COVER
Optical or electrical pulses can rapidly locate and manipulate the spin of a single electron in a quantum dot or of a nitrogen vacancy in diamond. Such techniques represent progress toward solid-state quantum computing (see pages 349 and 352).

Image: Peter Allen and Jesse Berezovsky

DEPARTMENTS
283 Science Online
285 This Week in Science
290 Editors’ Choice
294 Contact Science
297 Random Samples
299 Newsmakers
389 New Products
390 Science Careers

EDITORIAL
289 New Career Paths for Scientists by Bruce Alberts

LETTERS
Coral Adaptation in the Face of Climate Change
A. Baird and J. A. Maynard
Response O. Hoegh-Guldberg et al.
Freshwater Forcing: Will History Repeat Itself?
P. U. Clark, T. L. Delworth, A. J. Weaver
Response H. F. Kleiven et al.

CORRECTIONS AND CLARIFICATIONS
316

BOOKS
The Dismal Science How Thinking Like an Economist Undermines Community
S. A. Marglin, reviewed by E. R. Weintraub

SENSING THE PAST Seeing, Hearing, Smelling, Tasting, and Touching in History
M. M. Smith, reviewed by A. Keller

POLICY FORUM
Agriculture at a Crossroads
E. T. Kiers et al.

PERSPECTIVES
Frustation in Complexity
P.-M. Binder

NEWS OF THE WEEK
IPCC Tunes Up for Its Next Report Aiming for Better, Timely Results
Greenland Ice Slipping Away but Not All That Quickly
>> Science Express Reports by I. Joughin et al. and S. B. Das et al.
Team Unveils Mideast Archaeology Peace Plan
As Food Prices Rise, U.S. Support for Agricultural Centers Wilts

SCIENCESCOPE
Croatian Editors Fight With Medical School Over Journal’s Fate
Changes to EPA Toxicology—Speed or Delay?

NEWS FOCUS
The Greening of Synfuels
Watery Echoes Give Clues to the Past and Future of the Seas
Mapmaker for the World of Influenza
Coming Out of Asia—Year In, Year Out
>> Research Article p. 340
The Mad Dash to Make Light Crystals

LETTERS
Coral Adaptation in the Face of Climate Change
A. Baird and J. A. Maynard
Response O. Hoegh-Guldberg et al.
Freshwater Forcing: Will History Repeat Itself?
P. U. Clark, T. L. Delworth, A. J. Weaver
Response H. F. Kleiven et al.

CORRECTIONS AND CLARIFICATIONS
316

BOOKS
The Dismal Science How Thinking Like an Economist Undermines Community
S. A. Marglin, reviewed by E. R. Weintraub

SENSING THE PAST Seeing, Hearing, Smelling, Tasting, and Touching in History
M. M. Smith, reviewed by A. Keller

POLICY FORUM
Agriculture at a Crossroads
E. T. Kiers et al.

PERSPECTIVES
Frustation in Complexity
P.-M. Binder

NEWS OF THE WEEK
IPCC Tunes Up for Its Next Report Aiming for Better, Timely Results
Greenland Ice Slipping Away but Not All That Quickly
>> Science Express Reports by I. Joughin et al. and S. B. Das et al.
Team Unveils Mideast Archaeology Peace Plan
As Food Prices Rise, U.S. Support for Agricultural Centers Wilts

SCIENCESCOPE
Croatian Editors Fight With Medical School Over Journal’s Fate
Changes to EPA Toxicology—Speed or Delay?

NEWS FOCUS
The Greening of Synfuels
Watery Echoes Give Clues to the Past and Future of the Seas
Mapmaker for the World of Influenza
Coming Out of Asia—Year In, Year Out
>> Research Article p. 340
The Mad Dash to Make Light Crystals

LETTERS
Coral Adaptation in the Face of Climate Change
A. Baird and J. A. Maynard
Response O. Hoegh-Guldberg et al.
Freshwater Forcing: Will History Repeat Itself?
P. U. Clark, T. L. Delworth, A. J. Weaver
Response H. F. Kleiven et al.

CORRECTIONS AND CLARIFICATIONS
316

BOOKS
The Dismal Science How Thinking Like an Economist Undermines Community
S. A. Marglin, reviewed by E. R. Weintraub

SENSING THE PAST Seeing, Hearing, Smelling, Tasting, and Touching in History
M. M. Smith, reviewed by A. Keller

POLICY FORUM
Agriculture at a Crossroads
E. T. Kiers et al.

PERSPECTIVES
Frustation in Complexity
P.-M. Binder

NEWS OF THE WEEK
IPCC Tunes Up for Its Next Report Aiming for Better, Timely Results
Greenland Ice Slipping Away but Not All That Quickly
>> Science Express Reports by I. Joughin et al. and S. B. Das et al.
Team Unveils Mideast Archaeology Peace Plan
As Food Prices Rise, U.S. Support for Agricultural Centers Wilts

SCIENCESCOPE
Croatian Editors Fight With Medical School Over Journal’s Fate
Changes to EPA Toxicology—Speed or Delay?

NEWS FOCUS
The Greening of Synfuels
Watery Echoes Give Clues to the Past and Future of the Seas
Mapmaker for the World of Influenza
Coming Out of Asia—Year In, Year Out
>> Research Article p. 340
The Mad Dash to Make Light Crystals

LETTERS
Coral Adaptation in the Face of Climate Change
A. Baird and J. A. Maynard
Response O. Hoegh-Guldberg et al.
Freshwater Forcing: Will History Repeat Itself?
P. U. Clark, T. L. Delworth, A. J. Weaver
Response H. F. Kleiven et al.

CORRECTIONS AND CLARIFICATIONS
316

BOOKS
The Dismal Science How Thinking Like an Economist Undermines Community
S. A. Marglin, reviewed by E. R. Weintraub

SENSING THE PAST Seeing, Hearing, Smelling, Tasting, and Touching in History
M. M. Smith, reviewed by A. Keller

POLICY FORUM
Agriculture at a Crossroads
E. T. Kiers et al.

PERSPECTIVES
Frustation in Complexity
P.-M. Binder

NEWS OF THE WEEK
IPCC Tunes Up for Its Next Report Aiming for Better, Timely Results
Greenland Ice Slipping Away but Not All That Quickly
>> Science Express Reports by I. Joughin et al. and S. B. Das et al.
Team Unveils Mideast Archaeology Peace Plan
As Food Prices Rise, U.S. Support for Agricultural Centers Wilts

SCIENCESCOPE
Croatian Editors Fight With Medical School Over Journal’s Fate
Changes to EPA Toxicology—Speed or Delay?

NEWS FOCUS
The Greening of Synfuels
Watery Echoes Give Clues to the Past and Future of the Seas
Mapmaker for the World of Influenza
Coming Out of Asia—Year In, Year Out
>> Research Article p. 340
The Mad Dash to Make Light Crystals

LETTERS
Coral Adaptation in the Face of Climate Change
A. Baird and J. A. Maynard
Response O. Hoegh-Guldberg et al.
Freshwater Forcing: Will History Repeat Itself?
P. U. Clark, T. L. Delworth, A. J. Weaver
Response H. F. Kleiven et al.

CORRECTIONS AND CLARIFICATIONS
316

BOOKS
The Dismal Science How Thinking Like an Economist Undermines Community
S. A. Marglin, reviewed by E. R. Weintraub

SENSING THE PAST Seeing, Hearing, Smelling, Tasting, and Touching in History
M. M. Smith, reviewed by A. Keller

POLICY FORUM
Agriculture at a Crossroads
E. T. Kiers et al.

PERSPECTIVES
Frustation in Complexity
P.-M. Binder

NEWS OF THE WEEK
IPCC Tunes Up for Its Next Report Aiming for Better, Timely Results
Greenland Ice Slipping Away but Not All That Quickly
>> Science Express Reports by I. Joughin et al. and S. B. Das et al.
Team Unveils Mideast Archaeology Peace Plan
As Food Prices Rise, U.S. Support for Agricultural Centers Wilts

SCIENCESCOPE
Croatian Editors Fight With Medical School Over Journal’s Fate
Changes to EPA Toxicology—Speed or Delay?

NEWS FOCUS
The Greening of Synfuels
Watery Echoes Give Clues to the Past and Future of the Seas
Mapmaker for the World of Influenza
Coming Out of Asia—Year In, Year Out
>> Research Article p. 340
The Mad Dash to Make Light Crystals

LETTERS
Coral Adaptation in the Face of Climate Change
A. Baird and J. A. Maynard
Response O. Hoegh-Guldberg et al.
Freshwater Forcing: Will History Repeat Itself?
P. U. Clark, T. L. Delworth, A. J. Weaver
Response H. F. Kleiven et al.

CORRECTIONS AND CLARIFICATIONS
316

BOOKS
The Dismal Science How Thinking Like an Economist Undermines Community
S. A. Marglin, reviewed by E. R. Weintraub

SENSING THE PAST Seeing, Hearing, Smelling, Tasting, and Touching in History
M. M. Smith, reviewed by A. Keller

POLICY FORUM
Agriculture at a Crossroads
E. T. Kiers et al.

PERSPECTIVES
Frustation in Complexity
P.-M. Binder

NEWS OF THE WEEK
IPCC Tunes Up for Its Next Report Aiming for Better, Timely Results
Greenland Ice Slipping Away but Not All That Quickly
>> Science Express Reports by I. Joughin et al. and S. B. Das et al.
Team Unveils Mideast Archaeology Peace Plan
As Food Prices Rise, U.S. Support for Agricultural Centers Wilts

SCIENCESCOPE
Croatian Editors Fight With Medical School Over Journal’s Fate
Changes to EPA Toxicology—Speed or Delay?

NEWS FOCUS
The Greening of Synfuels
Watery Echoes Give Clues to the Past and Future of the Seas
Mapmaker for the World of Influenza
Coming Out of Asia—Year In, Year Out
>> Research Article p. 340
The Mad Dash to Make Light Crystals

LETTERS
Coral Adaptation in the Face of Climate Change
A. Baird and J. A. Maynard
Response O. Hoegh-Guldberg et al.
Freshwater Forcing: Will History Repeat Itself?
P. U. Clark, T. L. Delworth, A. J. Weaver
Response H. F. Kleiven et al.
SCIENCE EXPRESS

www.sciencexpress.org

CLIMATE CHANGE
Seasonal Speedup Along the Western Flank of the Greenland Ice Sheet
I. Joughin et al.
Measurements of ice motion from Greenland show that summer melt water accelerates ice sheet flow by 50 to 100% overall but has less effect in the faster outlet glaciers.

>> News story p. 301; Science Express Report by S. B. Das et al.
10.1126/science.1153288

CLIMATE CHANGE
Fracture Propagation to the Base of the Greenland Ice Sheet During Supraglacial Lake Drainage
S. B. Das et al.
A large lake on the surface of the Greenland Ice Sheet drained out through and along the base of the Ice Sheet within 2 hours, revealing an efficient basal hydrological system.

>> News story p. 301; Science Express Report by I. Joughin et al.
10.1126/science.1153360

PERSPECTIVE: Marine Calcifiers in a High-CO$_2$ Ocean
V. J. Fabry
>> Research Article p. 336
10.1126/science.1157130

REVIEW

MEDICINE
Qinghaosu (Artemisinin): The Price of Success
N. J. White

330

BREVIA

ECOLOGY
The Movement of Aquatic Mercury Through Terrestrial Food Webs
D. A. Cristol et al.
Industrial mercury in a contaminated river can spread beyond the immediate area to nearby terrestrial ecosystems through food web connections.

335

CELL BIOLOGY
Reconstitution of Contractile FtsZ Rings in Liposomes
M. Osawa, D. E. Anderson, H. P. Erickson
A tubulin homolog from prokaryotes can, without other proteins, assemble into rings around liposomes and constrict, suggesting a primordial cell division mechanism.

10.1126/science.1154520

PHYSICS
Quasi-Particle Properties from Tunneling in the $\nu = \frac{5}{2}$ Fractional Quantum Hall State
I. P. Radu, J. B. Miller, C. M. Marcus, M. A. Kastner, L. N. Pfeiffer, K. W. West
Tunneling measurements between the conduction channels in the fractional quantum Hall effect confirm that the charge is quantized in units of $\frac{1}{4}$ of an electron charge.

10.1126/science.1157560

RESEARCH ARTICLES

CLIMATE CHANGE
Phytoplankton Calcification in a High-CO$_2$ World
M. D. Iglesias-Rodriguez et al.
Experiments show that a coccolithophore grows better at elevated carbon dioxide levels, in contrast to predictions for most plankton, and is already increasing in abundance.

>> Science Express Perspective by V. J. Fabry

MEDICINE
The Global Circulation of Seasonal Influenza A (H3N2) Viruses
C. A. Russell et al.
Recent seasonal flu strains constantly evolved in overlapping epidemics in Asia, then erupted to periodically sweep the world, ending in South America 6 to 18 months later.

>> News story p. 310

REPORTS

MATHEMATICS
Generalized Voice-Leading Spaces
C. Callender, I. Quinn, D. Tymoczko
A geometric representation of Western music theory, in which distance represents similarity of chord types, reveals relations among diverse musical concepts.

>> Perspective p. 328

PHYSICS
Picosecond Coherent Optical Manipulation of a Single Electron Spin in a Quantum Dot
J. Berezovsky et al.
A series of ultrafast optical pulses can be used to rotate the spin of a single electron in a quantum dot by a specified angle within a few picoseconds.

328 & 346

346
**REPORTS CONTINUED…**

**PHYSICS**
Coherent Dynamics of a Single Spin Interacting with an Adjustable Spin Bath
R. Hanson et al.
Simulations successfully show how the spin of a nitrogen vacancy in diamond is coupled to those of surrounding nitrogen impurities and how coherence between them is lost.

**APPLIED PHYSICS**
Chaotic Dirac Billiard in Graphene Quantum Dots
L. A. Ponomarenko et al.
Graphene quantum dots vary with their size: Large dots form molecular-scale transistors, intermediate ones show quantum chaos, and the smallest act as single-electron detectors. >> Perspective p. 324

**CHEMISTRY**
Atomlike, Hollow-Core–Bound Molecular Orbitals of C60
M. Feng, J. Zhao, H. Petek
Scanning tunneling microscopy and density functional theory reveal that C60 acts as a superatom in which its unoccupied orbitals are atomlike and delocalized in aggregates.

**GENETICS**
The Chemical Genomic Portrait of Yeast: Uncovering a Phenotype for All Genes
M. E. Hillenmeyer et al.
Exposing yeast cultures to an extensive variety of small molecules and environmental stresses indicates that almost all genes have a demonstrable biological function.

**CELL BIOLOGY**
Wnt5a Control of Cell Polarity and Directional Movement by Polarized Redistribution of Adhesion Receptors
E. S. Witze et al.
A developmental signal causes clustering of membrane-associated proteins (including its receptor) at one end of the cell, marking the cell’s polarity for directional movement. >> Perspective p. 327

**NEUROSCIENCE**
A Model for Neuronal Competition During Development
C. D. Deppemann et al.
Modeling and experiments show that neurons survive during development when neuronal sensitization to survival signals outweighs antagonistic signals for cell death.

**MEDICINE**
Recapitulation of IVIG Anti-Inflammatory Activity with a Recombinant IgG Fc
R. M. Anthony et al.
By identifying the sugar modifications responsible for the therapeutic, anti-inflammatory effect of immunoglobulin, an improved recombinant version can be formulated.

**BIOCHEMISTRY**
Reconstitution of Pilus Assembly Reveals a Bacterial Outer Membrane Catalyst
M. Nishiyama, T. Ishikawa, H. Rechsteiner, R. Glockshuber
The cell-free formation of the protruberant pilus of a pathogenic bacteria is accelerated by a protein that catalyzes supramolecular assembly without input of cellular energy.

**BIOCHEMISTRY**
Structural Basis of Toll-Like Receptor 3 Signaling with Double-Stranded RNA
L. Liu et al.
Two horseshoe-shaped monomers of an innate immunity receptor bind to viral RNA through carboxyl-terminal dimerization, ultimately triggering inflammation.

**NEUROCIRCUITRY**
Divergence of Quaternary Structures Among Bacterial Flagellar Filaments
V. E. Galkin et al.
Flagellar proteins from two bacterial species diverge in their coiled-coil regions; only one triggers an immune response, which may have driven their evolutionary divergence.

**BIOCHEMISTRY**
The Antidepressant Fluoxetine Restores Plasticity in the Adult Visual Cortex
J. F. Maya Vetencourt et al.
An antidepressant drug increases growth factors and reduces inhibitory activity in the visual cortex of adult rats, thereby restoring the plasticity seen only during development.

**BIOCHEMISTRY**
Bacterial Outer Membrane Catalyst
M. Nishiyama, T. Ishikawa, H. Rechsteiner, R. Glockshuber
The cell-free formation of the protruberant pilus of a pathogenic bacteria is accelerated by a protein that catalyzes supramolecular assembly without input of cellular energy.

**CHEMISTRY**
Structural Basis of Toll-Like Receptor 3 Signaling with Double-Stranded RNA
L. Liu et al.
Two horseshoe-shaped monomers of an innate immunity receptor bind to viral RNA through carboxyl-terminal dimerization, ultimately triggering inflammation.

**BIOCHEMISTRY**
The Antidepressant Fluoxetine Restores Plasticity in the Adult Visual Cortex
J. F. Maya Vetencourt et al.
An antidepressant drug increases growth factors and reduces inhibitory activity in the visual cortex of adult rats, thereby restoring the plasticity seen only during development.
Financial trading can wreak havoc on physiology.

**SCIENCE NOW**

[www.sciencenow.org](http://www.sciencenow.org)  DAILY NEWS COVERAGE

Living in a World of Unfamiliar Voices
A woman with a lifelong inability to recognize voices is a medical mystery.

Bad Day for the Dow? Blame Hormones
Market activity is reflected in financial traders’ testosterone and cortisol levels.

Case Closed for Free Will?
The unconscious brain makes choices several seconds before the conscious mind knows about it.

**SCIENCE SIGNALING**

[www.sciencesignaling.org](http://www.sciencesignaling.org)

THE SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

ST NETWATCH: BioModels Database
Explore this collection of mathematical models of biological pathways; in Modeling Tools.

ST NETWATCH: CellDesigner
Build mathematical models of biological pathways with CellDesigner; in Modeling Tools.

ST NETWATCH: Systems Biology Workbench
Integrate mathematical models and share data between different applications; in Modeling Tools.

Help make public policy.

**SCIENCE CAREERS**

[www.sciencecareers.org/career_development](http://www.sciencecareers.org/career_development)

CAREER RESOURCES FOR SCIENTISTS

A Matter of Policy
B. Vastag
Fellowships are available that let scientists contribute to local and national policies.  [>> Editorial p. 289](http://science.sciencemag.org/content/320/5872/264)

Tooling Up: On Headhunters
D. Jensen
Recruiters may seem to offer some advantages, but early-career scientists should still keep their heads.

Home Stretch to Graduation
E. Pain
Submitting your Ph.D. dissertation isn’t always a relief.

From the Archives: What’s Love Got to Do With It?
I. S. Levine
Our Mind Matters expert studies the pros and cons of scientists tying the knot.

**SCIENCE PODCAST**

Download the 18 April Science Podcast to hear about seasonal influenza, aquatic mercury in terrestrial food webs, making synthetic fuels, a geometric model of music, and more.  [www.sciencemag.org/about/podcast.dtl](http://www.sciencemag.org/about/podcast.dtl)

---

Separate individual or institutional subscriptions to these products may be required for full-text access.

ARTICLE TOOLS
http://science.sciencemag.org/content/320/5874

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

Use of this article is subject to the Terms of Service.