

NIH News in Health

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Sex and Gender

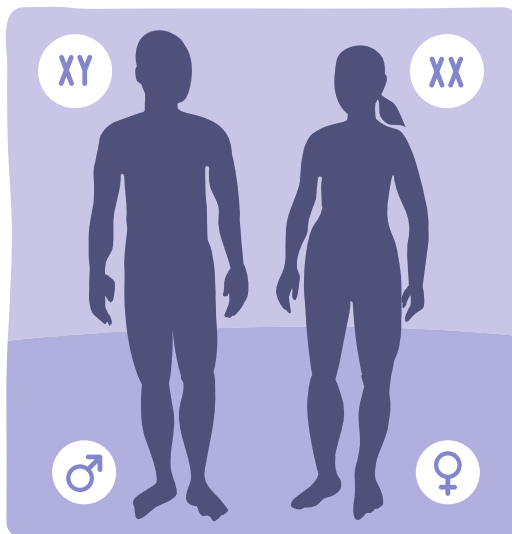
How Being Male or Female Can Affect Your Health

Are you male or female? The answer to this seemingly simple question can have a major impact on your health. While both sexes are similar in many ways, researchers have found that sex and social factors can make a difference when it comes to your risk for disease, how well you respond to medications, and how often you seek medical care. That's why scientists are taking a closer look at the links between sex, gender, and health.

Many people use the words sex and gender interchangeably, but they're distinct concepts to scientists.

Defining Differences • Sex is biological. It's based on your genetic makeup. Males have one X and one Y **chromosome** in every cell of the body. Females have two X chromosomes in every cell. These cells make up all your tissues and organs, including your skin, heart, stomach, muscles, and brain.

Gender is a social or cultural concept. It refers to the roles, behaviors, and identities that society assigns to girls and boys, women and men, and gender-diverse people. Gender is determined by how we see ourselves and each other, and how we act and interact with others. There's a lot of diversity in how individuals and groups understand, experience, and express gender. Because gender



influences our behaviors and relationships, it can also affect health.

Influences on Health • "Sex and gender play a role in how health and disease affect individuals. There was a time when we studied men and applied those findings to women, but we've learned that there are distinct biological differences between women and men," explains Dr. Janine Austin Clayton, who heads research on women's health at NIH. "Women and men have different hormones, different organs, and different cultural influences—all of which can lead to differences in health."

As scientists learn more about the biology of males and females, they're uncovering the influences of both sex and gender in many areas of health.

For instance, women and men can have different symptoms during a heart attack. For both men and women, the most common heart attack symptom is chest pain or discomfort. But women are more likely than men to have shortness of breath, nausea

and vomiting, fatigue, and pain in the back, shoulders, and jaw. Knowing about such differences can lead to better diagnoses and outcomes.

Men and women also tend to have different responses to pain. NIH-funded researchers recently learned that different cells in male and female mice drive pain processing.

"Without studying both sexes, we wouldn't know if we're taking steps in the right direction toward appropriate clinical treatment for men and women," Clayton says. "Our differences also affect how we respond to medications, as well as which diseases and conditions we may be prone to and how those diseases progress in our bodies." For example, women metabolize nicotine faster than men, so nicotine replacement therapies can be less effective in women.

Attention to Addiction • Scientists are finding that addiction to nicotine and other drugs is influenced by sex as well. "When it comes to addiction, differences in sex and gender can be found across the board," says Dr. Sherry McKee, lead researcher at an NIH-funded center at Yale University that studies treatments for tobacco dependence. "There are different reasons men and women pick up a drug and keep using a drug, and in how they respond to treatment and ex-

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Definitions

Chromosome

Structure made of genetic material and proteins. Humans normally have 46 chromosomes (23 pairs) in each cell.

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Wise Choices Women, Men, and Health

- Women and men have different symptoms of heart attack.
- Women are twice as likely as men to experience depression.
- Men are less likely than women to admit to negative moods and seek treatment for mental health issues.
- Men are more likely than women to have gout, a type of arthritis. Female risk for gout increases after menopause.
- Osteoporosis is more common in women than men, yet it still poses a risk to men as they age.
- Some medicines affect women and men differently, such as aspirin and some sleep medications.
- Females are more likely to injure their knees playing sports.
- Males are more likely than females to develop autism spectrum disorders and certain other neurodevelopmental conditions.
- Two-thirds of people age 40 and up who are visually impaired or blind are women.
- Pain disorders like chronic TMJ are more common in women.
- Women are often primary caretakers of children, household needs, and aging family members, but they are more likely to delay their own health needs.

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perience relapse. Sex also influences disease risk in addiction. For example, women who smoke are more susceptible to lung and heart disease than men who smoke."

One NIH-funded research team has detected some of these differences in the brain. In a recent study, 16 people who smoke—8 men and 8 women—underwent brain scans while smoking to create "movies" of how smoking affects dopamine, the chemical messenger that triggers feelings of pleasure in the brain.

These brain movies showed that smoking alters dopamine in the brain at different rates and in different locations in males and females. Dopamine release in nicotine-dependent men occurred quickly in a brain area that reinforces the effect of nicotine and other drugs. Women also had a rapid response, but in a different brain region—the part associated with habit formation. "We were able to pinpoint a different brain response between male and female smokers, a finding that could be useful in developing sex-specific treatments to help smokers quit," says lead study researcher Dr. Kelly Cosgrove, a brain-imaging expert at Yale University.

Finding better ways to help men and women quit smoking is important for everyone's health. More than 16 million Americans have diseases caused by smoking. It's the leading cause of preventable death in the U.S.

Autoimmune Disorders • Scientists have found sex influences in autoimmune disorders as well. About



Web Links

For more about sex, gender, and health, click the "Links" tab at:
<http://newsinhealth.nih.gov/issue/May2016/Feature1>

80% of those affected are women. But autoimmune conditions in men are often more severe. For instance, more women than men get multiple sclerosis (MS), a disease in which the body's immune system attacks the brain and spinal cord. But men seem more likely to get a progressive form of MS that gradually worsens and is more challenging to treat.

"Not only are women more susceptible to MS, but women also have many more considerations in the management of the disease, especially since it often begins during child-bearing years," says Dr. Ellen Mowry, a specialist who studies MS at Johns Hopkins University.

"There are a lot of unanswered questions when it comes to the study of sex differences in MS and other autoimmune disorders," Mowry explains. "Researchers can learn a lot by studying women and men separately and together, considering possible risk or predictive factors that may differ based on sex or gender, and working collaboratively with other scientists to improve the likelihood of detecting these factors."

Building Our Understanding • "NIH now requires scientists to ask: 'What are my research results for males and for females?'" Clayton says. "We need to learn more about the roles of sex and gender in health and disease. Understanding these influences improves health and saves the lives of both men and women."

You can improve your health and that of your loved ones by being more aware of sex and gender differences. See the Wise Choices box for details, and talk to your health care provider about any concerns you might have. ■

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Going Gluten Free?

Necessary for Some, Optional for Others

With the growing popularity of gluten-free products at your local grocery store, you may have wondered if you should avoid eating gluten. Sidestepping gluten can be a lifestyle choice for many. But for those with a condition known as celiac disease, it's a medical necessity.

Gluten is a protein found in wheat, barley, rye, and sometimes oats—ingredients often used in breads, pastas, and desserts. Some people get gas, diarrhea, or bloating after eating gluten. These symptoms could be caused by intolerance to the protein or a wheat allergy, but celiac disease is different.

When a person with celiac disease eats or drinks anything with gluten, the body's **immune system** attacks the inside of the small intestine. The damage from this attack keeps the body from absorbing needed nutrients. If left untreated, celiac disease can lead to malnutrition, depression, anxiety, anemia, or weakened bones. It can also delay children's growth.

Celiac disease can be hard to spot, because its symptoms can be similar to other disorders. The condition affects about 1% of people worldwide; nearly 80% of them haven't been diagnosed, says Dr. Alessio Fasano, a

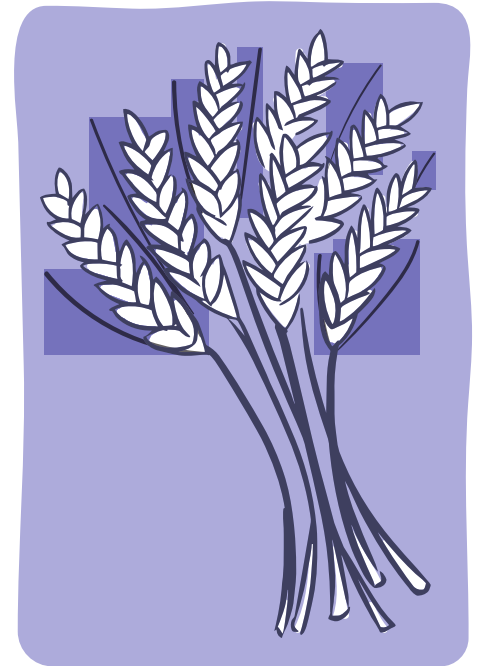
celiac disease specialist at Massachusetts General Hospital. "Celiac disease is a clinical chameleon. This creates tremendous confusion and challenging situations for both health care professionals and people who are trying to understand what's wrong with them," Fasano says.

Your doctor can use a blood test to look for signs of celiac disease. Before the test, continue eating foods with gluten. Otherwise, the results may be negative for celiac disease even if you have it. Eating a regular diet can also help your doctor determine if you have a form of gluten sensitivity that is not celiac disease. Gluten sensitivity is something you may grow out of over time, Fasano explains, whereas celiac disease is a lifelong condition.

If your tests and symptoms suggest celiac disease, your doctor may confirm the diagnosis by removing a small piece of your intestine to inspect it for damage.

Genetic tests may be used to detect the genes that turn on the body's immune response to gluten. Such tests can help rule out celiac disease, but they can't be used for diagnoses; many people who have the genes never develop celiac disease.

Fasano's team is studying why some people with these genes don't have symptoms. The NIH-funded researchers will follow infants who are at increased risk because a family member has celiac disease. The team hopes its findings will help doctors predict who will get celiac disease and learn how to prevent it.



People with one **autoimmune disease** are at increased risk for other autoimmune diseases. Because celiac disease and type 1 diabetes share risk genes, a large international study is following newborns at risk for both conditions to identify environmental factors that may trigger or protect from these diseases.

Going on a strict 100% gluten-free diet for life remains the only treatment for now. "We can't take the genes out, so we remove the environmental trigger," Fasano says.

Gluten is sometimes found in unexpected sources—such as medications, vitamins, or lip balms—so check ingredient lists carefully. The U.S. Food and Drug Administration has strict regulations for the use of "gluten-free" labels. Talking with a dietitian can also be helpful for learning about your food options.

If you suspect you may have celiac disease, talk with your doctor. Waiting too long for a diagnosis might lead to serious problems. ■



Wise Choices Recognizing Celiac Disease

Symptoms can be similar to other disorders, so medical tests may be needed to confirm a diagnosis. Celiac symptoms include:

- Stomach pain
- Gas
- Diarrhea
- Extreme fatigue
- Change in mood
- Weight loss
- Itchy, blistering skin rash



Definitions

Immune System

The body's defense against germs and foreign substances.

Autoimmune Disease

Condition in which the body's immune system mistakenly attacks and destroys the body's own cells and tissues.



Web Links

For more about celiac disease and gluten, click the "Links" tab at:
<http://newsinhealth.nih.gov/issue/May2016/Feature2>



Health Capsules

For links to more information, see these stories online:
<http://newsinhealth.nih.gov/issue/May2016/Capsule1>

Researchers Examine the Structure of Zika Virus

Scientists found a structural detail on the surface of the Zika virus that distinguishes it from similar viruses. Continuing to study this tiny difference might help researchers develop targeted therapies and better ways to diagnose Zika infections.

Zika virus is mainly transmitted to humans by the bite of infected mosquitoes. It's in the same family of viruses—called flaviviruses—that can cause the mosquito-borne diseases dengue, yellow fever, or West Nile illness. Most people infected with Zika virus don't get sick. If symptoms appear, they tend to be mild and go away within a week. Symptoms can include fever, rash, and joint pain.

But if a pregnant woman becomes infected with Zika virus, her unborn child may be at risk. Recent evidence confirms that Zika virus can cause

severe fetal brain abnormalities, including microcephaly, a rare condition in which an infant's head is unusually small.

To learn more about Zika virus, NIH-funded researchers examined its structure at near-atomic resolution. They used a technique called cryo-electron microscopy. The process involves freezing viruses and firing a stream of high-energy particles through the sample to create tens of thousands of images. These 2-D images are then combined to create a detailed 3-D view of the virus.

The 3-D images showed that Zika virus is structurally similar to other flaviviruses. But one difference in a protein on the virus surface may help it attach to and enter human cells. This detail might be something that researchers can take advantage of

in efforts to develop Zika drugs or vaccines.

"The structure of the virus provides a map that shows potential regions of the virus that could be targeted by a therapeutic treatment," says study co-author Dr. Richard Kuhn of Purdue University. The structure might also point to new approaches for vaccine development or improved diagnostics for Zika infection, the researchers say. ■

Children with Cancer: A Guide for Parents

If your child is diagnosed with cancer, you may feel upset and overwhelmed. NIH's recently updated booklet—*Children with Cancer: A Guide for Parents*—can help you and your family cope during this challenging time.

Designed to be used as a tool in consultation with your child's health care team, the guide book has information about childhood cancers; finding a doctor and hospital for your child; medical tests and procedures; treatments, including clinical trials;

and health issues like nutrition, infection, and pain. You can get tips for talking with your child about cancer, finding support, and staying organized by tracking key information. Each section includes quotes from parents, related resources, and questions to help you get more in-depth and personalized information.

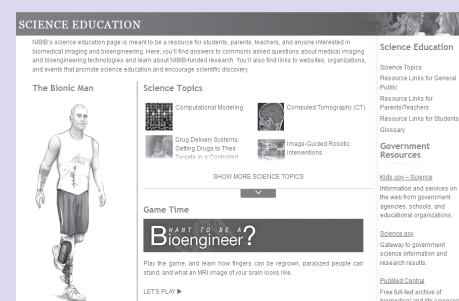
The 84-page booklet can be downloaded from the Web as a PDF or an e-book. Visit www.cancer.gov/publications/patient-education/guide-for-parents. ■



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