

## NIH RESEARCH MATTERS

### 2017 Research Highlights

With NIH support, scientists across the United States and the world conduct wide-ranging research to improve the health of our nation. Groundbreaking NIH-funded research often receives top scientific honors. In 2017, these included 4 [NIH-supported Nobel Prize winners](#) and 2 [NIH-funded recipients of top awards from the Lasker Foundation](#). Here's just a small sampling of the research accomplishments made by NIH-supported scientists in 2017. For more health and medical research findings from NIH, visit [NIH Research Matters](#).

### Clinical Advances

#### Prevention, Diagnosis, and Treatment of Human Disease



##### [Progress on two Ebola vaccines](#)

The 2014-16 outbreak of the highly contagious Ebola disease in West Africa sounded alarm bells around the world. The outbreak, while alarming, was also an opportunity for researchers to test two experimental vaccines in Liberia. Both vaccines induced lasting immune responses and were found to be safe. The results are an important step in the development of an effective Ebola vaccine.



##### [Genetic testing improves blood thinner dosing](#)

Some people are sensitive to a common type of blood thinner known as warfarin, which puts them at risk of bleeding, a life-threatening side effect. A study showed that a genetic test can help identify sensitive patients and predict the best warfarin dose to give them. Individually tailored dosing can improve the safety of this blood thinner.



##### [Bionic pancreas treats adults with type 1 diabetes](#)

To regulate blood glucose levels, people with type 1 diabetes must take insulin every day—either as a shot or with an insulin pump. A study showed that a bionic pancreas system, which relies on a continuous glucose monitor and smart phone connected to an insulin pump, was better than the usual pump method for blood glucose control. After more testing, the bionic pancreas could become another option for people with type 1 diabetes.



**[HIV prevention approach reduces new infections in Ugandan district](#)**

Combining several methods of HIV prevention significantly reduced the number of new HIV infections in a district of Uganda during a seven-year period. Large numbers of people were encouraged to adopt new behaviors, such as using HIV-suppressing treatment, having only one sexual partner, and choosing to have male circumcision. The study shows that this combined approach can reduce new HIV infections in a population.



**[Preventing alcohol use among American Indian and rural youth](#)**

Researchers have tested many approaches to curb underage drinking rates. But methods that work in one racial or ethnic group may not work well in another. Because American Indian teens have high rates of alcohol problems, researchers tested prevention strategies in six communities within the Cherokee Nation area of northeastern Oklahoma. Two distinct prevention strategies reduced alcohol use among American Indian and other youth living in these rural communities.



**[Minimizing surgery for melanoma that has spread](#)**

If there's a sign that the deadly skin cancer melanoma has spread to at least one nearby lymph node, surgeons usually remove the entire cluster of lymph nodes. Although this improves the chance of removing all the cancer cells that may be there, it also causes unwanted side effects. This year, a study showed that this practice doesn't extend life. Instead, patients can be monitored after surgery to remove a single node and then undergo more extensive surgery later, if needed.



**[Stem cell transplant induces multiple sclerosis remission](#)**

MS develops when the immune system attacks the central nervous system. Researchers have been developing a treatment that knocks out and replaces the malfunctioning immune system. [Three-year results reported in 2015](#) showed that most of the 24 study participants with early-stage MS survived without an increase in disability. The five-year results showed that most people didn't worsen, despite not taking MS medications.



**[Yoga eases moderate to severe chronic low back pain](#)**

A study with people from economically disadvantaged communities, who are disproportionately affected by chronic low back pain, showed that a specially designed yoga class was just as effective as physical therapy for reducing pain and improving physical function. While most studies have been conducted with white, middle class volunteers, this showed that a structured yoga program is helpful to those from economically disadvantaged communities.



## Promising Medical Advances

### Findings with Potential for Enhancing Human Health



#### [How dietary factors influence disease risk](#)

Of hundreds of thousands of deaths studied from heart disease, stroke, and type 2 diabetes, nearly half were associated with eating habits: low consumption of foods widely considered vital for health and overconsumption of other foods that are not. Experts attribute recent reductions in the annual death rate from these diseases to improvements in dietary choices.



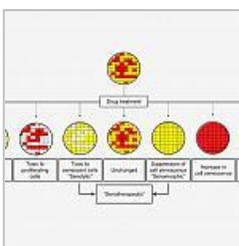
#### [Combatting epigenetic effects from outdoor air pollution](#)

Outdoor air pollution is associated with heart attacks, strokes, and cancers. Researchers found that particles in exhaust from cars and trucks can cause epigenetic changes—alterations that affect how genes are switched on and off without changing the DNA sequence itself. These changes weren't seen when people were given a daily B vitamin supplement before exposure to the particles. The findings could help guide the development of future prevention therapies.



#### [Changing gut bacteria in Crohn's disease](#)

Digestive problems can arise when the balance of microbes in the gut become out of whack. People with Crohn's diseases and other inflammatory bowel diseases tend to have an imbalance in their microbial populations. Researchers found a role for the bacterial enzyme urease in the development of microbial population imbalance and inflammatory bowel disease. Future treatments that target urease could be helpful for restoring balance.



#### [Drugs extend healthy lifespan in mice](#)

Drugs that remove senescent cells, which no longer divide, from the body have prolonged the healthy lifespan of lab animals. Scientists devised a method to identify different classes of compounds with the potential for eliminating senescent cells. One novel class of drug delayed several age-related symptoms in mice. Eliminating senescent cells might one day extend healthy lifespan in people, but these drugs will require careful study to discover any undesirable side effects.



#### [Methods detect prions in blood and skin](#)

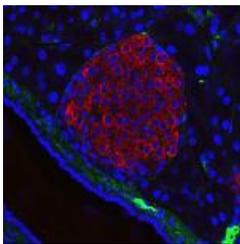
Prion diseases are a group of rare, fatal brain diseases that affect animals and humans. They're caused by normally harmless proteins that become abnormal and form clumps in the brain. An easy, noninvasive prion detection method is needed because prion carriers who haven't yet developed symptoms may unwittingly transmit prions to others when they donate blood. Researchers developed a [new method that accurately detects prions in blood](#). Another team

[detected prions in skin samples](#).



#### **[Quick, sensitive diagnostic tests with CRISPR](#)**

CRISPR is a gene-editing technique known for its ability to replace faulty genes, but it also has potential for diagnostics. Scientists reported that they've developed a CRISPR-based tool that can detect tiny amounts of Zika and Dengue virus, distinguish pathogenic bacteria, and identify tiny DNA variations. The components of the system can be freeze-dried and reconstituted on paper for field applications, opening the door to many practical uses.



#### **[Biomarkers for early organ transplant rejection](#)**

Receiving an organ from a donor can save a patient's life, but sometimes the patient's immune system will attack and destroy the donated organ. If doctors could detect organ rejection early on, they could adjust treatments and help reduce organ damage. Researchers showed that certain biomarkers released by the donor organs might be used to detect transplant injury earlier than current techniques.

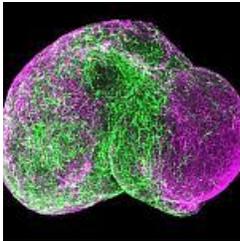


#### **[Predicting recovery time for sports concussions](#)**

After athletes are sidelined by a concussion, they need time to recover or they risk long-term problems like headaches and dizziness. Investigators are developing a blood test that measures the level of a brain injury marker to help determine which injuries need longer recovery times.

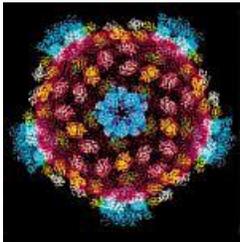
## Insights from the Lab

### Noteworthy Advances in Basic Research



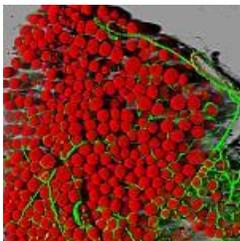
#### [3-D model of human brain development and disease](#)

Glitches during prenatal brain development are thought to set the stage for some neurodevelopmental brain disorders. To study this process, researchers created a 3-D model of the interactions between developing brain regions in a dish. They then looked at how mutations that cause an autism-related disorder affect brain development. They discovered a defect in how neurons migrate between regions. The results suggest a way to study personalized brain development and disease.



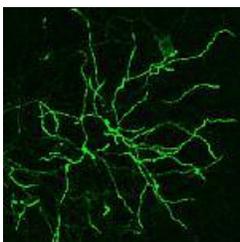
#### [Virus linked to food sensitivity](#)

Scientists don't know exactly what triggers celiac disease. Viral infections could be a possible trigger. Researchers found that reoviruses, once thought to be harmless, can provoke immune responses to a dietary protein in mice. Patients with celiac disease also showed high levels of antibodies to reovirus. More work will be needed to understand how certain viruses might provoke food intolerance. The findings could lead to new prevention and treatment strategies.



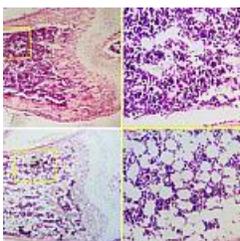
#### [Fat tissue can communicate with other organs](#)

Fat tissue helps your body store excess energy. It also releases hormones and other substances that help regulate your body's metabolism by communicating with other organs and tissues. Researchers discovered that fat tissue releases signals called microRNAs into the bloodstream that affect genes in another organ. Because fat is easily accessible, microRNAs might offer a way to regulate genes in other organs to treat diseases like obesity and diabetes.



#### [New role discovered for the thalamus](#)

The brain region known as the thalamus has long been thought of as merely a relay station for sensory information. Using a technology called optogenetics in mice, scientists found that the thalamus also sustains the ability to distinguish types of information and hold thoughts in mind. The findings suggest that it may play a pivotal role in the brain's thinking circuitry and might be a therapeutic target for certain psychiatric disorders.



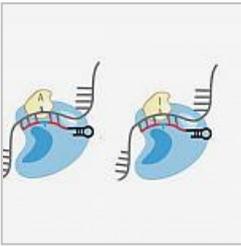
#### [Mechanisms of age-related bone loss](#)

Bone is continually broken down and renewed. Osteoblasts, the cells that build bone, are derived from stem cells that can also form other types of cells, including fat cells. Older adults have fewer osteoblasts and more fat cells in their bone marrow than younger people. Experiments in mice revealed the mechanisms that cause stem cells to create fat cells instead of bone-producing cells. These findings may help explain why bones become weaker in older adults.



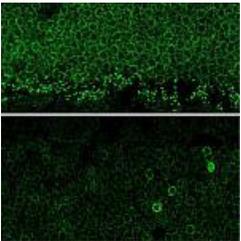
# National Institutes of Health

*Turning Discovery Into Health*



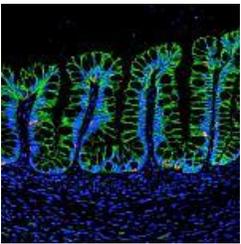
## [CRISPR technology adapted to edit RNA](#)

Genome editing is a powerful technique that has the potential to correct human diseases caused by genetic errors. However, genetic alterations pose numerous challenges. Scientists designed a potential alternative to gene therapy based on a newly discovered CRISPR/Cas system: a highly specific RNA editing system. The ability to edit RNA opens up more potential opportunities to treat many diseases in different kinds of cells.



## [Genetic engineering prevents retinal cell loss in mice](#)

Retinitis pigmentosa is a group of genetic disorders that lead to vision loss. Gene therapy or genome editing can correct individual genetic issues, but because there are many underlying causes for vision loss, scientists have been exploring common targets. Silencing a single gene in mouse models of retinal degeneration, researchers found, prevents the loss of cells from degenerative retinal diseases. The findings could lead to novel therapies for preventing vision loss.



## **Progress in biomaterials**

Researchers have been making progress in assembling functional biomaterials that can restore, maintain, or improve damaged tissues or whole organs. Among other advances in 2017, scientists used 3-D printers to make [artificial ovaries](#) and [blood vessel networks](#) that functioned in mice; used stem cells grown on a polymer scaffold to [help repair torn rotator cuff tendons](#) in rats; designed an [injectable hydrogel that grew intestine-like tissues](#) and accelerated wound healing in mice; and designed a family of [strong and stretchy medical glues](#), inspired by sticky slug mucus, that can be used on wet surfaces during surgery.