

NIH News in Health

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Medical Scans Explained

A Look Inside the Body

Have you ever had to get an X-ray, MRI, or other medical scan? Do you know what these tests involve? Or what they can do?

Medical scans help doctors diagnose everything from head trauma to foot pain. There are many different types of imaging technologies. Each works differently.

Some types of imaging tests use radiation. Others use sound waves, radio waves, or magnets. Learning about how medical scans work can help you feel more comfortable if you or a loved one needs one. It can also help you to know what to ask about before getting an imaging test.

X-Rays • The first revolution in seeing into the body came with X-rays. They have been used in the clinic for more than 120 years.

“X-rays are still used every day because they can do a lot,” says Dr. Kris Kandarpa, an imaging expert at NIH. They’re useful for looking at bones and finding problems in certain types of tissues, like pneumonia in the lungs.

X-ray imaging works by passing an energy beam through a part of your



CT Scans • CT scans also use X-ray beams. But the beams rotate around your entire body to create a 3D picture. These images contain more information than a regular X-ray. The scan can be done in less than a minute. That makes it especially useful in places like the emergency department. There, doctors need to know immediately if a patient has a life-threatening condition.

Because CT scans use more X-ray beams than a normal X-ray, they often deliver a higher dose of radiation. But medical specialists have ways to calculate the smallest radiation dose

needed, explains Dr. Cynthia McCollough, a CT imaging researcher at the Mayo Clinic.

“We tailor the dose to the patient’s size, and we tailor it to the reason for the exam,” McCollough says. For example, a CT scan of the chest needs less radiation than a CT scan of the stomach area.

McCollough’s lab, with four other NIH-funded teams, is working on ways to reduce the amount of radiation these scans deliver even more. Her team has used hundreds of CT scans to find the lowest radiation

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body. Your bones or other body parts will block some of the X-ray beams from passing through. That makes their shapes appear on the detectors used to capture the beams. The detector turns the X-rays into a digital image for a **radiologist** to look at.

X-ray beams use radiation. Radiation is energy that’s released as invisible particles or waves. Being exposed to very large amounts of radiation can damage cells and tissues. It may also increase your risk of developing cancer.

But modern X-ray tests use a very small dose of radiation. People are naturally exposed to radiation from many sources, such as the sky, rocks, and soil.

“A chest X-ray gives you similar amounts of radiation as you’d get in a plane flight across the Atlantic Ocean,” Kandarpa explains.



Definitions

Radiologists

Doctors who specialize in creating and analyzing images of the inside of the body.

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dose that's needed for a radiologist to make the right diagnosis.

"We've found that when you take the dose way down, the images are less pretty, but they often still get doctors the right answer," McCollough explains.

While lower doses of radiation would likely further lower risk, McCollough says that the standard doses are already quite low. That's important for people to know, because "some patients who really need a CT scan are afraid to get it," she says.

Fear can sometimes keep someone from getting a scan that could help improve their health, or even save their life. "Current CT doses are in a range where it's not possible to even prove a risk exists. They're that low," she says.

If you're concerned about a test that uses radiation, see questions you can "Ask Your Doctor" in the sidebar.

MRI • MRI works in a very different way. It doesn't use X-rays. Instead, it uses strong magnets and radio waves to affect atoms in the water molecules within your body's

tissues. When the radio waves are turned off, the atoms release energy that's detected by the MRI machine.

Atoms in different tissue types go back to normal at different speeds and release different amounts of energy. MRI software uses this information to create 3D pictures of the different tissue types.

"MRI is most helpful when you want to look at diseases that involve soft tissue, such as muscles, tendons, and blood vessels," explains Dr. Shreyas Vasanawala, an MRI researcher at Stanford University.

MRI can provide information about how the body is functioning in real time. "For example, we can measure how much blood is flowing in the vessels," Vasanawala says. That can help doctors find small blockages or defects in the heart.

Because MRI doesn't use X-rays, doctors would like to use it more in children. But MRI machines require you to lie motionless for a long time.

"It can be difficult for children to hold still," says Vasanawala. If needed, general anesthesia can help get kids through the test. It makes them unconscious and unable to move. It's typically very safe, but comes with some risks.

To help reduce the use of anesthesia, Vasanawala and his team have created a flexible, blanket-like version of MRI hardware to use with children. They coupled it with new methods for faster scanning. The soft blanket-like coil sits closely on top of the patient, providing a comforting environment. "It's helping some kids get tough exams without anesthesia," he explains.

Other Scans • Another commonly used imaging method is called ultrasound. It sends sound waves into the body. Different types of tissue reflect sound waves differently. These differences can be picked up by an ultrasound machine and turned



Ask Your Doctor

Before getting a medical scan, ask:

- What information will this test give you?
- How will the results guide my treatment?
- Does this test use radiation? If so, is the dose tailored to my size and what you need to know?
- Are there alternative tests that could be used? What are the risks and benefits of each?
- If this test is for a child, is the facility using pediatric protocols for the test?
- Is anesthesia required for this test?

into a picture. Ultrasound is helpful for looking at the heart and other organs, or a developing baby.

Doctors also use tests called nuclear imaging. These tests use a tiny amount of a radioactive substance, or "tracer." Most tracers are injected into the body, but some are inhaled or swallowed. The tracers inside the body release radiation that can be measured by a detector outside the body. The type of tracer differs depending on what the doctors want to see.

A positron emission tomography (PET) scan, for example, often uses a radioactive sugar to diagnose cancer. When cancer cells take up the radioactive sugar, they can be seen with the PET scanner.

Scientists are working to develop new types of tracers to detect different conditions, such as infections hiding deep in the body. They're also continuing to explore other ways to make medical scans faster and deliver less radiation.

Learn more about medical scans at www.nibib.nih.gov/understanding-medical-scans-app. ■

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Web Links

For more about medical scans, see "Links" in the online article: newsinhealth.nih.gov/2019/11/medical-scans-explained

Yoga for Health

Positioning Your Body and Mind

Have you rolled out a yoga mat lately? If so, you're among many who have taken up yoga to relax and stay fit. One in seven adults in the U.S. has practiced yoga in the past year. Yoga may help bring several health and wellness benefits.

Based in Indian philosophy, yoga involves both the body and mind. It began as a spiritual practice. Modern yoga focuses more on physical poses, breathing techniques, and meditation. Meditation involves exercises that help you clear and calm your thoughts.

"With practice, yoga can teach you to direct the mind on a single object," explains Dr. Pamela Jeter, an NIH expert on yoga research. "It's practicing being aware and present from moment to moment."

But, she says, it takes a lot of practice. She suggests focusing on the physical aspects at first. With time, the meditation part becomes easier.

There are many types of yoga. Some are slower and focus on holding poses. Others involve flowing movements that connect to your breathing.

Research suggests that yoga may help improve general wellness. In studies, yoga has helped some people manage stress, improve mental health, lose weight, or quit smoking.

There's also evidence that yoga may be helpful for some medical conditions. Yoga may help lessen pain and menopause symptoms. It improved sleep in studies of older adults and people with cancer.

Several studies have shown that yoga can help those with chronic low back pain. Some experts now recommend it as a first-line treatment for low back pain, among other non-drug treatments.

But, Jeter cautions, more high-quality research is needed to confirm yoga's health benefits. "There's a lot of research out there for different health conditions, but there's not enough to say for sure," she says. Yoga shouldn't replace treatment from your health care provider.

It's also unclear what it is about yoga that helps. The practice combines physical, mental, and spiritual elements. "There are a lot of components in yoga. We don't know what the active ingredient is," Jeter says.

Research into yoga is ongoing. Studies are now looking at whether yoga is helpful for specific groups of people. For example, whether it can reduce chronic pain for military veterans or improve quality of life for people who have had breast cancer. New studies are also looking into whether yoga may help mental



health conditions like anxiety, depression, and post-traumatic stress disorder (PTSD).

What should you know if you're thinking about starting yoga? "Start slowly and carefully in order to avoid any sort of injury," Jeter says. If you have a medical condition, talk with your health care provider before getting started.

Everyone's body is different. Yoga postures should be modified based on your abilities. Choose an instructor who is experienced and attentive to your needs.

You may also want to seek out a yoga therapist. "Yoga therapists have more extensive training than that required of a regular yoga teacher," Jeter explains. "They're trained to work with different conditions and mostly work one-on-one or in small groups."

If you want to try yoga, see the Wise Choices box for tips on getting started. ■



Wise Choices

Getting Started With Yoga

- Start with an appropriate yoga class. Look for ones called beginner level, "gentle" yoga, or senior classes.
- Ask about the training and experience of the yoga instructor you're considering.
- Talk with your health care provider before trying yoga if you're pregnant, older, or have a health condition.
- Let your yoga instructor know about your individual needs and any medical issues.
- Go slowly to prevent injury. Avoid extreme positions and forceful breathing. Listen to your body.
- Find studies recruiting people for research on yoga. You can start at [ClinicalTrials.gov](https://clinicaltrials.gov).



Web Links

For more about yoga, see "Links" in the online article: newsinhealth.nih.gov/2019/11/yoga-health



Health Capsules

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

Peanut Allergy Therapy Loses Effect After Stopping

Peanut is one of the most common food allergies. Some studies show oral immunotherapy (OIT) can prevent life-threatening allergic reactions. But a new study shows that OIT's protection doesn't always last if it is stopped or reduced.

Peanut allergy is caused by your immune system (the body's defense system) mistakenly treating peanut proteins as harmful. OIT involves eating small amounts of peanut protein. These doses slowly increase over time. This helps your body

gradually get used to, or tolerate, peanut.

Researchers carried out a three-year study with 120 people with peanut allergy. Participants ranged in age from 7 to 55. After two years, most people (83%) given peanut OIT were able to eat peanut without an allergic reaction.

The researchers then stopped the therapy or reduced the dose to see if its effects lasted. One year later, only 13% of those who had stopped OIT could still tolerate peanut. And only

37% on the reduced peanut dose still had protection.

"We hope that, with more research, blood tests can help us predict who may respond to OIT treatment," says NIH researcher Dr. Alkis Togias.

Researchers continue to study and develop ways to prevent and treat food allergy. Never give peanut products to someone with an allergy on your own. OIT should only be given under a doctor's care. ■

Healthy Eating Special Issue

Healthy eating is one of the best ways to prevent or delay health problems. What you eat helps shape how you feel and how your body performs. But how do you eat best for your health? Learn about how to reach your healthy eating goals in *NIH News in Health's* special issue on healthy eating.

Eating well, along with getting enough physical activity, can help you lower your risk of heart disease, diabetes, obesity, and other

health problems. But our scientific understanding of what's healthy to eat and drink is continuously evolving. These changes can be confusing.

Still, the basic ideas have been consistent over time. Healthy eating means getting a variety of foods, limiting certain kinds of carbs and fats, watching out for salt, and being aware of your portion sizes.

To reach your goals, experts advise making small, gradual

changes. It can be a lot easier than you might think to make smart, healthy choices. It takes just a little planning.

Read more in the new special issue. It's available in English at newsinhealth.nih.gov/special-issues or in Spanish at salud.nih.gov/recursos-de-salud/ediciones-especiales. There, you can also find two other special issues: senior health and parenting. ■



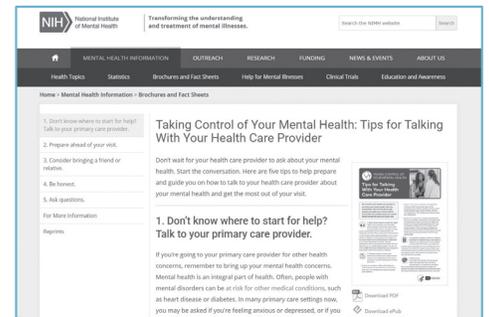
Featured Website

Take Control of Your Mental Health

www.nimh.nih.gov/talkingtips

Mental health is as important as physical health. Learn how to start the conversation about your mental well-being with your health care provider.

Be honest and ask questions. You can find more tips for getting the most out of your visit on the website.



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