

SPECIAL SECTION

Protein Dynamics

INTRODUCTION

197 Proteins in Motion

REVIEWS

 198 Sending Signals Dynamically
R. G. Smock and L. M. Gierasch

 203 Protein Dynamism and Evolvability
N. Tokuriki and D. S. Tawfik

 208 Multiscale Modeling of
 Form and Function
A. J. Engler et al.
PERSPECTIVE

 213 Trapping Moving Targets with
 Small Molecules
G. M. Lee and C. S. Craik

 >> For a list of all related content, see p. 197 or go to
www.sciencemag.org/sciext/proteindynamics/


page 166

EDITORIAL

 147 Helping the President
Neal Lane
NEWS OF THE WEEK

 157 Harvard's Financial Crunch Raises Tensions
 Among Biology Programs

 158 Unlucky CLOVER: U.K. Halts Unfinished
 Telescope Project

 159 Arne Duncan Hopes a Team Approach
 Will Improve U.S. Schools

 161 Lunar and Planetary Science Conference
 A Primal Crust Found on the Moon, While
 Mercury's Proves Elusive
 Water Everywhere on Mars, But Is Any of It
 Ever Liquid?

 162 Darwin Applies to Medical School
 Two Sides of the Same Coin?

 163 From *Science's* Online Daily News Site

 165 New Way to Target Hormone Receptor
 Thwarts Prostate Cancer
 >> *Science Express Report* by C. Tran et al.

 165 From the *Science* Policy Blog

NEWS FOCUS

 166 Newborn Blood Collections:
 Science Gold Mine, Ethical Minefield
 >> *Science Podcast*

 169 The 'Tamba Dragon' Has Japanese
 Dinosaur Hunters All Fired Up

170 Détente in the Fisheries War

 172 Renewables Test IQ of the Grid
 Students Energized by Power Engineering

LETTERS

176 Advancing Human Rights Through Science

J. H. Toney
Tracing Fossil History
R. McDowell
Response
S. Bengtson and B. Rasmussen
Risks of Extreme Heat and
Unpredictability
N. Hockley et al.
Response
D. S. Battisti and R. L. Naylor

 177 Life in Science: Seeds of Doubt
P. H. Klopfer
BOOKS ET AL.

 181 Freaks of Nature
M. S. Blumberg, reviewed by M. D. Laubichler

 182 The Lives of Ants
L. Keller and É. Gordon, reviewed by N. R. Franks
POLICY FORUM

 183 Legal Bedrock for Rebuilding
 America's Ocean Ecosystems
M. Turnipseed et al.
 >> *Science Podcast*
PERSPECTIVES

 185 Electrode-Cellular Interface
G. G. Wallace et al.

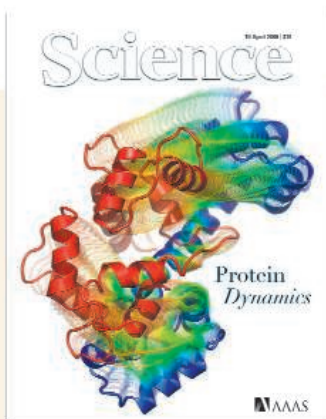
 186 Total Chemical Synthesis Peers
 into the Biosynthetic Black Box
S. J. Miller
 >> *Report p. 238*

 187 *Leshmania* Exploit Sex
M. A. Miles et al.
 >> *Report p. 265*

 190 Symmetry in Turns
B. W. Tobolske
 >> *Report p. 252*

 191 Green Evolution, Green Revolution
J. M. Archibald
 >> *Report p. 268*

 192 Puzzling Patterns of Predisposition
P. J. Pollard and P. J. Ratcliffe
 >> *Report p. 261*

 194 Laser Beams Take a Curve
J. Kasparian and J.-P. Wolf
CONTENTS continued >>

COVER

The dynamic nature of the master calcium signaling protein, calmodulin, schematically illustrated by snapshots from an interpolation between its calcium-bound state (blue) and its structure bound to both calcium and a peptide derived from one of its downstream cellular targets, myosin light chain kinase (red), generated using the Yale Morph Server and PyMol software. See the special section beginning on page 197.

Image: Robert Smock and Lila Gierasch
DEPARTMENTS

 143 This Week in *Science*
 149 Editors' Choice
 152 Science Staff
 155 Random Samples
 280 New Products
 281 Science Careers

BREVIA

- 217 Exomic Sequencing Identifies *PALB2* as a Pancreatic Cancer Susceptibility Gene
S. Jones et al.
Mutations in a gene previously implicated in breast cancer are a contributing factor in hereditary pancreatic cancer.

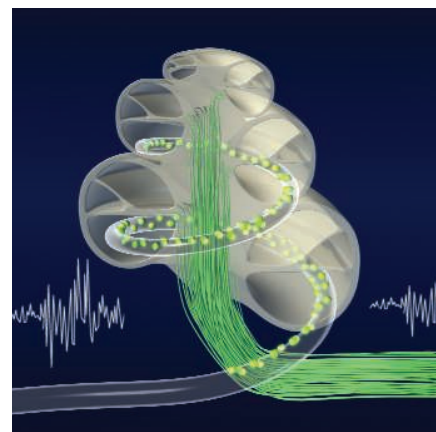
RESEARCH ARTICLE

- 218 Genome-Wide Analysis in Vivo of Translation with Nucleotide Resolution Using Ribosome Profiling
N. T. Ingolia et al.
Profiling the position of ribosomes on messenger RNA allows rapid, high-precision investigation of cellular protein translation.

REPORTS

- 224 Elastic Shear Anisotropy of Ferropericline in Earth's Lower Mantle
H. Marquardt et al.
A minor phase of the deep mantle causes marked differences in seismic travel times in different directions.
- 226 A Great Earthquake Rupture Across a Rapidly Evolving Three-Plate Boundary
K. P. Furlong et al.
This event revealed plate dynamics in the Solomon Islands and showed that subduction of young crust can produce great quakes.
- 229 Curved Plasma Channel Generation Using Ultraintense Airy Beams
P. Polynkin et al.
Propagating intense structured laser beams through air creates self-focused "light bullets" that take a curved trajectory.
- 232 Solar Power Wires Based on Organic Photovoltaic Materials
M. R. Lee et al.
A transparent polymer coating allows optics to compensate for the shadowing effects of a metal wire electrode.
- 236 Running Droplets of Gallium from Evaporation of Gallium Arsenide
J. Tersoff et al.
Oscillation of gallium droplets is driven by a disequilibrium between the droplets and the gallium arsenide surface.
- 238 Total Synthesis of (+)-11,11'-Dideoxyverticillin A
J. Kim et al.
The key step in the synthesis of this complex fungal metabolite replaces four introduced hydroxyl groups with thiols.
>> *Perspective p. 186*

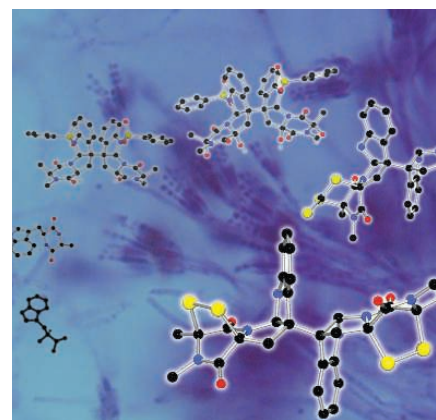
- 242 Pulsatile Stimulation Determines Timing and Specificity of NF- κ B-Dependent Transcription
L. Ashall et al.
The frequency of pulses of cytokine stimulation of a cell can determine the spectrum of genes whose transcription is regulated.
- 246 Antibody Recognition of a Highly Conserved Influenza Virus Epitope
D. C. Ekiert et al.
A broadly neutralizing antibody binds the hemagglutinin stalk of pathogenic influenza viruses to block membrane fusion.
- 252 Wingbeat Time and the Scaling of Passive Rotational Damping in Flapping Flight
T. L. Hedrick et al.
Morphology and flapping motion are combined in a model that predicts turn dynamics for flying animals ranging in size from fruit flies to cockatoos.
>> *Perspective p. 190; Science Podcast*
- 255 Coding-Sequence Determinants of Gene Expression in *Escherichia coli*
G. Kudla et al.
RNA structure, rather than optimal codon usage, determines translation efficiency in *Escherichia coli*.
- 258 Leucine-Rich Repeat Protein Complex Activates Mosquito Complement in Defense Against *Plasmodium* Parasites
M. Povelones et al.
A family of molecules, apparently unique to mosquitoes, binds to invading parasites and initiates innate immune responses.
- 261 Glioma-Derived Mutations in *IDH1* Dominantly Inhibit *IDH1* Catalytic Activity and Induce HIF-1 α
S. Zhao et al.
Mutations in isocitrate dehydrogenase-1 compromise enzyme function and activate a signaling pathway that helps brain tumors grow when oxygen is limited.
>> *Perspective p. 192*
- 265 Demonstration of Genetic Exchange During Cyclical Development of *Leishmania* in the Sand Fly Vector
N. S. Akopyants et al.
Diversity among *Leishmania* parasites is not just a product of divergent mutation but also of genetic exchange.
>> *Perspective p. 187*
- 268 Green Evolution and Dynamic Adaptations Revealed by Genomes of the Marine Picoeukaryotes *Micromonas*
A. Z. Worden et al.
An anciently derived clade of photosynthetic picoeukaryote, ubiquitous in the world's oceans, possesses surprising genetic diversity.
>> *Perspective p. 191*



page 185



page 232



page 238

CONTENTS continued >>

SCIENCEONLINE

SCIENCEEXPRESS

www.scienceexpress.org

Two-Color Single-Photon Photoinitiation and Photoinhibition for Subdiffraction Photolithography

T. F. Scott et al.

Polymerization activated by a beam of light was halted by inhibitors generated by a surrounding halo of a different color.
10.1126/science.1167610

Confining Light to Deep Subwavelength Dimensions to Enable Optical Nanopatterning

T. L. Andrew et al.

Molecules that photoisomerize and change in transparency are used to define narrow features on photoresists.
10.1126/science.1167704

Achieving $\lambda/20$ Resolution by One-Color Initiation and Deactivation of Polymerization

L. Li et al.

Polymerization activated by a pulsed light beam was halted by a continuous beam of the same color in a surrounding halo.
10.1126/science.1168996

Development of a Second-Generation Antiandrogen for Treatment of Advanced Prostate Cancer

C. Tran et al.

A drug that binds to the androgen receptor acts by disrupting its activity in the cell nucleus.
10.1126/science.1168175
>> *News story p. 165*

Cell Movements at Hensen's Node Establish Left/Right Asymmetric Gene Expression in the Chick

J. Gros et al.

Asymmetric gene expression is passively set up in the early chick embryo by cell rearrangements.
10.1126/science.1172478

SCIENCENOW

www.sciencenow.org

Highlights From Our Daily News Coverage

Double Amputees Shed Light on Brain's Flexibility

Brain reorganizes itself to accommodate new left and right hands.

Oldest Stone Blades Uncovered

Sophisticated cutting tools predate *Homo sapiens*.

Tropical Parents More Likely to Hear, 'It's a Girl!'

First global study on human sex ratios finds more girls born at warmer latitudes.

SCIENCE SIGNALING

www.sciencesignaling.org

The Signal Transduction Knowledge Environment

RESEARCH ARTICLE: Spatiotemporal Patterning During T Cell Activation Is Highly Diverse

K. L. Singleton et al.

The timing and the distribution of signaling intermediates reflects the efficiency and nature of T cell receptor activation.

PERSPECTIVE: Partitioning the Synaptic Landscape—Distinct Microdomains for Spontaneous and Spike-Triggered Neurotransmission

M. A. Sutton and E. M. Schuman

Spontaneous and evoked release of glutamate activates distinct NMDA receptor pools.

PERSPECTIVE: Brx Shines a Light on the Route from Hyperosmolarity to NFAT5

J. Aramburu and C. López-Rodríguez

The guanine nucleotide exchange factor Brx mediates an early event in lymphocytes exposed to osmotic stress.

PERSPECTIVE: Parkinson's Disease—To Live or Die by Autophagy

I. Irrcher and D. S. Park

The autophagic degradation of a neuronal survival factor is inhibited by a protein encoded by a Parkinson's disease-linked gene.

PODCAST

B. D. Manning and A. M. VanHook

The sets of kinases required by different cancer cell lines are highly divergent.

SCIENCE CAREERS

www.sciencecareers.org/career_magazine

Free Career Resources for Scientists

Making Room for Research During Residency

K. Hede

Research residencies give physician-scientists time for research during their clinical training.

Financial Crisis Reshaping the Life Sciences Industry

C. Mintz

Layoffs and mergers in life sciences companies make for a challenging job market.

Science Careers Blog

Science Careers Staff

Find advice, opinions, news, and funding opportunities at <http://blogs.sciencemag.org/sciencecareers/>.

SCIENCE PODCAST

www.sciencemag.org/multimedia/podcast

Free Weekly Show

Download the 10 April *Science* Podcast to hear about animal flight dynamics, rebuilding America's ocean ecosystems, genetic screening in newborns, and more.

ORIGINS BLOG

blogs.sciencemag.org/origins

A History of Beginnings

SCIENCE INSIDER

blogs.sciencemag.org/scienceinsider

Science Policy News and Analysis

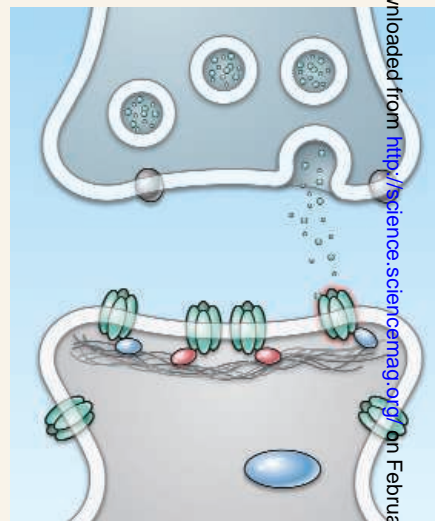
QUARTERLY AUTHOR INDEX

www.sciencemag.org/feature/data/aindex.dtl



SCIENCE NOW

Delicate work after double hand transplant.



SCIENCE SIGNALING

Activating a synaptic microdomain.

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 © 2009 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): \$146 (\$74 allocated to subscription). Domestic institutional subscription (51 issues): \$835; 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 #1254 88122. Publications Mail Agreement Number 1069624. **Printed in the U.S.A.**

Change of address: Allow 4 weeks, giving 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 \$20.00 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.

AAAS

ADVANCING SCIENCE. SERVING SOCIETY

Science

324 (5924)

Science **324** (5924), 143-280.

ARTICLE TOOLS

<http://science.sciencemag.org/content/324/5924>

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.