

**PUBLIC HEALTH**  
**The War  
on Ebola**

**PLANETARY SCIENCE**  
**Oceans from  
the Skies**

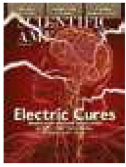
**TECHNOLOGY**  
**A World  
without Secrets**

# SCIENTIFIC AMERICAN

ScientificAmerican.com  
MARCH 2015

## Electric Cures

Bioelectronic medicine could create  
an “off switch” for arthritis,  
diabetes, even cancer



An overactive immune system can produce an inflammatory reaction that affects organs throughout the body. When the nervous system senses excessive inflammation, it tries to activate an immunological "off switch," sometimes with limited effectiveness. Medical implants that enhance the anti-inflammatory process may help fight rheumatoid arthritis and other diseases. Image by Bryan Christie.

# SCIENTIFIC AMERICAN

March 2015 Volume 312 Number 3

56



## FEATURES

### MEDICAL ELECTRONICS

#### 28 **Shock Medicine**

Doctors may soon treat inflammatory and autoimmune disorders with electricity. *By Kevin J. Tracey*

### PLANETARY SCIENCE

#### 36 **Oceans from the Skies**

Did Earth's water come from comets, asteroids or something else entirely? New evidence is rekindling the debate. *By David Jewitt and Edward D. Young*

### TECHNOLOGY

#### 44 **Sound Bytes**

Ears are such terrific pattern finders that scientists are using them to find cancer cells and particles from space. *By Ron Cowen*

### PUBLIC HEALTH

#### 48 **Ebola War**

Africa's crisis has jump-started efforts to develop critically needed vaccines and treatments. *By Helen Branswell*

### CLIMATE CHANGE

#### 56 **Fantasy Island**

The rush to save coral atolls from rising seas may be doing more harm than good. *By Simon D. Donner*

### SCIENCE AND SOCIETY

#### 64 **Our Transparent Future**

Now that no secret is safe, what will become of our society and its institutions? *By Daniel C. Dennett and Deb Roy*

### SPECIAL REPORT

## INNOVATIONS IN THE MICROBIOME

#### S3 **The Peacekeepers**

Among the trillions of microbes in the human intestinal tract, a few play an outsized role in keeping us healthy. *By Moises Velasquez-Manoff*

#### S5 **Why Microbiome Treatments Could Pay Off Soon**

*By Rob Knight*

#### S7 **The Gene-Microbe Link**

*By Ruth E. Ley*

#### S9 **INFOGRAPHIC Your Microbes at Work:**

**Fiber Fermenters Keep Us Healthy**

#### S10 **Microbiome Engineering**

*By Justin L. Sonnenburg*

#### S13 **Thinking from the Gut**

A new class of drugs aimed at the microbiome may make effective treatments for anxiety, depression and other mood disorders. *By Charles Schmidt*

#### S14 **The Diverse Microbiome of the Hunter-Gatherer**

*By Stephanie L. Schnorr*



23



25



72

# SCIENTIFIC AMERICAN

## DEPARTMENTS

### 3 From the Editor

### 4 Letters

### 6 Science Agenda

Worker sick time benefits everyone. *By the Editors*

### 8 Forum

American tech companies, ensnared by the NSA, must act boldly to restore the world's confidence. *By Karl Frederick Rauscher*

### 10 Advances

HPV cancers on the rise in men. Rubbery glass. Eccentricity and alien life. Cockroach superpowers.

### 25 The Science of Health

New ways to fix damaged knees. *By Claudia Wallis*

### 27 TechnoFiles

E-mail is becoming the new snail mail. *By David Pogue*

### 72 Recommended

Killer whales at SeaWorld. The war against rust. Historical neuroscience. Junk DNA. *By Clara Moskowitz*

### 74 Skeptic

Just because we don't know everything doesn't mean we know nothing. *By Michael Shermer*

### 76 Anti Gravity

In the ER, doctors may resort to Google Translate, with varying outcomes. *By Steve Mirsky*

### 77 50, 100 & 150 Years Ago

### 78 Graphic Science

What if the Yellowstone supervolcano erupted? *By Mark Fischetti*

## ON THE WEB

### Consumer Electronics In-Depth Report

*Scientific American* looks at the latest trends in flexible device screens, automotive gadgets and voice recognition, with reporting from the International Consumer Electronics Show. Go to [www.ScientificAmerican.com/mar2015/consumer-electronics](http://www.ScientificAmerican.com/mar2015/consumer-electronics)

Scientific American (ISSN 0036-8733), Volume 312, Number 3, March 2015, published monthly by Scientific American, a division of Nature America, Inc., 75 Varick Street, 9th Floor, New York, N.Y. 10013-1917. Periodicals postage paid at New York, N.Y., and at additional mailing offices. Canada Post International Publications Mail (Canadian Distribution) Sales Agreement No. 40012504. Canadian BN No. 127387652RT; TVQ1218059275 TQ0001. Publication Mail Agreement #40012504. Return undeliverable mail to Scientific American, P.O. Box 819, Stn Main, Markham, ON L3P 8A2. Individual Subscription rates: 1 year \$39.97 (USD), Canada \$49.97 (USD), International \$61 (USD). Institutional Subscription rates: Schools and Public Libraries: 1 year \$72 (USD), Canada \$77 (USD), International \$84 (USD). Businesses and Colleges/Universities: 1 year \$330 (USD), Canada \$335 (USD), International \$342 (USD). Postmaster: Send address changes to Scientific American, Box 3187, Harlan, Iowa 51537. Reprints available: write Reprint Department, Scientific American, 75 Varick Street, 9th Floor, New York, N.Y. 10013-1917; fax: 646-563-7138; reprints@SciAm.com. Subscription inquiries: U.S. and Canada (800) 333-1199; other (515) 248-7684. Send e-mail to [scacustserv@cdsfulfillment.com](mailto:scacustserv@cdsfulfillment.com). Printed in U.S.A. Copyright © 2015 by Scientific American, a division of Nature America, Inc. All rights reserved.

