

NIH News in Health

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Your Body's Disease Defenses Building and Boosting the Immune System

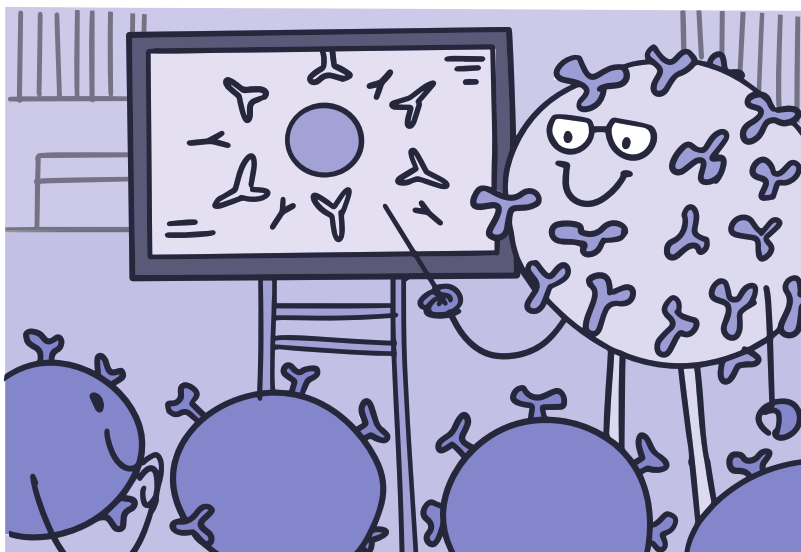
Every day while you eat, sleep, work, and play, battles are being fought throughout your body. You rarely feel it. But bacteria, viruses, and other microbes are constantly invading from the outside world.

Your body has a defense system for such invaders. It's called the immune system. Your immune system is made up of trillions of cells and proteins. These are found in your blood and every organ of your body. The immune system learns and changes over your lifetime—even before birth.

Building Your Defenses • You're not born with a fully equipped immune system. Fetuses can produce some immune protection. But before birth, "the vast majority of protection against infection comes from the mother," explains Dr. Whitney Harrington, who studies immune system development at Seattle Children's Research Institute.

Germ-fighting molecules made by the immune system, called antibodies, are transferred to the fetus through the placenta. They can also be passed to the baby after birth through breastfeeding. Antibodies stick to germs and stop them from infecting cells.

"The peak risk of severe disease from many infections is under six months of life," says Harrington. That's because the baby's immune



system is just starting to develop. Antibodies that are passed along from the mother can last for many months. They help protect a new baby until their immune system starts to develop.

The immune system builds many lines of defense. The cells of the innate immune system provide an early response to danger. They move through the body looking for signs of damage or infection of other cells. Then they destroy those cells.

Another major defense is called the adaptive immune system. It's activated by signals from the innate immune system and the infectious germs and makes a powerful response. The cells of this system keep a long-term memory of the germs they fight. They also respond to vaccinations and make all your antibodies.

Researchers have found that, like antibodies, some adaptive immune cells also cross from the mother to the fetus. These cells may start

teaching the fetus's immune system about germs the mother has been exposed to.

Harrington and her team have been trying to learn more about these cells. They want to understand when this transfer happens and to use it to maximize immune protection provided by the mother.

Through infancy and childhood, your immune system matures and continues

to build its own disease-fighting cells. Exposure to germs in childhood helps the immune system grow stronger over time, Harrington says.

Protection as You Age • By the time you've reached young adulthood, you've been exposed to many germs. So your immune system is likely to have a strong response to many infections you encounter.

Vaccines further strengthen your defenses. Vaccines expose your immune system to dead or weakened germs, or just pieces of them. That helps your immune cells learn how to fight these threats and remember

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them without you getting sick.

Certain vaccines are recommended during pregnancy. These boost protection provided by the mother against deadly diseases during a baby's first months of life. Vaccines are then recommended shortly after birth through adulthood.

Some vaccines require additional shots during adulthood to boost your immune system's memory. And some people—depending on their health, job, or other factors—may need extra vaccines to keep them safe. Keep up with current vaccine recommendations at www.cdc.gov/vaccines.

But, like other systems in your body, the immune system can begin to decline as you age. These changes can prevent immune cells from working to the best of their ability.

“With age, immune cells lose their ability to respond rapidly and robustly to infection,” says Dr. Ronald Germain, an immune system expert at NIH.

Other parts of your body, such as the heart or lungs, can accumulate wear and tear with age, too. This reduced function puts older adults at greater risk for developing more severe disease from many infections.

Even a bit more damage from an infection can cause an older adult's organs and tissues to not perform their jobs well, Germain says. That's why certain vaccines are especially recommended for people over age 50.

Making Better Defenses •

Researchers are still learning how to improve immune responses and vaccines. Some microbes are very good at hiding from the immune system. Many avoid detection by mutating, or changing, so that previously exposed immune cells can no longer recognize them.

Dr. Shane Crotty at the La Jolla Institute for Immunology and his team are trying to take advantage of the body's way of keeping up with these changes. They're studying a part of the adaptive immune system called germinal centers. These are areas in the lymph nodes where immune cells go to develop and learn to produce more effective antibodies.

Germinal centers form temporarily in response to infection or vaccination. They don't just produce antibodies against the germs that are in your body. They also produce antibodies against different versions (variants) of those germs that you haven't been exposed to. Cells in the germinal centers essentially guess at how the virus may change over time.

“Germinal centers are one of the most amazing things your immune system does,” says Crotty. Take the COVID vaccines as an example. The COVID vaccines developed against the original virus caused people to make antibodies that guarded against other variants.

“All the antibodies anybody developed against other variants from vaccination came from germinal centers,” Crotty explains.

Germinal centers can last in the body for up to six months. And the longer they're around, the more varied the antibodies they produce.

Crotty and his team are testing if changing the way vaccines are given can help germinal centers last longer. Their recent study tested an experimental HIV vaccine in animals. Researchers gave the vaccine in many small doses over time. This produced antibodies that were more varied and lasted longer than those from the single large vaccine dose.

As researchers continue looking for new ways to protect you from disease, staying current on your vaccines and living a healthy lifestyle are the best ways to boost your defenses. See the Wise Choices box for tips. ■



Wise Choices

How to Help Your Immune System

- **Eat a healthy diet.** Read about healthy eating at bit.ly/3W21PN9.
- **Make time for physical activity.** Experts recommend that adults get at least two and a half hours of moderate exercise each week. Find tips at bit.ly/3iGjRX4.
- **Maintain a healthy weight.** Learn more at bit.ly/3F2urPO.
- **Get a good night's sleep.** Most adults need at least seven hours or more of sleep each night, and kids and teens need even more.
- **Quit smoking.** Get free help at smokefree.gov, call 1-800-QUIT-NOW (1-800-784-8669), or text QUIT to 47848.
- **Manage stress.** See stress reduction tips at bit.ly/3VHXajX.
- **Limit drinking alcohol.** For more on alcohol's effects on health, see bit.ly/3FA9tJw.
- **Wash your hands often to avoid getting sick.** Use hand sanitizer if soap and water are not available.
- **Stay up to date with the recommended vaccines.** See the CDC's website: www.cdc.gov/vaccines.

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Web Links

For more about keeping your immune system healthy, see “Links” in the online article: newsinhealth.nih.gov/2023/01/your-bodys-disease-defenses

The Powerful Placebo

Helping the Brain Heal the Body

If you're feeling unwell, you may turn to medicine to find relief. But how do you know it was the drug that made you feel better? Sometimes, when you expect a treatment to work, it will. This phenomenon is called the placebo effect. Scientists are looking for ways to harness this effect for medical treatments.

A placebo is an inactive substance or action that resembles a drug or medical treatment. But it isn't meant to actually fix anything in your body. A pill that doesn't contain any medicine is one example.

Historically, placebos have been a key part of testing if a new treatment works. In some types of clinical trials, participants are given either an active treatment or a placebo. But they aren't told which one they're getting. The treatment must do more to improve the participants' condition than the placebo. If both groups show similar improvement, it may be from the placebo effect, not the drug.

The placebo effect works by turning on the body's natural mecha-

nisms for helping us feel better. Our brains make many substances that can lessen pain, stress, anxiety, and other unpleasant feelings.

Dr. Luana Colloca, a physician-scientist at the University of Maryland, Baltimore, calls this our "inner pharmacy." Just expecting to feel better can cause the release of these substances.

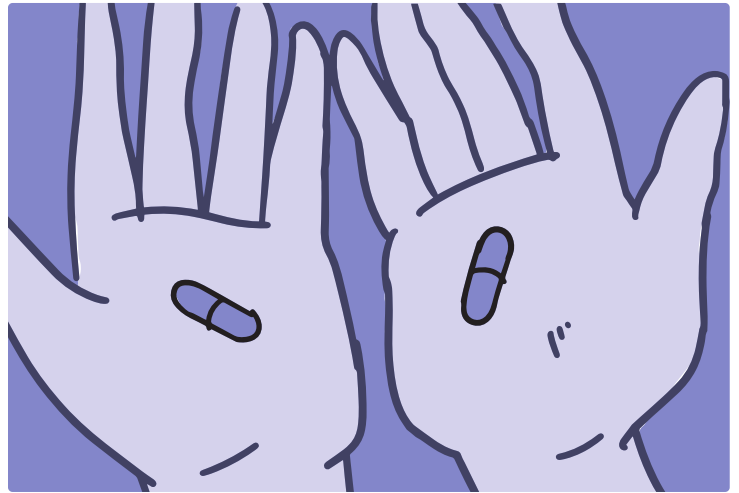
"Our mindset is so critical," Colloca says, "because our thoughts are not independent from our bodies' responses."

The placebo effect can be powerful. It can help with pain, fatigue, depression, anxiety, or nausea. But our inner pharmacy can't treat everything. It can't, for instance, make tumors go away, lower your cholesterol, or get rid of infections.

NIH-funded researchers are trying to understand the brain pathways underlying the placebo effect. They're also looking for ways to use it to improve treatments.

Recent studies have been exploring if placebos can be used to cut down on how much medication people take. People with a **chronic disease** may need to take a drug for a long time. Researchers are testing if placebos can be used to replace some drug doses. These are called dose-extending placebos. The drug effects might continue working for some time as if the patient had taken a real dose.

Dose-extending placebos may be particularly useful with opioids. Opioids are sometimes used to treat chronic pain. But they can be highly addictive and may pose risk for over-



dose or even death. Scientists are studying whether dose-extending placebos can reduce the chances of opioid addiction.

But for a placebo to work, do you need to believe you're taking the real thing? Recent research suggests that may not be the case. That's because your expectations can also affect how well a treatment works.

For instance, if you're given a drug for pain, it may work better if you're told that it's a potent pain treatment. This approach can work for placebos, too—if you're truthfully told that it has been shown to help.

A drug may also be more effective if you've had a good experience with it before. Colloca's research has shown that even seeing someone else get relief from a treatment can make it more effective.

For these reasons, good communication between patients and health care providers is an essential part of treatment. Having a provider you trust, who is supportive and has empathy, can produce better treatment results. ■



Wise Choices

Help Advance Placebo Research

You may be able to help scientists learn more about the placebo effect:

- To participate in a clinical trial, visit www.clinicaltrials.gov. Use the search terms "placebo effect" or "open-label placebo" and [your state] to find trials in your area.
- Learn about participating in clinical trials at bit.ly/3h5heO5.
- Create a volunteer profile for yourself or for someone else as their parent or guardian at ResearchMatch.org. This NIH-funded resource is a free, secure registry. It keeps you informed of clinical research studies that need volunteers matching your profile.



Definitions

Chronic Disease

A disease or condition that lasts for three months or longer.



Web Links

For more about the placebo effect, see "Links" in the online article: newsinhealth.nih.gov/2023/01/powerful-placebo





Health Capsules

For links to more information, please visit our website and see these stories online.

Experimental Cat Allergy Therapy Gives More Effective Relief

Researchers are testing a new way to treat people with allergies. The method uses regular allergy shots plus a lab-made molecule. The molecule blocks substances involved in allergic reactions in the body. For people with cat allergies, the combination therapy gave more effective relief than allergy shots alone.

When you breathe in high amounts of a substance you're allergic to—such as pollen, mold, pet dander, or dust mites—the resulting reactions in the nose are called allergic rhinitis. You may develop a stuffy, runny, and itchy nose as well as sneezing. These problems are caused by the body's disease defenses

reacting to something that's harmless for most people.

Some people get allergy shots to reduce these reactions. The shots gradually expose them to higher doses of the substance they're allergic to. This can train the body's defenses not to react when these things are in the air. Unfortunately, allergy shots don't work for everyone. And the shots usually need to be given for at least three years.

To test the new treatment, an NIH-funded research team studied 121 adults with cat allergies. Some participants received allergy shots alone. Others received the new combination treatment. Treatments

lasted nearly a year.

By the time the treatments ended, both groups had improved. But when exposed to cat proteins, those given the experimental combination therapy had fewer symptoms than people given allergy shots alone. A year after the treatments were stopped, the effects from the standard allergy shots started wearing off. But the experimental treatment was still working to reduce symptoms.

Researchers are continuing to study how the treatment works. They also plan to test and see if the approach might help to treat food allergies. ■

Artificial Intelligence and Medical Research

Artificial intelligence, or AI, has been around for decades. In the past 20 years or so, it's become a growing part of our lives. Researchers are now drawing on the power of AI to improve medicine and health care in innovative and far-reaching ways. NIH is on the cutting edge supporting these efforts.

At first, computers could simply do calculations based on human input. In AI, they learn to perform

certain tasks. Some early forms of AI could play checkers or chess and even defeat human world champions. Others could recognize and convert speech to text.

Today, different forms of AI are being used to improve medical care. Researchers are exploring how AI could be used to sift through test results and image data. AI could then make recommendations to help with treatment decisions.

Some NIH-funded studies are using AI to develop “smart clothing” that can reduce low back pain. This technology could warn the wearer of unsafe body movements. Other studies are seeking ways to better manage blood glucose (or blood sugar) levels using wearable sensors.

To learn more about the different types of AI and their use in medical research, visit bit.ly/3FjZAhA. ■



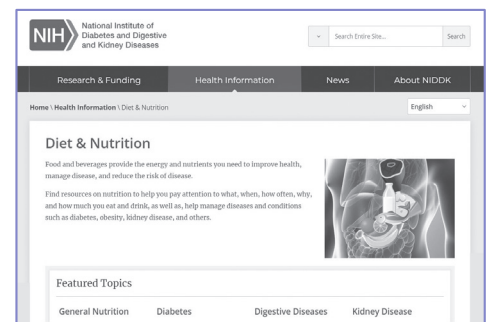
Featured Website

Diet & Nutrition

www.niddk.nih.gov/health-information/diet-nutrition

Want to start the new year on a healthy note? Find a wealth of information to help you pay attention to what you're eating

and make healthier food choices. Get links to nutrition-related resources, weight loss info, online tools for healthy living, and more.



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