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Summer 2012

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Why it's important and what you can do

- **Basic Research for Better Health**

NIGMS marks 50 years of discovery

- **Celebrities have heart problems, too**

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Understanding Heart Health

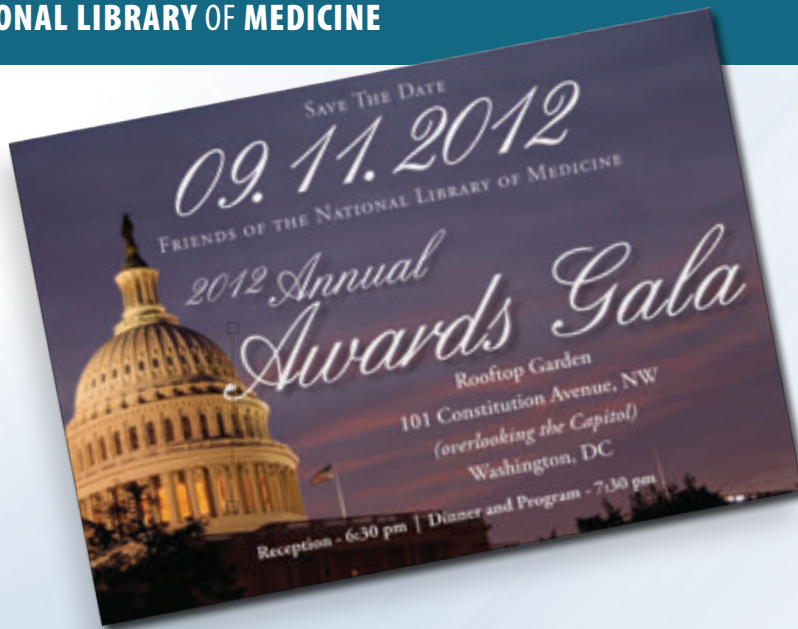
Avoiding high cholesterol and heart disease

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Photo: NLM

Donald West King, M.D.
FNLM Chairman & President



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Photo: John Edward Porter

John Edward Porter

We are delighted once again to announce that the Friends will hold an Awards Gala to celebrate advances in public health, medicine, and health communications, as well as the individuals and organizations dedicated to this cause. The 2012 Gala will bring together representatives from the public, professional, and business sectors in health care to show their support for the Library.

For their achievements and support of the advancement of health, four recipients will be honored:

- **Paul Rogers Award for Public Service:** The Honorable John Edward Porter, longtime U.S. Congressman from Illinois' 10th district, currently chair of Research!America and vice-chair of the Foundation for the NIH, and a partner in the international law firm of Hogan Lovells US LLP
- **Distinguished Medical Science Award:** Alfred Sommer, MD, MHS, Professor, Johns Hopkins Bloomberg School of Public Health
- **Distinguished Health Communications Award:** Karen Hunter, Senior Vice President Global Academic & Customer Relations, Elsevier
- **Michael DeBakey Library Services Outreach Award:** Anna Ercoli Schnitzer, MLIS, Disabilities Librarian, Taubman Health Sciences Library, University of Michigan

We hope that you will join us for this gala evening!

Sincerely,
Donald West King, M.D., Chairman & President
Friends of the National Library of Medicine



Photo: Dr. Alfred Sommer

Alfred Sommer, M.D., MHS



Photo: Anna Ercoli Schnitzer

Anna Ercoli Schnitzer, MLIS

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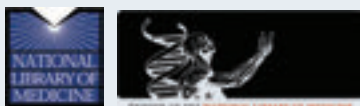
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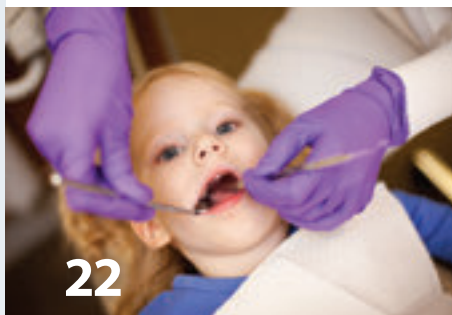
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The National Institutes of Health (NIH)—the Nation's Medical Research Agency—includes 27 Institutes and Centers and is a component of the U.S. Department of Health and Human Services. It is the primary federal agency for conducting and supporting basic, 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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From the Director:

The Weight of the Nation

Obesity has become one of the greatest health challenges facing Americans today. In May, a groundbreaking HBO documentary series on the U.S. obesity epidemic—*The Weight of the Nation*—featured National Institutes of Health Director Dr. Francis S. Collins. His remarks and those of others, plus 12 bonus short films, are available for viewing at theweightofthenation.hbo.com/. Dr. Collins had this to say on the following:

Obesity's dangerous impact:

If you were told your child is at risk for cancer, that would get your attention. If you were told your child is at risk for some sort of brain disease, that would get your attention. Well, obesity ought to be on that list. If we don't succeed in turning this epidemic around, we are going to face, for the first time in our history, a situation in which our children are going to live shorter lives than we do.

The challenging complexity of obesity:

Obesity is an enormously complex problem, with inputs from several places. Genetics is one—we know that about 60-to-70 percent of the risks of obesity are inherited. If we don't now take this as an urgent, national priority, we are all—individually and as a nation—going to pay a very serious price.

Obesity, especially in the abdominal area, makes you resistant to your own insulin. So what happens? Your pancreas tries to keep up by making more insulin to keep your blood glucose from rising too high. Ultimately, it gets exhausted, and the cells that are making the insulin are now themselves sick, because of being over-stimulated. Then, diabetes ensues.

The threat to our children:

We never thought that type 2 diabetes would occur in 10 or 12 year olds; but now it's not uncommon to see that. These are serious consequences. And the tendency to dismiss this or to, perhaps, even see it in some cultures as a norm, is getting in the way of recognizing this as a real public health emergency.

This is a tragedy. After all of these years of building up our health care in order that people are saved from premature disability and death, we could lose these gains. It could hardly be more serious, when you think about it in those terms. Do you want your children and your grandchildren to inherit a society where their hopes for a long and healthy life are not even as good as yours were?

The promise of research and public understanding:

We are not doomed to this situation. But it takes diverse and rigorous research to understand obesity and to identify interventions that work in the real world. The results from federally funded research can help to prevent and treat obesity and its complications.

NIH Director Dr. Francis Collins is interviewed for the HBO series The Weight of the Nation.





The statistics are dramatic: More than two-thirds of U.S. adults are overweight or obese, while nearly one-third of the nation's children and teens are overweight or obese. Obesity contributes to five of the 10 leading causes of death in the U.S.—heart disease, type 2 diabetes, cancer, stroke, and kidney disease.

Dr. Francis Collins shows *The Colbert Report* host Stephen Colbert what five pounds of fat looks like—using a synthetic prop—as part of their discussion of *The Weight of the Nation*.

A National Epidemic That Weighs On Us All

In mid-May, a multi-part television series that takes a hard look at all aspects of obesity in the U.S. debuted on HBO and online. *The Weight of the Nation* included four documentary films, 12 bonus short films, an interactive website, an online social media campaign, a companion book, and screening kits for nationwide outreach to more than 40,000 community-based organizations.

Scientific guidance for the series was provided by members of the NIH obesity research task force*. NIH-funded research progress on obesity already includes:

- finding effective lifestyle changes that can be implemented in communities to reduce weight, lower risk factors for heart disease, and prevent or delay type 2 diabetes
- identifying new targets and pathways for prevention and treatment of obesity, including the role of sleep, and how bacteria in the intestine may have an impact on obesity
- showing that exposure in the womb to maternal obesity or diabetes may increase the risk of obesity or diabetes in offspring, suggesting a critical period for intervention
- investigating genetic factors contributing to obesity and its complications

*The NIH obesity research task force members that provided scientific guidance for the HBO series included the National Institute of Diabetes and Digestive and Kidney Disorders (NIDDK), the National Heart, Lung, and Blood Institute (NHLBI), the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), and the National Cancer Institute (NCI). The series is a presentation of HBO and the Institute of Medicine (IOM), in association with the NIH and the Centers for Disease Control and Prevention (CDC), in partnership with the Michael & Susan Dell Foundation and Kaiser Permanente.

To Find Out More

Obesity

www.nlm.nih.gov/medlineplus/obesity.html

Obesity in Children

www.nlm.nih.gov/medlineplus/obesityinchildren.html

NIH's obesity research links

<http://www.obesityresearch.nih.gov/>

NIH's obesity research task force

<http://dpcpsi.nih.gov/council/pdf/CoC-112008-Nabel-Rodgers-ORTF.pdf>

Understanding Cholesterol and Heart Health

Many Americans do not understand the role that cholesterol—a fat-like substance found in all cells of the body—plays in heart health and heart disease. When there is too much cholesterol in the blood, cholesterol can build up on artery walls and slow or stop blood flow to the heart.

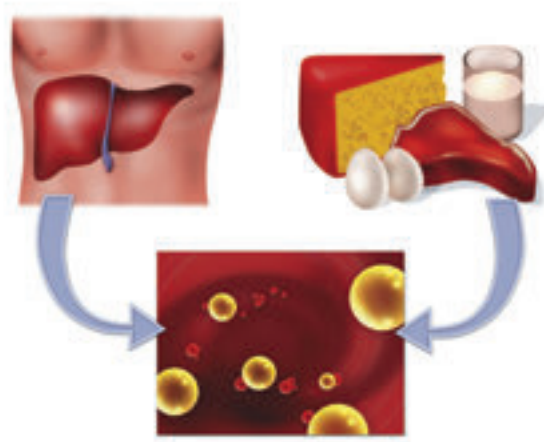
Here's what you need to know . . .

To understand high blood cholesterol it helps to learn about cholesterol, a waxy, fat-like substance found throughout the body.

Our bodies need some cholesterol to make hormones, vitamin D, and substances that help digest foods. Our bodies make all the cholesterol we need. However, cholesterol also is found in some of the foods we eat.

Cholesterol travels through the bloodstream in small packages called lipoproteins. These packages are made of fat (lipids) on the inside and proteins on the outside. Two main kinds of lipoproteins carry cholesterol throughout the body:

- Low-density lipoproteins (LDL): LDL cholesterol sometimes is called “bad” cholesterol. A high LDL level leads to a buildup of cholesterol in your arteries. (Arteries are blood vessels that carry blood from your heart to your body.)
- High-density lipoproteins (HDL): HDL cholesterol sometimes is called “good” cholesterol. This is because HDL carries cholesterol from other parts of your body back to your liver. Your liver removes the cholesterol from your body.



The liver (upper left) produces cholesterol (bottom). We also get cholesterol from what we eat, especially meat and dairy products.

Illustration: iStockphoto

Having healthy levels of both types of lipoproteins is important.

High Blood Cholesterol and Triglycerides

High blood cholesterol is a condition in which you have too much cholesterol in your blood. By itself, the condition usually has no signs or symptoms. So, many people don't know that their cholesterol levels are too high.

People who have high blood cholesterol have a greater chance of getting coronary heart disease, also called coronary artery disease. Coronary heart disease is a condition in which plaque builds up inside the coronary (heart) arteries. Plaque is made up of cholesterol, fat, calcium, and other substances found in the blood.

When plaque builds up in the arteries, the condition is called *atherosclerosis*. Atherosclerosis can lead to serious problems, including heart attack, stroke, or even death. The higher the level of LDL cholesterol in your blood, the GREATER your chance is of developing heart disease. The higher the level of HDL cholesterol in your blood, the LOWER your chance is of developing heart disease.



Dr. Michael Lauer and his wife, Dr. Robin Avery, agree on the health benefits of a diet that emphasizes vegetables, fruits, and whole grains.

High Blood Cholesterol

Q & A

with
Dr. Michael Lauer

Michael Lauer, M.D., is the director of the Division of Cardiovascular Sciences at the National Heart, Lung, and Blood Institute (NHLBI). Recently, he discussed progress on high cholesterol research.

As our nation gets heavier and older, what does recent research on cholesterol and heart health tell us that Americans need to understand?

We are making progress. A newly released survey from the Centers for Disease Control and Prevention (CDC) shows that only 13 percent of Americans have elevated cholesterol levels, down 27 percent over the past 10 years. We think this is because of better diet and greater use of statins. Americans need to understand that the “cholesterol hypothesis” is for real—there no longer is any question that elevated cholesterol causes atherosclerosis, and that, in appropriate settings, reducing cholesterol is the way to go.

What is the current status of treatment for very high cholesterol? And how effective is that treatment?

We treat very high cholesterol levels with a combination of diet and drugs, mostly statins, sometimes in combination with other medications. There is clear evidence that statins reduce the risk of major clinical events—such as heart attack and stroke—in people with very high cholesterol.

Does research hold promise that someday we can better treat cholesterol problems?

Yes. There is now evidence that a monoclonal antibody to the enzyme PCSK9 can substantially reduce cholesterol levels, both in healthy volunteers and in people with familial hypercholesterolemia (a genetic cause of very high cholesterol).

Do gene-based challenges like familial hypercholesterolemia perhaps hold a key to how we understand cholesterol in all people?

Yes. Our understanding of the role of the LDL-receptor contributed to the eventual discovery of statins and their potential role in preventing heart attacks and strokes. Current work on PCSK9, which binds to and degrades the LDL-receptor is, in a way, a continuation of the same theme.

What would you say are areas of promising research related to high cholesterol and blood fat?

There are a number of exciting avenues, in addition to the PCSK9-based treatment:

- Determining the role, if any, of niacin (a vitamin) and ezetimibe (a drug that inhibits the absorption of cholesterol by the small intestine) as complementary agents to statins.
- Determining the role of anti-inflammatory therapies on top of statins, which themselves have anti-inflammatory properties. NHLBI is funding a large-scale trial of the drug methotrexate in high-risk patients with vascular disease. We have come to appreciate that hypercholesterolemia (gene-based high cholesterol) and chronic inflammation are tightly intertwined.
- Determining whether it’s possible to “transform” fat from primarily white (energy-storing) to primarily brown (energy-burning) forms, thereby correcting the metabolic abnormalities associated with obesity.
- Evaluating the “local effects” of fat. For example, Dr. Caroline Fox and her colleagues at the Framingham Heart Study are finding that fat collections in the pericardium (the sack around the heart) may have direct toxic effects on the coronary arteries.

Measuring Cholesterol Levels

Everyone age 20 and older should have his or her cholesterol measured at least once every five years. A blood test called a lipoprotein panel can help show whether you're at risk for coronary heart disease by looking at substances in your blood that carry cholesterol. This blood test is done after a 9-to-12-hour fast (no eating) and gives information about your:

- **Total cholesterol**—a measure of the total amount of cholesterol in your blood, including low-density lipoprotein (LDL) cholesterol and high-density lipoprotein (HDL) cholesterol.
- **LDL (bad) cholesterol**—the main source of cholesterol buildup and blockage in the arteries
- **HDL (good) cholesterol**—HDL helps remove cholesterol from your arteries
- **Triglycerides**—another form of fat in your blood that can raise your risk for heart disease

Risk Factors

Major Risk Factors That Affect Your LDL Goal

- **Cigarette smoking**
- **High blood pressure** (140/90 mmHg or higher or on blood pressure medication)
- **Low HDL cholesterol** (less than 40 mg/dL)
- **Family history** of early heart disease (heart disease in father or brother before age 55; heart disease in mother or sister before age 65)
- **Age** (men 45 years or older; women 55 years or older)

See how your cholesterol numbers compare to the table below:

Total Cholesterol Level	Category
Less than 200mg/dL	Desirable
200-239 mg/dL	Borderline high
240mg/dL and above	High
LDL (Bad) Cholesterol Level	LDL Cholesterol Category
Less than 100mg/dL	Optimal
100-129mg/dL	Near optimal/above optimal
130-159 mg/dL	Borderline high
160-189 mg/dL	High
190 mg/dL and above	Very High
HDL (Good) Cholesterol Level	HDL Cholesterol Category
Less than 40 mg/dL	A major risk factor for heart disease
40—59 mg/dL	The higher, the better
60 mg/dL and higher	Considered protective against heart disease

Source: National Heart, Lung, and Blood Institute

On the Cover ...



Celebrities today are not shy about reporting their struggles with heart disease—whether it is a heart attack, heart surgery, or a stroke. This issue's cover celebrities have all had heart problems of one kind or another. As a result, they often speak out about heart health.

- 1—**Miley Cyrus:** Non-life threatening rapid heartbeat (tachycardia).
- 2—**Bruce Johnson:** Veteran television journalist survives a heart attack at 42.
- 3—**Bill Clinton:** 90% artery blockage led to 2004 heart surgery and much healthier diet.
- 4—**Dick Cheney:** A smoker for almost 20 years, he had the first of five heart attacks at age 37.
- 5—**Barbara Walters:** ABC journalist had heart valve replacement surgery in 2010.
- 6—**Star Jones:** Signs of heart disease helped her lose weight and have heart surgery.
- 7—**Robin Williams:** Heart valve replacement surgery corrected an irregular heartbeat.
- 8—**Toni Braxton:** High blood pressure and a heart flutter helped the singer adopt healthier eating and exercise.
- 9—**Jennie Garth:** A family history of heart disease and a leaky heart valve have the actress on her guard.
- 10—**Shaun White:** Born with a heart defect, the Olympic snowboarder had two heart operations to overcome the challenges.

What Affects Cholesterol Levels?

A variety of things can affect cholesterol levels. These are things you can do something about:

- **Diet.** Saturated fat and cholesterol in the food you eat make your blood cholesterol level rise. Saturated fat is the main problem, but cholesterol in foods also matters. Reducing the amount of saturated fat and cholesterol in your diet helps lower your blood cholesterol level.
- **Weight.** Being overweight is a risk factor for heart disease. It also tends to increase your cholesterol. Losing weight can help lower your LDL and total cholesterol levels, as well as raise your HDL and lower your triglyceride levels.
- **Physical Activity.** Not being physically active is a risk factor for heart disease. Regular physical activity can help lower LDL (bad) cholesterol and raise HDL (good) cholesterol levels. It also helps you lose weight. You should aim to be physically active for 30 minutes on most, if not all, days.

Things outside of your control that also can affect cholesterol levels include:

- **Age and Gender.** As women and men get older, their cholesterol levels rise. Before the age of menopause, women have lower total cholesterol levels than men of the same age. After the age of menopause, women's LDL levels tend to rise.
- **Heredity.** Your genes partly determine how much cholesterol your body makes. High blood cholesterol can run in families.

New Cholesterol Recommendations Expected by End of 2012

In May of this year, an important study on HDL cholesterol was published in *The Lancet* medical journal, questioning its beneficial effects concerning heart disease.

The study tested the hypothesis that genetically raised HDL (good) cholesterol might protect against heart attack. The authors concluded that some genetic mechanisms that raise HDL cholesterol do not appear to lower the risk of heart attack. "This outstanding research provides some insight as to why HDL clinical trials have been disappointing," says Michael Lauer, M.D., director of the Division of Cardiovascular Sciences at the National Heart, Lung, and Blood Institute (NHLBI).

New clinical practice guidelines on the detection, evaluation, and treatment of high blood cholesterol are expected to be released at the end of 2012. These guidelines will be available at www.nhlbi.nih.gov/guidelines/cholesterol/atp4/index.htm

All in the Family

When High Blood Cholesterol Occurs in Families

Katherine Wilemon is lucky to be alive today. When she experienced the symptoms of a first heart attack in 2006 at age 38, she had trouble convincing even paramedics and other medical personnel that she was a prime candidate for an attack.



Photo: Katherine Wilemon

Katherine Wilemon and her 5-year-old daughter Ella both have the genetic condition called familial hypercholesterolemia (FH).

But that is the reality for Wilemon and thousands of men and women suffering from familial hypercholesterolemia, or FH, a genetic disorder in which bad cholesterol (LDL) bathes the arteries from birth. The cholesterol builds up in the body, clogging the arteries and threatening the heart. Wilemon's body has no natural way to get rid of those high levels of blood fat. FH is a devastating disease that kills people at a very young age.

FH is an inherited genetic condition. Those with FH who inherit a single faulty gene from a parent typically have an LDL cholesterol level two to three times higher than normal. Those with FH who inherit two faulty genes—one from each parent—have LDL levels from three to six times higher than normal.

People with one faulty gene who go untreated with medications can anticipate having a heart attack or other cardiac event in their 40s or 50s; those with two faulty genes, left

“If there is premature heart disease in your family, talk with your healthcare provider about FH and get tested.”

untreated, typically have a cardiac event in their late teens or early 20s.

Diagnosed with high cholesterol at the age of 15, Wilemon was not actually diagnosed with FH until after her heart attack in 2006. That was when Dr. John Guyton,

a lipidologist at Duke University, thoroughly explained the condition to her.

People with FH need to follow a heart-healthy diet and get regular exercise. The total amount of fat eaten should be no more than 30 percent of the total daily calories.

But a healthy diet and exercise are not enough for people with FH. To lower the cholesterol level sufficiently, a person with FH must be placed on significant medication at an early age. A number of cholesterol-lowering medications are currently used. The first and more effective choice are drugs called “statins.”

Today, Wilemon has become a tireless advocate for more FH research and for the need to make more people

aware of the genetic condition. “The consensus among experts is that only 20 percent of those with FH in the U.S. have been diagnosed,” she says. “I was not properly diagnosed with FH in either of two trips to the emergency room prior to my first heart attack, or even after the installation of a stent.”

Her own 5-year-old daughter has inherited FH, which gives Wilemon even more urgency to bring the disease into greater visibility among the public and physicians. “She and tens of thousands of other children deserve greater awareness of FH, so that they receive proper treatment and avoid premature cardiac events,” Wilemon says.

She recently started a non-profit organization—the FH Foundation—to raise awareness about the genetic condition, which health professionals estimate could affect somewhere between one in 500 to even one in 300 Americans.

If there is premature heart disease in your family,” says Wilemon, “talk with your healthcare provider about FH and get tested.”

To Find Out More

- **MedlinePlus:** www.medlineplus.gov; type “cholesterol” in the Search box.
- **National Heart, Lung, and Blood Institute (NHLBI): Information for patients and the public on heart and vascular diseases:** www.nhlbi.nih.gov/health/public/heart/index.htm
- **NHLBI’s National Cholesterol Education Program booklet:** www.nhlbi.nih.gov/health/public/heart/chol/wyntk.pdf
- **What You Need To Know About High Blood Cholesterol** www.nhlbi.nih.gov/health/public/heart/chol/cholesterol_atglance.htm
- **Your Guide to Lowering Cholesterol with Therapeutic Lifestyle Changes** http://www.nhlbi.nih.gov/health/public/heart/chol/cholesterol_tlc.htm
- **High Blood Cholesterol** www.nhlbi.nih.gov/health/health-topics/topics/hbc/

Lowering Cholesterol Using Therapeutic Lifestyle Changes (TLC)

TLC is a set of lifestyle changes you can make to help lower your LDL cholesterol. The main parts of TLC are:

- **The TLC Diet.** This is a low-saturated-fat, low-cholesterol eating plan that calls for less than 7 percent of calories from saturated fat and less than 200mg of dietary cholesterol per day. The TLC diet encourages you to choose a variety of nutritious and tasty foods. Choose fruits, vegetables, whole grains, low-fat or nonfat dairy products, fish, poultry without the skin, and, in moderate amounts, lean meats. The TLC diet recommends only enough calories to maintain a desirable weight and avoid weight gain. If LDL is not lowered enough by reducing saturated fat and cholesterol intake, the amount of soluble fiber in your diet can be increased. Certain food products that contain naturally occurring substances found in some plants (for example, cholesterol-lowering margarines) can also be added to the TLC diet to boost its LDL-lowering power. More information on the TLC diet is available in the Your Guide to Lowering Your Cholesterol with TLC (www.nhlbi.nih.gov/health/public/heart/chol/cholesterol_tlc.pdf).
- **Weight Management.** Losing weight if you are overweight can help lower LDL and is especially important for those with a cluster of risk factors that includes high triglyceride and/or low HDL levels and being overweight with a large waist measurement (more than 40 inches for men and more than 35 inches for women).
- **Physical Activity.** Regular physical activity (30 minutes on most, if not all, days) is recommended for everyone.
- **Drug Treatment.** Even if you begin drug treatment to lower your cholesterol, you will need to continue your treatment with lifestyle changes. This will keep the dose of medicine as low as possible, and lower your risk in other ways as well. There are several types of cholesterol-lowering drugs available, including:
 - Statins, which block the liver from making cholesterol
 - Bile acid sequestrants, which decrease the amount of fat absorbed from food
 - Cholesterol absorption inhibitors, which decrease the amount of cholesterol absorbed from food and lower triglycerides
 - Vitamins and supplements—Niacin, which blocks the liver from removing HDL and lowers triglycerides, and omega-3 fatty acids, which increase the level of HDL and lowers triglycerides.
- **Your healthcare provider can help decide which type of drug is best for you.**



National Institute of
General Medical Sciences

1962–2012

Five Decades of Discovery

National Institute of General Medical Sciences



Judith H. Greenberg, Ph.D., is acting director of the National Institute of General Medical Sciences. A developmental biologist, she has directed the NIGMS Division of Genetics and Developmental Biology since 1988. She also led the development of the Institute's 2008 strategic plan and its 2011 strategic plan for research training.

“Since 1962, we have supported highly creative people committed to building a broad and deep foundation of discovery.”

It is an honor to mark the 50th anniversary of the National Institute of General Medical Sciences (NIGMS), known to many as NIH's “basic research institute.” Since 1962, we have supported highly creative people committed to building a broad and deep foundation of discovery. Shared with and applied by scientists around the world, these findings have led to new diagnostics, new therapies, and new ways to prevent a wide range of diseases.

Among the advances that scientists have made with NIGMS support are:

- Discovering a gene-silencing process called RNA interference, or RNAi, that is both a powerful research tool and a promising new approach for treating diseases.
- Revealing how a protein's shape affects its function, which plays a key role in health and disease and also informs the design of new drugs.
- Increasing survival from burn injury, in part by improving methods of wound care, nutrition, and infection control.
- Explaining how genes affect the way a person responds to drugs, including those to treat cancer and prevent blood clots.
- Shedding light on the critical functions of carbohydrates, sugar molecules found on all living cells that are vital to fertilization, inflammation, blood clotting, and viral infection.
- Modeling infectious disease outbreaks and the impact of interventions through computer simulations to provide valuable information to public health policymakers.
- Developing new methods to look inside cells and other living systems. These approaches have advanced what we know about basic life processes in a range of organisms.

Basic Research for Better Health

Established in 1962, the National Institute of General Medical Sciences primarily supports research that lays the foundation for advances in disease diagnosis, treatment, and prevention. The Institute's research training programs help prepare the next generation of scientists.

Each year, NIGMS-supported scientists increase our knowledge about fundamental life processes and disease mechanisms. Institute grantees also develop important new tools and techniques.

The vast majority of the Institute's annual funds go into local economies through grants to scientists at universities, medical schools, hospitals, and other research institutions throughout the country. NIGMS supports approximately 4,700 research grants—about 11 percent of the grants funded by NIH as a whole. NIGMS also supports about 26 percent of the trainees who receive assistance from NIH.

The Institute places great emphasis on supporting investigator-initiated research grants. It funds a small number of research center grants in selected fields, including structural genomics, trauma and burn research, systems biology, and biomedical technology. It also supports centers that build research capacities in states that have historically received low levels of NIH funding. In addition, NIGMS supports several important scientific resources, including the NIGMS Human Genetic Cell Repository and the Protein Data Bank.

NIGMS research training programs recognize the interdisciplinary nature of biomedical research and stress approaches that cut across disciplinary and departmental lines. Such experience prepares trainees to pursue creative research careers in a wide variety of areas.

Some NIGMS training programs address areas in which there are particularly compelling needs. One of these, the Medical Scientist Training Program, produces M.D./Ph.D.s who are well trained in both basic science and clinical research. Other programs train scientists to conduct research in rapidly growing areas like biotechnology.

NIGMS also has a Pharmacology Research Associate Program, in which postdoctoral scientists receive training in NIH or Food and Drug Administration (FDA) laboratories.



FASTFACTS

- The National Institute of General Medical Sciences was created in 1962.
- NIGMS supports basic research and scientific training nationwide, increasing understanding of life processes and laying the foundation for advances in the diagnosis, treatment, and prevention of disease.
- Six divisions make up NIGMS: Biomedical Technology, Bioinformatics, and Computational Biology; Cell Biology and Biophysics; Extramural Activities; Genetics and Developmental Biology; Pharmacology, Physiology, and Biological Chemistry; and Training, Workforce Development, and Diversity.
- The 2012 NIGMS budget totals just under \$2.5 billion.
- NIGMS will support about 4,704 research grants and 4,310 research trainees in 2012.
- NIGMS has supported the work of 74 Nobel Prize winners—38 in physiology or medicine, and 36 in chemistry.

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National Institute of
General Medical Sciences

1962–2012

By studying bacteria on healthy skin, Elizabeth Grice hopes to figure out what's different about the microbes on diseased skin—and maybe even find a way to fix the problem.

NIGMS Researcher Explores Skin Cities

By Allison Maclachlan, NIGMS

“The skin is an important organ for human health,” says Elizabeth Grice, Ph.D., a former NIGMS postdoctoral fellow who did her research in an NIH genetics lab. Our skin is home to about a trillion microscopic organisms like bacteria and fungi. Together, they and their genetic material—their genomes—make up the skin’s microbiome.

Grice studies the skin microbiome to learn how and why bacteria live on particular places on the body. Already, she’s found that the bacterial communities on healthy skin are different from those on diseased skin. She hopes her work will point to ways of treating some skin diseases, especially chronic wounds.

Grice earned a bachelor’s degree in biology from Luther College in Decorah, Iowa, where she studied plant genetics. She received a Ph.D. in human genetics and molecular biology from the Johns Hopkins School of Medicine before coming to NIH to tackle bacterial genomics.

Beneficial Bacteria

Bacteria aren’t all bad. Many are harmless, and some are very helpful. On the skin, they can protect us by taking up space where harmful bacteria would otherwise live.

It might sound unhealthy or even dangerous to have skin that’s teeming with bacterial colonies. But your body relies on some of these bacteria as part of its first line of defense. Many bacteria on the skin defend themselves by secreting small proteins that kill harmful invaders. In protecting themselves, they also protect us.

Diverse Settlements

From a study of 20 different skin sites on a group of healthy people’s bodies, Grice and her colleagues identified three types of environments: moist, dry, and sebaceous (oily). They then used a new technique to investigate which bacteria colonize what sites.

They found that moist areas tend to host similar bacterial communities in all of the volunteers. The same holds for dry and oily areas. Even with these patterns, skin microbiomes vary greatly from person to person. Your unique pattern depends on things like your age, sex, sun exposure, diet, hygiene, and even where you live and work.

By getting a sense of bacteria on healthy skin, Grice hopes to figure out what’s different about the microbes on diseased skin—and maybe even find a way to fix the problem. She’s most excited about applying her work to the chronic wounds that are common in people who have diabetes or spend most of their time in beds or wheelchairs.

A Problem Afoot

Almost 24 million Americans have diabetes, and as many as a quarter of them will get a painful wound known as a diabetic foot ulcer. These are very

difficult and expensive to treat. And as obesity rates rise, diabetes—and diabetic foot ulcers—are becoming more common.

“It’s such a far-reaching problem that it’s clearly an area of need,” says Grice. “That’s what really drives me the most.”

She suspects that bacteria make chronic wounds worse because they spur the human immune system to trigger inflammation. Although designed to kill infected cells, inflammation also prevents skin cells from regrowing after an injury.

To investigate what role bacteria play in diabetic wounds, Grice compared healthy lab mice with a group of lab mice bred to display common features of diabetes—like wounds that don’t heal well. She found that the diabetic mice had far fewer types of bacteria on their skin than did the healthy mice.

Grice also observed that small wounds on the diabetic mice healed much more slowly than those on the healthy mice.

In about two weeks, most healthy mice looked as good as new. But most diabetic mouse wounds had barely healed even after a month.

Interestingly, bacterial communities in the wounds became more diverse in both groups of mice as they healed—although the wounds on diabetic mice still had less diversity than the ones on healthy mice.

“Bacterial diversity is probably a good thing, especially in wounds,” says Grice. “Often, potentially infectious bacteria are found on normal skin and are kept in check by the diversity of bacteria surrounding them.”

Grice and her colleagues also found very different patterns of gene activity between the two groups of mice. As a result, the diabetic mice put out a



Photo: Bill Branson, NIH

Elizabeth Grice, a former NIGMS postdoctoral fellow, studies the genetics of bacteria that live on and in humans.

longer-lasting immune response, including inflamed skin. Scientists believe prolonged inflammation might slow the healing process. Grice suspects that one of the main types of bacteria found on diabetic wounds, *Staphylococcus*, activates inflammation.

Knowing more about the bacteria that thrive on diabetic wounds, Grice and her colleagues are a step closer to looking at whether they could reorganize these colonies to help the wounds heal.

More Than Skin Deep

Grice also spends time studying bacteria that live in the intestines. There, too, microbes can be helpful. Certain strains of *E. coli* in our digestive tracts help keep dangerous bacteria at bay. They also produce K- and B-complex vitamins, which our bodies can’t make enough of on their own.

She is involved with a study of Hirschsprung disease. This is a genetic disorder that leaves parts of the digestive tract without enough

nerve endings to push wastes out. Some children born with the disease get a painful inflammation in the gut, but others don’t. Together with NIH geneticist Bill Pavan, Grice is looking at gut bacteria to see if their distribution differs between the two groups.

If they find a pattern, it might help predict which patients will need surgery to reduce inflammation.

Taking Exploration Global

Outside of her work, Grice enjoys traveling to exotic locations to soak up the culture. “I really like experiencing different cultures, and science is so multicultural—you get to interact with a diverse group of people,” she says.

Now working at the University of Pennsylvania, Grice aims to sustain a successful research program, improve the way chronic wounds are managed, and be a good mentor to students. And she hopes to make time for personal goals like traveling to new continents.



National Institute of
General Medical Sciences

1962–2012

For the past five decades, scientists supported by the National Institute of General Medical Sciences have been making discoveries that lead to medical advances.

NIGMS-Supported

Cholesterol May Play a Role in Alzheimer's Disease —Alisa Machalek, NIGMS

Scientists have long known that cholesterol plays a number of roles—both good and bad—in the body. Now, they suspect it might also contribute to the development of Alzheimer's disease.



Photo: iStock Photo

A team of researchers at Vanderbilt University Medical Center in Nashville, Tennessee, used laboratory-made membranes and structural biology techniques to examine how this might happen.

The scientists, led by Charles Sanders, proved that cholesterol can hook up with a protein called APP in the synthesized membranes. Based on other studies, the researchers believe that cholesterol then drives APP into crowded areas of membranes known as lipid rafts. There, enzymes hack off pieces of APP, transforming it into a substance called amyloid beta. Long linked with Alzheimer's, amyloid beta accumulates in the brains of those with the disease.

The Vanderbilt scientists propose that this process leads to Alzheimer's. If so, a drug that prevents cholesterol from connecting to APP might forestall the disease. Such a drug would require many years to develop and test. But, if successful, it might be the first therapy to prevent a condition that affects up to 5 million people in the U.S.

Enzyme Might Help Heal Sun Damage

—Jilliene Mitchell, NIGMS

Too much sun makes your skin wrinkled, burned, and leathery. It also damages your DNA, increasing your risk for cancer. Plants and many animals have an enzyme called photolyase that can repair sun damage. Humans lack it.

Recent studies revealing the workings of photolyase provide a ray of hope for preventing or treating sun damage in people. The research was led by Dongping Zhong, a physicist and chemist at Ohio State University in Columbus.

The scientists first exposed a strand of DNA to ultraviolet (UV) light, causing the same kind of damage as the sun. Then they added photolyase. Using an ultrafast laser as a sort of high-tech flashbulb, they were able to see photolyase in action as it repaired the UV-damaged DNA.

Zhong's group discovered that photolyase sends an electron and a proton to repair the damaged genetic material. After this process, the electron and proton return to the enzyme—possibly to start over and heal other areas.

More research on photolyase might lead to new treatments for skin cancer and better sunscreen products.

Research Results

Why Sleep?—Alison Davis, NIGMS

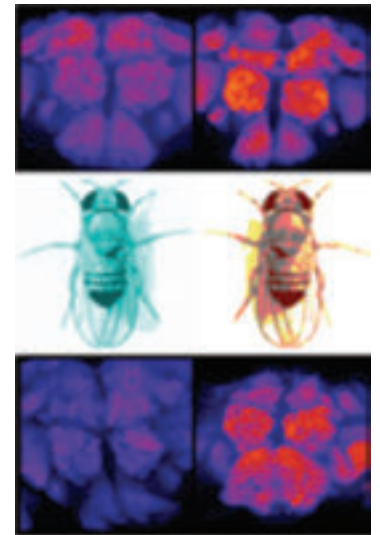
All animals sleep, including flies. Like us, these insects need more sleep if deprived of it; they perk up with caffeine, and their primitive brains have small electrical surges while they snooze.

However, unlike people, flies breed quickly, and since researchers have a detailed knowledge of their genetics and behavior, flies are an ideal model system for studying biology. Scientists are using fruit flies to find out why we sleep—and what happens when we do.

Neuroscientists Chiara Cirelli and Giulio Tononi of the University of Wisconsin-Madison have concluded that sleep refreshes nerve cell connections that become overworked while we are awake.

They found that levels of proteins in synapses—the working ends of nerve cells—plummet at night in well-rested flies, presumably clearing away excess “noise” built up during the preceding day.

The scientists reason that the molecular housecleaning that takes place during sleep readies the brain for learning and allows it to save energy. If proven true in humans, the results could deepen understanding about insomnia and other sleep disorders.



Nerve cell proteins (reddish orange) build up in the brains of sleep-deprived flies (right).

Courtesy: UW Health Public Affairs

A New View of the Flu—Kirstie Saltsman, NIGMS

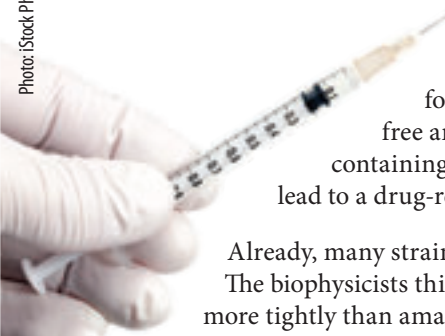
If you’ve ever gotten the flu, you know that we don’t have many drugs to treat it. New information from scientists studying one antinfluenza medicine, amantadine, may pave the way for designing more such drugs.

Biophysicists Mei Hong at Iowa State University and William DeGrado at the University of Pennsylvania discovered how amantadine interacts with a flu protein called M2. This protein launches infection by creating a channel between the flu virus and a healthy cell.

When the researchers determined the detailed, 3-D structure of amantadine bound to M2, they revealed that the drug plugs this channel, preventing infection. They also noticed that amantadine fits loosely inside M2, possibly leaving room for altered versions of the protein to wiggle free and go on to infect a cell. If virus particles containing this version of M2 multiplied, they could lead to a drug-resistant strain.

Already, many strains of the flu resist treatment by amantadine. The biophysicists think that designing drugs that fit into M2 more tightly than amantadine does could provide an effective treatment for the flu that is more difficult for the virus to resist.

Photo: iStock Photo



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Photo: iStock Photo

Is it difficult for you to fall asleep or stay asleep through the night? Do you wake up feeling tired? Do you feel sleepy during the day, even if you think you've had enough sleep? You might have a sleep disorder. There are many treatments for sleep disorders and ways to make sure you are getting enough healthy sleep.

Are You Sleep-Deprived?

Learn More About Healthy Sleep

A variety of conditions plague the sleep of Americans. These sleep disorders include:

- sleep apnea (a condition that causes pauses in breathing, shallow breaths, and occasionally snoring during sleep)
- insomnia (trouble falling or staying asleep)
- restless legs syndrome
- narcolepsy (extreme daytime sleepiness), and
- parasomnias (abnormal sleep behaviors).

Add to those challenges the demands of daily life that require many people to cut short the hours they spend sleeping each night, and the sleep problem becomes even greater, according to Michael J. Twery, Ph.D., director of the National Center on Sleep Disorders Research in NIH's National Heart, Lung, and Blood Institute (NHLBI).

The alarm bell for sleep disorders is that unlike many other medical conditions, your healthcare provider depends on you to explain the problem, which occurs in the privacy of your bedroom while you are sleeping. There is no pain associated with sleep disorders. Instead, people often have daytime symptoms, such as a morning headache or daytime sleepiness. There is no blood test to help diagnose a sleep

disorder. Instead, successful diagnosis depends on the patient. It is important to discuss your symptoms with your physician so he or she can help you determine if you have sleep apnea or another sleep disorder.

"As many as 30 percent or more of U.S. adults are not getting enough sleep," says Dr. Twery. Chronic sleep loss and sleep disorders are estimated to cost the nation as much as \$16 billion in healthcare expenses and \$50 billion in lost productivity.

The consequences can be severe. Drowsy driving, for example, is responsible for an estimated 1,500 fatalities and 40,000 nonfatal injuries each year.

"It's actually quite serious," says Daniel Chapman, Ph.D., MSc, at the Centers for Disease Control and Prevention (CDC). "Drowsy driving was implicated in about 16 percent of fatal crashes and about 13 percent of crashes resulting in hospitalization."

Dr. Chapman says sleep is as important to health as eating right and getting enough physical activity. And research has been finding that lack of sleep—like poor diet and lack of physical activity—has been associated with weight gain and diabetes.

Sleep Disorder Symptoms

Look over this list of common signs of a sleep disorder, and talk to your healthcare provider if you have any of these signs on three or more nights a week:

Photo: Dr. Michael Twery



Michael J. Twery, Ph.D.,
director of the National Center
on Sleep Disorders Research

- It typically takes you more than 30 minutes to fall asleep at night.
- You awaken frequently in the night and have trouble falling back to sleep.
- You awaken too early in the morning.
- You often don't feel well rested despite spending seven to eight hours or more asleep at night.
- You feel sleepy during the day and fall asleep within five minutes if you have an opportunity to nap, or you fall asleep unexpectedly or at inappropriate times during the day.
- Your bed partner reports that you snore loudly, snort, or make choking sounds while you sleep, or your partner notices your breathing stops for short periods.
- You have creeping, tingling feelings in your legs that are relieved by moving or massaging them, especially in the evening or when you try to fall asleep.
- You have vivid, dreamlike experiences while falling asleep or dozing.
- You have episodes of sudden muscle weakness when you are angry or fearful, or when you laugh.
- You feel as though you cannot move when you first wake up.
- Your bed partner notes that your legs or arms jerk often during sleep.
- You regularly depend on wake-promoting products, such as caffeinated beverages, to stay awake during the day.

Also keep in mind that the symptoms of a sleep problem in children can be complicated. Some children may show signs of excessive daytime sleepiness, while others may not do their best in school. Discuss such symptoms with a physician.

The need for sleep may be nine hours or more a night as a person goes through adolescence. At the same time, there is a natural biological tendency for young adults to show a preference for a later bedtime and a later wake time in the morning. This natural tendency to start sleeping later can conflict with daytime schedules, leading to insufficient sleep.

“We think that as many as 70 percent of adolescents are not obtaining enough sleep, according to survey data from the Centers for Disease Control and Prevention,” says Dr. Twery.

The Importance of Sleep

Many people view sleep as merely a “down time,” when their brains shut off and their bodies rest. People may cut back on sleep, thinking it won't be a problem, because other responsibilities seem much more important. But research shows that a number of vital tasks carried out during sleep help people stay healthy and function at their best.

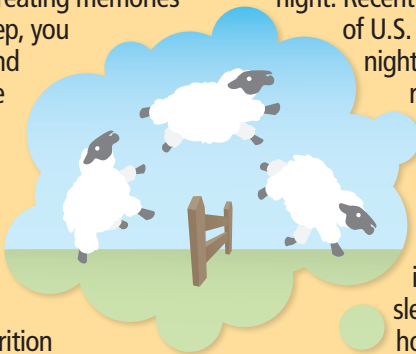
While you sleep, your brain is hard at work forming the pathways necessary for learning and creating memories and new insights. Without enough sleep, you can't focus and pay attention or respond quickly. A lack of sleep may even cause mood problems. Growing evidence shows that a chronic lack of sleep can also increase your risk of obesity, diabetes, cardiovascular disease, and infections.

Despite growing support for the idea that adequate sleep, like adequate nutrition and physical activity, is vital to our well-being, people are sleeping less. The nonstop “24/7” nature of the

world today encourages longer or nighttime work hours and offers continual access to entertainment and other activities. To keep up, people cut back on sleep.

A common myth is that people can learn to get by on little sleep (such as less than six hours a night) with no negative effects. Research suggests, however, that adults need at least seven to eight hours of sleep each night to be well rested. Indeed, in 1910, most people slept nine hours a night. Recent national surveys show that 30 percent of U.S. adults sleep fewer than seven hours a night. As many as 30 percent of adults also report daytime sleepiness so severe that it interferes with work, driving, and social functioning at least a few days each month.

Evidence from other national surveys indicate that 70 percent of adolescents sleep less than the recommended 8 to 9 hours each night. Lack of sleep may have a direct effect on children's health, behavior, and development.



Diagnosing Sleep Disorders

Depending on your symptoms, it may help you to gather information on your sleep behaviors. Your healthcare provider will review this information and consider several possible tests when trying to diagnose a sleep disorder:

Sleep history and sleep log. If you believe you have a sleep problem, consider keeping a sleep diary and bringing it to your next medical appointment. Your physician will ask you how many hours you sleep each night, how often you awaken during the night and for how long, how long it takes you to fall asleep, how well rested you feel upon awakening, and how sleepy you feel during the day. If you don't already keep a sleep diary, your health professional may ask you to keep one for a few weeks. (See sample sleep diary on page 21.) Your provider also may ask you whether you have any symptoms of a sleep disorder, such as loud snoring, snorting or gasping, morning headaches, tingling or unpleasant sensations in the limbs that are relieved by moving them, and jerking of the limbs during sleep. You may want to ask your sleeping partner if you have these symptoms, since you may not be aware of them yourself.

Sleep recording in a sleep laboratory (polysomnogram). A sleep recording or polysomnogram (PSG) is usually done while you stay overnight at a sleep center or sleep laboratory. Electrodes and other monitors are placed on your scalp, face, chest, limbs, and finger. While you sleep, these devices measure your brain activity, eye movements, muscle activity, heart rate and rhythm, blood pressure, and how much air moves in and out of your lungs. This test also checks the amount of oxygen in your blood. A PSG test is painless. In certain circumstances, the PSG can be done at home. A home monitor can be used to record heart rate, how air moves in and out of your lungs, the amount of oxygen in your blood, and your breathing effort.

Multiple sleep latency test (MSLT). This daytime sleep study measures how sleepy you are and is particularly useful for diagnosing narcolepsy. The MSLT is conducted in a sleep laboratory and typically done after an overnight sleep recording (PSG). In this test, monitoring devices for sleep stage are placed on your scalp and face. You are asked to nap four or five times for 20 minutes every two hours during the day. Technicians note how quickly you fall asleep and how long it takes you to reach various stages of sleep, especially REM (rapid eye movement) sleep, during your naps. Normal individuals either do not fall asleep during these short designated naptimes or take a long time to fall asleep. People who fall asleep in less than five minutes are likely to require treatment for a sleep disorder, as are those who quickly reach REM sleep during their naps.



Photo: leopoldphotography.com

At a SleepMed diagnosis and therapy center in Maryland, a participant has his sleep patterns and possible problems diagnosed.

What Are Sleep Studies?

Sleep studies are tests that measure how well you sleep and how your body responds to sleep problems. These tests can help your healthcare provider find out whether you have a sleep disorder and how severe it is. Sleep studies are important because untreated sleep disorders can raise your risk for heart disease, high blood pressure, stroke, and other medical conditions. Sleep disorders also have been linked to an increased risk of injury, such as falling (in the elderly) and car accidents.

Research is helping to improve our understanding of the connection between sleep disorders and the impact of untreated sleep disorders on our physical, mental, and behavioral health. NIH supports a range of sleep-related research that focuses on:

- Better understanding of how a lack of sleep increases the risk for obesity, diabetes, heart disease, and stroke.
- Genetic, environmental, and social factors that lead to sleep disorders.
- The adverse effects from a lack of sleep on body and brain.

Globetrotting to a good night's sleep



A former National Basketball Association (NBA) player and member of the Harlem Globetrotters, David Nash knows the value of a good night's sleep.

That's why, when he began to be troubled by sleep apnea, he talked to his health provider about solutions right away.

Sleep apnea—a condition that causes sufferers to snore, repeatedly awaken, and take in too little oxygen while trying to sleep—affects an estimated 28 million Americans. It is one of the most common and troubling sleep disorders. At least 1 in 10 older adults, and as many as 1 in 5 older adults have sleep apnea.

Like many sleep apnea sufferers, Nash has gotten relief through the use of a continuous positive airway pressure (CPAP) machine, the most common device for treating this problem. With CPAP machines (above), a mask covers the mouth and nose, or sometimes just the nose. The mask is connected to a machine that gently blows air into the throat to keep the airways open. Your healthcare provider will suggest the appropriate treatment based on your individual needs.

When Nash travels as part of his education and outreach work for the National Library of Medicine, he takes the CPAP machine along to make sure he gets a good night's uninterrupted sleep.

To Find Out More

MedlinePlus Sleep Disorders

www.nlm.nih.gov/medlineplus/sleepdisorders.html

NHLBI Your Guide to Healthy Sleep

http://www.nhlbi.nih.gov/health/public/sleep/healthy_sleep.pdf

NHLBI Diseases and Conditions Index (DCI)

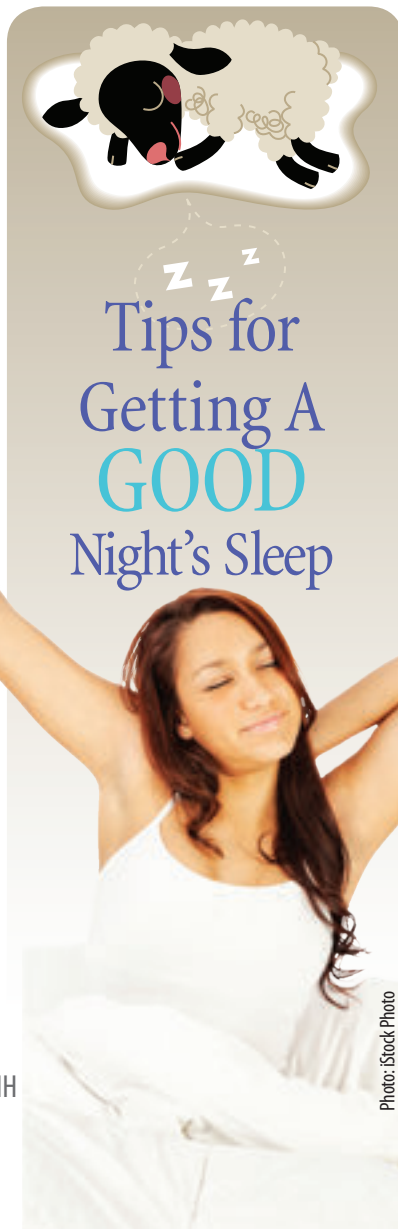
Includes articles on sleep disorders, tests, and procedures, along with videos, podcasts, and Spanish-language articles.

www.nhlbi.nih.gov/health/dci/index.html

NHLBI Health Topics pages for sleep conditions:

- **Sleep Studies:** www.nhlbi.nih.gov/health/health-topics/topics/slpst/
- **Insomnia:** www.nhlbi.nih.gov/health/health-topics/topics/inso/
- **Sleep Apnea:** www.nhlbi.nih.gov/health/health-topics/topics/sleepapnea/

- **Stick to a sleep schedule.** Go to bed and wake up at the same time each day. As creatures of habit, people have a hard time adjusting to changes in sleep patterns. Sleeping later on weekends won't fully make up for a lack of sleep during the week and will make it harder to wake up early on Monday morning.
- **Exercise is great, but not too late in the day.** Try to exercise at least 30 minutes on most days but not later than 2—3 hours before your bedtime.
- **Avoid caffeine and nicotine.** Coffee, colas, certain teas, and chocolate contain the stimulant caffeine, and its effects can take as long as 8 hours to wear off fully. Therefore, a cup of coffee in the late afternoon can make it hard for you to fall asleep at night. Nicotine is also a stimulant, often causing smokers to sleep only very lightly. In addition, smokers often wake up too early in the morning because of nicotine withdrawal.
- **Avoid alcoholic drinks before bed.** Having a "nightcap" or alcoholic beverage before sleep may help you relax, but heavy use robs you of deep sleep and REM sleep, keeping you in the lighter stages of sleep. Heavy alcohol ingestion also may contribute to impairment in breathing at night. You also tend to wake up in the middle of the night when the effects of the alcohol have worn off.
- **Avoid large meals and beverages late at night.** A light snack is okay, but a large meal can cause indigestion that interferes with sleep. Drinking too many fluids at night can cause frequent awakenings to urinate.
- **If possible, avoid medicines that delay or disrupt your sleep.** Some commonly prescribed heart, blood pressure, or asthma medications, as well as some over-the-counter and herbal remedies for coughs, colds, or allergies, can disrupt sleep patterns. If you have trouble sleeping, talk to your healthcare provider or pharmacist to see whether any drugs you're taking might be contributing to your insomnia and ask whether they can be taken at other times during the day or early in the evening.
- **Don't take naps after 3 p.m.** Naps can help make up for lost sleep, but late afternoon naps can make it harder to fall asleep at night.
- **Relax before bed.** Don't overschedule your day so that no time is left for unwinding. A relaxing activity, such as reading or listening to music, should be part of your bedtime ritual.
- **Take a hot bath before bed.** The drop in body temperature after getting out of the bath may help you feel sleepy, and the bath can help you relax and slow down so you're more ready to sleep.
- **Have a good sleeping environment.** Get rid of anything in your bedroom that might distract you from sleep, such as noises, bright lights, an uncomfortable bed, or warm temperatures. You sleep better if the temperature in the room is kept on the cool side. A TV, cell phone, or computer in the bedroom can be a distraction and deprive you of needed sleep. Having a comfortable mattress and pillow can help promote a good night's sleep. Individuals who have insomnia often watch the clock. Turn the clock's face out of view so you don't worry about the time while trying to fall asleep.
- **Have the right sunlight exposure.** Daylight is key to regulating daily sleep patterns. Try to get outside in natural sunlight for at least 30 minutes each day. If possible, wake up with the sun or use very bright lights in the morning. Sleep experts recommend that, if you have problems falling asleep, you should get an hour of exposure to morning sunlight and turn down the lights before bedtime.
- **Don't lie in bed awake.** If you find yourself still awake after staying in bed for more than 20 minutes or if you are starting to feel anxious or worried, get up and do some relaxing activity until you feel sleepy. The anxiety of not being able to sleep can make it harder to fall asleep.
- **See a health professional if you continue to have trouble sleeping.** If you consistently find it difficult to fall or stay asleep and/or feel tired or not well rested during the day despite spending enough time in bed at night, you may have a sleep disorder. Your family healthcare provider or a sleep specialist should be able to help you, and it is important to rule out other health or emotional problems that may be disturbing your sleep.



—Source: *Your Guide to Healthy Sleep*,
National Heart, Lung, and Blood Institute, NIH

One of the best ways you can tell if you are getting enough good quality sleep, and whether you have signs of a sleep disorder, is by keeping a sleep diary. Use this sample diary to get started. —Source: NHLBI



Cut and Carry

Sample Sleep Diary								
Name								
Complete in the Morning	Today's date (include month/day/year):	Mon*	Tues	Wed	Thurs	Fri	Sat	Sun
	Time I went to bed last night:	11 p.m.						
	Time I woke up this morning:	7 a.m.						
	No. of hours slept last night:	8						
	Number of awakenings and total time awake last night:	5 times 2 hours						
	How long I took to fall asleep last night:	30 mins.						
	How awake did I feel when I got up this morning? 1—Wide awake 2—Awake but a little tired 3—Sleepy	2						
Complete in the Evening	Number of caffeinated drinks (coffee, tea, cola) and time when I had them today:	1 drink at 8 p.m.						
	Number of alcoholic drinks (beer, wine, liquor) and time when I had them today:	2 drinks 9 p.m.						
	Nap times and lengths today:	3:30 p.m. 45 mins.						
	Exercise times and lengths today:	None						
	How sleepy did I feel during the day today? 1—So sleepy had to struggle to stay awake during much of the day 2—Somewhat tired 3—Fairly alert 4—Wide awake	1						
* This column shows example diary entries—use as a model for your own diary notes								

Children's Dental Health

Why it's important and what you can do

Despite the fact that it is almost entirely preventable, tooth decay is the most common chronic disease in children. More than 40 percent of children ages 2 to 11 have had a cavity in their primary (baby) teeth, and more than two-thirds of 16- to 19-year-olds have had a cavity in their permanent teeth. Although overall rates of tooth decay have decreased over the past four decades, decay has actually increased in preschool age children in recent years.

The good news is there are safe and effective preventive measures that can protect teeth. Good oral hygiene practices such as thorough brushing with a fluoride toothpaste can help keep children from getting cavities. In addition, dental sealants and community water fluoridation are two other strategies that can help prevent tooth decay.

Dental Sealants

Dental sealants are thin, plastic coatings painted on the chewing surfaces of the back teeth to keep germs and food out of their pits and grooves. Studies supported by the NIH's National Institute of Dental and Craniofacial Research and others have shown that sealants are safe and effective. But many people don't know about sealants. In fact, fewer than one-third of children in the U.S. have sealants on their teeth.

How can I get sealants for my children?

Talk to your dentist about getting sealants for your children. Some health insurance programs pay for sealants; ask your health insurance provider or your state Medicaid office. Sometimes sealants are also put on at school. Check with your school about whether it has a dental sealant program.

Community Water Fluoridation

Nearly all naturally occurring water sources contain fluoride—a mineral that prevents tooth decay and even reverses early decay. Community water fluoridation adjusts the amount of fluoride in an area's water supply to a level that helps to prevent tooth decay and promote oral health. Today, 74 percent of Americans served by a community water supply receive fluoridated water. But that still leaves many people in the U.S. without access to fluoridated tap water.

How can I find out if my water has fluoride?

The best way to find the fluoride level of your local public water system is to contact your water utility provider. You can find the name and contact information of the water utility on your water bill. Your child's dentist or physician may also know if your water has fluoride in it.



What causes tooth decay?

Tooth decay is the result of an infection with certain types of bacteria that use sugars in food to make acids.

Over time, these acids can make a cavity (hole) in the tooth.

What Parents Can Do: Babies & Toddlers

Healthy teeth are important—even baby teeth. Children need healthy teeth to chew and to speak clearly. And baby teeth hold space for adult teeth. Here are five things you can do to keep your baby's mouth healthy and give him or her a healthy start!

1. Find out if your tap water has fluoride in it (check with your local water utility).

- If your tap water does not have fluoride, your dentist or physician might suggest fluoride in other forms to keep your child's teeth healthy.
- If your tap water does have fluoride—and your baby drinks only formula that has to be mixed with water—you may want to use bottled water (without added fluoride) some of the time. Here's why: Mixing powdered or liquid infant formula concentrate with fluoridated water on a regular basis may increase the chance of a child developing dental fluorosis on his or her permanent teeth.* Fluorosis appears as white lines or flecks on the teeth. It is usually mild; in many cases, only a dental professional would notice it.

*If children regularly consume higher-than-recommended amounts of fluoride during the teeth-forming years (age 8 and younger), their permanent teeth may develop dental fluorosis.

2. Check and clean your baby's teeth.

Clean the teeth as soon as they come in with water and a clean, soft cloth or a baby's toothbrush. Healthy teeth should be all one color. If you see spots or stains on the teeth, take your baby to a dentist. At about age 2 (or sooner if a dentist or physician suggests it) you should start putting fluoride toothpaste on your child's toothbrush. Use only a pea-sized drop of toothpaste.

3. Don't put your baby to bed with a bottle.

Milk, formula, juice, and other drinks such as soda all have sugar in them. Bacteria in the mouth use sugar to make acid. Over time, this acid can make a cavity in the tooth. The longer sugar stays on your baby's teeth, the more chances the bacteria have to make acid. And more acid means more decay. So if you do put your baby to bed with a bottle, fill it only with water.

4. Feed your baby or toddler healthy food.

- Choose foods without a lot of sugar in them.
- Give your child fruits and vegetables for snacks.
- Save cookies and other treats for special occasions.

5. Take your child to the dentist by age 1.

At this visit, the dentist will check your child's teeth and show you the best way to clean them.



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Improving Dental Health *in* Underserved Communities

By Christopher Klose

“Healthy smiles are the door to opportunity,” says Denver, Colorado pediatrician Dr. Patty Braun. “Brown or missing teeth don’t help kids—or adults—one bit.”



Photo: Dr. Patty Braun

“My dream is that someday all kids will come to expect good teeth—regardless of their social or economic status.”

Braun is an associate professor of Pediatrics and Family Medicine at the University of Colorado Denver School of Medicine with a master’s degree in public health. She is passionate about improving children’s oral health. “Tooth decay is the number one chronic infectious disease in children,” she said. It disproportionately affects disadvantaged and underserved communities and it’s especially common in the Native American population, which has some of the country’s greatest medical and dental health disparities.

Since 2008, Braun has played a key role in the Cavity Free at Three Oral Health Initiative, a statewide Colorado program to prevent oral disease in young children. The goal is to build partnerships among dentists, physicians, nurses, dental hygienists, public health practitioners, and early childhood educators in the prevention and early detection of oral disease in pregnant women, infants, and toddlers.

“Tooth decay is preventable but it can progress rapidly when it starts,” says Braun. “That can lead to severe medical consequences, such as progressive, invasive infection and pain, difficulty eating, and visits to the emergency room. It can also cause lowered self-esteem.”

As leader of the Dental Hygienist Co-location project, Braun also has placed dental hygienists into general medical and pediatric practices. “The child can be seen in one place and the healthcare providers can work together. That means less stress for the child.”

In a project funded by the National Institute of Dental and Craniofacial Research, she is working to reduce tooth



Photo: Dr. Patty Braun

Dr. Patty Braun, a pediatrician and associate professor at the Colorado Denver School of Medicine, is also a co-investigator with the NIDCR-funded Center for Native Oral Health Research.

decay among Native Americans by training community oral health specialists. These community members teach the benefits of good oral health practices to children in Head Start classrooms—and through them, their parents. “Parents can help with tooth brushing and seeing that their children get regular dental care,” says Braun. “Tooth decay

is a family illness. Giving parents the knowledge of how to prevent empowers them to act.

“My dream is that someday all kids will come to expect good teeth—regardless of their social or economic status.”

Latest Research from NIH's National Institute of Dental and Craniofacial Research

The NIH's National Institute of Dental and Craniofacial Research (NIDCR) is the federal government's lead agency for scientific research on oral, dental, and craniofacial health and disease. Scientists supported by NIDCR conduct research on the full spectrum of topics related to oral health, including oral cancer, chronic pain conditions, salivary gland function and dysfunction, craniofacial development and disorders, bio-materials, and tissue engineering, as well as periodontal (gum) disease and tooth decay.



Photo: NIDCR

Martha J. Somerman, D.D.S., Ph.D., is director of NIH's National Institute of Dental and Craniofacial Research (NIDCR).

NIDCR-supported scientists are designing specialized instruments that will be able to detect early mineral loss in tooth enamel before a cavity develops. Other studies are focused on comparing DNA from people with tooth decay to those without it to look for genetic differences associated with the disease. Scientists also are identifying genes within bacteria thought to play a role in decay, and are looking at how these bacteria communicate with one another in the plaque or bio-film, the complex community in which they live. Such studies could one day lead to new ways to prevent decay or to detect it early and reverse it, before it becomes a cavity.

Through its Centers for Research to Reduce Disparities in Oral Health, NIDCR continues to identify effective and culturally appropriate methods to reduce oral diseases in disadvantaged and underserved communities. Studies are testing a variety of strategies, such as providing oral health preventive services and education through Head Start programs and community health settings, and interventions with pregnant mothers to reduce early childhood tooth decay.

To Find Out More

National Institute of Dental and Craniofacial Research (NIDCR) <http://www.nidcr.nih.gov/>

MedlinePlus Child Dental Health
www.nlm.nih.gov/medlineplus/childdentalhealth.html

What Parents Can Do: School-Age Children

As kids get older, they still need a parent's help to keep their teeth sparkling clean and healthy. Here are five tips—

1. Find out if your water has fluoride in it (check with your local water utility).

If it does, drink tap water instead of bottled water. Most bottled water does not contain enough fluoride to prevent tooth decay. If your water is not fluoridated, talk to a dentist or physician about whether your child needs fluoride in other forms.

2. Help your children brush their teeth (with a fluoride toothpaste) twice a day.

Young children cannot get their teeth clean by themselves. Until they are 7 or 8 years old, you will need to make sure they do a thorough job. Use no more than a pea-size amount of toothpaste on the toothbrush, and encourage your child to spit out toothpaste rather than swallow it.

3. Serve healthy meals and snacks.

- Limit between-meal snacks.
- Save candy, cookies, soda, and other sugary drinks for special occasions.
- Limit fruit juice. Follow the Daily Juice Recommendation from the American Academy of Pediatrics (visit www.aap.org).

4. Take your children to the dentist for regular cleanings and check-ups.

5. Ask your dentist about dental sealants.

Sealants are put on in dentists' offices, clinics, and sometimes in schools.



Photo: Shutterstock

Colorectal Cancer Screening: Just Do It

New research shows that a screening test called flexible sigmoidoscopy can reduce the risk of colorectal cancer. It's different than a colonoscopy, which is considered the gold standard in screening. Sigmoidoscopy doesn't look at the entire colon, just the lower part. Patients don't have to be sedated. And, they don't have to go through quite as much preparation before the procedure. But they would likely follow up with a colonoscopy if something abnormal is found.

Colorectal cancer is the second-leading cause of cancer death in the United States. Studies show it can be prevented with screening, yet some people put that off. "Sigmoidoscopy is less invasive than colonoscopy and carries a lower risk of the colon being perforated, which may make it more acceptable as a screening test to some patients," says Barnett Kramer, MD, of NIH's National Cancer Institute, which funded the study. "There are several effective screening tests for colorectal cancer and the most effective screening test is the one that people choose to take."

Quitting Smoking: The Genetics Connection

Why can some people quit smoking on their own, while others need the help of medication? Scientists say that it's, at least in part, because of genes. Researchers focused on genetic variations already associated with a higher risk of nicotine dependence and found that smokers who carry those variants have a harder time quitting on their own and



Photo: iStock

Photo: Photomundo/Getty

benefit more than smokers without those variants from taking medications, such as nicotine replacement. Scientists say this information puts health providers a step closer to one day coming up with individualized plans to help patients quit smoking. The study was funded by several parts of the NIH: the National Institute on Drug Abuse, the National Human Genome Research Institute, the National Cancer Institute, and the Clinical and Translational Science Awards program administered by the National Center for Advancing Translational Sciences.

Growing Up Bilingual

A new study finds that children who grow up speaking two languages are better at multi-tasking than children who speak one language. But bilingual children aren't as quick to build a vocabulary of words they understand. Researchers asked the children to switch between different tasks and found that bilingual children

made the change faster than students who learn only one language. "Bilinguals have two sets of language rules in mind, and their brains apparently are wired to toggle back and forth between them, depending on the circumstances," says Peggy McCardle, PhD., of NIH's Eunice Kennedy Shriver National Institute of Child Health and Human Development, which funded the study. McCardle heads a branch in the Institute that supports studies in child development, learning, and learning disabilities, to help children become skilled at reading and writing.

Treating Young People with Type 2 Diabetes

The obesity epidemic is causing more children to develop type 2 diabetes. Because type 2 diabetes has primarily been an adult illness until recently, there's little information on how to treat it in young people. Now, a new study provides much-needed information for this emerging health problem. Researchers have found treating young people who recently developed diabetes with a combination of two drugs, metformin and rosiglitazone, worked better than giving them metformin alone. Rosiglitazone is not recommended for use in practice, due to health risks found in adults. But the study shows the combination of two drugs worked better than single-drug therapy. The study also found type 2 diabetes progressed more quickly, and it was harder to treat, in youth than in adults. The study was funded by NIH's National Institute of Diabetes and Digestive and Kidney Diseases.

Info to Know

NIH Quickfinder

For more information or to contact any of the following NIH institutes, centers, and offices directly, please call or go online as noted below:

Institutes

- **National Library of Medicine (NLM)**
www.nlm.nih.gov
1-888-FIND-NLM (1-888-346-3656)
- **National Cancer Institute (NCI)** www.cancer.gov
1-800-4-CANCER (1-800-422-6237)
- **National Eye Institute (NEI)** www.nei.nih.gov
(301) 496-5248
- **National Heart, Lung, and Blood Institute (NHLBI)**
www.nhlbi.nih.gov (301) 592-8573
- **National Human Genome Research Institute (NHGRI)** www.genome.gov (301) 402-0911
- **National Institute on Aging (NIA)** www.nia.nih.gov
Aging information 1-800-222-2225
Alzheimer's information 1-800-438-4380
- **National Institute on Alcohol Abuse and Alcoholism (NIAAA)** www.niaaa.nih.gov
(301) 443-3860
- **National Institute of Allergy and Infectious Diseases (NIAID)** www.niaid.nih.gov
(301) 496-5717
- **National Institute of Arthritis and Musculoskeletal and Skin Diseases** www.niams.nih.gov
1-877-22NIAMS (1-877-226-4267)
- **National Institute of Biomedical Imaging and Bioengineering (NIBIB)** www.nibib.nih.gov
(301) 451-6772
- **Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)**
www.nichd.nih.gov 1-800-370-2943
- **National Institute on Deafness and Other Communication Disorders (NIDCD)**
www.nidcd.nih.gov 1-800-241-1044 (voice)
1-800-241-1055 (TTY)
- **National Institute of Dental and Craniofacial Research (NIDCR)** www.nidcr.nih.gov
(301) 480-4098
- **National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)** www.niddk.nih.gov
Diabetes 1-800-860-8747
Digestive disorders 1-800-891-5389
Overweight and obesity 1-877-946-4627
Kidney and urologic diseases 1-800-891-5390

- **National Institute on Drug Abuse (NIDA)**
www.nida.nih.gov (301) 443-1124
- **National Institute of Environmental Health Sciences (NIEHS)** www.niehs.nih.gov
(919) 541-3345
- **National Institute of General Medical Sciences (NIGMS)** www.nigms.nih.gov
(301) 496-7301
- **National Institute of Mental Health (NIMH)**
www.nimh.nih.gov 1-866-615-6464
- **National Institute on Minority Health and Health Disparities (NIMHD)** www.nimhd.nih.gov
(301) 402-1366
- **National Institute of Neurological Disorders and Stroke (NINDS)** www.ninds.nih.gov
1-800-352-9424
- **National Institute of Nursing Research (NINR)**
www.ninr.nih.gov (301) 496-0207

Centers & Offices

- **Fogarty International Center (FIC)**
www.fic.nih.gov (301) 402-8614
- **National Center for Complementary and Alternative Medicine (NCCAM)**
www.nccam.nih.gov 1-888-644-6226
- **National Center for Research Resources (NCRR)**
www.ncrr.nih.gov (301) 435-0888
- **NIH Clinical Center (CC)**
www.cc.nih.gov (301) 496-2563
- **Office of AIDS Research (OAR)**
<http://www.oar.nih.gov> (301) 496-0357
- **Office of Behavioral and Social Sciences Research (OBSSR)**
<http://obssr.od.nih.gov> (301) 402-1146
- **Office of Rare Diseases Research (ORDR)**
<http://rarediseases.info.nih.gov>
Genetic and Rare Disease Information Center
1-888-205-2311
- **Office of Research on Women's Health (ORWH)**
<http://orwh.od.nih.gov> (301) 402-1770

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