SCIENTIFIC AMERICAN

October 2010 ScientificAmerican.com

S2

Stephen
Hawking on
the Theory of
Everything

In Science We Trust?

Human Genome

Why the Revolution Is Late

Human Evolution Is Not Over

How our species is still changing over time

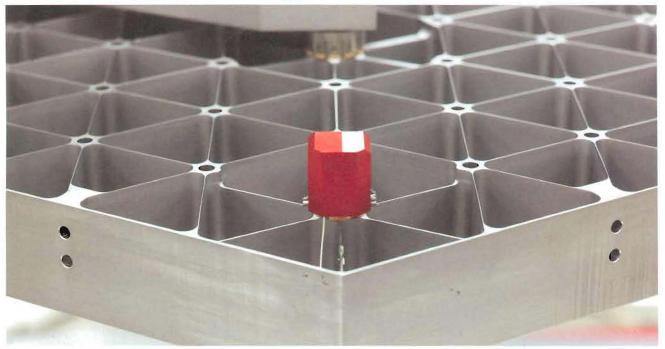


\$5.99

October 2010 Volume 303, Number 4

MERIO

Humans are still evolving, but apparently not always in the classic way nor as quickly as some recent findings have suggested. Scientists say that we are thus more likely to combat the problems of the coming millennium with culture and technology than to evolve biological defenses against them, Photograph by Craig Cutler.



48

FEATURES

Evolution

40 How We Are Evolving

Human evolution may be taking a different course than biologists expected.

By Jonathan K. Pritchard

Astronomy

48 Origami Observatory

NASA's replacement for the Hubble Space Telescope will need to unfold perfectly in deep space. By Robert Irion

Exclusive Poll

56 In Science We Trust

In our Web survey, readers show strong support for science—with some notable exceptions.

Medicine

60 Revolution Postponed

The medical miracles of the Human Genome Project have yet to appear. Biologists are divided. By Stephen S. Hall

Physics

68 The (Elusive) Theory of Everything

Physicists searched for a single theory. Instead they found several. By Stephen Hawking and Leonard Modinow

Robotics

72 Robot Be Good

Independent-minded machines will soon live and work among us. It's time they learned how to behave.

By Michael Anderson and Susan Leigh Anderson

Biology

78 Sensational Sucker

No mere suction cup, the octopus sucker can feel, taste, grip—and act of its own accord. By Frank W. Grasso

Mind

80 Desperate for an Autism Cure

Diagnoses have skyrocketed, but valid treatments are virtually nonexistent. By Nancy Shute

Energy

86 Reinventing the Leaf

The ultimate liquid fuel may come not from corn or algae but directly from the sun itself. *By Antonio Regalado*

Information Science

90 Digitizer in Chief

U.S. information czar Vivek Kundra wants to put all the government's data on the Web. *By Michael Moyer*

OVER SKULLS COURTESY OF THE

SCIENTIFIC AMÉRICAN

November 2010 ScientificAmerican.com

Hidden Worlds of Dark Matter

An entire universe may be interwoven silently with our own

Vaccines

New Ways to Beat Malaria

Neuroscience

Brain Control with Light

Climate Critic

What Science Gets Wrong

Energy

How to Build the Supergrid



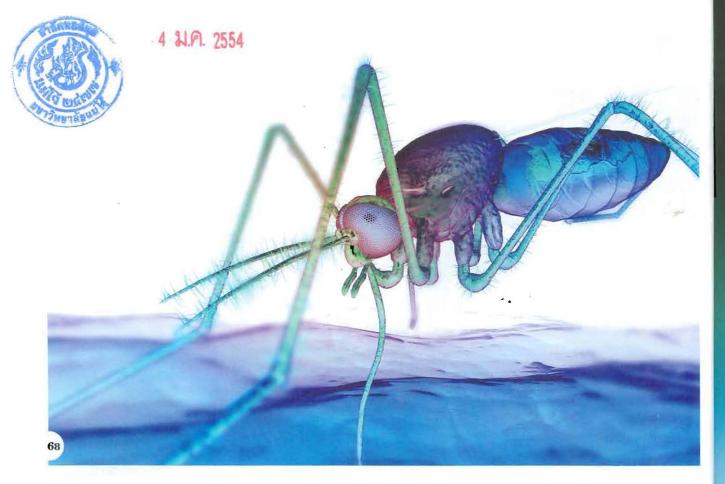
\$5.99 U.S.

SCIENTIFIC AMERICAN

November 2010 Volume 303, Number 5



The famous Hubble Space Telescope image of the "Pillars of Creation" in the Eagle Nebula, superposed on an image of Earth, evokes the idea of the invisible world of dark matter and the forces it exerts on our own. Image by Kenn Brown, Mondolithic Studios.



FEATURES

Cosmology

38 Dark Worlds

A shadow cosmos in our midst may be as dynamic as the visible one. By Jonathan Feng and Mark Trodden

Neuroscience

48 Controlling the Brain with Light

Researchers now use light to probe in detail how the nervous system works. Their work could lead to better treatments for psychiatric problems. *By Karl Deisseroth*

Engineering

56 How to Build the Supergrid

The U.S. needs a new electric transmission system to deliver cleaner, more reliable power nationwide. Here's how to get it done. By Matthew L. Wald

Ecology

62 Phosphorus Lake

To supply the nation with fertilizer, Florida gets stripmined. By $Mark\ Fischetti$

Physics

64 Dr. Unification

If anybody can make the field of physics whole, it's Steven Weinberg. Interview by Amir D. Aczel

Medicine

68 Halting the World's Most Lethal Parasite

Prospects for protecting children against malaria have brightened because of a new vaccine in late-stage clinical trials. *By Mary Carmichael*

Technology

76 From Silk Cocoon to Medical Miracle

Scientists are crafting arteries, ligaments, circuitry and holograms from worm yarn. By Fiorenzo Omenetto and David Kaplan

Environment

78 Climate Heretic

Can we have a civil conversation about global warming? By Michael D. Lemonick

4 Scientific American, November 2010

Web

Wou

Weh

May alon

scier Doin

comi

Arou

clien

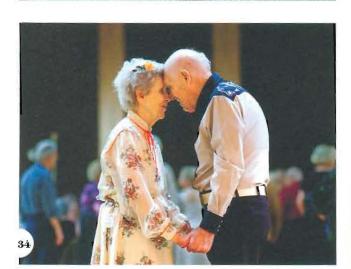
respe Rathe

Spec

An Equa







SCIENTIFIC AMERICAN

DEPARTMENTS

- 10 From the Editor
- 12 Letters
- 16 Science Agenda

Revitalize music education in the schools. By the Editors

18 Forum

Confirmation bias and Marc Hauser. By Scott O. Lilienfeld

20 Advances

The EPA's new car labels. A flu breakthrough. Hawking hubbub. Microbial miners. Disney physics. Turkey genomics. Inside a mosquito heart.

34 The Science of Health

Stress alone does not explain why women live longer. By Thomas Kirkwood

36 TechnoFiles

Reading devices are still too crude to replace ink and paper. By David Pogue

84 Recommended

Dinosaur field guide. Massive missing particle. By Kate Wong

86 Skeptic

What science can learn from master logician Christopher Hitchens. *By Michael Shermer*

88 Anti Gravity

The smelly reality of space travel. By Steve Mirsky

- 90 50, 100 & 150 Years Ago
- 92 Graphic Science

Untested chemicals surround us. By Mark Fischetti $\,$

ON THE WEB

The 2010 Nobel Prizes

Learn all about the achievements that netted the latest crop of laureates the most prestigious prize in science. Go to www.ScientificAmerican.com/nov2010

Scientific American (ISSN 0036-8733), Volume 303, Number 5, November 2010 published monthly by Scientific American, a trading name 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: OST No. 01015332537. 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: 5 chools and Public Libraries: 1 year \$69 (USD). Canada \$74 (USD). International \$81 (USD). Bostmasters: Seen address changes to Scientific American, 80x 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 sacust@sciam.com. Printed in U.S.A. Copyright © 2010 by Scientific American, a division of Nature America, Inc. All rights reserved.

SCIENTE

S2 Power Plants Gas from Garbage

Anxiety **Psychedelic** Cures

Dinosaurs **Blood from Stone**

The Universe's Hidden Geometry

Better Living through Gaming

Nanotech Water **Filters**

Innovations for a brighter future

Transistor







This year's edition of World Changing Ideas explores the leading ways that technology and innovation can create a healthier, cleaner, smarter world, from biologically inspired algorithms to vegetarian robots to a cheap nanotech-based water filter.

Photograph by Mark Hooper.

62

FEATURES

INNOVATION

42 World Changing Ideas

A special report on thoughts, trends and technologies that have the power to change our lives.

PHYSICS

54 A Geometric Theory of Everything

Deep down, the particles and forces of the universe are a manifestation of exquisite geometry. By A. Garrett Lisi and James Owen Weatherall

PALEONTOLOGY

62 Blood from Stone

Mounting evidence from dinosaur bones (such as "Big Mike's," shown above) shows that, contrary to common belief, soft tissue can survive in fossils for millions of years. By Mary H. Schweitzer

BIOLOGY

70 Life Unseen

The biological world reveals microscopic landscapes of surprising beauty. By Davide Castelvecchi

HEALTH

76 Hallucinogens as Medicine

In a matter of hours, mind-altering substances may induce the profound psychological realignments that can take

decades to achieve on a therapist's couch. By Roland R. Griffiths and Charles S. Grob

INFORMATION SCIENCE

80 Long Live the Web

In an exclusive essay, the Web's inventor argues that protecting the Web is critical not merely to the digital revolution but to our continued prosperity—and even our liberty. By Tim Berners-Lee

LIFE SCIENCE

86 Jane of the Jungle

Primatologist Jane Goodall shares insights from her 50 years among the chimpanzees of Gombe. *Interview by Kate Wong*

SPACE EXPLORATION

88 Jump-Starting the Orbital Economy

For the first time in five decades, NASA will soon be out of the astronaut-launching business. The only way to save manned spaceflight may be to outsource it to private companies. By David H. Freedman

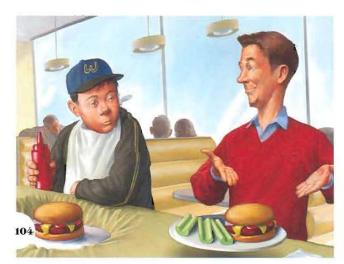
ROBOTICS

94 Cyborg Beetles

Tiny flying robots that are part machine and part insect may one day save lives in wars and disasters. By Michel M. Maharbiz and Hirotaka Sato



18



SCIENTIFIC AMERICAN

DEPARTMENTS

- 10 From the Editor
- 12 Letters
- 16 Science Agenda

The laws of physics are the least of NASA's challenges. By the Editors

18 Forum

Truth, witnesses and brain scans. By Hank Greely

20 Advances

Exoplanetary life. Malaria genetics. Beer foam math. Proving Hawking right. Wireless body armor. Science books and toys for kids. Jellyfish propulsion.

36 The Science of Health

Do exercising and quitting smoking delay the onset of dementia? *By Christine Gorman*

40 TechnoFiles

Speech-recognition software has quietly grown tendrils into every corner of our lives. By David Pogue

100 Recommended

Eye-catching books for holiday gift-giving. By Kate Wong

102 Skeptic

The difference between true and false conspiracy theories. By $Michael\ Shermer$

104 Anti Gravity

Anti GravityA mind is a terrible thing to your waist. *By Steve Mirsky*

- 106 50, 100 & 150 Years Ago
- 108 Graphic Science

Smart controls can rebuild collapsed fisheries. By Mark Fischetti $\,$

ON THE WEB

Tour Seven Amazing Exoplanets

Astronomers are turning up exoplanets in droves, but what do these distant worlds look like? Hugo Award-winning artist Ron Miller interprets the data to give us a glimpse. Go to www.ScientificAmerican.com/dec2010

Scientific American (ISSN 0036-8733), Volume 303, Number 6, December 2010 published monthly by Scientific American, a trading name 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. 1273876528T; QST No. 01015332537. 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 \$40.000, Canada \$40.97 (USD), International Subscription rates: 5 year \$299 (USD), Canada \$40.000, Canada \$