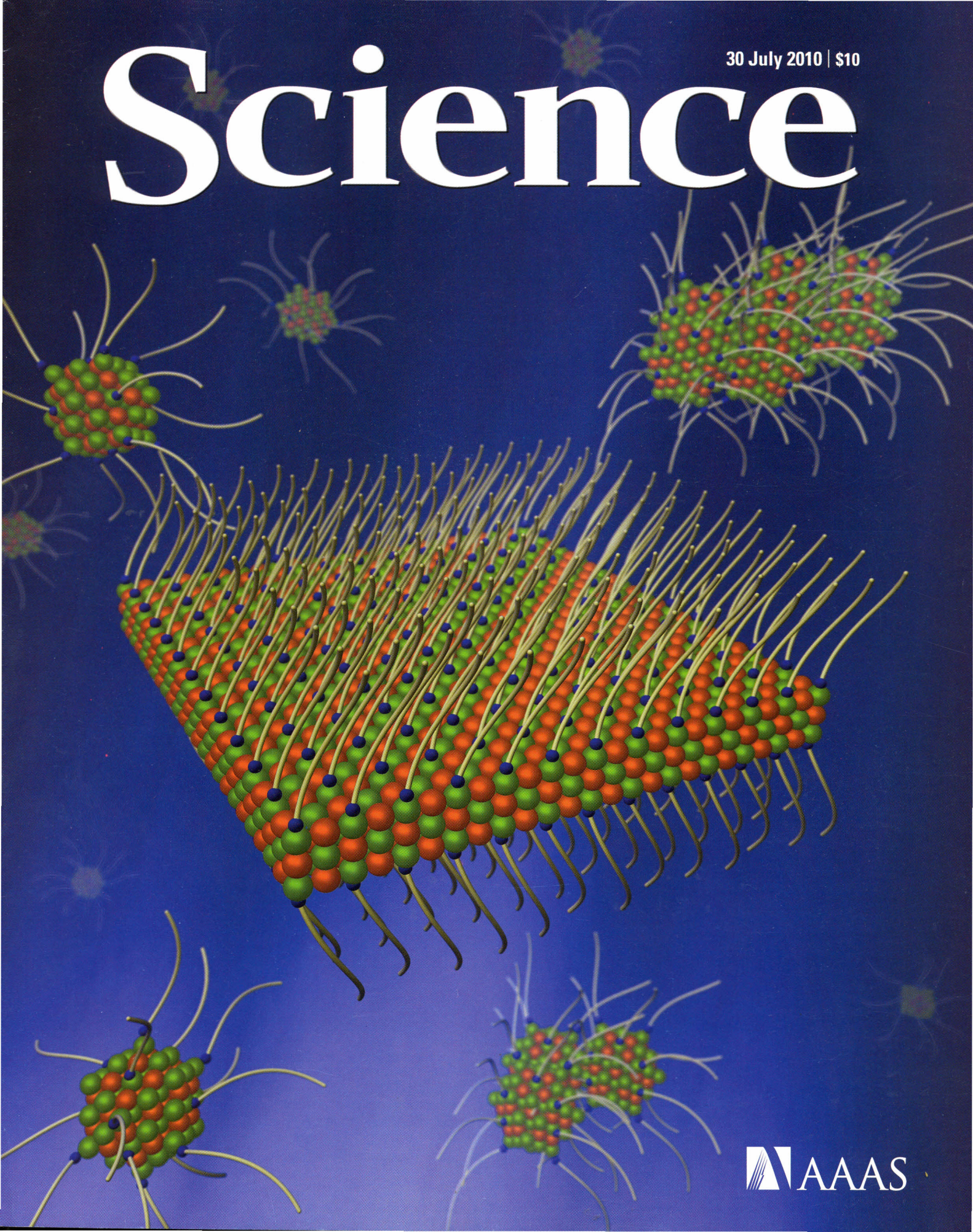


30 July 2010 | \$10

Science



AAAS

EDITORIAL

- 491 Reframing Science Standards
Bruce Alberts

NEWS OF THE WEEK

- 496 Copper Mine Threatens Ancient Monastery in Afghanistan
- 497 NSF Funding Request Faring Well in Congress
- 498 Is China's Riskiest Volcano Stirring or Merely Biding Its Time?
- 498 Fermilab Physicists Don't See Higgs, Argue They Should Keep Looking
- 499 From the *Science* Policy Blog
- 500 Money Woes Cast Shadow Over HIV/AIDS, But Ray of Light in South Africa
- 501 From *Science's* Online Daily News Site

NEWS FOCUS

- 502 Is Pharma Running Out of Brainy Ideas?
>> Science Podcast
- 505 Europe Tries to Save Its Eels
- 508 Making Smarter, Savvier Robots

LETTERS

- 511 Immigration Law Jeopardizes University Collaboration
J. A. de la Peña et al.
- Graduate Education: The Future Is Now
W. B. Russel and S. Ortega
- Sustainability: A Household Word
J. Liu
- Studies Support Probable Long-Term Safety of MRI
S. K. Holland et al.
- 512 CORRECTIONS AND CLARIFICATIONS
- 512 TECHNICAL COMMENT ABSTRACTS

BOOKS ET AL.

- 514 Scientific Europe
C. Madsen, reviewed by M. Stampfer
- 515 Dead or Alive
D. R. McFadden et al., curators reviewed by A. Keller

POLICY FORUM

- 516 To Reform U.S. Health Care, Start with Systematic Reviews
K. Dickersin

PERSPECTIVES

- 518 *E. coli*, What a Noisy Bug
S. Tyagi
>> Research Article p. 533
- 519 Winds of Change on Titan
R. D. Lorenz
- 520 Reconstructing the Lung
W. R. Wagner and B. P. Griffith
>> Research Article p. 538
- 522 Connecting Biomass and Petroleum Processing with a Chemical Bridge
J. J. Bozell
- 523 An Atomic View of Quantum Phase Transitions
B. DeMarco
>> Report p. 547

SCIENCE PRIZE ESSAY

- 525 MIT OpenCourseWare: Unlocking Knowledge, Empowering Minds
C. d'Oliveira et al.

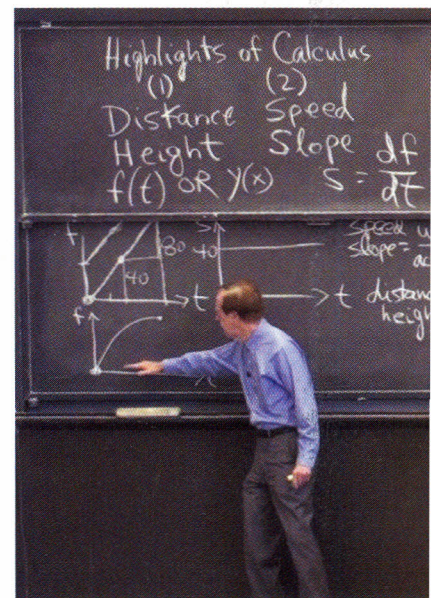
REVIEW

- 528 New Opportunities for an Ancient Material
F. G. Omenetto and D. L. Kaplan

CONTENTS continued >>



page 505



page 525



COVER

Lead sulfide nanocrystals (green, lead; orange, sulfur) self-assemble in solution, forming two-dimensional aggregates and ultrathin single-crystal sheets on the micrometer scale. The formation of dense and highly ordered oleic acid monolayers (dark blue spheres with long projections) on the sheets' surfaces helps drive the oriented attachment of the nanocrystals, resulting in a material with outstanding photoconductive properties. See page 550.

Image: Christian Klinke/Hamburg University, Germany

DEPARTMENTS

- 488 This Week in *Science*
- 492 Editors' Choice
- 494 *Science* Staff
- 495 Random Samples
- 527 AAAS News & Notes
- 576 New Products
- 577 *Science* Careers

BREVIA

- 532 Dopaminergic Network Differences in Human Impulsivity**
J. W. Buckholz et al.
Highly impulsive individuals have diminished regulatory control of dopamine release.
>> *Science Podcast*

RESEARCH ARTICLES

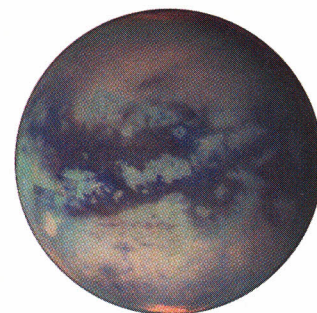
- 533 Quantifying *E. coli* Proteome and Transcriptome with Single-Molecule Sensitivity in Single Cells**
Y. Taniguchi et al.
Measurement of protein and messenger RNA copy numbers in single *Escherichia coli* cells gives a system-wide view of stochastic gene expression.
>> *Perspective p. 518*
- 538 Tissue-Engineered Lungs for in Vivo Implantation**
T. H. Petersen et al.
Decellularized rat lungs rebuilt with new cells in vitro can function at a rudimentary level when implanted back into a rat.
>> *Perspective p. 520*

REPORTS

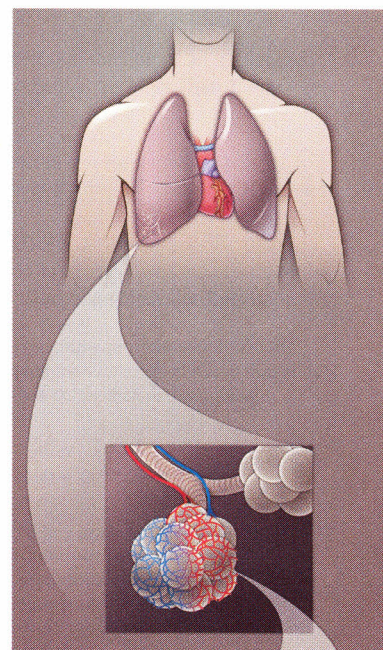
- 542 Single-Shot Readout of a Single Nuclear Spin**
P. Neumann et al.
The quantum state of a single nitrogen vacancy in diamond can be read out nondestructively in a single-shot measurement.
- 544 Strain-Induced Pseudo-Magnetic Fields Greater Than 300 Tesla in Graphene Nanobubbles**
N. Levy et al.
Strain creates energy levels in graphene that are similar to those seen in very high applied magnetic fields.
- 547 Probing the Superfluid-to-Mott Insulator Transition at the Single-Atom Level**
W. S. Bakr et al.
Imaging of atoms that were optically trapped in lattice sites reveals local dynamics of a quantum phase transition.
>> *Perspective p. 523*

- 550 Ultrathin PbS Sheets by Two-Dimensional Oriented Attachment**
C. Schliehe et al.
Self-assembled two-dimensional nanocrystals of lead sulfide have excellent photoconductive properties.
- 553 Steric Effects in the Chemisorption of Vibrationally Excited Methane on Ni(100)**
B. L. Yoder et al.
The reaction underlying industrial hydrogen production depends subtly on the reagent's orientation toward the catalyst.
- 556 Decrease in the CO₂ Uptake Capacity in an Ice-Free Arctic Ocean Basin**
W.-J. Cai et al.
The current carbon dioxide levels in the Arctic Ocean basin will limit further uptake under ice-free conditions.
- 559 Microbial Biosynthesis of Alkanes**
A. Schirmer et al.
Alkane biosynthesis genes were identified in cyanobacteria and engineered into *Escherichia coli* for recombinant hydrocarbon production.
- 562 Btdb7 Regulates Epithelial Cell Dynamics and Branching Morphogenesis**
T. Onodera et al.
A regulatory gene suppresses cell adhesion and enhances cell motility to help form branched organs.
- 565 Early Chordate Origins of the Vertebrate Second Heart Field**
A. Stolfi et al.
The mammalian heart and pharyngeal muscles of tunicates may originate from the same precursor cells in a shared ancestor.
- 568 Identification of a Cell of Origin for Human Prostate Cancer**
A. S. Goldstein et al.
A new experimental model identifies basal cells, rather than luminal cells, as the origin of prostate cancer.
- 571 Astrocytes Control Breathing Through pH-Dependent Release of ATP**
A. V. Gourine et al.
Central nervous system glial cells are key players in the chemo-reflex essential for breathing.

CONTENTS continued >>



page 519



pages 520 & 538



page 556

SCIENCEONLINE

SCIENCEEXPRESS

www.scienceexpress.org

PTIP Promotes Chromatin Changes Critical for Immunoglobulin Class Switch Recombination
J. A. Daniel et al.

A factor that regulates chromatin accessibility and recombination during immunoglobulin rearrangements is identified.

10.1126/science.1187942

FAN1 Acts with FANCD2 to Promote DNA Interstrand Cross-Link Repair
T. Liu et al.

The nuclease FAN1 acts with Fanconi anemia proteins to help repair damaged DNA.

10.1126/science.1192656

Planar Cell Polarity Acts Through Septins to Control Collective Cell Movement and Ciliogenesis

S. K. Kim et al.

A gene involved in morphogenesis and ciliogenesis is mutated in patients with Bardet-Biedl syndrome.

10.1126/science.1191184

Quantum Oscillations and Hall Anomaly of Surface States in the Topological Insulator Bi_2Te_3

D.-X. Qu et al.

Quantum oscillations are used to detect the surface current of a topological insulator, yielding high carrier mobilities.

10.1126/science.1189792

Land-Level Changes Produced by the M_w 8.8 2010 Chilean Earthquake

M. Farias et al.

The 2010 M_w 8.8 Chilean earthquake ruptured ~500 kilometers and vertically displaced over three meters.

10.1126/science.1192094

TECHNICALCOMMENTS

Comment on "Patterns of Diversity in Marine Phytoplankton"

J. Huismán

Full text at www.sciencemag.org/cgi/content/full/329/5991/512-c

Response to Comment on "Patterns of Diversity in Marine Phytoplankton"

A. D. Barton et al.

Full text at www.sciencemag.org/cgi/content/full/329/5991/512-d

SCIENCENOW

www.sciencenow.org

Highlights From Our Daily News Coverage

'Locked-In' Patients Can Follow Their Noses
New technology could allow paralyzed patients to type and move a wheelchair by sniffing.

'Mind Meld' Enables Good Conversation
When two people talk, similar areas of their brains activate.

Obscure Immune Cells Thwart Ticks
New technique for deleting cells allows researchers to pin down their function.

SCIENCESIGNALING

www.sciencesignaling.org

The Signal Transduction Knowledge Environment

RESEARCH ARTICLE: Autocrine Purinergic Receptor Signaling Is Essential for Macrophage Chemotaxis
M. Kronlage et al.

Amplification of outside-in chemotactic signaling by inside-out purinergic signaling drives macrophage migration.

RESEARCH ARTICLE: Decoupling of Receptor and Downstream Signals in the Akt Pathway by Its Low-Pass Filter Characteristics

K. A. Fujita et al.

The Akt pathway can serve as a signal decoupler, converting a weak receptor signal into a strong effector signal.

RESEARCH ARTICLE: The *Drosophila* Female Germline Stem Cell Lineage Acts to Spatially Restrict DPP Function Within the Niche

M. Liu et al.

Drosophila ovarian stem cells communicate with somatic cells to define the size of the stem cell niche.

PERSPECTIVE: Inhibiting the Inhibitor of the Inhibitor—Blocking PKC- θ to Enhance Regulatory T Cell Function

K. T. Roybal and C. Wülfing

PKC- θ functions differently in regulatory T cells, which may be linked to its exclusion from immune synapses.

SCIENCECAREERS

www.sciencereers.org/career_magazine

Free Career Resources for Scientists

Feeding Your Research Into the Policy Debate

E. Pain

Early-career scientists who want their research to inform policymaking need to learn how to navigate the public arena and communicate effectively.

Answering Biomedical Questions With Information Technology

N. Volkers

Harvard physician-scientist Lynn Bry has developed an informatics system for matching biological samples to research needs.

SCIENTETRANSLATIONAL MEDICINE

www.sciencetranslationalmedicine.org

Integrating Medicine and Science

PERSPECTIVE: The Wnt Signaling Pathway as a Potential Target for Therapies to Enhance Bone Repair

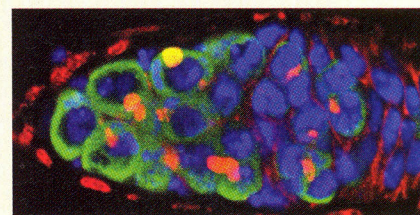
T. A. Einhorn

Modulating Wnt signaling may be an effective means of stimulating skeletal healing after fractures or surgery.

PERSPECTIVE: Channelopathies—Decoding Disease Pathogenesis

A. Terzic and C. Perez-Terzic

Tissue-specific potassium channel dysfunction has been implicated in a complex multiorgan syndrome.



SCIENCESIGNALING

Defining the size of the stem cell niche.

RESEARCH ARTICLE: Function of an Implanted Tissue Glucose Sensor for More Than 1 Year in Animals

D. A. Gough et al.

An implanted tissue glucose sensor can provide stable readings of glucose concentrations for more than a year.

RESEARCH ARTICLE: A Human-Specific Deletion in Mouse *Cmah* Increases Disease Severity in the mdx Model of Duchenne Muscular Dystrophy

K. Chandrasekharan et al.

A mouse model for Duchenne muscular dystrophy engineered to produce humanlike glycosylation mimics the human disease better than existing models.

SCIENCEPODCAST

www.sciencemag.org/multimedia/podcast

Free Weekly Show

Download the 30 July *Science* Podcast to hear about how dopamine influences human impulsivity, the stalling of psychiatric drug development, your letters to *Science*, and more.

SCIENCEINSIDER

news.sciencemag.org/scienceinsider

Science Policy News and Analysis

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 © 2010 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): \$910; 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.



ADVANCING SCIENCE. SERVING SOCIETY