## SCIENTIFIC AMERICAN

VOLUME 315, NUMBER 3



How smart are we? We changed the world irrevocably and may soon transform ourselves as a species. Here's a status report on the human experiment.

## **GEOLOGY**

- 30 A History in Layers
  What mark will we leave on
  the planet? By Jan Zalasiewicz
  ENVIRONMENT
- 38 Coping Skills
  Will climate change us? By Katie Peek
- 42 A Tale of Two Worlds
  Who will be the winners and losers
  in an increasingly crowded world?
  By Mara Hvistendahl
- 48 The Threat of Inequality
  Can civil society endure extreme
  economic disparity? By Angus Deaton

  BIOTECHNOLOGY
- 54 The Red Line
  Will we learn to control our genetic
  destinies? By Stephen S. Hall
  HEALTH
- 62 Living to 120
  Can we defeat aging? By Bill Gifford
  ROBOTICS
- 70 All Too Human Would we want to live forever (if we could)? By Hillary Rosner
- 76 Deep Time, Deep Survival How long will our species last? By David Grinspoon ESSAY
- 80 The Great Unknown
  Can we trust our own predictions?
  By Kim Stanley Robinson



ON THE COVER
"Prediction is very difficult,
especially if it's about the
future." With this caveat
from physicist Niels Bohr
in mind, we look at what
science has to tell us
about the trajectory of
the human species.
Illustration by
Charles Williams.

## On the Web: What Else Is in Store?

Scientific American took to the streets to ask people what they most want to know about the future. Find the video, plus interactive maps and more predictions from experts, at ScientificAmerican.com/report/future-of-humanity

## SCIENTIFIC AMERICAN







4 From the Editor

5 Letters

7 Science Agenda

When it comes to science, the political conversation is appalling. *By the Editors* 

8 Forum

The universe is teeming with life—or not. By Paul Davies

10 Advances

Medical marijuana could lessen opioid dependence. Chiral molecules in space. An updated kilogram.

24 The Science of Health

Genetically based cancer care faces an uphill climb. By Jessica Wapner

27 TechnoFiles

What should you do with all those obsolete cassettes? By David Pogue

86 Recommended

Global Seed Vault. How to reverse science denial. The search for alien life goes on. *By Clara Moskowitz* 

88 Skeptic

Where the known meets the unknown. By Michael Shermer

90 Anti Gravity

Can cat training be simple? By Steve Mirsky

91 50, 100 & 150 Years Ago

92 Graphic Science

Urban wealth moves downtown, pushing out the poor. By Katie Peek

ON THE WEB

2016 Summer Olympics

Scientific American investigates artificial enhancements, Zika fears and the limits of human achievement at the Games of the XXXI Olympiad in Rio de Janeiro.

 $Go\ to\ www. Scientific American. com/sep 2016/olympics$ 

Scientific American (ISSN 0036-8733), Volume 315, Number 3, September 2016, published monthly by Scientific American, a division of Nature America, Inc., 1 New York Plaza, Suite 4500, New York, N.Y. 10004-1562. 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 L37 8A2. Individual Subscription rates: 1 year \$49.99 (USD), Canada \$90, USD), International \$69.99 (USD). Institutional Subscription rates: 1 year \$49.99 (USD), Canada \$89 (USD), International \$96 (USD), International \$96 (USD), International \$96 (USD), International \$96 (USD), International \$97 (USD), Postmaster: Send address changes to Scientific American, Box 3187, Harlan, Iowa 51537. Reprints available: write Reprint Department, Scientific American, 1 New York Plaza, Suite 4500, New York, N.Y. 10004-1562. Par. 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. Printed in U.S.A.

Scientific American is part of Springer Nature, which owns or has commercial relations with thousands of scientific publications (many of them can be found at www.springernature.com/us). Scientific American maintains a strict policy of editorial independence in reporting developments in science to our readers.

Copyright © 2016 by Scientific American, a division of Nature America, Inc. All rights reserved.