

CONTENTS



183, 199, & 200

Rules of protein degradation

10 APRIL 2015 • VOLUME 348 • ISSUE 6231

NEWS

IN BRIEF

160 Roundup of the week's news

IN DEPTH

164 IRAN DEAL WOULD TRANSFORM ITS NUCLEAR INFRASTRUCTURE

Secretive Fordow facility could become a stable isotope factory and international accelerator center *By R. Stone*

165 ACID OCEANS CITED IN EARTH'S WORST DIE-OFF

Signature of acidification found in Permian extinctions 250 million years ago *By E. Hand*

► REPORT P. 229



169

167 U.S. AGENCIES FALL IN LINE ON PUBLIC ACCESS

Major research funders move to make papers free to all *By J. Kaiser*

168 BULLY FOR BRONTOSAURUS!

A comprehensive study of one branch of the dinosaur family tree resurrects *Brontosaurus* as a valid genus

By M. Balter

169 BRAZIL ROILS WATERS WITH MOVES TO PROTECT AQUATIC LIFE

Fishing moratorium draws fire from industry and scientists *By H. Escobar*

170 INFECTIOUS CANCER FOUND IN CLAMS

A single leukemia afflicts shellfish beds across hundreds of kilometers, puzzling biologists *By E. Stokstad*

SCIENCE sciencemag.org

FEATURES

172 STARTUP LIFTOFF

How flocks of small, cheap satellites, hatched in Silicon Valley, will constantly monitor a changing Earth *By E. Hand*

176 Thinking inside the box

By E. Hand

INSIGHTS

PERSPECTIVES

178 TRANSATLANTIC LESSONS IN REGULATION OF MITOCHONDRIAL REPLACEMENT THERAPY

The UK has approved MRT for clinical use, but the discussion has just begun in the U.S. *By I. G. Cohen et al.*

180 ANEUPLOIDY AND MOTHER'S GENES

A human genetic variant found at high frequency is associated with reduced fertility *By S. H. Vohr and R. E. Green*

► REPORT P. 235

182 FINDING NASCENT PROTEINS THE RIGHT HOME

A protein complex prevents promiscuous targeting of nascent polypeptides in the cell *By G. Kramer et al.*

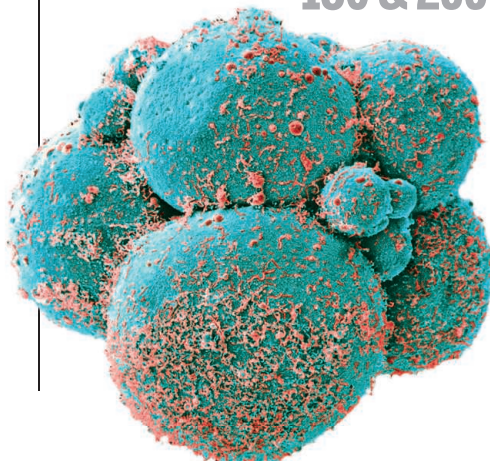
► RESEARCH ARTICLE P. 201

183 DETAILS OF DESTRUCTION, ONE MOLECULE AT A TIME

Protein ubiquitination and destruction by the proteasome is examined at the single-molecule level *By D. Komander*

► RESEARCH ARTICLES PP. 199 & 200

180 & 235



188

185 ASSEMBLING A COMPLEX QUANTUM ENSEMBLE

A cold-atom technique is used to identify hidden constraints in thermodynamic ensembles

By I. B. Spielman

► REPORT P. 207

186 AN EARLY START FOR THE PANAMA LAND BRIDGE

The land bridge between North and South America formed 10 million years earlier than previously thought

By C. Hoorn and S. Flantua

► REPORT P. 226

188 ARE TRADE SECRETS DELAYING BIOSIMILARS?

Regulations for approving biologic drugs thwart the market for would-be competitors *By W. N. Price II and A. K. Rai*

189 A CHAOTIC APPROACH CLEARS UP IMAGING

A laser that emits bright, incoherent light provides an ideal light source for imaging *By H. G. L. Schwefel and H. E. Türeci*

BOOKS ET AL.

192 SCIENTIFIC BABEL

By M. D. Gordín, reviewed by L. K. Nyhart

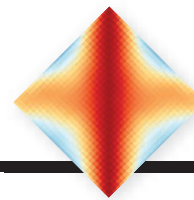
193 FUTURE CRIMES

By M. Goodman, reviewed by D. Greenbaum

Science Staff 158
New Products 246
Science Careers 247

10 APRIL 2015 • VOL 348 ISSUE 6231 **155**

CONTENTS



185 & 207

Where quantum mechanics meets thermodynamics

10 APRIL 2015 • VOLUME 348 • ISSUE 6231

LETTERS

194 A NEW PRIVACY DEBATE

By A.-M. Meyer and D. Gotz

194 ASSESSING DATA INTRUSION THREATS

By D. Barth-Jones et al.

195 RESPONSE

By Y.-A. de Montjoye and A. Pentland

195 OUTSIDE THE TOWER: ACTING TO BUILD TRUST

By J. Liu

RESEARCH

IN BRIEF

196 From *Science* and other journals

RESEARCH ARTICLES

BIOCHEMISTRY

199 Specificity of the anaphase-promoting complex: A single-molecule study Y. Lu et al.

RESEARCH ARTICLE SUMMARY; FOR FULL

TEXT: dx.doi.org/10.1126/science.1248737

200 Substrate degradation by the proteasome: A single-molecule kinetic analysis Y. Lu et al.

RESEARCH ARTICLE SUMMARY; FOR FULL

TEXT: dx.doi.org/10.1126/science.1250834

► PERSPECTIVE P. 183

201 PROTEIN TARGETING

The principle of antagonism ensures protein targeting specificity at the endoplasmic reticulum

M. Gamberdinger et al.

► PERSPECTIVE P. 182

REPORTS

207 QUANTUM GASES

Experimental observation of a generalized Gibbs ensemble

T. Langen et al.

► PERSPECTIVE P. 185

211 BIOANALYSIS

Mass spectrometry imaging with laser-induced postionization J. Soltwisch et al.

215 QUANTUM COMPUTING

Quantum versus classical annealing of Ising spin glasses B. Heim et al.

218 MARS ATMOSPHERE

Strong water isotopic anomalies in the martian atmosphere: Probing current and ancient reservoirs

G. L. Villanueva et al.

222 OCEANOGRAPHY

Eddy-driven subduction exports particulate organic carbon from the spring bloom M. M. Omand et al.

226 PALEOCEANOGRAPHY

Middle Miocene closure of the Central American Seaway C. Montes et al.

► PERSPECTIVE P. 186

229 EARTH HISTORY

Ocean acidification and the Permo-Triassic mass extinction

M. O. Clarkson et al.

► NEWS STORY P. 165

232 COMETARY FORMATION

Molecular nitrogen in comet 67P/Churyumov-Gerasimenko indicates a low formation temperature M. Rubin et al.

235 HUMAN GENETICS

Common variants spanning *PLK4* are associated with mitotic-origin aneuploidy in human embryos

R. C. McCoy et al.

► PERSPECTIVE P. 180

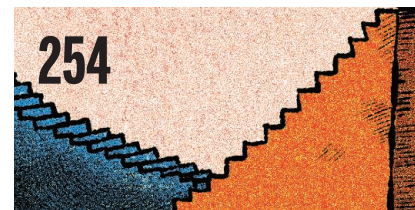
239 PROTEOSTASIS

Preventing proteostasis diseases by selective inhibition of a phosphatase regulatory subunit I. Das et al.

242 PRIMATE GENOMICS

Mountain gorilla genomes reveal the impact of long-term population decline and inbreeding Y. Xue et al.

► PODCAST



DEPARTMENTS

159 EDITORIAL

NIH research: Think globally

By Anthony S. Fauci and Francis S. Collins

254 WORKING LIFE

Love knows no boundaries

By Maria Fadri-Moskwick

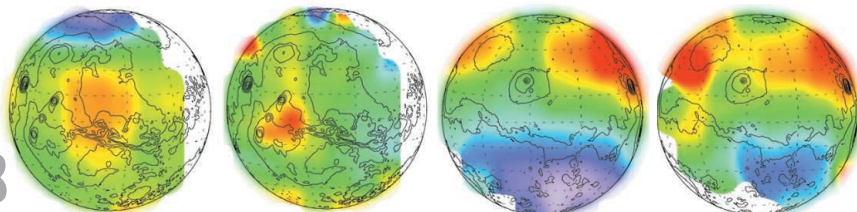
ON THE COVER



On 27 February 2015, Planet Labs released two CubeSats from the International Space Station, adding to its swarm of Earth-observing satellites, which are no larger than a loaf of bread. Each

CubeSat can discern features as small as trees and trucks. But the real power comes from having dozens, even hundreds, in space; the company plans to image the entire Earth every day. See page 172. Photo: NASA

218



SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005. Periodicals mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Copyright © 2015 by the American Association for the Advancement of Science. The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (51 issues): \$153 (\$74 allocated to subscription). Domestic institutional subscription (51 issues): \$1282. Foreign postage extra: Mexico, Caribbean (surface mail) \$55; other countries (air assist delivery) \$85. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request. GST #R1254 88122. Publications Mail Agreement Number 1069624. Printed in the U.S.A. Change of address: Allow 4 weeks. Give old and new addresses and 8-digit account number. Postmaster: Send change of address to AAAS, P.O. Box 96178, Washington, DC 20090-6178. Single copy sales: \$10.00 current issue, \$15.00 back issue prepaid includes surface postage; bulk rates on request. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that \$30.00 per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923. The identification code for Science is 0036-8075. Science is indexed in the Reader's Guide to Periodical Literature and in several specialized indexes.

Science

348 (6231)

Science **348** (6231), 159-254.

ARTICLE TOOLS

<http://science.sciencemag.org/content/348/6231>

PERMISSIONS

<http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

Science (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. 2017 © The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. The title *Science* is a registered trademark of AAAS.