

# 20

## Best Medical Breakthroughs of 2016

THE PAST YEAR HAS BEEN filled with medical firsts, game-changing new drugs and devices, and fascinating research discoveries. Some of these findings will change your life immediately, while others will be available soon. We've chosen some of the most exciting to highlight here.

BY BETH HOWARD • ILLUSTRATIONS BY BRIAN STAUFFER

### 1

#### MAMMOGRAMS FOR HEART DISEASE SCREENING

Researchers at Mount Sinai Hospital in New York City confirmed **a link between the amount of calcium in the arteries of the breasts, which can be seen on digital mammo-**

**grams, and the level of calcium buildup in the coronary arteries.** This means that routine mammo-grams could be a useful tool for identifying women at a higher risk of heart disease. Breast imaging centers will need to create systems for reporting heart problems found on the images, but women can take advantage of the finding now: If you get a digital mammo-gram, ask if your vessels show calcifications. If your breast arteries suggest a heart disease risk, you may be referred for additional tests.





## 2

### THE WORLD'S FIRST VIRTUAL HEALTH CARE CENTER

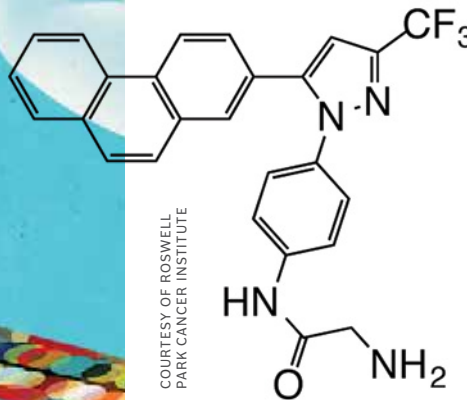
← The new Mercy Virtual Care Center in Chesterfield, MO, has no waiting rooms, hospital beds, or patients. Instead, Mercy Virtual, which opened last winter, houses more than 300 doctors and nurses who sit in front of computer displays, watching over the care of patients at 38 hospitals in six states. Some are highly trained intensive care specialists who oversee ICUs remotely, alerting nurses at the bedside to changes in a patient's condition before a crisis occurs. Others monitor the health of chronically ill patients at home using iPads and medical devices that relay vital signs to the hospital's "command center" via telemedicine technology. The goal: to catch problems early and keep patients out of the ER. The first-of-its-kind facility may be shepherding in a new era of health care—one in which only the sickest patients need hands-on care in a hospital and others are tended remotely or through the occasional house call. "This is the new model—**moving away from brick and mortar and relying on technology to keep people healthier,**" says Randall Moore, Mercy Virtual's president.



## 3

### A VACCINE AGAINST LUNG CANCER

Researchers at the Roswell Park Cancer Institute in Buffalo are just beginning clinical testing of the world's first lung cancer vaccine, called CimaVax. Used in Cuba since 2011, the widely anticipated vaccine "**targets the cancer's fuel source in a deceptively simple way and with minimal side effects,**" says Kelvin Lee, Roswell Park's chair of immunology.



COURTESY OF ROSWELL PARK CANCER INSTITUTE

## 4

### A DRUG TO DESTROY SUPERBUGS

Every few years, the world seems to face a new microbial menace, such as Ebola. New research suggests that these bugs may have met their match in an experimental cancer drug known as AR-12 that may combat drug-resistant bacteria and viruses. AR-12 works by targeting a family of proteins that is essential for the replication of almost every type of bacterial or viral pathogen while leaving the normal cells of the body unharmed. "It's not an antibiotic itself, but it **interferes with the ability of bacteria to become and stay resistant to antibiotics,**" says lead investigator Paul Dent, a professor of biochemistry and molecular biology at Virginia Commonwealth University.





# 5

## A PERSONAL CHEMICAL ANALYZER

Want to know how many calories or carbs a restaurant meal contains? Or check your own body fat? Those and more are jobs for a new handheld sensor called SCiO by Consumer Physics that **reads the molecular makeup of foods, medications, and even your own body** with an infrared spectroscopy scan and sends that information to a smartphone app for interpretation.

# 6

## DIAGNOSIS VIA SUPERCOMPUTER

In August, NHK News in Japan announced that IBM's AI computer Watson had helped oncologists correctly diagnose a 64-year-old Japanese woman with a rare form of leukemia, solving a medical mystery that had stumped her doctors for months. It took Watson a mere 10 minutes to arrive at the right diagnosis after consulting some 20 million research studies to compare symptoms. Watson's medical training started in 2011 and includes reading through massive volumes of medical literature, according to IBM. **The computer now consults with doctors, cancer researchers, and health systems around the world.**

# 7

## A ONE-OF-A-KIND OSTEOPOROSIS DRUG

Until now, people with the bone-weakening disease osteoporosis—some 54 million in the US—had limited options. But that's about to change. A new bone builder called abaloparatide may hit the European market soon and is expected to gain FDA approval in early 2017. **"Abaloparatide works by stimulating bone formation through direct effects on the bone-forming cells in our skeletons,"** says researcher Felicia Cosman, medical director of the Clinical Research Center at Helen Hayes Hospital and a professor of medicine at Columbia University College of Physicians and Surgeons. By contrast, she says, most other osteoporosis medications only reduce the rate of bone breakdown. As a result, they can't renew bone tissue and can't improve bone density



as well as abaloparatide does—or as quickly. Adds Cosman, "What's really unique about abaloparatide is that it improves bone mass in both the spine and hip rapidly and reduces fractures very quickly."

FROM TOP: COURTESY OF SCiO. STOCKDEVIL/GETTY IMAGES. OPPOSITE PAGE: COURTESY OF NOVO NORDISK



# 8

## A WAY TO OUTSMART ZIKA-SPREADING MOSQUITOES

Following the recent outbreak of Zika on US soil, the FDA's Center for Veterinary Medicine OK'd a trial of genetically modified mosquitoes in the Florida Keys to combat the threat. GM males will be released to mate with wild female *Aedes aegypti*, which carry the Zika virus. **The males have a "self-limiting gene" that programs their offspring to die before maturity**, meaning that the population of Zika-carrying bugs will gradually decline. "Mosquito control is currently the most effective tool we have," says Anthony Fauci, head of the National Institute of Allergy and Infectious Diseases.

# 9

## DIABETES DRUGS THAT REDUCE HEART RISKS

Knowing that many people with type 2 diabetes die from cardiovascular problems, researchers have tried to find a medication that can improve both glucose control and heart health. Two drugs are showing promise. A study presented at the American Diabetes Association's annual meeting showed that liraglutide, a glucose-lowering drug, also **lowers the risk of death from cardiovascular causes by 22%** in those with type 2 diabetes. Another new study found the diabetes drug empagliflozin cuts cardiovascular deaths by 38% and hospitalizations due to heart failure by 35%.



## REPORT

# 10

## A DNA APP STORE

provides a platform for companies and research labs to use the information to create health apps. **Consumers receive a detailed history about their genetic makeup, while app developers get lots of new data to work with.** The company expects to see an explosion of new DNA-related health apps, such as one to help people with the gene for familial hypertrophic cardiomyopathy—an inherited heart disease.



The first “app store” for genomic information is coming soon. Helix, a San Francisco Bay Area-based company, sequences consumers’ genomes for a small fee, stores the DNA data, and

# 12

## AN ALTERNATIVE TO BLOOD THINNERS FOR AFIB

People with atrial fibrillation, in which an irregular heartbeat increases the risk of blood clots and stroke, are usually treated with blood thinners like warfarin that can cause dangerous bleeding. But a new minimally invasive procedure called the Watchman became available to millions of Americans in February when Medicare agreed to cover the cost. Shaped like an umbrella, **the implant enters the heart via a catheter** and is placed at the opening of the left atrial appendage (a small pouch), where most clots develop. When tissue forms over the device, it seals the appendage, and patients no longer need blood thinners.

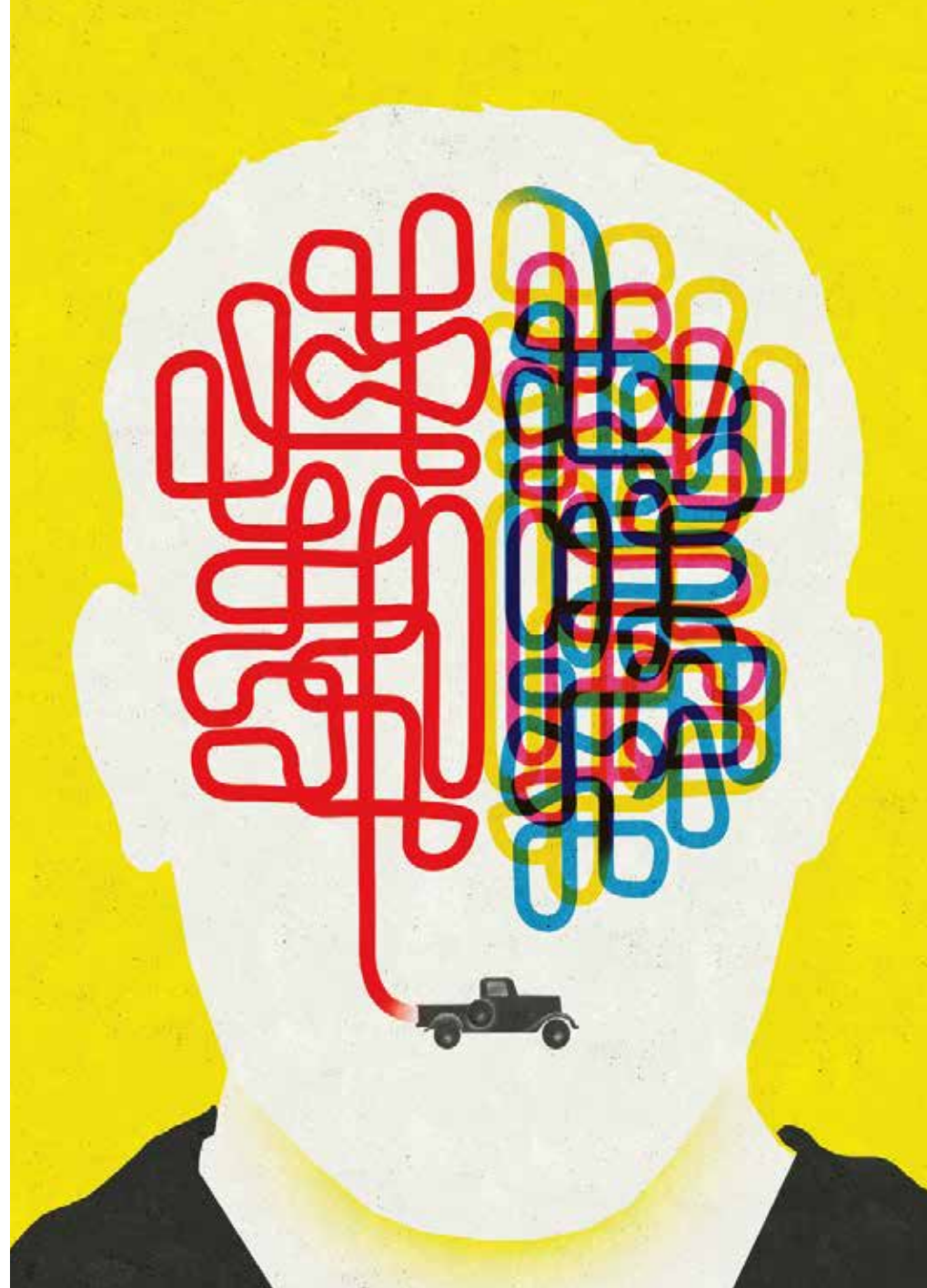


# 11

## BRAIN TRAINING THAT LOWERS DEMENTIA RISK

→ Claims made by companies offering computerized brain training have raised the ire of the Federal Trade Commission in recent years. But in a landmark study released in August, researchers at the University of Florida showed for the first time that a particular form of computerized brain exercise may reduce the risk of dementia by as much as 48%. The game Double Decision (from Posit Science) **simulates driving on a road while dealing with distractions and obstacles**; it was designed to improve mental quickness. According to study author Jerri Edwards, the training has only been shown to prevent dementia, not treat those already diagnosed. “You need to start the training before you think you need it,” she says.

FROM TOP: JEZPERKLAUZEN/GETTY IMAGES. DEVICE: COURTESY OF WATCHMAN. HAND: CONTRAL/GETTY IMAGES



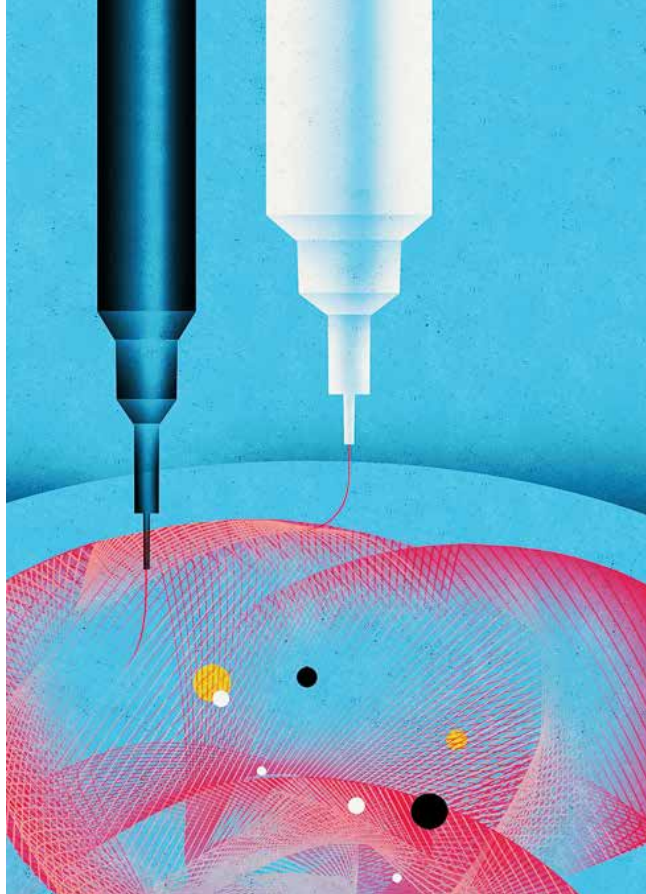


## REPORT

# 13

### 3-D PRINTED ORGAN TISSUE THAT TESTS DRUG TOXICITY

A company called Organovo recently showed that livers it created with 3-D bioprinted tissues can be used to test the toxicity of new drugs, the crucial first step in a medication's development. **"The goal is to create a reproducible and reliable source of tissues to screen potential drugs for safety before the drugs are administered to people,"** says Keith Murphy, Organovo's chairman and CEO. Such tissue also allows drug makers to rely less on animal testing. Already, seven of the world's largest pharmaceutical companies have signed on to use the bioengineered tissue.



# 14

### THE LAUNCH OF PRECISION MEDICINE

The National Institutes of Health is seeking to engage 1 million people willing to share their lifestyle habits, medical history, and genetic information, with the aim of learning more about the factors that influence health. The first participants may be enrolled in the coming months.



The past year has seen significant progress in President Obama's Precision Medicine Initiative, which is poised to **revolutionize medicine from a one-size-fits-all approach to treatments and prevention strategies tailored to the individual.**

URFINGUS/GETTY IMAGES

# 15

### PROGRESS TOWARD A ZIKA VACCINE

More than 23,000 Zika cases have been reported in the US and its territories. Many scientists believe vaccines will eventually be the key to eradicating the disease. In August, the National Institute of Allergy and Infectious Diseases conducted **the first human trial of a vaccine containing pieces of DNA that researchers encoded with genes for Zika virus proteins.** When the vaccine is injected, the body's cells create the proteins that transform into viruslike particles. The body then mounts an immune response. Next up: the second and third phases of testing for the vaccine.



# 17

### A BETTER STROKE STOPPER

Stroke specialists have a new tool: a mesh cage called a stent retriever. The device is threaded through a catheter into a blood vessel in the leg, then guided up to the blocked artery in the brain. **Doctors open the cage and grab the clot, removing it from the body and restoring blood flow.** Stroke patients treated with stent retrievers plus the drug tPA were significantly more likely to be able to care for themselves than patients who got the drug alone, says study author Lahoud Touma, a researcher at McGill University in Montreal.

# 16

### IMPLANTED BIONIC LIMBS

In January, researchers from Johns Hopkins University reported that a modular prosthetic limb had been attached directly to a man for the first time. **The high-tech limb is designed to allow users to move the device simply by thinking about it,** using implanted sensors that convey signals from the brain to a computer and then back to the limb. Two surgeries made the implanted prosthesis functional: Johnny Matheny, who lost his arm to cancer, first underwent a procedure to reassign the nerves that once controlled movement of his arm and hand, preparing them to move the prosthetic arm. Then University of Pittsburgh surgeon Richard McGough attached the prosthesis to the remaining bone, creating a permanent bond that allows the advanced prosthesis to be used. Says McGough, "Matheny is likely the most sophisticated upper-extremity amputee in the world."

FROM TOP: COURTESY OF MEDTRONIC; COURTESY OF THE JOHNS HOPKINS APPLIED PHYSICS LABORATORY



## 18

NEEDLE-FREE  
GLUCOSE  
TESTING

blood sugar levels without a needle. Users place their finger on a piece of silica glass containing ions that fluoresce when hit with a low-powered laser. The reflected fluorescence signal varies according to the concentration of glucose in the blood. Meanwhile, scientists at Cardiff University in Wales have created a glucose monitor that uses microwave energy to detect glucose levels through the skin and then send the data to an app. The era of painless blood testing is in sight.

Good news for people with diabetes who currently require several painful skin pricks a day to test their blood sugar: **2016 was the year for developing bloodless ways of measuring glucose.** At the University of Leeds in England, researchers have invented a device called Glucosense that “reads”



## 19

AN APP TO  
DIAGNOSE  
SLEEP APNEA

Obstructive sleep apnea affects more than 25 million Americans, raising

their risk of high blood pressure, stroke, heart problems, depression, and diabetes. Yet there aren't enough sleep labs to diagnose every person who may have it. Now researchers at the University of Washington have come up with a simple smartphone app that wirelessly tests for sleep apnea in a person's own bedroom. Called the ApneaApp, **it uses inaudible sound waves from the phone's speakers—like a bat's sonar—to track breathing patterns without sensors or special equipment,** allowing a diagnosis to be made at home. Preliminary tests are positive: During nearly 300 hours of testing, the app achieved 95 to 99% accuracy, compared with polysomnography, the state-of-the-art test used in sleep labs.

FREDRIC CIROU/GETTY IMAGES

## 20

A NEW  
ALZHEIMER'S  
TREATMENT

A technique being studied at the Sutter Neuroscience Institute in Sacramento may be a game-changer for Alzheimer's disease. It involves infusions of a blood product called intravenous immunoglobulin (IVIG) that contains antibodies to amyloid, an abnormal brain protein found in Alzheimer's patients. Among people who have mild cognitive impairment from the disease, **those who received infusions of IVIG over 2 months performed better on cognitive tests and had significantly less brain atrophy after 1 year** than those who were given a placebo. IVIG could be one of the first Alzheimer's treatments that can change the course of the disease if offered early.