

# NIH News in Health

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## Trouble With Touch? Feeling Your World

Your senses let you experience the world. Sight, hearing, taste, or even smell may be the first sense to spring to mind. But don't forget touch. Your sense of touch helps keep you safe from physical threats and can strengthen social bonds. It can also be altered by many health conditions.

"Your skin is your largest sensory organ by far," says Dr. Alexander Chesler, a touch researcher at NIH. "It encompasses your entire body. And the precision, accuracy, and speed at which it can sense touch is absolutely extraordinary."

Feeling too little or too much sensation from touch can affect your quality of life. Over the last decade, researchers have made major progress in understanding how touch works. They're now using this information to help address pain and other conditions where your sense of touch can turn against you.

**From Pleasure to Pain** • Nerve cells in your skin are the first to sense when you touch something. They send electrical impulses to your spinal cord, which then passes the signal on to your brain.

Each nerve cell can respond with a different level of sensitivity to different types of sensations. Some nerve cells in the skin sense things



that hurt, like a pinch or a sharp object. Others pick up sensations like hot, cold, or the burning feel of spicy foods, like a chili pepper. Your skin is also coated in nerve endings that sense different types of force, like pressure or being stretched.

Researchers are just beginning to uncover the way pressure-sensing nerve cells affect how sensations are felt throughout the body, and what happens if they're damaged.

For example, researchers recently discovered a protein that triggers the sensation of gentle touch. It's called PIEZO2. People born with a rare condition in which they lack PIEZO2 struggle to feel certain types of light sensations on their skin, like vibrations. They also have trouble sensing how their body is positioned when their eyes are closed.

Chesler and other researchers have found that PIEZO2 also

plays a role in sexual sensation. The protein is found in many organs inside the body, too. Researchers now are trying to figure out what these touch receptors do internally. For example, they may help trigger the urge to urinate by sensing pressure in a full bladder.

"Touch is really about the skin. But if you look underneath the skin, there's a range of mechanical forces that you feel in every single tissue of your

body," Chesler explains.

Researchers have found that the signal PIEZO2 sends to the brain can sometimes go haywire. In a condition called tactile allodynia, the sensation of gentle touch turns painful. One example is when your skin gets damaged, like with a sunburn. The pain usually goes away after the skin heals. But for some people it doesn't, and they experience chronic pain.

"We've found that PIEZO2 is absolutely essential for generating

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this type of pain,” Chesler says. His team is searching now for drugs that could potentially block PIEZO2 at the skin while allowing it to work elsewhere in the body.

**From Skin to the Brain** • Once sensations from touch leave the nerve cells in the skin, they can be altered in different ways before they reach the brain. Understanding how this happens is just as important as understanding what happens in the skin, Chesler explains.

“If we can understand these basic principles about how touch and pain work, we can find new ways to intervene to stop pain,” he says.

“We also want to know: How is the brain transforming all of this physical information into something that we can interpret?” adds Dr. Jerry Chen, a neuroscientist at Boston University.

His lab is using imaging technologies to track the activity of single nerve cells in living mice. This lets them watch as touch messages are processed and move through the body and up to the brain. His team hopes this will help them under-

stand how sensations like pleasant touch are processed differently than pain. The researchers also recently discovered a type of brain cell that appears to play an important role in our memories of touch.

“There are physical aspects of the world that never change, like the fact that glass is smooth or that sandpaper is rough,” Chen says.

These types of memories help us process other aspects of our environment more quickly. They let our brain focus on the unexpected, like the feel of something sharp on what should be a smooth surface. This, in turn, helps keep us safe.

**Solving Touch Problems** • Certain physical and mental health conditions can affect a person’s sense of touch. “A lot of neurologic disorders, like stroke or autism, can affect the way we process sensory information,” Chen explains.

After a stroke, some people may become less able to process touch. A person with autism, on the other hand, may feel overwhelmed by touch.

“If we can pinpoint certain nodes in the touch network that are involved in these experiences, then we have an access point to change how touch is processed,” Chen says.

A better understanding of touch—from the skin to the brain—will hopefully lead to new treatment approaches. It may also lead to artificial limbs that feel more realistic. For example, a field called haptics examines the connections between humans and machines.

Haptics researchers are trying to develop ways to provide feedback from electronics to our touch nerve cells and vice versa. This could lead to artificial limbs that work and sense touch like real body parts, Chesler says.

Researchers also are exploring how our emotions affect our sense of touch. “The context in which touch happens is really important,” Chesler says. “Having a friend rub your shoulders feels great. But what if it’s a stranger on the subway? That’s not so great.”

Understanding how touch and emotion work together may lead to a better understanding of conditions like chronic pain, Chesler explains.

If you’re having pain or other trouble with touch, talk with your health care provider. They can help you find ways to make feeling your world more comfortable. ■



## Wise Choices

### Which Organs Sense Touch?

Organs inside your body sense different types of force, similar to the ways that skin senses touch. Scientists are only starting to understand why. Some examples include:

- **The gut:** senses when the stomach is full and sends signals to the brain to stop eating.
- **The lungs:** signal when it’s time to stop inhaling and start exhaling, and vice versa.
- **The bladder:** senses when it’s full and sends the urge to urinate to the brain.
- **Blood cells:** know when to change shape to pass through small blood vessels.
- **Blood vessels:** help regulate blood pressure.
- **The bones:** trigger bone formation and maintenance in response to activity.
- **The joints:** make sure tendons stretch, but not too much.

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## Web Links

For more about the sense of touch, see “Links” in the online article: [newsinhealth.nih.gov/2024/04/trouble-touch](https://newsinhealth.nih.gov/2024/04/trouble-touch)

# Appendix Pain

## Preventing Appendicitis Complications

The appendix is a finger-like pouch that branches off from your large intestine. No one is sure what it does or why it evolved. But when something goes wrong, it can be dangerous.

“We do know that it causes problems,” says Dr. Nicole Wilson, a pediatric surgeon at the University of Rochester. “And we do know that people do just fine without it.”

Some studies suggest that your appendix may help your body’s disease defenses, or immune system. But some people get appendicitis, or **inflammation** of the appendix. This can happen for different reasons. Sometimes the tiny opening that leads from the appendix to the large intestine gets blocked by stool. Other times an infection can be the cause. Swelling from inflammation can lead to pain in your abdomen, the cavity that



People who get these internal infections are usually hospitalized. They’re given IV antibiotics for days or weeks.

Wilson’s research focuses on a new way to prevent infections from a perforated appendix. It’s called photo-dynamic therapy, or PDT. The technique uses laser light and a light-reactive dye. When combined, they produce molecules that cause bacteria to burst open and die. Surgeons might use the technique to sterilize the abdomen after removing the appendix.

With antibiotics alone, some bacteria can survive. They can develop resistance to the drugs. But PDT kills all the bacteria. Wilson and her colleague, Dr. Timothy Baran, are testing PDT in animal models and on bacteria collected from patients with perforated appendicitis.

Baran’s work has already shown that the technique can be used to treat abscesses in people. Now, Wilson and Baran are testing whether PDT can be used to prevent and treat internal infections.

“For a long time, we’ve treated appendicitis the same way, and this is one of the first studies that I know of looking at new and innovative ways to add to the treatment of it,” Wilson says. “It’s probably years down the road, but I’m really excited about it.” ■

holds your organs.

“The classic symptoms of appendicitis are pain that starts around the belly button and kind of migrates down to the right lower side of the belly,” Wilson explains. Other symptoms include an upset gut, like nausea, vomiting, or not wanting to eat. Sometimes appendicitis also comes with a fever.

If you have these symptoms, get medical care right away. The sooner appendicitis is caught, the better. You’re less likely to have complications like a perforated, or “burst,” appendix. This is when a hole forms in your appendix. The hole lets bacteria leak into your abdomen, which can be life threatening.

Doctors diagnose appendicitis based on symptoms and lab and imaging tests. Treatment depends on the severity of inflammation and whether your appendix has burst. You may only need antibiotics. But often, patients require both surgery and antibiotics. If your appendix bursts, you’ll need surgery.

Patients with a perforated appendix are at risk for getting an abscess, Wilson says. This is a pocket of pus that forms within the abdomen.



### Wise Choices

#### Appendicitis Symptoms

The most common symptom of appendicitis is pain in your belly. This pain may:

- Begin near your belly button and move lower and to your right.
- Start suddenly and may even wake you if you’re sleeping.
- Get worse when you move around, take deep breaths, cough, or sneeze.
- Be severe and may feel different than any pain you’ve ever felt.
- Happen before other symptoms, and worsen in a matter of hours.

Other symptoms may include loss of appetite, nausea or vomiting, or a fever.



### Definitions

#### Inflammation

Heat, swelling, and redness caused by the body’s protective response to injury or infection.



### Web Links

For more about appendicitis, see “Links” in the online article: [newsinhealth.nih.gov/2024/04/appendix-pain](https://newsinhealth.nih.gov/2024/04/appendix-pain)





## Health Capsules

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

### Comparing Side Effects of Prostate Cancer Treatments

Prostate cancer is the most common cancer for men in the United States. Luckily, most men with prostate cancer will still be alive 15 years after diagnosis.

Men with prostate cancer that hasn't spread outside the gland have several treatment choices. These include surgery, radiation therapy, and active surveillance, where treatment is delayed until a cancer starts to grow.

Men live a similar length of time regardless of the chosen treatment.

But it's been unclear if there were significant differences in the long-term side effects of these treatments. Side effects can include bladder and bowel problems, and difficulty with sexual functioning.

To learn more, researchers followed 2,500 men for 10 years after prostate cancer treatment. As expected, survival rates were similar. But the long-term side effects differed depending on the treatment.

Men who had surgery had a higher risk of leaking urine. But men who

had radiation therapy had a higher risk of bowel problems. Certain men had a higher risk of sexual problems soon after surgery. But by 10 years, no significant differences were found between the treatment groups.

"Given the similar survival rates, the choice of treatment for patients may be influenced by the adverse effects of the treatments," says Dr. Bashir Al Hussein Al Awamlh, of Vanderbilt University, who helped lead the study. ■

### All About Acne

Acne is a common skin condition that causes pimples. These bumps usually arise on your face. Acne can also appear on your back, chest, or shoulders. Anyone can get acne. But it is most common in teens and young adults. For most people, acne goes away by about age 30.

Acne usually pops up when hair follicles under the skin become clogged with oil or other substances. This can lead to swelling and redness, or inflammation.

There are different types of acne,

including whiteheads, which produce a white bump. Blackheads look black because air changes the color of oils in the clog. The color is not caused by dirt. Severe nodular acne, sometimes called cystic acne, can cause deep, painful, pus-filled bumps.

Acne can usually be treated with over-the-counter products that you put on the skin. For more severe acne, health care providers may suggest prescription treatments.

Stress or certain foods do not cause acne, but they may make it

worse. Pressure from sports helmets, tight clothes, or backpacks can also inflame acne.

If you have acne, take good care of your skin. Wash gently and avoid strong soaps or rough scrub pads. Resist the temptation to squeeze or pick at pimples. That can lead to scars or dark blotches. Choose oil-free cosmetics and hair care products.

Learn more about acne at [www.niams.nih.gov/health-topics/acne](http://www.niams.nih.gov/health-topics/acne). ■



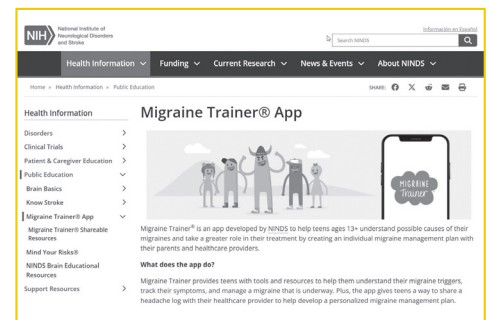
### Featured Website

#### Migraine Trainer App

[go.nih.gov/NIHNiHApr24Migraines](http://go.nih.gov/NIHNiHApr24Migraines)

Some teens get severe headaches known as migraines. This free app from NIH can help teens figure out what's triggering their migraines. Understanding migraine triggers

can help them take control to manage their pain. The app also lets them share a headache log with their health care provider.



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