NIH MedlinePlus
Trusted Health Information from the National Institutes of Health
SUMMER 2013
the magazine

This summer, protect yourself and your loved ones from the dangers of skin cancer.

Skin Cancer Can Strike Anyone

Former presidents George W. Bush and Bill Clinton are just two among millions of Americans who have faced skin cancer.

A publication of the **NATIONAL INSTITUTES OF HEALTH** and the **FRIENDS** of the **NATIONAL LIBRARY OF MEDICINE**

Mentoring in Medicine

Giving Students a Vision of Healthcare Careers

Research has shown that many students are unaware of healthcare careers other than those of nurse and doctor, and of the need to increase the diversity of students pursuing those careers.

To help remedy that, a New York-based healthcare careers education program for underrepresented minority students recently expanded its pilot program efforts to urban Washington, D.C., and rural Hardin, Montana. Mentoring in Medicine (MIM), Inc. is a nonprofit organization that works with students in disadvantaged areas from 3rd grade through health professional schools. MIM is sponsored by the National Library of Medicine (NLM) and the Friends of the National Library of Medicine (FNLM).

More than 400 students—many of them American Indians—came to Hardin High School in mid-May for a three-day Healthy Living Week series of exhibits, hands-on demonstrations, and lectures about healthcare topics and career opportunities. At the same time, more than 500 students—many of them African American or Hispanic—from a number of D.C.-area schools attended a similar series of presentations at the National Institutes of Health in Bethesda, Maryland, according to MIM president Lynne Holden, MD.

Photo: National Library of Medicine

▲Students in Hardin, Montana, got hands-on healthcare experience through Mentoring in Medicine (MIM). At front is Andrew Morrison, MIM vice president of marketing.

"Mentoring in Medicine is a unique educational program that helps interest underrepresented students in healthcare careers," says Donald A.B. Lindberg, MD, NLM director. "We are delighted to help promote this pioneering effort to bring more diversity into the healthcare professions."

Among the presentations at Hardin High School was an iPad version of "Native Voices: Native Peoples Concepts of Health and Illness," an interactive exhibit from the National Library of Medicine. Students at the NIH visited the actual exhibit in the National Library of Medicine display area.

Mentoring in Medicine plans to continue its efforts in other venues in the future. For more information, visit medicalmentor.org.

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A doctor's physical exam of Dr. Edward Long (center) turned up an early-stage melanoma.

When does minor forgetfulness turn into something more serious? And how can we tell?

Photos: (Cover) Corbis, (Top) Dr. Edward Long, (Center) Shana Potash, NLM, (Bottom) ThinkStock

Rockville, Maryland, science teacher Kathryn Sander uses the GeneEd Web as part of her lessons on genetics.

The National Institutes of Health (NIH)—the Nation's Medical Research Agency—includes 27 Institutes and Centers and is a component of the U.S. Department of Health and Human Services. It is the primary federal agency for conducting and supporting basic, clinical, and translational medical research, and it investigates the causes, treatments, and cures for both common and rare diseases. For more information about NIH and its programs, visit www.nih.gov.

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Unlocking the Brain

The National Institutes of Health is leading a bold new project to revolutionize understanding of the human brain. It is called the BRAIN Initiative—short for Brain Research through Advancing Innovative Neurotechnologies. NIH Director Dr. Francis S. Collins recently outlined the challenge—and its potential benefits—for *NIH MedlinePlus* magazine.

◀ President Barack Obama and Dr. Francis Collins, Director, National Institutes of Health, at the BRAIN Initiative event in the East Room of the White House, April 2, 2013.

How difficult will it be to understand how the brain works?

Given that a typical human brain contains 86 billion neurons, each with thousands of connections, it sounds like an impossible task.

So what even makes such a challenge possible?

New advances in computer science, math, nanotechnology, imaging, and data visualization are empowering us to study simpler neural systems, and ultimately the living brain as an entire organ. Like the heart, for example, and at a level of detail not previously imagined.

By accelerating development and application of innovative technologies, researchers will be able to produce a picture of neural systems that, for the first time, shows how individual cells and complex nerve circuits interact in both time and space.

So, what is the payoff to this?

By exploring exactly how the brain enables the human body to record, process, utilize, store, and retrieve vast quantities of information, all at the speed of thought, researchers will be able to develop new ways to treat, cure, and even prevent brain disorders.

Why is the BRAIN Initiative needed?

The human brain remains one of science's greatest mysteries and one of the greatest challenges in medicine. Alzheimer's disease, Parkinson's disease, autism, epilepsy, schizophrenia, depression, traumatic brain injury, and other neurological and psychological disorders exact a tremendous toll on us as individuals, our families, and society at large. Despite the many recent advances, the underlying causes of these conditions remain largely unknown.

If we are to develop effective ways of helping people suffering from them, researchers need a more complete array of tools and better understanding of how the brain functions in both sickness and in health.

What is the rush?

Five years ago, a project like this would have been considered impossible. Five years from now will be too late. While the goals are profoundly ambitious, the time is right to inspire a new generation of scientists to take on the most groundbreaking approach ever contemplated to finding out how the brain works and how disease occurs.

Could you describe some of the specific research opportunities you see?

In the last decade alone, there have been a number of landmark discoveries that make unlocking the brain possible. We have sequenced the human genome, developed new tools for mapping neuronal connections, increased the resolution of imaging technologies, and witnessed the explosion of nanoscience. Integration across these and more scientific fields has become a reality.

For instance, by combining advanced genetic and optical techniques, scientists can now determine how specific cell activities within the mouse brain affect behavior. Through the integration of neuroscience and physics, researchers can use high-resolution imaging technologies to observe how the brain is structurally and functionally connected in living humans.

Photo: National Institutes of Health

▲Image showing individual neurons in the brain using fluorescent colors.

What do such advances mean for the future?

While these innovations have expanded our knowledge of the brain, significant breakthroughs in how we treat neurological and psychiatric disease will require researchers to record signals from brain cells in much greater numbers and at even faster speeds. We can't do this now but great promise for doing so lies at the intersection of nanoscience, imaging, engineering, informatics, and other rapidly emerging areas of science.

How will the BRAIN Initiative work?

Given the ambitious scope, it is vital that a wide range of expertise and experience inform the initiative. Therefore, NIH is establishing a high-level working group, co-chaired by Dr. Cornelia ("Cori") Bargmann, of The Rockefeller University, and Dr. William Newsome, from Stanford University, to work out the scientific goals and develop a multi-year plan for achieving them, including timetables, milestones, and cost estimates.

As part of the planning process, the working group will seek broad input from the scientific community, patient advocates, and the general public. By this fall, the group is supposed to make specific recommendations on high-priority investments for 2014.

How will the BRAIN Initiative be supported?

NIH intends to allocate $40 million for the project in 2014. Given the crosscutting nature, we will need the ideas of the best scientists and engineers across many diverse disciplines and sectors. Therefore, NIH is collaborating closely with the Defense Advanced Research Projects Agency (DARPA) and the National Science Foundation (NSF).

> Alzheimer's disease, Parkinson's disease, autism, epilepsy, schizophrenia, depression, traumatic brain injury and other neurological and psychological disorders exact a tremendous toll on us, our families, and society at large.

There also is strong interest from several private foundations, including the Howard Hughes Medical Institute, the Allen Institute for Brain Science, The Kavli Foundation, and the Salk Institute for Biological Studies. Many private companies are also interested in participating in this groundbreaking effort.

MP

Skin Cancer STRIKE ANYONE

In the U.S., skin cancer is the most common cancer. Melanoma, the most dangerous type of skin cancer, is still on the rise.

More than 2 million people are treated each year for the most common forms of skin cancer—basal cell and squamous cell. Basal cell skin cancer is several times more common than squamous cell skin cancer. Each year, more than 68,000 Americans are diagnosed with melanoma, and another 48,000 are diagnosed with an early form of the disease that involves only the top layer of skin.

Melanoma is less common than the others, but far more dangerous — even deadly. It involves the cells that produce the skin pigment melanin, which is responsible for skin and hair color. Melanoma can spread very rapidly, and the incidence of melanoma in the United States is steadily increasing. It is the leading cause of death from skin disease.

The development of melanoma is related to sun exposure, particularly to sunburns during childhood. It is most common among people with fair skin, blue or green eyes, and red or blond hair.

Corbis

Presidents George W. Bush and Bill Clinton both had basal cell carcinomas removed. That is the most common form of skin cancer and not as dangerous as melanoma.

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Senator John McCain of Arizona has had several melanomas removed, the most serious on his left temple. He has spoken out about the importance of regular screening for skin cancer.

Helga Esteb / Shutterstock.com

Actress Cybill Shepherd was found to have a single melanoma growth on her back. It was successfully treated. She now speaks out for skin cancer awareness and regular skin cancer screening.

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Jamaican singer-songwriter Bob Marley was just 36 when he died from a combination of melanoma and brain cancer. Although the melanoma was found early, Marley delayed treatment until it was too late.

Cancer Cells

Cancer begins in cells, the building blocks that make up *tissues*. Tissues make up the skin and other *organs* of the body. Normal cells grow and divide to form new cells as the body needs them. When normal cells grow old or get damaged, they usually die, and new cells take their place.

But sometimes this process goes wrong. New cells form when the body doesn't need them, and old or damaged cells don't die as they should. The buildup of extra cells often forms a mass of tissue called a growth or *tumor*.

Growths on the skin can be *benign* (not cancer) or *malignant* (cancer). Benign growths are not as harmful as malignant growths.

- **Benign growths** (such as *moles*) are rarely a threat to life, generally can be removed, and usually don't grow back. They also don't invade the tissues around them and don't spread to other parts of the body.
- **Malignant growths** (such as melanoma, basal cell cancer, or squamous cell cancer):
  - May be a threat to life
  - Often can be removed but sometimes grow back
  - May invade and damage nearby organs and tissues
  - May spread to other parts of the body

Risk Factors

When you're told that you have skin cancer, it's natural to wonder what may have caused the disease. The main *risk factor* for skin cancer is exposure to sunlight (UV radiation), but there are also other risk factors. A risk factor is something that may increase the chance of getting a disease. People with certain risk factors are more likely than others to develop skin cancer. Some risk factors vary for the different types of skin cancer.

Studies have shown that the following are risk factors for the three most common types of skin cancer:

- **Sunlight:** Sunlight is a source of **UV radiation**. It's the most important risk factor for any type of skin cancer. The sun's rays cause skin damage that can lead to cancer.
- **Severe, blistering sunburns:** People who have had at least one severe, blistering sunburn are at increased risk of skin cancer. Although people who burn easily are more likely to have had sunburns as a child, sunburns during adulthood also increase the risk of skin cancer.
- **Lifetime sun exposure:** The total amount of sun exposure over a lifetime is a risk factor for skin cancer.
- **Tanning:** Although a tan slightly lowers the risk of sunburn, even people who tan well without sunburning have a higher risk of skin cancer because of more lifetime sun exposure.

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Timely Healthcare Checkup Catches Melanoma Early

Dr. Edward Long of Arlington, Virginia, for many years was the staff director of the United States Senate panel that is responsible for funding of medical research. Now a melanoma survivor, he is advocating for improved screening, prevention, and research.

How did you discover you had skin cancer?

It was 1996, I had just left the Congress and starting working as a healthcare consultant, when I finally decided to have a full-fledged physical. During the exam my doctor saw an irregular looking mole on my back and sent me to a dermatologist to have it examined further. The dermatologist did a biopsy and based on that they found irregularity in the cells. Then he cut the mole out and made sure he had gotten all the irregular cells out at the margins.

My melanoma was classified as *in situ* (on the site)—it hadn't penetrated below the surface of the skin before it had progressed to a Stage 1 melanoma. So I didn't need to have chemotherapy after the mole was removed. About half of the melanoma cases diagnosed every year fall into this category.

Did you have a history of lots of sun exposure?

I had been a lifeguard when I was a teenager and, like a lot of people, had never used much sunscreen. But I had no family history of skin cancer. I had no idea I had a problem before I had the physical. If I hadn't gotten that physical the cancer wouldn't have been discovered until it was too late. I was very fortunate it was discovered early.

What were your first thoughts upon learning you had skin cancer?

I remember lying there on the chair and I asked "when will this become cancerous?" And the doctor said, "You don't understand, it is cancerous. But we caught it early."

My first thought was disbelief. I didn't think I could get cancer. And the next thought was, "I have cancer," and I had a profound sense of my own mortality. I recognized that I could die from this. That was shocking and very humbling.

How did your diagnosis and treatment change your lifestyle and health habits?

Ever since then I go to the dermatologist every 4 to 6 months to get a full body check, and anything that looks strange is removed. I also began not only wearing sunscreen

Photo: Dr. Edward Long

▲Dr. Edward Long, shown here with his two sons, survived melanoma because his physician caught it early during an office checkup.

but protective clothing—hats, long-sleeved shirts. Also, as a father of two boys, I have really tried to make sure they wear sunscreen and long sleeve shirts whenever possible.

How have you become involved in advocating for the fight against melanoma?

I have tried to translate my knowledge of how government works and my personal experience to work with organizations to improve melanoma screening, prevention, and research. I have tried to raise awareness about the importance of screening, particularly for men over 50 and young women under 29. There has been almost an 8-fold increase in melanoma since the '70s among young women, a dramatic rise that is in large part the result of increased use of tanning beds. I have also been working to strengthen the Food and Drug Administration's regulation of tanning beds. And I have been helping to advance research supported by the National Cancer Institute and private organizations like the Melanoma Research Foundation.

Another important effort is to raise awareness about this problem among our military. With so many men and women having served long tours in the deserts of Iraq and high elevation regions like Afghanistan, we can expect growing rates of skin cancer from all that sun exposure as the warfighters of today become the veterans of tomorrow.

Fast Facts!

- Skin cancer is the most common form of cancer in the United States. The two most common types are basal cell cancer and squamous cell cancer. Melanoma, a more serious type of skin cancer, is less common.
- More than 2 million people are treated for basal cell or squamous cell skin cancer each year. Basal cell skin cancer is several times more common than squamous cell skin cancer.
- The number of cases of skin cancer has been increasing. Exposure to the sun is a major factor.
- Estimated new cases and deaths from melanoma in the United States in 2013: New cases: 76,690; deaths: 9,480.

NIH Research to Results

Scientists are studying new ways of working with the immune system to fight cancer. This includes vaccines aimed at making a person immune to his or her skin cancer cells. Another method is to train a person's immune cells to attack the skin cancer cells.

- **New melanoma drugs.** The U.S. Food and Drug Administration recently approved two new drugs, Tafinlar (dabrafenib) and Mekinist (trametinib), for patients with advanced (metastatic) or unresectable (cannot be removed by surgery) melanoma. Tafinlar is approved to treat patients with melanoma whose tumors express the BRAF V600E gene mutation. Mekinist is approved to treat patients whose tumors express the BRAF V600E or V600K gene mutations. Approximately half of melanomas arising in the skin have a BRAF gene mutation.
- **Immune-system cells.** A recent small study showed that treating patients with immune system cells found in tumors could shrink skin cancer tumors and possibly prolong life.
- **Melanoma increasing among children.** Although rare, melanoma among children is on the rise, according to recent research published in the journal *Pediatrics*. The biggest increase was among adolescent girls, ages 15 to 19, according to the study authors, including researchers from the National Cancer Institute (NCI). These increases, along with those increases among adults, are thought to stem from increased exposure to ultraviolet radiation from the sun and from tanning booths.
- **Sensitized T cells:** NCI researchers recently genetically engineered some melanoma patients' white blood cells to recognize and attack their own cancer cells. The NCI researchers sought an effective way to convert normal white blood cells (lymphocytes) in the lab into cancer-fighting cells. The research demonstrated a successful regression of advanced melanoma.

Treatment

The most common treatments for skin cancer are surgery, chemotherapy, and radiation therapy.

You may need a procedure called surgical lymph node biopsy to check if the cancer has spread to nearby lymph nodes. If it has, these lymph nodes may also need to be removed. A skin graft may be necessary after the surgery if a large area of skin is affected.

Chemo (which is short for chemotherapy) is the use of drugs to kill cancer cells or to slow their growth. Some chemo can be given by I.V. (into a vein by a needle) and others are swallowed in pill form. Because chemo drugs travel to nearly all parts of the body, they are useful for cancer that has spread.

Radiation treatment is also used to kill or slow the growth of cancer cells. It can be used alone or with surgery or chemo. Radiation treatment is like getting an x-ray. Or, sometimes it can be given by placing a "seed" inside the cancer to give off the radiation.

Questions to Ask

- What treatment choices do I have? What do you recommend and why?
- What is the stage of the disease? Has the cancer spread? Do any lymph nodes or other organs show signs of cancer?
- What are the benefits of each kind of treatment?
- What can I do to prepare for treatment?
- Will I need to stay in the hospital? How long?
- What are the risks and possible side effects of each treatment? How can side effects be managed?
- What is the treatment likely to cost? Will my insurance cover it?
- How will treatment affect my normal activities?
- Would a research study (clinical trial) be a good choice for me?

Skin and Sun—Safety First

Good skin care begins with sun safety. Whether it is something as simple as age spots or as serious as skin cancer, the simplest and cheapest way to keep your skin healthy is to limit your exposure to the sun. Yet, Americans spend billions of dollars each year on skin care products that promise to erase wrinkles, lighten age spots, and eliminate itching, flaking, or redness.

As you age, your skin changes. It becomes thinner and loses fat, making your skin look less smooth. When your skin looks less plump, your veins and bones become more noticeable. You sweat less, which causes your skin to be drier. Also, your skin can take longer to heal from bruises or cuts as you get older. With all of these age-related changes, sunlight is a major contributing factor. You can delay these changes by avoiding prolonged and regular exposure to the sun.

Although nothing can completely undo sun damage, the skin sometimes can repair itself. So, it's never too late to protect yourself from the harmful effects of the sun.

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- **New sunscreen rules.** The Food and Drug Administration (FDA) has been developing rules about sunscreens over the past three years that manufacturers are now implementing. In short, sunscreens labeled "Broad Spectrum" will protect against all types of sun damage (including ultraviolet A and B) and have a sun protection factor (SPF) of 15 or higher. A higher number means longer, stronger protection. Also look for products with a label that says water-resistant and either 40 or 80 minutes—the amount of time before the sunscreen needs to be reapplied.
- **Stay out of the sun.** Avoid the sun between 10 a.m. and 3 p.m. This is when the sun's harmful ultraviolet (UV) rays are strongest.
- **Wear protective clothing.** A hat with a wide brim shades your neck, ears, eyes, and head. Look for sunglasses with a label saying the glasses block 99 to 100 percent of the sun's rays. Wear loose, lightweight, long-sleeved shirts and long pants or long skirts when in the sun.
- **Avoid artificial tanning.** Don't use sunlamps, tanning beds, tanning pills, or tanning makeup. Tanning pills have a color additive that turns your skin orange after you take them. The FDA has not approved this for tanning the skin. Tanning make-up products will not protect your skin from the sun.
- **Check your skin often.** Look for changes in the size, shape, color, or feel of birthmarks, moles, and spots. If you find any changes, see a doctor. The American Academy of Dermatology suggests that older, fair-skinned people have a yearly skin check as part of a regular physical exam.
- **Dark skin needs protection, too.** The incidence of skin cancer in African Americans and other dark-skinned people is much lower than in Caucasians due to the additional melanin, a pigment, in the skin. While this pigment offers some sun protection, dark brown or black skin is not a guarantee against skin cancer.

▶This photo (right) shows an asymmetric melanoma with irregular and scalloped borders. The color varies from gray to brown to black. The melanoma is about 1.2 centimeters.

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▲Recent studies have shown that the use of indoor tanning devices increases melanoma risk, especially for those who use them frequently.

◀Be sure to wear sunscreen with a sun protective factor (SPF) of 15 or higher any time you're out in the sun.

Find Out More

- ✔NCI's Cancer Information Service: 1–800–4–CANCER (1–800–422–6237) can help locate programs, services, and NCI publications. They can send you a list of organizations that offer services to people with cancer.
- ✔MedlinePlus: Visit medlineplus.gov and type "skin cancer" or "melanoma" into the Search box.
- ✔National Cancer Institute Melanoma Home Page: www.cancer.gov/cancertopics/types/melanoma

Test Your Skin Cancer IQ

1. Skin cancer is
A. the most common form of cancer in the United States.
B. the second most common form of cancer in the United States.
C. the rarest form of cancer in the United States.

2. There are
A. three main types of skin cancer.
B. two main types of skin cancer.
C. four main types of skin cancer.

3. The most dangerous form of skin cancer is
A. melanoma.
B. squamous cell carcinoma.
C. basal cell carcinoma.

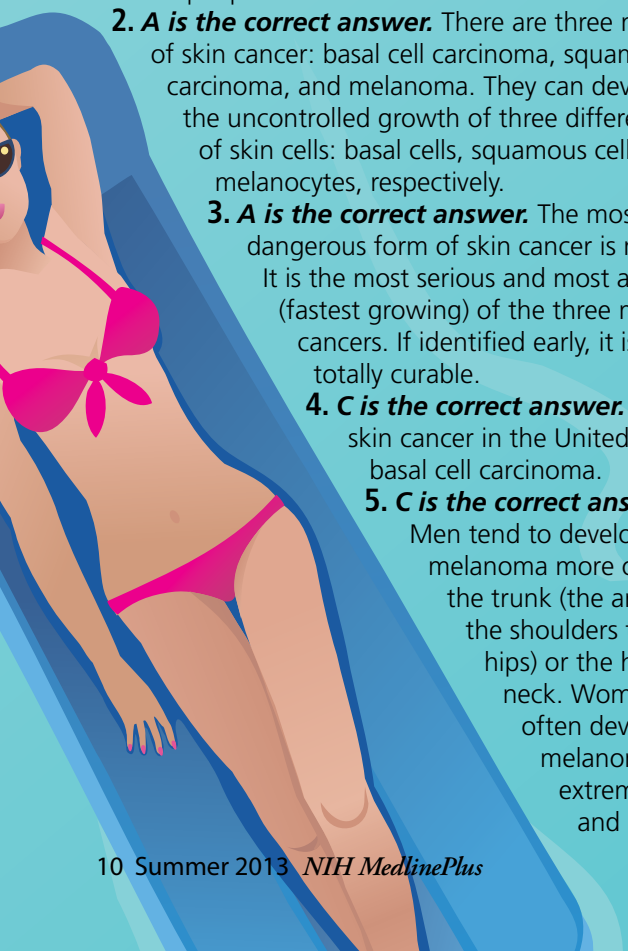
4. The most common type of skin cancer is
A. melanoma
B. squamous cell carcinoma
C. basal cell carcinoma

5. Men tend to develop melanoma more often
A. on the toes.
B. on the arms and legs.
C. on the trunk.

6. The most common sign of skin cancer is
A. a change on the skin.
B. hives.
C. itching.

7. If the cancer hasn't spread, the first choice for therapy is usually
A. immunotherapy.
B. radiation therapy.
C. surgery.

8. Someday, cancer vaccines might be used to
A. prevent melanoma.
B. prevent polio.
C. treat melanoma.



ANSWERS

1. ***A is the correct answer.*** Skin cancer is the most common type of cancer in the U.S. It occurs in more than a million people each year, including many older people.
2. ***A is the correct answer.*** There are three main types of skin cancer: basal cell carcinoma, squamous cell carcinoma, and melanoma. They can develop from the uncontrolled growth of three different types of skin cells: basal cells, squamous cells, and melanocytes, respectively.
3. ***A is the correct answer.*** The most dangerous form of skin cancer is melanoma. It is the most serious and most aggressive (fastest growing) of the three main skin cancers. If identified early, it is almost totally curable.
4. ***C is the correct answer.*** 90% of skin cancer in the United States is basal cell carcinoma.
5. ***C is the correct answer.*** Men tend to develop melanoma more often on the trunk (the area from the shoulders to the hips) or the head and neck. Women more often develop melanoma on the extremities (arms and legs).
6. ***A is the correct answer.*** The most common sign of skin cancer is a change on the skin. This may be a new growth, a sore that doesn't heal, or a change in an old growth. Not all skin cancers look the same. Sometimes skin cancer is painful, but usually it is not.
7. ***C is the correct answer.*** Surgery to remove the suspicious area of skin is usually the first step in skin cancer treatment and may have already occurred in the process of diagnosis. However, chemotherapy or radiation therapy may be recommended first if the cancer has already metastasized at the time of diagnosis.
8. ***C is the correct answer.*** Cancer vaccines are similar to traditional vaccines, like those that prevent polio, but cancer vaccines are given as treatment to a person who already has cancer, rather than preventatively given before the onset of disease. These vaccines work by stimulating the body's immune system to fight against melanoma.

MP

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Genetics 101

The Hereditary Material of Life

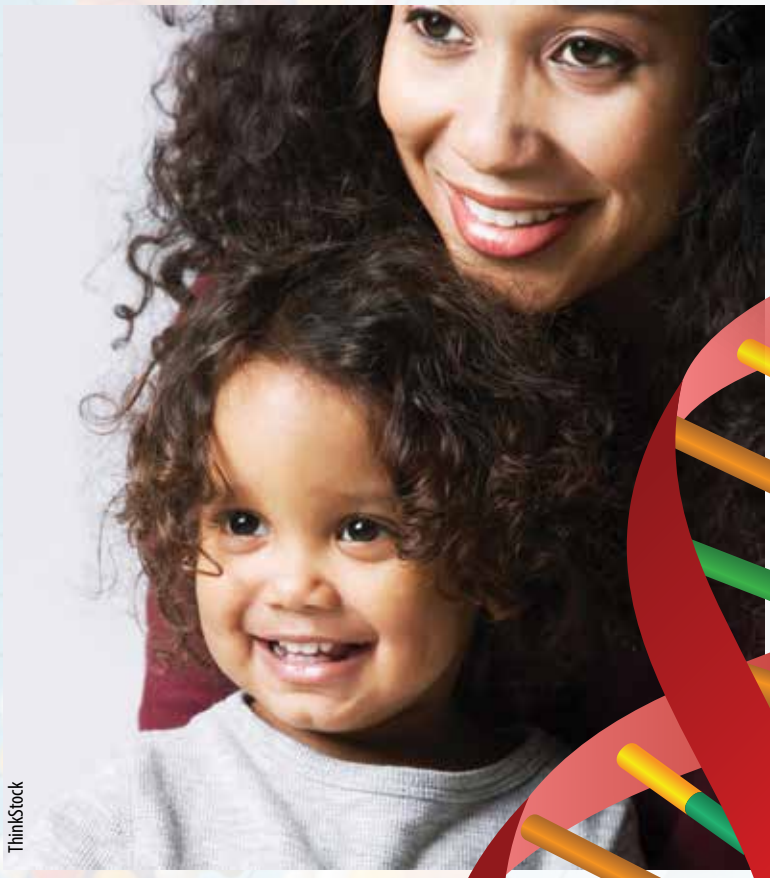
Genetics is the study of heredity, the process in which parents pass certain genes onto their children. A gene is a short piece of DNA—*deoxyribonucleic acid*, the hereditary material in humans and almost all other organisms. There are about 30,000 genes in each cell of the human body. Together, these genes make up the blueprint for the human body and how it works.

A person's appearance—height, hair color, skin color, and eye color—is determined by genes. Other characteristics affected by heredity include the likelihood of getting certain diseases, mental abilities, and natural talents.

An abnormal genetic trait passed down through families (inherited) may:

- Have no effect on your health or well being—for example, it may just involve a white patch of hair or an extended earlobe
- Be of minor consequence—for example, color blindness
- Have a dramatic effect on your quality or length of life

For most genetic disorders, genetic counseling is advised. Many people may also want to seek prenatal diagnosis if they plan to have children. The terms anomaly, abnormality, disorder, defect, disease, and syndrome are not used consistently, and do not have precise definitions.



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▲DNA is a double helix formed by base pairs attached to a sugar-phosphate backbone.

What is DNA?

DNA, or deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms. Nearly every cell in a person's body has the same DNA. Most DNA is located in the cell nucleus (where it is called nuclear DNA), but a small amount of DNA can also be found in the mitochondria (where it is called mitochondrial DNA or mtDNA).

The information in DNA is stored as a code made up of four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T). Human DNA consists of about 3 billion bases, and more than 99 percent of those bases are the same in all people. The order, or sequence, of these bases determines the information available for building and maintaining an organism, similar to the way in which letters of the alphabet appear in a certain order to form words and sentences.

DNA bases pair up with each other, A with T and C with G, to form units called base pairs. Each base is also attached to a sugar molecule and a phosphate molecule. Together, a base, sugar, and phosphate are called a nucleotide. Nucleotides are arranged in two long strands that form a spiral called a double helix. The structure of the double helix is somewhat like a ladder, with the base pairs forming the ladder's rungs and the sugar and phosphate molecules forming the vertical sidepieces of the ladder.

An important property of DNA is that it can replicate, or make copies of itself. Each strand of DNA in the double helix can serve as a pattern for duplicating the sequence of bases. This is critical when cells divide because each new cell needs to have an exact copy of the DNA present in the old cell.

What is a gene?

A gene is the basic physical and functional unit of heredity. Genes, which are made up of DNA, act as instructions to make molecules called proteins. In humans, genes vary in size from a few hundred DNA bases to more than 2 million bases. The Human Genome Project has estimated that humans have between 20,000 and 25,000 genes.

Every person has two copies of each gene, one inherited from each parent. Most genes are the same in all people, but a small number of genes (less than 1 percent of the total) are slightly different between people. Alleles are forms of the same gene with small differences in their sequence of DNA bases. These small differences contribute to each person's unique physical features.

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What is gene therapy?

Gene therapy is an experimental technique that uses genes to treat or prevent disease. In the future, this technique may allow doctors to treat a disorder by inserting a gene into a patient's cells instead of using drugs or surgery. Researchers are testing several approaches to gene therapy, including:

- Replacing a mutated gene that causes disease with a healthy copy of the gene.
- Inactivating, or "knocking out," a mutated gene that is functioning improperly.
- Introducing a new gene into the body to help fight a disease.

Although gene therapy is a promising treatment option for a number of diseases (including inherited disorders, some types of cancer, and certain viral infections), the technique remains risky and is still under study to make sure that it will be safe and effective. Gene therapy is currently only being tested for the treatment of diseases that have no other cures.

GeneEd—A Genetics Educational Resource

A recently developed educational website about genetics—GeneEd.nlm.nih.gov—is helping teachers inform their students about genetic topics in ways that are more interactive, up-to-date, and engaging.

For Kathryn Sander, a science teacher at Thomas S. Wootton High School in Rockville, Maryland, teaching her students about genetics has always had its challenges.

"With genetics, one of the difficulties is that it's very abstract for a lot of students," she says. "You can see organisms and body systems, but when you are talking about genetics, presenting it to students in a way that's more visual is something they really need."

That's one of the reasons that Sander is teaching genetics using GeneEd Web, a website that helps educators teach genetics topics more effectively. The Division of Specialized Information Services (SIS) of the National Library of Medicine, in collaboration with the National Human Genome Research Institute (NHGRI), teachers, and experts in genetics and genetic counseling released the website in 2012.

GeneEd is a safe and useful resource for students and teachers in grades 9-12 to learn genetics. Topics include cell biology, DNA, genes, chromosomes, and much more. GeneEd also provides lesson plans, genetic educational materials, printable activity sheets, and other teaching resources for educators seeking to increase genetic and genomic literacy.

▲Science teacher Kathryn Sander often uses the GeneEd Web website as part of her lessons on genetics.

"When I first looked at GeneEd, one of the things that struck me was how up-to-date the information was," says Sander. "A lot of the topics we cover, there's not a lot of information because it's so new. The fact that GeneEd had that information and had it in a way the kids could understand really impressed me."

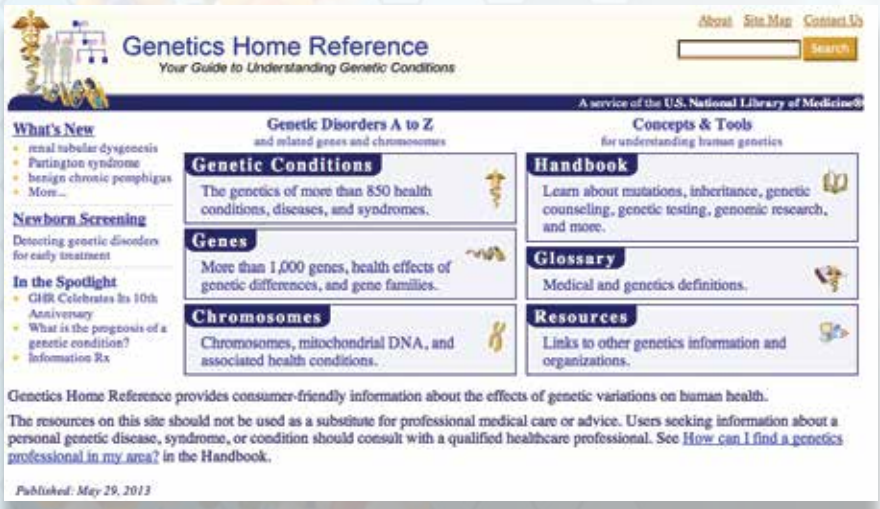
Photos: Shana Potash, National Library of Medicine

▲Student uses the GeneEd Web website as part of her lessons on genetics.

Teachers can use the site to introduce topics, supplement existing materials, and provide as a reliable source to students conducting research. The site links to categories such as research articles, animation, games, videos, interactive tutorials, and labs and experiments. 3D images, illustrations, and text from the NHGRI Talking Glossary (www.genome.gov/glossary/index.cfm) help to enrich the user experience by providing vivid imagery to reinforce genetic concepts.

Karen Gutzman, National Library of Medicine, contributed to the article.

Using the Genetics Home Reference Website



▲The opening welcome page for the Genetics Home Reference website—"Your Guide to Understanding Genetic Conditions"

The Genetics Home Reference (GHR) website—ghr.nlm.nih.gov—is a free, trustworthy, patient-friendly guide to the science of genetics. The site has topics on genetic conditions and related genes, and an illustrated tutorial that explains the basics of genetics and a glossary of genetics terms. Summaries are written in lay language by Library staff, and each is reviewed by an expert in human genetics before being posted to GHR and again with each substantive update.

In April, the GHR celebrated its 10th anniversary since being launched on April 25, 2003. GHR currently offers more than 2,000 total summaries of genetic information, comprising more than 850 genetic conditions, more than 1,060 genes, about 80 gene families, and all 24 human chromosomes, plus mitochondrial DNA. About 650 genetics experts worldwide have reviewed this information. The "Help Me Understand Genetics" section has expanded to more than 70 pages and several dozen illustrations in nine chapters. New information is added regularly as the GHR website keeps growing.

What Is Genetic Counseling?

Genetic counseling provides information and support to people who have, or may be at risk for, genetic disorders. A genetics professional meets with you to discuss genetic risks. You may follow up with genetic testing. There are many reasons to seek genetic counseling. You may consider it if you:

- Have or are concerned you have an inherited disorder
- Are pregnant or planning to be pregnant after age 35
- Already have a child with a genetic disorder or birth defect
- Have had two or more pregnancy losses or a baby who died
- Have had ultrasound or screening tests that suggest a possible problem

Several resources for locating a genetics professional in your community are available online:

- The American College of Medical Genetics (www.acmg.net)
- The National Society of Genetic Counselors (www.nsgc.org)
- The National Cancer Institute provides a Cancer Genetics Services Directory (www.cancer.gov/cancertopics/genetics/directory)

Find Out More

- ✔Genetics Home Reference: http://ghr.nlm.nih.gov/
- ✔GeneEd Web: http://geneed.nlm.nih.gov/
- ✔MedlinePlus offers a list of links to information about genes and gene therapy. (www.nlm.nih.gov/medlineplus/genesandgenetherapy.html)
- ✔The fact sheet Gene Therapy from the U.S. Department of Energy Office of Science offers an overview of this topic. (http://genomics.energy.gov)

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Understanding the Human Genome Project—

A Fact Sheet

Yesterday

- Just a half-century ago, very little was known about the genetic factors that contribute to human disease.
- In 1953, James Watson and Francis Crick described the double helix structure of deoxyribonucleic acid (DNA), the chemical compound that contains the genetic instructions for building, running, and maintaining living organisms.
- In 1990, the National Institutes of Health (NIH) and the Department of Energy joined with international partners in a quest to sequence all 3 billion letters, or base pairs, in the human genome, which is the complete set of DNA in the human body. This concerted, public effort was the Human Genome Project.
- The Human Genome Project's goal was to provide researchers with powerful tools to understand the genetic factors in human disease.
- All data generated by the Human Genome Project were made freely and rapidly available on the Internet.
- The Human Genome Project spurred a revolution in biotechnology innovation around the world and played a key role in making the U.S. the global leader in the new biotechnology sector.
- In April 2003, researchers successfully completed the Human Genome Project, under budget and more than two years ahead of schedule.

Today

- The Human Genome Project has already fueled the discovery of more than 1,800 disease genes.
- As a result of the Human Genome Project, today's researchers can find a gene suspected of causing an inherited disease in a matter of days, rather than the years it took before the genome sequence was in hand. There are now more than 2,000 genetic tests for human conditions. These tests enable patients to learn their genetic risks for disease and also help healthcare professionals to diagnose disease.
- Having the complete sequence of the human genome is similar to having all the pages of a manual needed to make the human body. The challenge now is to determine how to read the contents of these pages and understand how all of these many, complex parts work together in human health and disease.
- With the drastic decline in the cost of sequencing whole exomes or genomes, groundbreaking comparative genomic studies are now identifiying the causes of rare diseases.
- Much work still remains to be done. Despite many important genetic discoveries, the genetics of complex diseases such as heart disease are still far from clear.

Tomorrow

- An ambitious new initiative, The Cancer Genome Atlas (http://cancergenome.nih.gov), aims to identify all the genetic abnormalities seen in 50 major types of cancer.
- Based on a deeper understanding of disease at the genomic level, we will see a whole new generation of targeted interventions, many of which will be drugs that are much more effective and cause fewer side effects than those available today.
- NIH is striving to cut the cost of sequencing an individual's genome to $1,000 or less.
- Individualized analysis based on each person's genome will lead to a powerful form of preventive, personalized and preemptive medicine. By tailoring recommendations to each person's DNA, health care professionals will be able to work with individuals to focus efforts on the specific strategies—from diet to high-tech medical surveillance—that are most likely to maintain health for that particular individual.
- Professionals will be able to work with individuals to focus efforts on the specific strategies—from diet to high-tech medical surveillance—that are most likely to maintain health for that particular individual.
- The increasing ability to connect DNA variation with non-medical conditions, such as intelligence and personality traits, will challenge society, making the role of ethical, legal, and social implications research more important than ever.

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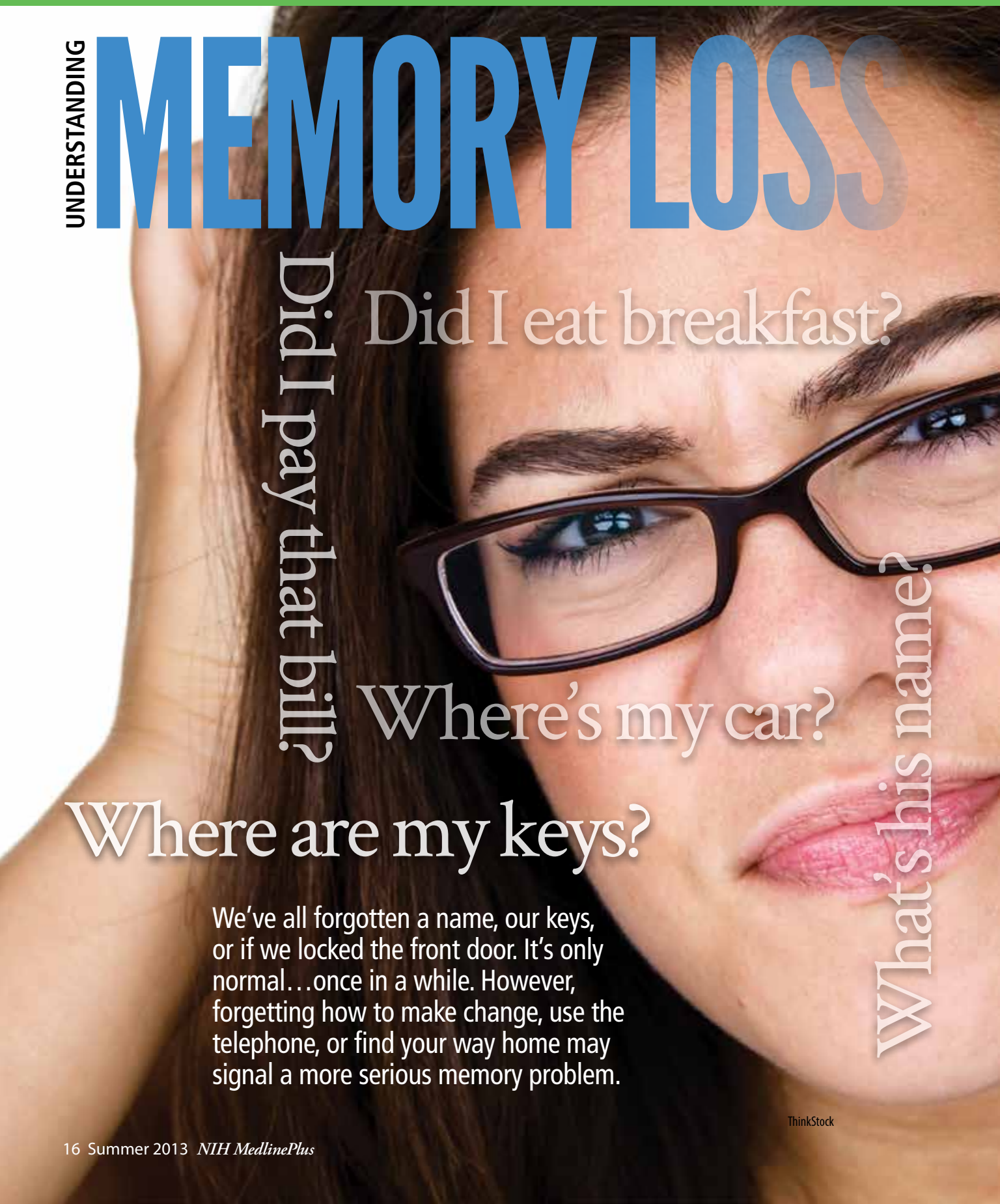
National Human Genome Research Institute (NHGRI): www.genome.gov
For the full text of this Human Genome Project Fact Sheet and additional information, contact the Communications and Public Liaison Branch, NHGRI, at (301) 402-0911.

UNDERSTANDING

MEMORY LOSS



We've all forgotten a name, our keys, or if we locked the front door. It's only normal…once in a while. However, forgetting how to make change, use the telephone, or find your way home may signal a more serious memory problem.

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What is mild forgetfulness?


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Some of us do get more forgetful as we age. It may take longer to learn new things, call up certain words, or find our glasses. These are often signs of mild forgetfulness, not serious memory problems.

If you're worried about being forgetful, see your doctor. Tell him or her what's bothering you. Be sure to make a follow-up appointment to check your memory in the next six months or year. If you're afraid you'll forget, ask a family member, friend, or the doctor's office to remind you.

What can I do about mild forgetfulness?

You can do many things to help keep your memory sharp and stay alert. Look at the list below for some helpful ideas.

Here are some ways to help your memory:

- Learn a new skill.
- Volunteer in your community, at a school, or at your place of worship.
- Spend time with friends and family.
- Use memory tools—to-do lists, reminder notes to yourself, big calendars.
- Put your wallet or purse, keys, and glasses in the same place each day.
- Get lots of rest.
- Exercise and eat well.
- Don't drink a lot of alcohol.
- Get help if you feel depressed for weeks at a time.

Some Treatable Causes of Memory Loss

As we age, our bodies change, including the brain. In older adults, some memory problems are related to treatable health conditions, such as:

- **Drugs**—These include sleeping pills, anti-anxiety medications, painkillers, antihistamines (allergy medications), and antidepressants.
- **Vitamin B12 Deficiency**
- **Alcoholism**
- **Brain tumors or infections**
- **Thyroid, kidney, or liver disorders**
- **Emotional stress, anxiety, or depression**

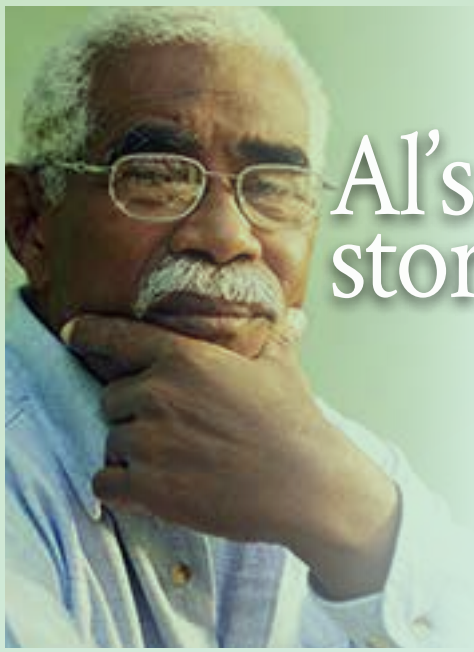
Memory Conditions at a Glance

Alzheimer's disease—A disease that causes large numbers of nerve cells in the brain to die. This makes it hard for a person to remember things, think clearly, and make good judgments. The symptoms begin slowly and get worse over time.

Mild cognitive impairment—Also called MCI. It causes people to have more memory problems than other people their age. The signs of MCI are not as severe as those of Alzheimer's disease. They include losing things often, forgetting to go to events and appointments, and having more trouble coming up with the right words than other people their age. MCI may be an early sign of Alzheimer's.

Vascular dementia—A medical condition caused by small strokes or changes in the brain's blood supply. Signs can appear suddenly. They include changes in memory, language, thinking skills, and mood.

Al's story



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Al didn't know what was happening. He was having a hard time remembering things. He wasn't eating or sleeping well and didn't want to see friends. He was confused and irritable.

His wife was worried. She took him to the doctor. It turned out that Al was having a bad reaction to one of his medicines. Once his doctor changed the medicine, Al felt more like himself.

Mary's story

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Mary couldn't find her car keys. Not on the hook just inside the front door, or in her purse. Finally, she found them on her desk. Yesterday, it was her neighbor's name. Her memory was playing tricks on her. She was worried.

So she went to her doctor for a check-up. She was fine. Her forgetfulness was a normal part of aging. The doctor suggested that Mary take a class, play cards with friends, or help out at the local school to sharpen her memory.

What is a serious memory problem?

Serious memory problems make everyday things hard to do. You may find it hard to drive, shop, or even talk with a friend. Signs of serious memory problems may include:

- asking the same questions over and over again
- getting lost in places you know well
- not being able to follow directions
- becoming more confused about time, people, and places
- not taking care of yourself—eating poorly, not bathing, or being unsafe

What can I do about serious memory problems?

See your doctor if you are having any of the problems listed above. It's important to find out the cause. Once you know, you can get the right treatment.

Help for serious memory problems

What can I do if I'm worried about my memory?

See your doctor. If your doctor thinks your memory problems are serious, you may need a complete health check-up. The doctor will review your medicines and may test your blood and urine. She or he also checks your memory, problem solving, counting, and language skills.

The doctor also may suggest a brain scan to show the normal and problem areas in the brain. Once the cause of the problem is discovered, you can ask what treatment might be best for you.

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What you need to know

There are differences between normal forgetfulness and more serious memory problems. It's important to understand the causes of memory problems and how they can be treated. You can get help for mild and serious memory problems.

See your doctor if you are worried about your memory. It's important to find out what is causing your memory problems.

The following "memory helpers" may help you help your loved ones:

- big calendars to highlight important dates and events
- "to do" lists for each day
- notes about safety in the home
- written directions for using common household items (most people with Alzheimer's disease can still read)

What can family members do to help?

If a family member or friend has a serious memory problem, you can help them live as normally as possible. You can help her or him stay active, go places, and keep up everyday routines. You can remind about the time of day, where he or she lives, and what's happening at home and in the world. You also can help the person remember to take medicine or visit the doctor.

Find Out More

The Department of Health and Human Services sponsors a website, **www.alzheimers.gov**, that links to information about memory loss and Alzheimer's disease, care, and services. It is a one-stop web portal directing you to information from the following organizations and others, which can give you information about memory loss, support groups and services, and publications on dementia and Alzheimer's. It can also provide information about research centers and clinical trials and studies.

- **National Institute on Aging (NIA):** Forgetfulness resources; www.nia.nih.gov/health/featured/memory-cognitive-health
- **MedlinePlus:** www.medlineplus.gov; in the Search box, type in "forgetfulness" or "memory" or "Alzheimer's"
- **Eldercare Locator:** Information on home care, adult day care, nursing homes, and more in your community. Phone: 1-800-677-1116; www.eldercare.gov
- **Alzheimer's Disease Education and Referral (ADEAR) Center:** Information on diagnosis, treatment, patient care, caregiver needs, long-term care, and research related to Alzheimer's disease. Phone: 1-800-438-4380; www.nia.nih.gov/alzheimers

NIH Research

The National Institute on Aging (NIA), which leads a broad scientific effort to understand the nature of aging and to extend the healthy, active years of life, is also the primary federal agency for research on Alzheimer's disease and related memory research.

- An analysis funded by the NIA finds that the costs of caring for people with dementia in the United States in 2010 were between $159 billion to $215 billion, and those costs could rise dramatically with the increase in the numbers of older people in coming decades.
- A recent study supported by funding from the NIA found that a variant of a gene involved in cholesterol and lipid production is associated with significantly higher risk of late-onset Alzheimer's disease in African Americans than in non-Hispanic whites of European ancestry. Although preliminary, the findings suggest that the two racial groups may have different genetic risk profiles for the most common form of Alzheimer's dementia.
- The Alzheimer's Disease Neuroimaging Initiative (ADNI), a landmark study in the early detection of Alzheimer's, is seeking volunteers for a new study related to memory concerns. Researchers are recruiting people 65 to 90 years old with a "significant memory concern" but no signs of memory loss or other cognitive impairment. Volunteers will undergo neurological testing and brain imaging. To find out more details on how you can participate, call 1-800-438-4380 or visit www.nia.nih.gov/alzheimers/clinical-trials.
- People with Alzheimer's disease, mild cognitive impairment (MCI), or a family history of Alzheimer's may be able to take part in clinical trials, a type of research study. Healthy people with no memory problems or family history of Alzheimer's also may be able to participate in clinical trials.

Joining a clinical trial or other research study is a way to help fight Alzheimer's disease and other memory diseases and conditions. To find out more:

- Call the Alzheimer's Disease Education and Referral (ADEAR) Center at 1-800-438-4380; www.nia.nih.gov/alzheimers/clinical-trials.
- Check out www.ClinicalTrials.gov.
- See NIH Clinical Research Trials and You at www.nih.gov/health/clinicaltrials.

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Medicines: Use Them Safely

When Jerry, age 71, came home from the drug store with his latest prescription, he placed all his pill bottles on the kitchen counter and counted them. "I take five different medications, and you take four," he said to his wife. "We need a system. We need to know what medicines we have, what they're for, and when we should take them."

Modern medicine has made our lives better in many ways. It has helped us live longer, healthier lives. But people over 65 have to be careful when taking medications, especially when they're taking many different drugs.

Questions To Ask Your Doctor About A New Medicine

- What is the name of the medicine, and why am I taking it?
- How many times a day should I take it? At what times? If the bottle says take "4 times a day," does that mean 4 times in 24 hours or 4 times during the daytime?
- Should I take the medicine with food or without? Is there anything I should not eat or drink when taking this medicine?
- What does "as needed" mean?
- When should I stop taking the medicine?
- If I forget to take my medicine, what should I do?
- What side effects can I expect? What should I do if I have a problem?

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At Your Doctor's Office

If you've gone to your doctor because you don't feel well, the doctor might decide a medicine will help and will write a prescription. Be sure you:

- Tell your doctor or nurse about all the medicines you take whenever a new drug is prescribed.
- Remind your doctor or nurse about your allergies and any problems you have had with medicines, such as rashes, indigestion, dizziness, or mood changes.
- Understand how to take the medicine before you start using it. Ask questions. It might help to write down the answers.

MY MEDICINES

NAME_____

DOSAGE _____

SCHEDULE _____ AM _____ PM_____PM_____ PM_____

NAME_____

DOSAGE _____

SCHEDULE _____ AM _____ PM_____PM_____ PM_____

NAME_____

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SCHEDULE _____ AM _____ PM_____PM_____ PM_____

For more information about
your medication or to learn more about your health visit…

MedlinePlus.gov

THE WEB SITE YOUR DOCTOR PRESCRIBES

Ask Your Pharmacist

Your pharmacist is an important part of your healthcare team. If you have questions about your medicine after you leave the doctor's office, the pharmacist can answer many of them. For example, a pharmacist can tell you how and when to take your medicine, whether a drug may change how another medicine you are taking works, and any side effects you might have. Also, the pharmacist can answer questions about over-the-counter medications.

Try to have all your prescriptions filled at the same pharmacy so your records are in one place. The pharmacist will keep track of all your medications and will be able to tell you if a new drug might cause problems. If you're not able to use just one pharmacy, show the new pharmacist your list of medicines and over-the-counter drugs when you drop off your prescription.

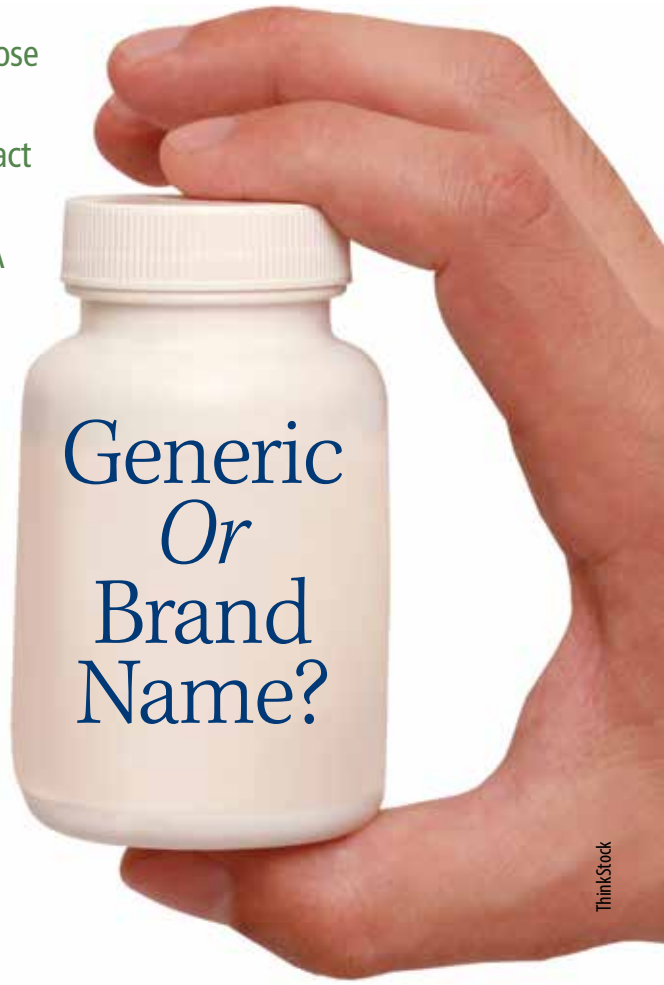
When you have a prescription filled:

- Tell the pharmacist if you have trouble swallowing pills. There may be liquid medicine available. Do not chew, break, or crush tablets without first finding out if the drug will still work.
- Make sure you can read and understand the name of the medicine and the directions on the container and on the color-coded warning stickers on the bottle. If the label is hard to read, ask your pharmacist to use larger type.
- Check that you can open the container. If not, ask the pharmacist to put your medicines in bottles that are easier to open.
- Ask about special instructions on where to store a medicine. For example, should it be kept in the refrigerator or in a dry place?
- Check the label on your medicine before leaving the pharmacy. It should have your name on it and the directions given by your doctor. If it doesn't, don't take it, and talk with the pharmacist.

When getting a prescription filled, sometimes you can choose between either a generic or brand name drug.

Generic and brand name medicines are alike because they act the same way in the body. They contain the same active ingredients—the part of the medicine that makes it work. A generic drug is the same as a brand name drug in dosage, safety, strength, quality, the way it works, the way it is taken, and the way it should be used. Generic drugs usually cost less.

If you want a generic drug, ask your healthcare provider if that's a choice. Not all drugs are available in the generic form, and there might be medical reasons your doctor prefers the brand name medicine.



What About Over-The-Counter Medicines?

Be careful when taking an OTC drug. For example, don't take a cough and cold product if you only have a runny nose and no cough. And, check with your doctor before taking aspirin if you are on a blood-thinning medicine, because aspirin also slows blood clotting.

Other things to remember:

- Measure the dose of a liquid OTC medicine as carefully as you would a prescription drug. Use a measuring spoon, since spoons you eat with vary in size.
- Be careful—OTC medicines can have side effects.
- Take the amount suggested on the label. If you don't get better, see your doctor.
- Read the label—even if you have used the OTC product in the past. Important information can change.
- Remember, medicines—whether prescription or over-the-counter—can hurt you if they aren't used the right way. Learn to be a smart consumer of medicine.

Shopping For Medicines Online

Medicines can cost a lot. If you have a drug plan through your insurance, you can probably save money by ordering yours from them rather than at your neighborhood pharmacy. Or, you might be thinking about buying yours on the Internet. But how can you tell which websites are safe and reliable? The Food and Drug Administration (see For More Information) has more information on buying medicines and medical products online.

Now, It's Your Turn

Your doctor has prescribed a medicine. The pharmacist has filled the prescription. Now it's up to you to take the medicine safely. Here are some tips that can help:

- Make a list of all the medicines you take, including over-the-counter products and dietary supplements. Show it to all of your healthcare providers including physical therapists and dentists. Keep one copy in your medicine cabinet and one in your wallet or pocketbook. The list should include the: name of each medicine, doctor who prescribed it, reason it was prescribed, amount you take, and time(s) you take it.
- Read and save in one place all written information that comes with the medicine.
- Take your medicine in the exact amount and at the time your doctor prescribes.
- Call your doctor right away if you have any problems with your medicine or if you are worried that it might be doing more harm than good. Your doctor may be able to change your prescription to a different one that will work better for you.
- Use a memory aid to take your medicines on time. Some people use mealtime or bedtime as a reminder to take their medicine. Other people use charts, calendars, and weekly pill boxes. Find a system that works for you.
- Do not skip doses of medication or take half doses to save money. Talk with your doctor or pharmacist if you can't afford the prescribed medicine. There may be less costly choices or special programs to help with the cost of certain drugs.
- Avoid mixing alcohol and medicine. Some medicines may not work correctly or may make you sick if taken with alcohol.
- Take your medicine until it's finished or until your doctor says it's okay to stop.
- Don't take medicines prescribed for another person or give yours to someone else.
- Don't take medicine in the dark. To avoid making a mistake, turn your light on before reaching for your pills.
- Check the expiration dates on your medicine bottles. Your pharmacist can probably tell you how to safely get rid of medicine you no longer need or that is out of date. The pharmacist might be able to dispose of it for you.
- Make sure you store all medicines and supplements out of sight and out of reach of children. And don't take your medicines in front of young children. They might try to copy you.

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Medicare Prescription Drug Plans

Medicare has prescription drug plans for people with Medicare to help save money on medicines. For information please call 1-800-633-4227 (1-800-MEDICARE) or visit the Medicare website at www.medicare.gov.

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Find Out More

- **National Institute on Aging (NIA) Information Center**
  1-800-222-2225 (toll-free)
  1-800-222-4225 (TTY/toll-free)
  www.nia.nih.gov/health
  www.nia.nih.gov/espanol

To sign up for regular email alerts about new publications and other information from the NIA, go to www.nia.nih.gov/health.

- **MedlinePlus:** www.medlineplus.gov. Type in "medicines" in the Search box. Also, click on "Drugs & Supplements" to search for specific medicines.
- **Visit www.nihseniorhealth.gov,** a senior-friendly website from the NIA and the National Library of Medicine. This website has health and wellness information for older adults. Special features make it simple to use. For example, you can click on a button to have the text read out loud or to make the type larger.
- **Centers for Medicare and Medicaid Services**
  7500 Security Boulevard
  Baltimore, MD
  21244-1850
  1-800-633-4227 (1-800-MEDICARE/toll-free)
  www.medicare.gov
- **Food and Drug Administration**
  10903 New Hampshire Avenue
  Silver Spring, MD 20993
  1-888-463-6332 (toll-free)
  www.fda.gov
- **Partnership for Prescription Assistance**
  1-888-477-2669 (toll-free)
  www.pparx.org

HEALTHLINES

Scientific Breakthrough: Creating a See-Through Brain

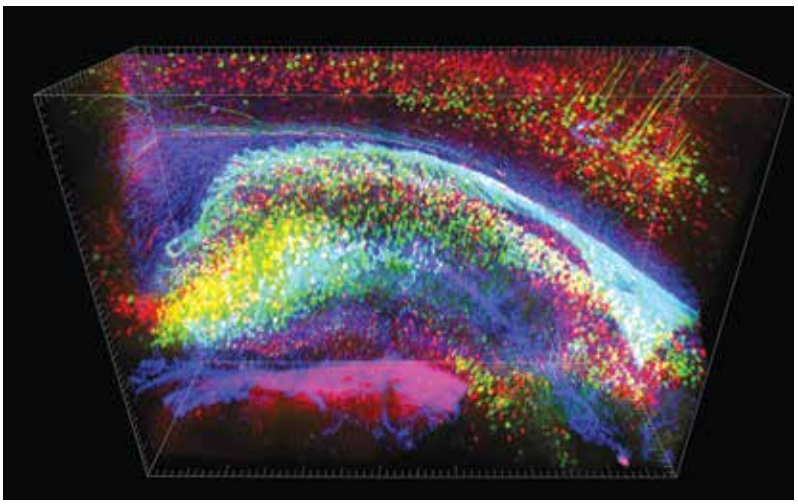

Photo: Kwanghun Chung, Ph.D., and Karl Deisseroth, M.D., Ph.D., Stanford University

▲CLARITY provided this 3D view showing a thick slice of a mouse brain's memory hub, or hippocampus. It reveals a few different types of cells: projecting neurons (green), connecting interneurons (red), and layers of support cells, or glia (blue). Conventional 2D methods require that brain tissue be thinly sliced, sacrificing the ability to analyze such intact components in relation to each other. CLARITY permits such typing of molecular and cellular components to be performed repeatedly in the same brain.

Scientists have created a new way to study the brain. They replaced the fat that gives brain cells their structure with a clear gel. The end result is a whole brain that's see-through.

"This feat of chemical engineering promises to transform the way we study the brain's anatomy and how disease changes it," says Thomas R. Insel, M.D. He directs NIH's National Institute of Mental Health, which helped fund the research.

Scientists studying cells, molecules, and other fine details have been doing it by slicing brain tissue into extremely thin sections. It's time consuming and difficult to relate the fine structure to the bigger picture of how the brain is wired.

This breakthrough method, called CLARITY, allows scientists to see both the details and the big picture. There's no slicing. The gel holds the brain intact so it can be studied as the three-dimensional organ it is. The gel is permeable, so features such as proteins and genes can be highlighted with stains.

"CLARITY has the potential to unmask the fine details of brains from people with brain disorders without losing larger-scale circuit perspective," says NIH Director Francis S. Collins, M.D., Ph.D.

Researchers at Stanford University developed the technique. It's for use only on tissue recovered after death. The Stanford team has used it to study an intact mouse brain and portions of a human brain.

Giving Statins a Second Chance

A new study finds that most people who quit statins because of side effects can tolerate them when tried a second time. Statins are drugs that lower cholesterol to prevent heart disease. The study found more than 90 percent of people who quit had success when they tried again (for example, with a lower dose or a different statin).

"There are potentially millions of patients who could take statins again and ultimately reduce their risk of heart disease," says researcher Alexander Turchin, MD., of Brigham and Women's Hospital. He suggests it's something doctors and patients should discuss.

The research team examined the electronic medical records of people who had been prescribed a statin at two Boston hospitals. Researchers developed software that allowed them to scour more than 5 million notes on more than 100,000 patients covering nearly a decade. Researchers say a clinical trial would be an important next step. NIH's National Library of Medicine helped fund the study.

Anti-Smoking Med Shows Promise for Treating Alcohol Dependence

A smoking-cessation medicine may be a viable option for treatment of alcohol dependence, according to a study by scientists at the National Institute on Alcohol Abuse and Alcoholism (NIAAA). The study found that varenicline (marketed under the name Chantix), approved in 2006 to help people stop smoking, significantly reduced alcohol consumption and craving among people who are alcohol-dependent. The findings were published online in the *Journal of Addiction Medicine*.

"This is an encouraging development in our effort to expand and improve treatment options for people with alcohol dependence," says Kenneth R. Warren, Ph.D., acting director of NIAAA. This study is the first multi-site clinical trial to test the effectiveness and safety of varenicline in a population of smokers and nonsmokers with alcohol dependence. Alcohol craving was significantly reduced in people treated with varenicline. The study was conducted under the direction of NIAAA.

Info to Know

NIH Quickfinder

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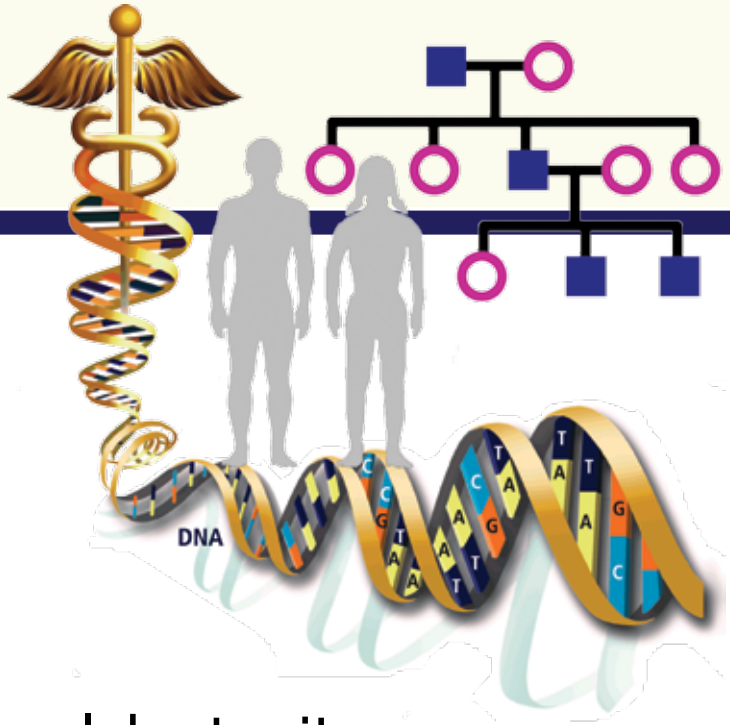

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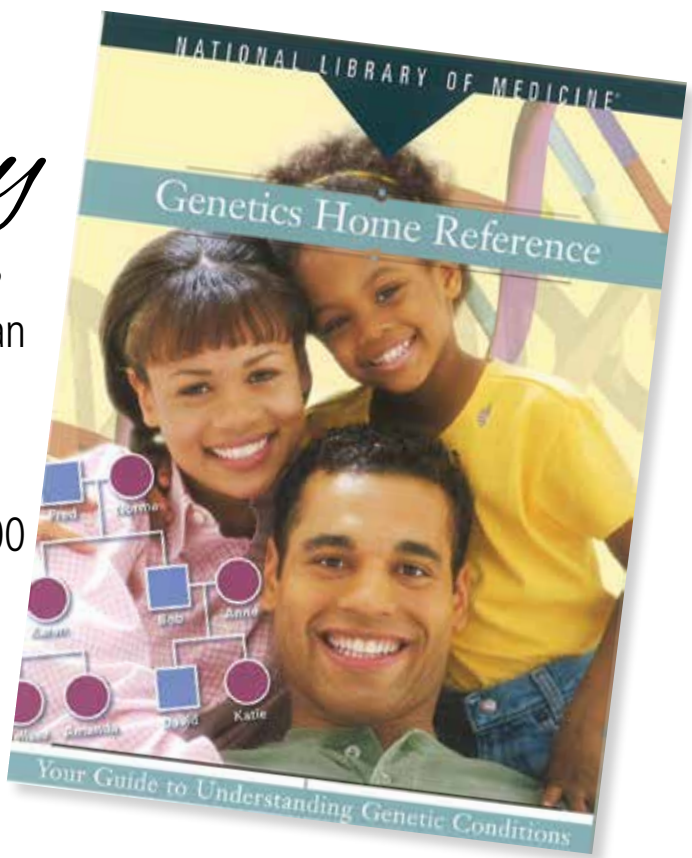

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