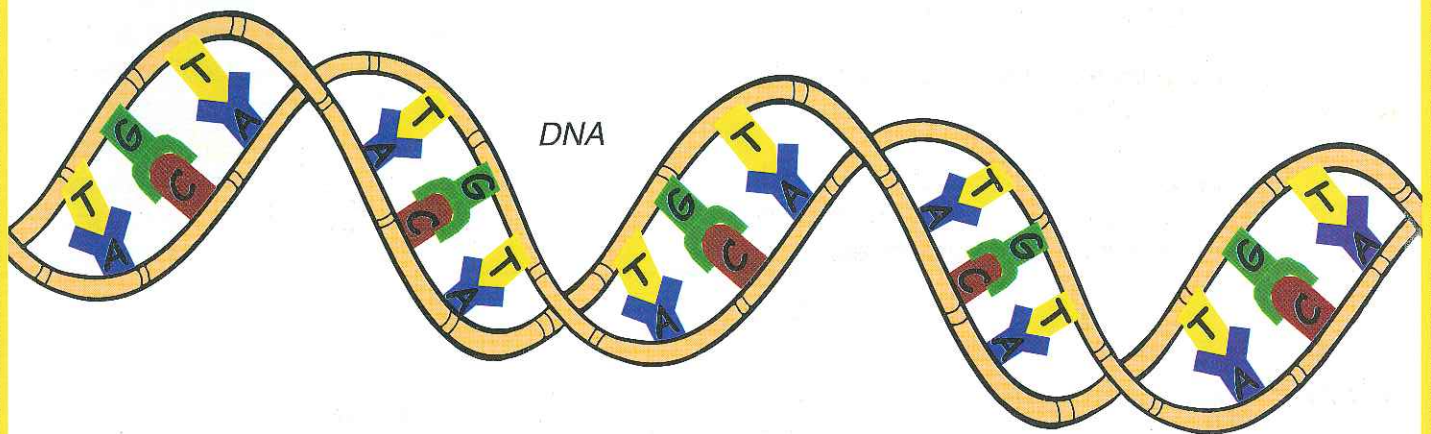


Cell Chemistry

DNA is a very complex chemical. In many ways, it is like the blueprint needed to build a house. DNA is the blueprint for each cell, and it tells that cell exactly how to grow and develop. DNA makes sure your bone cells grow to be bone cells, your blood cells grow to be blood cells, and so on.

Every single cell in your body has the same DNA blueprint buried deep inside of it. Then, how do cells grow differently from one another? The answer is that cells grow differently because DNA has directed them to make different kinds of protein. It is the **ribosomes** (see diagram) that make the protein each cell needs to grow and perform its special function.

Look at the diagram below. This is a drawing of a molecule of DNA. DNA looks like a ladder that's been twisted. Think of the steps of the ladder as different letters. DNA uses these "letters" to spell out the directions that make each special kind of cell.

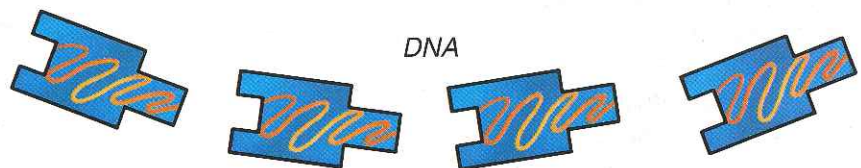


DNA makes up your **genes**. Each tiny gene is made of the DNA needed for one body characteristic.

In other words, the gene determines whether your eyes will be blue or brown. Another gene gives you curly or straight hair, and yet another makes your skin dark or light. You inherit your genes from both your mother and your father. That's why you look like your father's side of the family in some ways, and like your mother's in other ways.

If you looked at the nucleus of a cell through a very powerful microscope, you would see that it was filled with long, tangled strands. These strands are actually groups of genes, and they are called **chromosomes**. There are about 500 genes on each chromosome. With a few exceptions, each cell in your entire body has 46 chromosomes inside its nucleus.

Molecules of DNA are strung together to make genes.



Genes are strung together to make chromosomes.



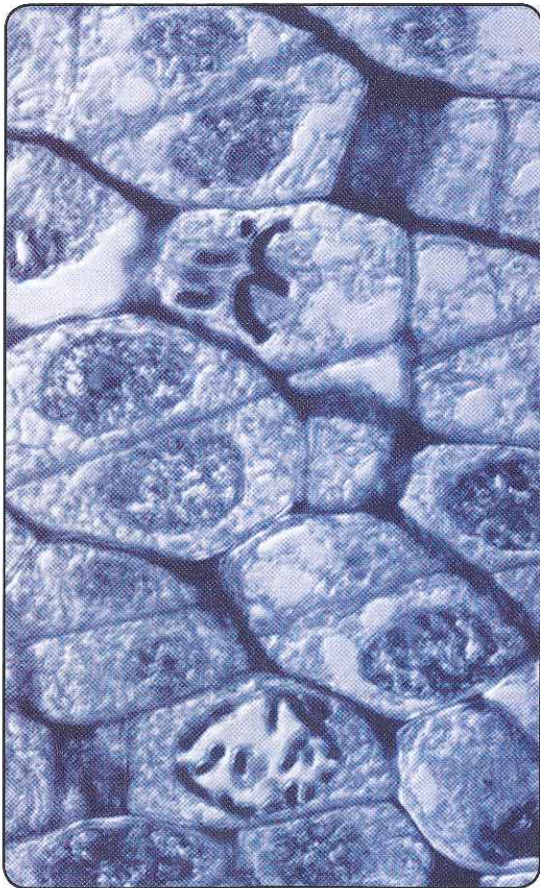
Chromosomes carry different messages for all the different cells that make you!



Dividing and Multiplying

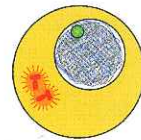
Cells reproduce in a very simple way. When they are fully grown, they **simply split in two** (see diagram). This is called **mitosis**. For some types of cells, mitosis takes less than an hour. For other types, it takes several hours. Most cells can reproduce themselves many times during their lifetime.

1. Just before mitosis, the cell prepares itself to split.
2. The 46 chromosomes untangle and make copies of themselves. They then pair up into 23 sets, and line up in the middle of the cell.
3. Then, the chromosomes split apart from their copies. Half the chromosomes move to one side of the cell, and the other half move to the other side. Just then, the cell begins to “pinch” itself in half.
4. Each new cell is an exact copy of the old one. It will grow just like the cell it came from because it inherited the same DNA blueprints.

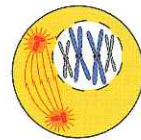


Mitosis: Step-by-Step

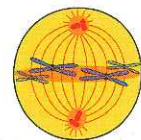
1. One cell before mitosis



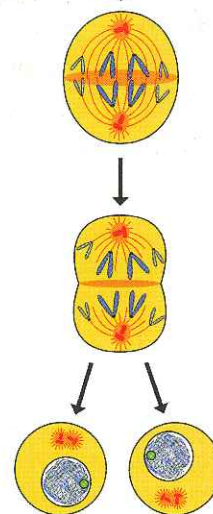
2. Pairs of chromosomes line up in the center of the cell



3. Half of the chromosomes go to one side of the cell, half to the other. Cell starts to pinch in two.

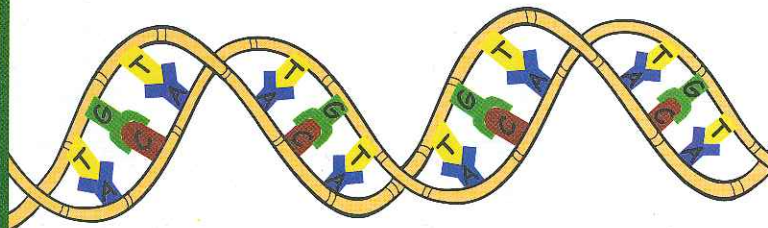


4. Two “daughter” cells after mitosis



Deoxyribonucleic Acid

Can you guess what this word is?



(Answer on page 8)

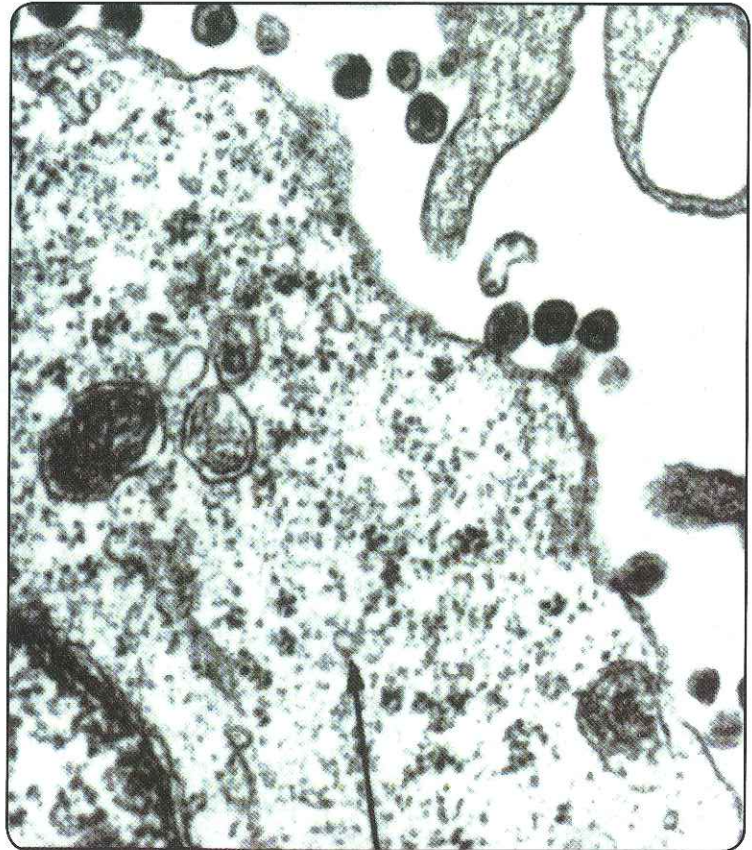
Muscular Dystrophy

Another type of illness that affects cells is called **muscular dystrophy** (muss-kyu-lur dis-troh-fee). There are actually several types of muscular dystrophy. The most common types are Duchenne, facioscapulohumeral, and myotonic. People with muscular dystrophy have problems with the cell membranes around their skeletal muscles. The membranes lack the important proteins to stay healthy and as a result these membranes develop holes and break, damaging the muscle fibers. This condition weakens the muscles and may require a person to use leg braces, canes, or a wheelchair. **Muscular dystrophy is caused by the genetic code either leaving out information or giving the wrong information to the proteins that have the recipe for making skeletal muscle membranes.**



HIV

AIDS is a disease that involves certain white blood cells. It is caused by a virus called **HIV**. When **HIV** attaches itself to a white blood cell, it turns that cell into a factory to make more HIV. After a period of time, **HIV will destroy most of the body's healthy white blood cells.** Once that happens, the body has no way to protect itself from invading germs.



nucleus

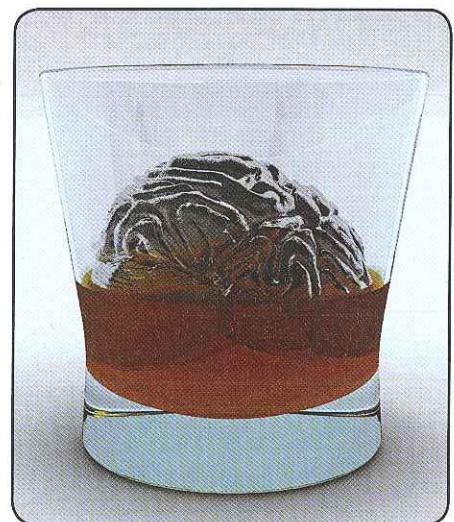
cytoplasm

mature HIV-1 particle

The Incredible Shrinking Brain!

You know that excessive (heavy) alcohol use makes it harder for the drinker to think clearly. The drinker may feel sad or angry and may do and say things he/she wouldn't normally. He/she has a much greater chance of having an accident if he/she drives. But what does long-term drinking do to the drinker's brain cells?

"Plenty," say researchers. After years of heavy drinking, the brain tissue of heavy drinkers actually shrinks! The brain shrinks because **neurons (nerve cells)** are destroyed. Unlike other cells, neurons can never replace themselves. The brain damage is permanent, even if the drinker stops drinking. So do your brain a favor—don't shrink it!

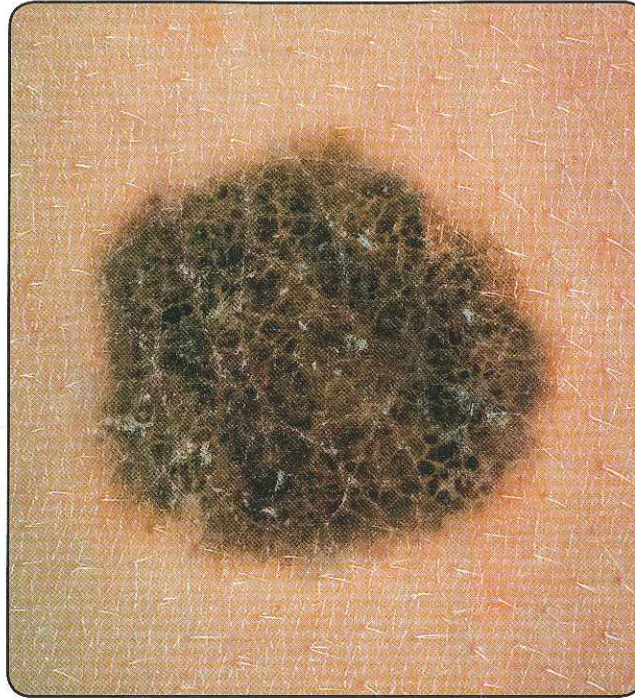


Cancer

Once in a while, something may go wrong that changes the way the cells in part of your body grow and reproduce. **Cancer**, for example, is a disease that causes cells to divide and multiply abnormally. Cancer cells can reproduce quickly and eventually they crowd out healthy cells and choke them. If too many of the healthy cells die, the person with cancer will die, too. Doctors try to stop the cancer cells with treatments including surgery (cutting out the cancer cells), radiation (a special kind of X-ray beam that penetrates the skin), and medicine.

Many things can cause cancer. Smoking can cause cancer in the lungs. Certain chemicals in your food, air, or water can cause cancer in the blood, lungs, or other organs. Getting sunburned now can cause skin cancer when you get older.

The tendency to get cancer can be inherited. If one of the parents in a family has a type of cancer, for example, the children may have more of a chance of getting that type when they are older. Doctors should be aware of family history of disease so that they can detect any problems early, when they can be treated more easily.



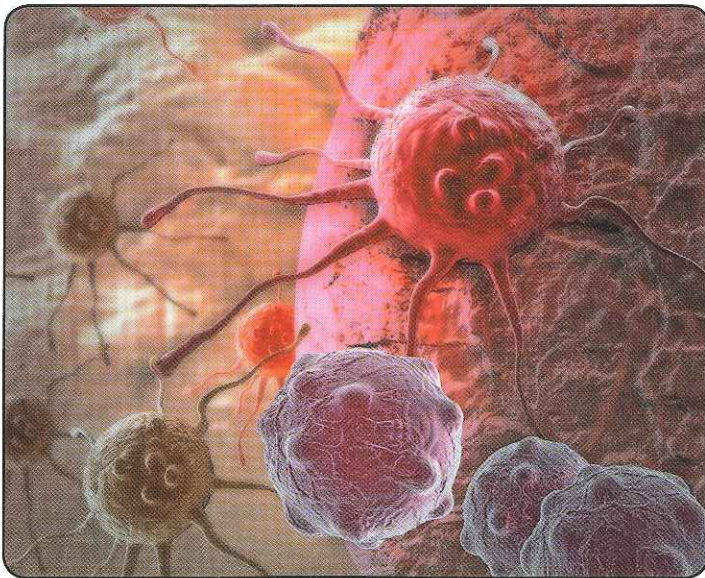
Melanoma is a type of skin cancer that is fast moving and can be deadly if left untreated.

Cancer Facts

- You can't catch cancer from someone else, no matter what.
- Cancer is scary, but we have a lot of treatments today and getting cancer doesn't necessarily mean you are going to die.
- Even if you have a gene that means you are at higher risk for cancer, that doesn't mean you can't get cancer.
- The cause of many cancers is unknown, but many others are linked to behavioral and environmental factors.
- Surgery does not cause cancer.

Cancer Cells

The difference between a cancer cell and a healthy cell is very subtle. However, a trained scientist can detect if some cells have a larger nucleus and a smaller cytoplasm. This signals that they may be cancerous.



Read All About It

Cells (Science Concepts, Second Series)

by Alvin Silverstein, Virginia Silverstein, and Laura Silverstein Nunn

These well-known science authors explore cellular functions, from the simplest prokaryotes to the ten-foot-long neurons in a giraffe's neck.

DNA (Science Concepts, Second Series)

by Alvin Silverstein, Virginia Silverstein, Laura Silverstein Nunn

Word Wise

AIDS—Acquired Immune Deficiency Syndrome, a fatal disease that is caused by HIV

cancer—a disease in which the cells in a certain part of the body reproduce uncontrollably and abnormally

cell—the basic unit of every living thing

chromosomes—strands of genes (Just about every cell in your body has 46 chromosomes.)

cytoplasm—the jelly-like fluid inside the cell membrane that contains nutrients for the cell

DNA—the chemical blueprints for the cell

endoplasmic reticulum—the channels, or railways, through which materials are transported from one part of the cell to the next

gene—a unit of heredity made of the DNA for one body characteristic

HIV—the name of the virus that causes AIDS

membrane—a cell's outer wall

mitochondria—power plants in the cell that burn nutrients and oxygen to give the cell energy

mitosis—cell division

muscular dystrophy—a group of genetic diseases that impact the skeletal muscles

neurons—nerve cells

nucleus—a cell's control center

organ—different kinds of tissues that work together to perform a job

ribosomes—bodies in the cytoplasm that make protein

system—different organs that work together to perform a job

tissue—a group of cells that are all alike

From the Cover

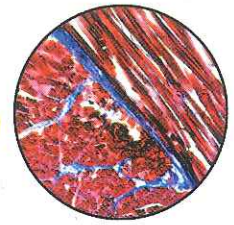
There are many different types of cells in the body. Here are a few more to illustrate!

Red Blood Cells: Red blood cells carry oxygen and nutrients to other cells. White blood cells are an important part of your immune system.

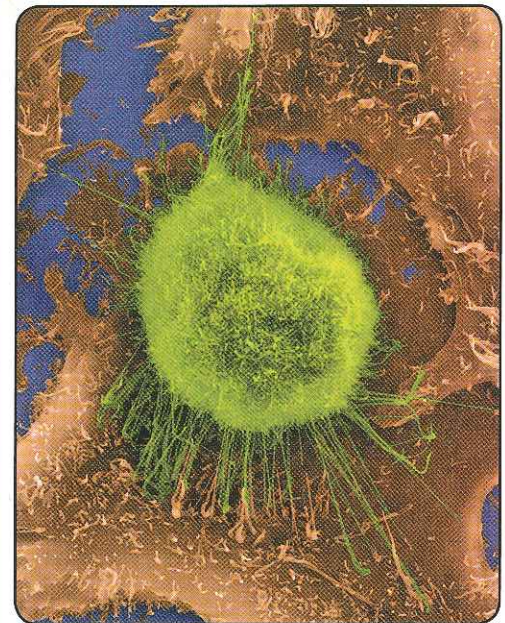
Smooth Muscle Cells: Smooth muscle cells make up the muscles that control your organs (such as your stomach and intestines).

Skin Cells: This type of skin cell covers your entire body and is your body's largest organ. Skin cells protect your body from harmful dirt, bacteria, and more.

Skeletal Muscle Cells: Skeletal muscle cells form the muscles attached to your bones. They help your body move.



Skeletal muscle cells



Cancer cell among healthy lung cells

Photo: Copyright Dennis Kunkel Microscopy, Inc.

Read All About It

Genes & DNA

by Richard Walker

Explore modern genetics, from an investigation of genes and their function, to forensics, therapy, and cloning.



Cells

This month in THE GREAT BODY SHOP, we talked about cells.

Lesson 1: The Cells in Your Body

Lesson 2: How Cells Grow, Reproduce, and Work Together

Lesson 3: You and Your Genes

Lesson 4: Sick Cells

When Cells Get Cancer

Your child has learned that cancer can change the way cells grow and reproduce. Cancer causes the cells in a certain part of the body to grow and reproduce abnormally. Eventually, these cells choke healthy cells. With your son or daughter, why not discuss some of the most common types of cancer, and what we know can cause them?

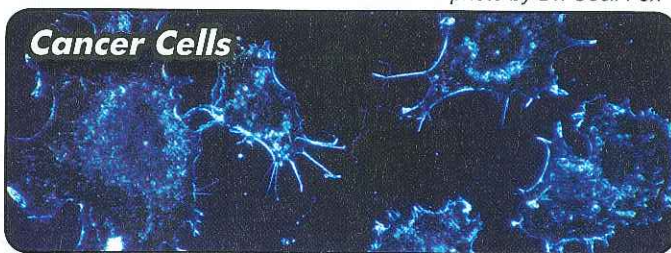
LUNG CANCER. Smoking is the #1 contributing factor for this cancer, which causes a type of tumor (a mass of cancer cells) to grow on the lungs. Chewing tobacco can cause cancer of the mouth and tongue.

COLON CANCER. The tendency to get colon cancer is hereditary. That is, if one or both parents had it, you are more likely to get it, too. A high-fiber (30–35 grams/day) diet from fruits, vegetables, and whole grains helps maintain a healthy colon.

BREAST CANCER. Again, the tendency to get breast cancer is hereditary. However, it has been theorized that a high fat diet and taking certain types of birth control pills can increase the risk of breast cancer.

SKIN CANCER. Skin cancer is largely the result of sun exposure. The deep tans that were popular years ago are now known to cause cancer. And the ozone layer, which protects the earth against much of the sun's ultraviolet rays, has been depleted due to pollution. That means that going out in the sun is actually more damaging to skin now than it was 20 years ago. Using a sunscreen with a high SPF (15 or above) and avoiding the sun during the middle of the day is the best protection. Use hats and sunglasses to increase your protection.

photo by Dr. Cecil Fox



Key Vocabulary Words

cell—the basic unit of every living thing

membrane—the cell's outer wall

cytoplasm—the jelly-like fluid inside the cell membrane. It contains nutrients for the cell.

nucleus—the cell's control center

Vocab Recall

After studying all the lessons in school, your child should be able to figure out these riddles. (answers, below)

1. I'm a string of genes with three O's in my name. What am I?
2. I'm at the center of each little cell. What am I?
3. I'm a little bundle of energy—you might even call me a "cell battery." What am I?
4. My name is so big that everyone knows me by my initials. I give your cells orders about what to do and how to grow. I am _____.
5. I'm probably the smallest railroad around. I transport material through your cells. I am the _____.

Read All About It

Microscopic Life

by Richard Walker, Peter C. Doherty.

Discover the tiny worlds that exist around us and even within us! Examine how some organisms help us fight diseases and others help to produce food.

Answers

- | | |
|--|---|
| <p>Deoxyribonucleic Acid</p> <p>This is the complete name for DNA. It's pronounced dee-oxy-rye-bow-new-clay-ick acids. Try saying that four times fast!</p> | <p>1. Chromosomes</p> <p>2. Nucleus</p> <p>3. Mitochondrion</p> <p>4. DNA</p> <p>5. Endoplasmic reticulum</p> |
|--|---|