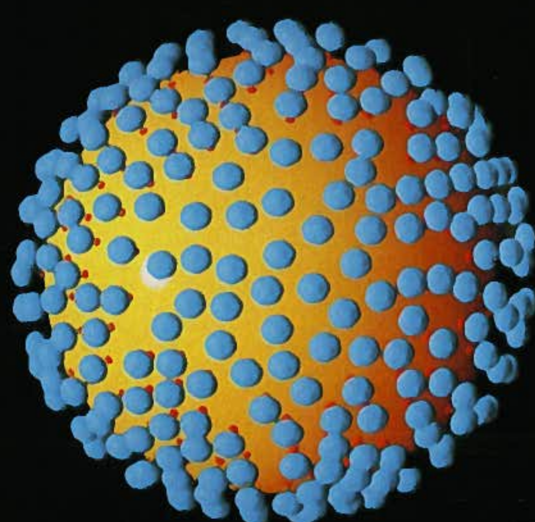
What's the Point of Bioscience Research?



Cover: Computer model of the human immunodeficiency virus (HIV), the virus that causes AIDS.

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Let's Play...Research Jeopardy!

Here are the answers.
Check out the following list, then look for the "questions" you don't know as you read through this booklet. The correct questions are on page 17.

1. Answer: The process of seeking information using scientific principles.
Question: What is ______________________________?

2. Answer: Formulating a question, setting up experiments to answer the question, then observing, collecting data, analyzing it and making conclusions.
Question: What is ______________________________?

3. Answer: Means "in glass," outside the living body; observable in a test tube.
Question: What is ______________________________?

4. Answer: They let scientists see how a drug will act in a whole living being.
Question: What are ______________________________?

5. Answer: Type of research study where scientists test drugs in human volunteers.
Question: What are ______________________________?

6. Answer: Studies of human populations that help scientists find out how a disease is spread.
Question: What are ______________________________?

7. Answer: Research that isn't aimed at curing a specific disease. It helps scientists understand how the body works.
Question: What is ______________________________?

8. Answer: A federal agency that gives its permission to test new drugs in humans.
Question: What is ______________________________?

9. Answer: Very tiny microorganisms that require a living cell to multiply and are responsible for some of the world's most deadly diseases.
Question: What are ______________________________?

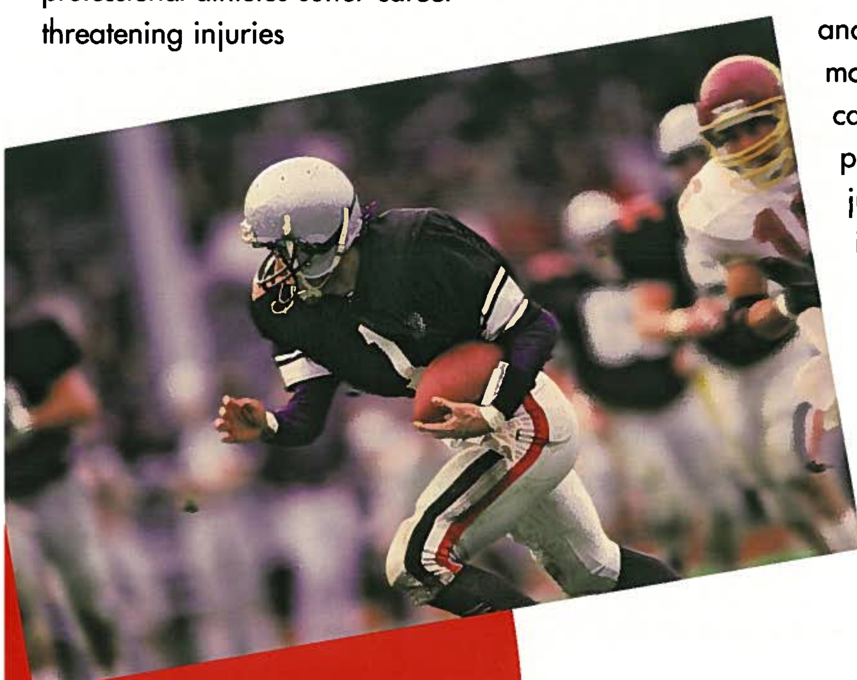
10. Answer: The part of sunlight that causes sunburns, wrinkles and skin cancer.
Question: What is ______________________________?

A Whole New Ball Game

It's Friday night. You're watching your football team cream its cross-town rival when SMASH! Your star running back is carried off the field.

Every weekend, hundreds of athletes are pounded and stretched until their bodies give out. But it's not the end. Thanks to medical miracles, "week-end warriors" are hurrying back to the battlefield. Every year professional athletes suffer career-threatening injuries and make it back to the top of their sport.

Advances — like arthroscopy — have allowed athletes to return to sports faster and with less pain. For example, cartilage injuries used to mean painful surgery and a long recovery time. Then came arthroscopy. Using an instrument the size of a pencil connected to a miniature camera and video monitor, doctors can fix problems with just a tiny incision (and watch the whole operation on a T.V. screen!).



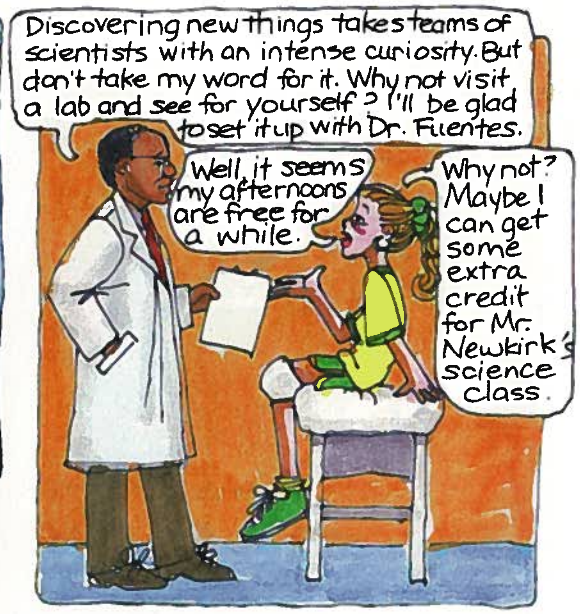
Arthroscopy is a valuable technique for patients of all ages and activity levels — from tennis pros to armchair quarterbacks.

But what about the rest of us? Not everyone is into sports. And not everyone gets injured. But everyone, in some way, is affected by medicine's miracles.

Everyday Miracles

Have you ever had strep throat? An ear infection? How about a bad case of zits? Chances are, your doctor gave you an antibiotic — a 20th century miracle.

Perhaps you wear contacts. Or use sunscreen. Have you ever wondered how we know they're safe? That they work?



More than 50 years ago, the iron lung (a forced breathing system that operates by creating a vacuum inside a tank) was the only hope of many polio victims. In the mid-1950s, after many years of research, a polio vaccine became available. Within a few short years, there was a 97 percent reduction in new cases of the crippling disease.

The point is — we do know! And it's because teams of curious scientists have been exploring life's processes and diseases for a very long time. It's called bioscience research. It gives us the information to make choices — choices that allow us to take care of our health. And it affects us every day of our lives.

Playing for Keeps

Early in the 20th century, life was very different. Many children died of scarlet fever or diphtheria, or were crippled by polio — diseases we rarely hear about nowadays. As a result of research, those diseases are almost as extinct as dinosaurs.

Today, we're all a lot healthier. And we're expected to live a much longer time. One of the main reasons is that scientists have learned a lot about why we get sick and how we can get well. They've created vaccines to keep us from catching diseases, and antibiotics to fight disease-causing bacteria.

But how do scientists do it? How do they know where to look and what to look for?

Let's look at the process — called the "scientific method" — and see how it works.

What's the Point?

No matter who we are, what we do or where we live, bioscience research affects our daily lives.


Hi, Beth. Sorry to hear about the injury.
Doc Miller says I'll be running again soon thanks to research in labs like this one.
Not all labs are the same. In this one, we're studying the virus that causes AIDS. But we use many of the same methods as labs studying cancer or heart disease or even acne.
What do you mean?
Sometimes scientists use computers to mimic how the body works, then conduct experiments with cells in test tubes or other lab dishes.
You mean petri dishes?
Hey -- score a point for knowing your lab equipment!
In the later stages, we use animals - mostly mice and rats - to give us an idea of how a chemical will act in humans. We also test in humans - with their permission - but only once we know a drug or procedure is safe.
The methods work together to give scientists answers.
Sort of like a soccer team - where we work together to score a goal?
Exactly!
But you're not at all like I thought a scientist would be.
There is no typical scientist. We're just normal people who are curious about the world around us.

Making the Rules

You've been up half the night sneezing and blowing your nose. You wake up and look in the mirror. Ugh! You reach for the eye drops to "get the red out." You take a couple of cold tablets, chug a glass of milk and brush your teeth. Time for school.

It's easy to take for granted products we use everyday. Medicine. Food. Even basic health products like shampoo, deodorant and toothpaste. But how do we know that what we use works, and that it's safe? Research.

Research is the process of seeking information. By simply asking questions, anyone can become a researcher. For example, imagine your class is holding elections for class president. Before voting, you might watch the candidates, ask them questions and then decide which one will get your vote.

By drawing a conclusion, based on the information you find, you're acting like a researcher of sorts. You're doing a simple form of research.

In actuality, bioscience research can be a very slow process. Sometimes scientists feel like they're going down blind alleys. But they learn as much from their dead ends and failures as they do from their successes.

When scientists conduct research, they use the scientific method and follow these steps:

- **They observe and ask questions.** They watch the world around them and ask questions about how it works.
- **They form and test hypotheses.** To answer the questions they have asked, they propose explanations that can be tested by further investigation. They design and conduct experiments as a way to gather information.
- **They analyze the data and draw a conclusion.** Using information from experiments, they look for patterns or trends in the data, then they draw conclusions to explain them.

As scientists look for clues and cures to human and animal diseases, they use a combination of highly interdependent, state-of-the-art research methods.

Teamwork

There is no question that bioscience research is a complex process. But scientists use a number of research methods that often work together to lead them to discoveries. The research methods are so closely linked that, without one, it would be like a musical without singing or a football game without plays. Something important would be missing. These research methods can be grouped into five general categories: simulations, *in vitro* tests, animal models, human clinical trials and epidemiological studies.

Simulations

Chemical, mechanical, mathematical and computer simulations are useful in the early stages of research, where they can help scientists understand and simulate living systems. While simulations give scientists a simplified version of reality, they can help scientists sort out problems and spark ideas about new research directions. Many times, simulations need information from other methods, like animal tests. But they can speed up the process and reduce the number of animals needed.

In Vitro Tests

In vitro tests are most useful in the early and middle stages of research. *In vitro* is Latin for "in glass," and these studies are done in lab dishes or test tubes (which nowadays are usually made of plastic, not glass!). *In vitro* tests often use cells or tissues from a human, animal or plant that are "cultured" — grown in lab dishes containing all the nutrients they need. Using cell or tissue cultures allow scientists to look at one single effect of a substance by itself — without interference. Many potential remedies are first tested *in vitro* to see how they react to cells and tissues. *In vitro* tests are easily controlled, so the results are easy to reproduce.

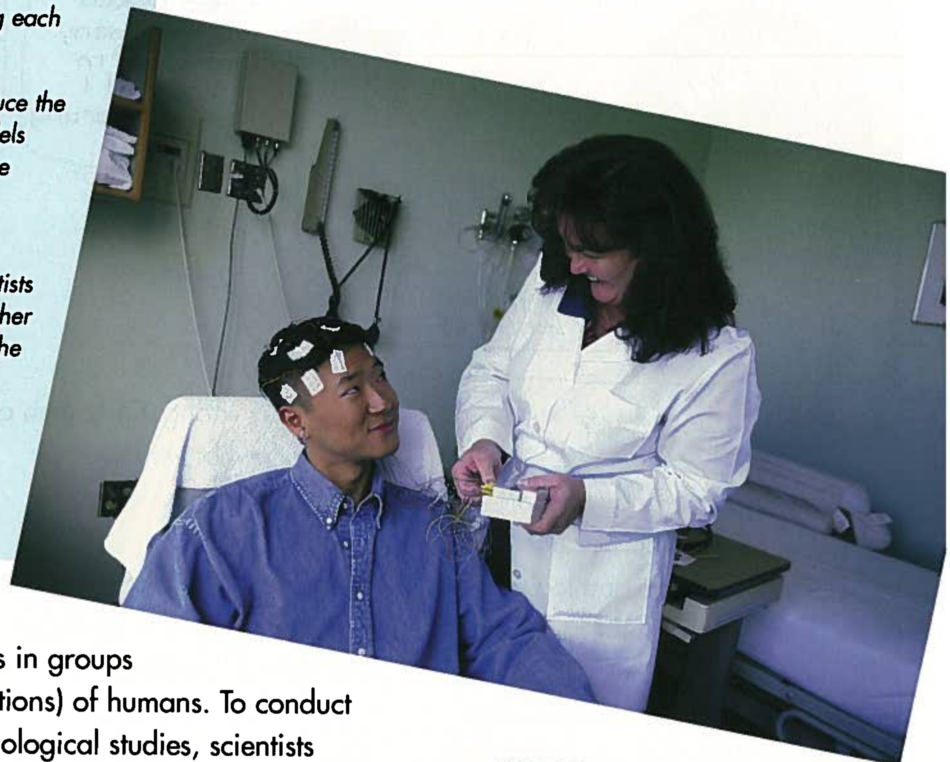
Animal Models

Although computer simulations and *in vitro* testing give scientists valuable information, they don't necessarily mimic how a substance reacts in a whole living being. Our bodies are so complex that a substance can have many more effects than can be detected in a lab dish or by a computer model — no matter how sophisticated.

But testing a substance in humans too soon is unethical. And possibly dangerous. So scientists rely on animal models to test how substances may act in the body. These models allow scientists to study something in a whole, complex living system that reacts similarly to that of humans. Research in animals is useful in finding out how people may recover from a surgical procedure, or how we might respond to a drug, chemical or something in the environment. Although animals and humans are different in many ways, our similarities far outweigh our differences. Animal models give scientists a

fastfacts

- Of the millions of animals used in research and testing each year, the majority are rats, mice and other rodents.
- Scientists place a high priority on "The Three Rs": reduce the number of animals used, replace them with other models whenever possible, and refine procedures to ensure the most humane treatment of them.
- Good laboratory animal care and good science are inseparable. If research animals are not healthy, scientists cannot depend on the results of their experiments. Further assurance of high quality animal care is provided by the numerous laws, regulations and guidelines governing animal research.



way to study how a substance will act before testing it on humans.

Human Clinical Trials

Once a new drug has been extensively tested *in vitro* and on animals, scientists need to know how it will work in humans, and if it is safe. To find out, they conduct clinical trials, which are tests using human volunteers who have been given information about the study and have agreed to participate. The scientists test the effectiveness of the experimental medicine or vaccine in a "controlled" trial — that is, some of the people in the trial get the experimental drug, vaccine or medicine, and others get a placebo, an inactive substance.

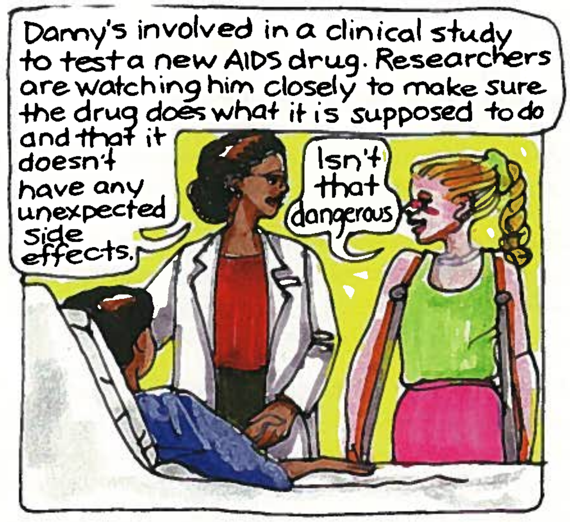
Epidemiological Studies

Epidemiology is the branch of medicine that deals with the causes, distribution and control of diseases in groups (populations) of humans. To conduct epidemiological studies, scientists become "medical detectives." First, they collect information on which people get diseases, how they get them and where they get them. Then they look for things that correlate with the disease, such as diet, air or even a certain type of job. For example, through these types of studies, we know that exposure to tobacco smoke can lead to lung cancer. And the same type of detective work led to the discovery of HIV, a virus that no one knew existed before the 1980s.

Epidemiological studies are usually done "after the fact," sometimes many years after the exposure. They identify those substances or microorganisms that cause a disease in order to prevent people in the future from being exposed to them.

What's the Point?

Today's research methods are like city roads. They are linked together to get you from one point to another. Together, the methods lead scientists from darkness to discovery.



Building Blocks

You just got a brand new car! You spend hours under the hood inspecting the engine and locating the parts. Then you rev it up and listen to it hum. You climb behind the wheel and take off... that is, until the hum turns into a ping. Something's wrong. And you know it. You know what it should sound like. You look under the hood. Aha! A wire is unattached! Must have been loosened when you were checking out the engine and slipped off when you started driving.

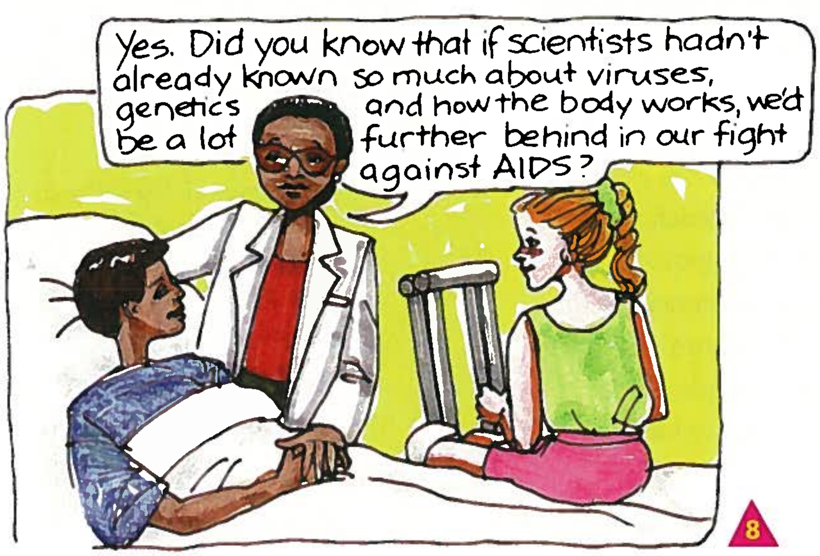
Whether it's learning about cars or learning about our bodies, we have to start somewhere. So we start with the basics. We learn how things work when everything is OK. Then we explore how things work when something goes wrong. Only then can we apply what we know to solving problems.

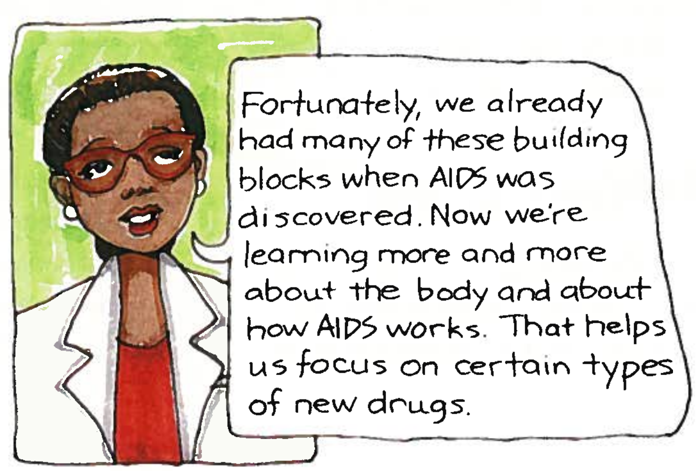
There are three main types of bioscience research: basic, applied and clinical. Each adds information that scientists need to search for treatments, cures and ways to prevent disease. They are like building blocks, and basic research is the foundation.

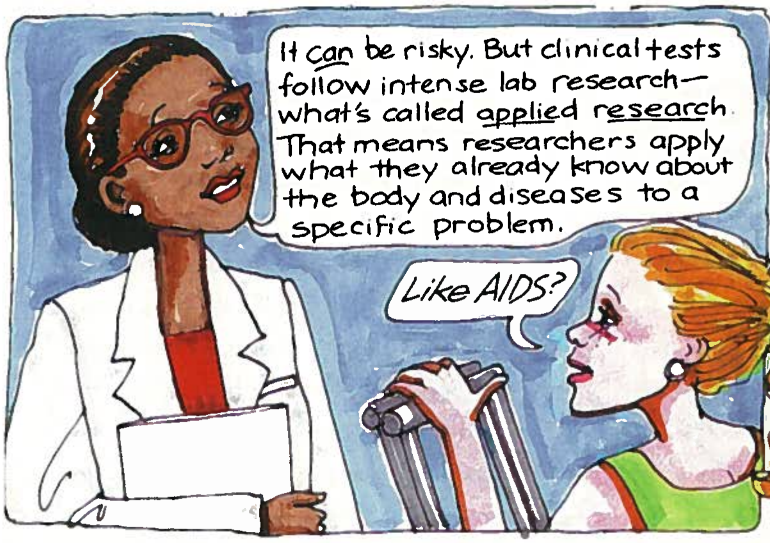
Basic Research

Basic bioscience research gives scientists a better understanding of life processes and how diseases work. It isn't directed to curing any specific disease in humans or animals. But without it, we wouldn't have the information needed to develop cures. We wouldn't even know what's wrong, where to look for treatment, or how to prevent a disease. The antibiotic penicillin is just one example of a remarkable find of basic research. Who would have thought a moldy piece of bread would have led to such a breakthrough? Sometimes scientists discover incredible things by chance — what's called "serendipity."

Among other things, basic research has brought us blood transfusions, organ transplantation and gene therapy. New medications, amazing imaging techniques that go way beyond simple x-rays and new treatments for numerous diseases — all began with "the basics." And basic research studies have told scientists how HIV — the virus that causes AIDS — works in the body, where it goes, how it multiplies, and how and why it makes people sick.







fastfacts

- A 17th-century hat maker named Antoni van Leeuwenhoek opened up the world of disease-causing microbes. He invented the microscope!
- A 19th-century German country doctor, Robert Koch, was the first to prove a specific microbe causes a specific disease.
- At the turn of the 20th century, a group of American army doctors used guesswork and experiments on human volunteers (including themselves!) to discover that the virus that causes yellow fever is carried by a nasty little mosquito.
- Paul Ehrlich, a German-born rebel of sorts, was the first to design a "magic bullet" to fight disease. He used arsenic to attack syphilis.

Applied Research

Once they have information about how a disease disrupts body processes, scientists apply what they know to find treatments or vaccines to prevent disease. Applied research is directed toward something specific, like developing a new drug, treatment or prevention.

For example, using a powerful tool called x-ray crystallography, scientists have determined the three-dimensional shape of HIV proteins. This information helped scientists design medicines that stop HIV from multiplying and may lead to drugs that prevent HIV from infecting our white blood cells (or T-cells) in the first place.

Clinical Research

Information found in basic and applied research often leads to new treatments or cures for diseases. Once the other stages of research have taken place, scientists look to clinical research — testing that takes place in humans — to measure the effectiveness and safety of a treatment. For the first phase of these clinical trials, a small number of human volunteers are given a drug to see how they tolerate it, how it is absorbed, and how long it stays in the blood. Sometimes drugs don't work at this stage, and scientists head back to the drawing board.

If all goes well, the drug can then be tested in a larger number of patients in the second phase of clinical trials. At this point, researchers want to know if the drug will have any effect on a disease or its symptoms. In AIDS studies, scientists watch how a drug affects HIV infection, or AIDS-related immune deficiencies and infections.

If a drug succeeds, it will be tested on an even larger number of patients in a third phase of clinical trials. This time, researchers look for long-term side effects that may not have shown up in earlier testing. Equally important, the researchers confirm the effectiveness of the drug in this phase of testing.

What's the Point?

Research does not always have a clear direction or application. Rather, it's gaining knowledge for knowledge's sake. That way, we already have the information when we need it.

Scoring Against AIDS

Imagine you're 15. You have everything you want — good friends, a great family, and OK classes. Then you find out you're sick. And there's nothing available to cure you of your disease.

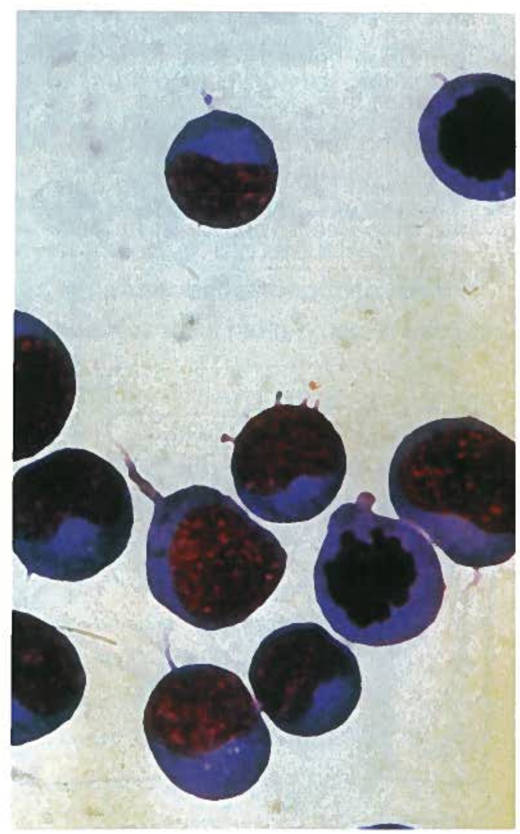
A nightmare? Definitely. But for teens with AIDS, it's reality. Let's take a look at this real-life killer and what researchers are doing to stop it.

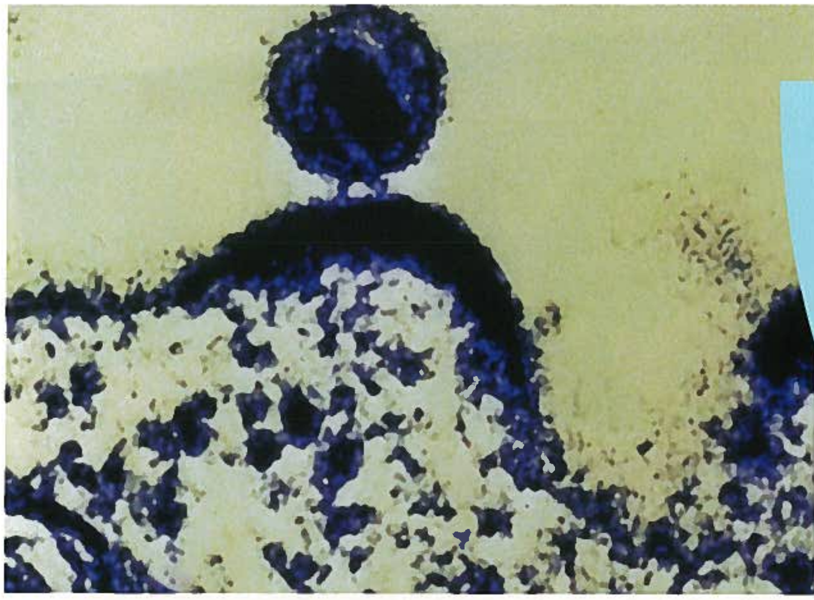
In 1984, the human immunodeficiency virus (HIV) was identified as the cause of AIDS. Since that time, researchers worldwide have learned so much about the biology of HIV, and so much faster than for any other disease-causing virus. They've used a variety of research methods to find clues to the deadly virus.

To understand how researchers are trying to fight AIDS, it helps to understand how HIV works in the body. Once a person is infected with HIV, the viruses attach themselves to cells and release their genetic material (which is RNA, not DNA like virtually all life forms) into the cell. Through a series of steps, a DNA copy is synthesized and inserted into one of the cell's chromosomes. Then, numerous new copies of the viral RNA are produced by the cell, and new viruses are created, released through the cell membrane and head off to infect other cells.

People infected with HIV develop AIDS when the amount of virus in their bodies (the "viral load")

Normal human T-cells





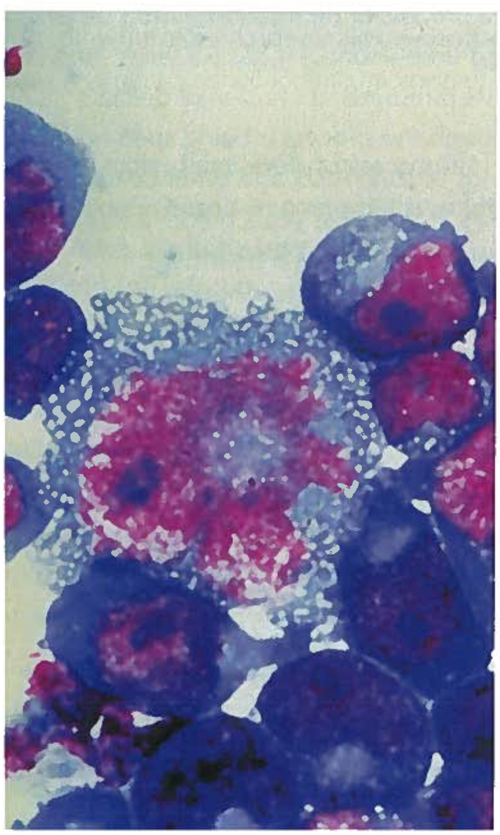
HIV "budding" out of a helper T-cell. T-cells play an important role in directing immune system defenses. The immune system is the part of the body that fights disease.

fastfacts

- *More than 40 million people in the world are living with HIV, and about 4 million people each year become infected with the virus. Young people (those younger than 25 years old) account for half of all new HIV infections worldwide — around 6,000 of these become infected with HIV every day. Although access to treatment and care has increased greatly in recent years, most deaths occur among African populations that still have limited access to HIV medications.*
- *One of the first clues that AIDS was caused by a virus came from research into a type of leukemia in cats.*
- *Chimpanzees and rhesus macaque monkeys are especially helpful to scientists studying HIV and AIDS therapies. Nonhuman primates can become infected with a simian HIV, which is very similar to the human HIV.*

becomes too great and destroys too many immune system cells. So scientists developing anti-HIV medications study each step in the HIV life cycle and look for ways to block each step and keep it from multiplying. They also are looking for ways to prevent the virus from attaching to the cell in the first place.

HIV-infected T-cells



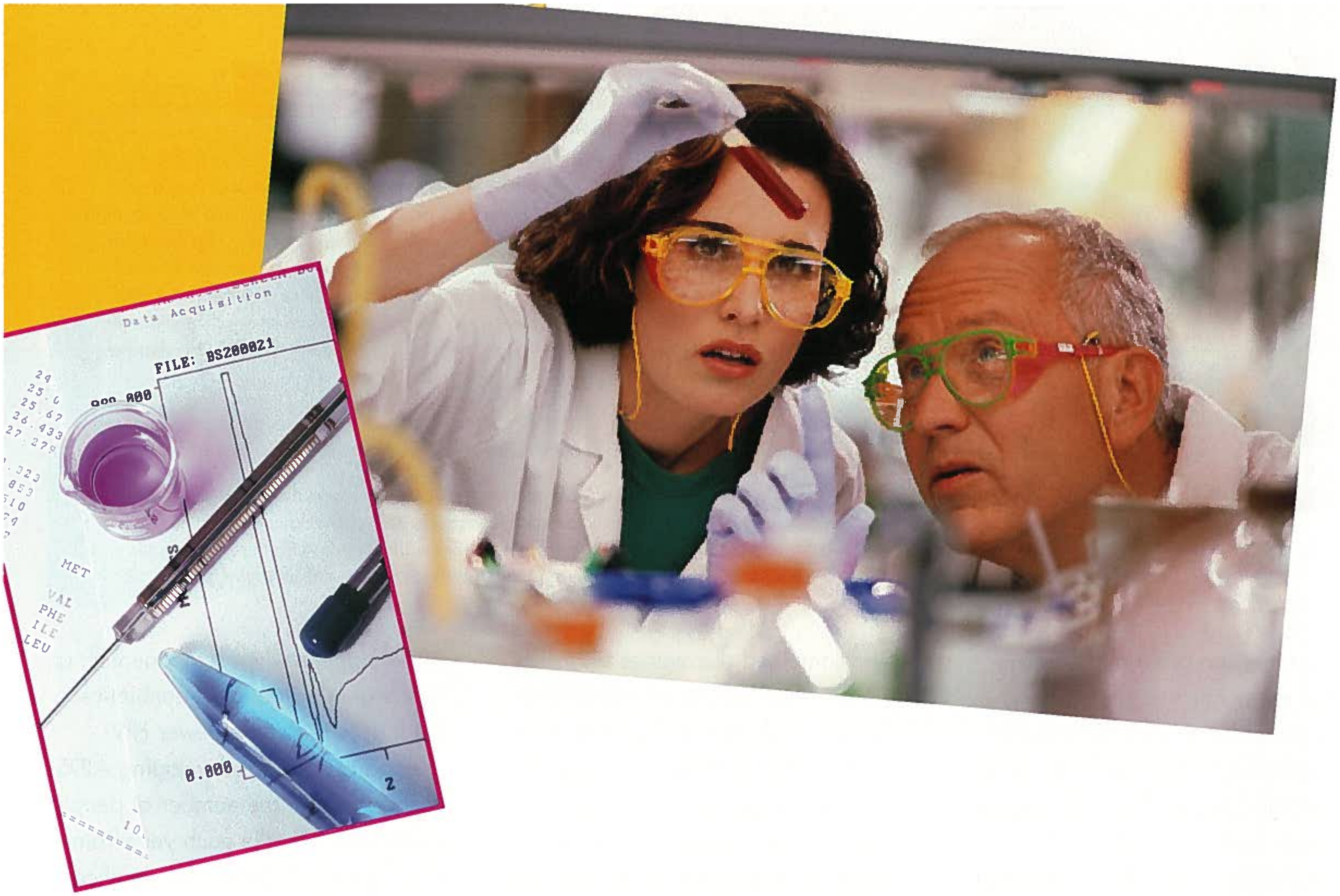
The combined discoveries of basic, applied and clinical research about HIV have resulted in the development of a number of different classes of anti-HIV drugs, with each class blocking one step of the HIV life cycle. By testing various combinations of drugs from the different classes in clinical trials, researchers have found they can keep the virus in check for several years or more. These combination treatments aren't a cure, like what happens when someone with a bacterial infection takes antibiotics. But it does mean that fewer HIV-infected people are developing AIDS each year, and the number of people in the U.S. who die each year from the disease has decreased significantly as well. Because of research, people with HIV are healthier and living longer.

LETHAL WEAPONS

Viruses are even smaller microorganisms than bacteria. In fact, they are so small that scientists have to use electron microscopes to see them. These tiny destroyers live and multiply in the body's cells and are responsible for some of the most lethal diseases — including rabies, some cancers and AIDS.

Searching for a Winner

Whether from a natural source or from a discovery scientists have made in a lab, a drug has to be evaluated carefully before people can use it. And before it can even be tested in humans, the U.S. Food and Drug Administration (FDA) has to give permission. Studies required are part of a "critical path" the drug has to take before human testing. The steps in the path are designed to answer three main questions: How effective is the drug? How does it react in living systems? And is it safe to take?



The process of developing new anti-AIDS drugs follows a number of steps. First, scientists treat infected cells *in vitro* with a promising new drug to see if there is any anti-HIV activity.

If a drug shows promise, researchers turn to animal models of AIDS. They need to know if the drug's success in cell cultures can be reproduced in animals, how the drug acts in a living being and if it is safe.

Since HIV does not infect animals other then humans (except other primates), drugs are tested in animals that develop AIDS-like symptoms — weight loss, abnormal blood cells and diarrhea. But before drugs are tested on the animals, more cell culture work is done to make sure the drug works as well against the animal's virus infection as it does against HIV.

Mice, cats and monkeys all serve as animal models. But because chimpanzees can be infected by HIV, AIDS researchers rely heavily on nonhuman primates. Even so, the number used is small. Researchers have also discovered the macaque monkey is a good animal model for AIDS.

After animal testing, drugs may need to be refined or changed so they'll be more effective and stable in humans. Only if a drug is safe and likely to be effective will researchers use it with humans in clinical trials.

The process of developing most drugs takes a long time — often a decade or more. And it costs hundreds of millions of dollars. Though the process is being sped up for drugs to treat AIDS and other deadly diseases, it still takes years before a research discovery becomes a treatment.

DEADLY INFECTIONS

For people infected with HIV, the virus is rarely the direct cause of death. Because HIV triggers a collapse in the immune system, common disease-causing organisms prosper. Infections the body would normally fight off become life threatening. These are called opportunistic infections, and they can be deadly to someone with AIDS.

Scouting the Possibilities

AIDS research is progressing in small but significant steps. Scientists continue to investigate exactly how the virus can undergo changes (mutations) to avoid destruction by the immune system. Other studies focus on how opportunistic infections can cause HIV to multiply. While the body tries to rid itself of HIV and the infections, it has a tough time recognizing the "enemy" and actually destroys some of its own uninfected cells. Researchers are also looking at a small fraction of HIV-infected people who are termed "nonprogressors" — the virus they carry does not seem to grow and the disease does not progress (get worse), even though these infected people are not taking any medications.

With more and more information available about how the disease works, scientists are better able to focus research into possible treatments and vaccines. Like drugs that inhibit the virus and vaccines that help the body fight HIV. Scientists also are testing vaccines to prevent HIV infection.

Although scientists have yet to find the "magic bullet" that will wipe AIDS off the face of the Earth, research is offering hope to the millions of people who now or will suffer from AIDS.

What's the Point?

Though researchers have not yet found a cure for AIDS, they have unraveled many of its mysteries thanks to valuable clues from the studies of genetics, microbiology, virology and animal models.

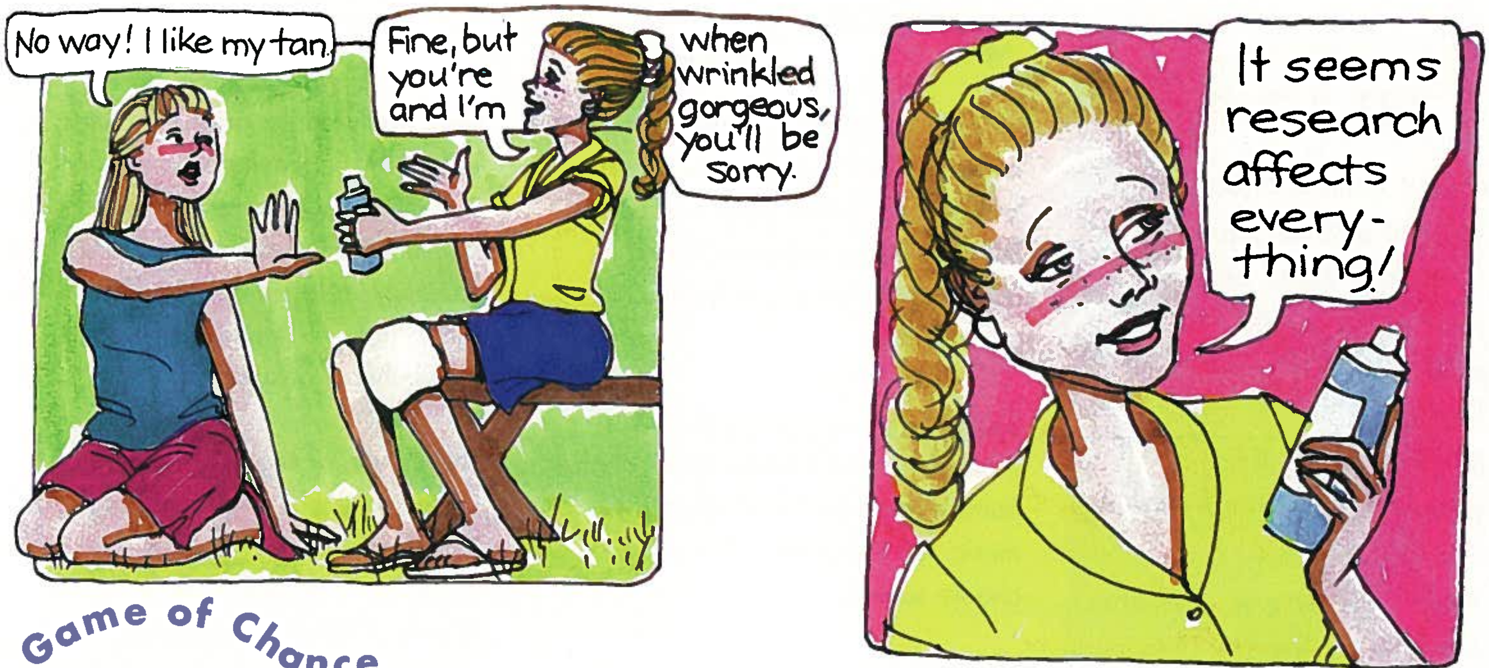
Catching Rays

It's summertime! And you're heading to the beach with your best buddies. You pack your mom's leftover fried chicken, a 12-pack of soda and several bags of chips. You grab your towel and sunscreen, then head out the door. Oops! You almost forgot your iPod. What's the beach without music? Soaking up the sun is one of life's simple pleasures. The heat warms us from head to toe, and the sun gives our skin that "healthy" look. But it can also harm us.

Through research, we know a lot about how the sun affects our bodies. We also know how we can have fun in the sun and prevent harmful effects.

fast*facts*

- *The color of our skin depends on melanin, made by skin cells called melanocytes. When UV (ultraviolet) light hits it, skin makes more melanin and produces a tan.*
- *Physicians consider tanning the skin's response to injury because the sun kills some cells on contact and injures others.*
- *Approximately 60,000 new cases of melanoma — the deadliest type of skin cancer — are diagnosed in the U.S annually, and this figure increases by about 3 percent every year. Melanoma is one of the more common cancers in adolescents and young adults. UV radiation from sunlight is thought to be the major risk factor for most melanomas. Tanning lamps and booths are another source of UV radiation.*
- *UV rays can travel through clouds, water and some clothes. The little devils can even bounce off sand, water or decks to a person lounging under an umbrella.*



A Game of Chance

The sun gives us light we can see and heat we can feel. But it also gives off something that we can't see — ultraviolet (UV) rays. About 6 percent of the sun's radiation that reaches the Earth's surface comes in the form of UV radiation. These UV rays can cause suntans and sun-burns, make some diseases worse, and can lead to allergies, wrinkles and leathery skin — even skin cancer.

Skin cancer is a disease that can be caused by too much exposure to the sun over a long period of time. It rarely strikes the occasional sunbather. But for sun worshippers who shun sunscreens and cover-ups, dark tans and cute freckles aren't the only reward. Skin cancer may be the ultimate "prize."

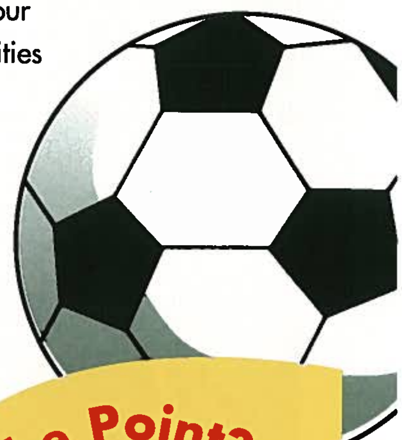
The sun has been around for millions of years. But the number of skin cancer cases is on the rise. Some scientists think this increase might be related to the rise in "cosmetic tanning." There is also growing concern about the thinning ozone layer in the Earth's upper atmosphere. (Ozone is a form of oxygen, and it stops UV light from reaching us.) The fact that we're living longer may also have something to do with the increase. The longer we live, the more time there is for skin cancer to show up.

But how do we know this stuff? Research. Scientists study the sun and how it affects our bodies. They also study drugs and various treatments for skin cancer and other diseases.

They study other parts of the environment as well. Like air pollution. And water quality. Every part of our environment — from the products we use to the air we breathe — affects us. And scientists use research to find out how!

Using many of the same methods employed by researchers studying diseases, scientists identify which chemicals can harm us, and at what levels. They help determine what's an acceptable risk, and what's not.

Scientists give us information we need to change our lifestyles — to avoid things that can hurt us. Their research findings help us make decisions as a society, too. Like what types laws we need to consider to protect our environment and ourselves. And their research findings help us understand the world around us — and our responsibilities to it and to each other.



What's the Point?

Researchers studying the environment and the things in it give us information to help us protect ourselves and our world.

TRAINING FOR THE "PROS"

If a professional career in science excites you, start "training" now. Stretch your mind a little — look past what we know and find out how we know it. Be observant. Ask questions — like why things are the way they are. And what we can do with what we know.

Take advantage of your high school years, and learn as much science and math as you can. Try to get a job as a research assistant. Or work in a hospital or veterinary clinic. Any job experience in the sciences will help you make choices later on.

Whatever you do, choose something that interests you. Then go for it!

A Winning Choice

Imagine you can be anything you want to be. A reporter, policeman, teacher, lawyer, accountant, artist — anything. But you choose to be a scientist. Farfetched? Perhaps. Then again, perhaps not.

Each day, young men and women around the world make career choices. Some choose to study business. Or music. Or computers. And some choose science.

Learning for a Brighter Future

Some bioscience researchers start out as physicians. Others are biologists or biochemists. Still others are pathologists, geneticists or ecologists. The common thread is their curiosity. They're curious about the world around them and want to make life better. Today, only a small percentage of students pursue careers in science. As a result, there is a continuing need for research professionals. And there are still so many of life's mysteries for researchers to explore.

Despite major progress in the past century, millions of people suffer from illnesses that have no cures. Like AIDS. Alzheimer's disease. Cancer. Cystic fibrosis. Diabetes. Heart disease. Multiple sclerosis. And schizophrenia. There is so much left to be discovered.

But even if a career in research doesn't appeal to us, we need to know about science and what it can do. The more we know, the better decisions we can make for the sake of our own health and the health of our society. We make lifestyle choices. We pass laws. Doing this requires a basic understanding of science, which affects us every day of our lives.

Let's Play...Research Jeopardy!

Here are the questions to the answers on page 1, along with the page number where the information can be found.

Questions

1. **What is research?** *(page 5)*
2. **What is the scientific method?** *(page 5)*
3. **What is in vitro?** *(page 6)*
4. **What are animal models?** *(pages 6-7)*
5. **What are human clinical trials?** *(page 7)*
6. **What are epidemiological studies?** *(page 7)*
7. **What is basic research?** *(page 8)*
8. **What is the U.S. Food and Drug Administration (FDA)?** *(page 11)*
9. **What are viruses?** *(page 11)*
10. **What is UV (ultraviolet) radiation?** *(page 15)*

fastfacts

- *Fewer than 20 percent of Americans feel well-informed about new scientific discoveries and the use of new inventions and technologies, according to a National Science Foundation report.*
- *"Stubborn" and "determined." Those are the words medical physicist Dr. Rosalyn S. Yalow uses to describe herself as a child. In 1977, she won a Nobel Prize in Medicine or Physiology for helping to develop the testing technique called radioimmunoassay, which can measure tiny quantities of biologic substances in blood. The test can lead to early diagnosis of disease.*
- *A man of many talents, Dr. J. Michael Bishop had a tough time choosing between music and science. He even considered careers in journalism and forestry. But at the age of 30, he decided on research. In 1989, he won a Nobel Prize in Medicine or Physiology for his discovery that normal cells contain genes that can cause a cell to become cancerous.*

What's the Point?

No matter what we choose as a career, understanding how science affects our lives is essential to being an informed citizen.

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