



COVER

The Ginza area of Tokyo in 2006. By 2030 the number of urban dwellers will have exploded to 4.8 billion people, roughly 60 percent of the projected world population, whereas only 13 percent lived in cities in 1900. The special section beginning on page 739 includes News stories, Reviews, and Perspectives that explore the ramifications of urban transformation.

Photo: Getty Images

DEPARTMENTS

- 691 *Science Online*
- 693 *This Week in Science*
- 699 *Editors' Choice*
- 702 *Contact Science*
- 705 *Random Samples*
- 707 *Newsmakers*
- 829 *New Products*
- 830 *Science Careers*

EDITORIAL

- 697 *Science for the Globe*
by David Baltimore
>> *Cities special section p. 739*

SPECIAL SECTION

Cities

INTRODUCTION

Reimagining Cities 739

NEWS

- China's Living Laboratory in Urbanization 740
- Calming Traffic on Bogotá's Killing Streets 742
- Durban's Poor Get Water Services Long Denied 744
- Pipe Dreams Come True 745
- Rebuilt From Ruins, a Water Utility Turns Clean and Pure 746
- Living in the Danger Zone 748
- Choking on Fumes, Kolkata Faces a Noxious Future 749
- From Gasoline Alleys to Electric Avenues 750
 - Unclogging Urban Arteries
- Upending the Traditional Farm 752
- Imagining a City Where (Electrical) Resistance Is Futile 753
- Money—With Strings—to Fight Poverty 754
 - Building on a Firm Foundation

REVIEWS

- ECOLOGY: Global Change and the Ecology of Cities 756
N. B. Grimm et al.
- ECONOMICS: Urbanization and the Wealth of Nations 772
D. E. Bloom, D. Canning, G. Fink

PERSPECTIVES

- The Urban Transformation of the Developing World 761
M. R. Montgomery
- Reproducing in Cities 764
R. Mace
- Health and Urban Living 766
C. Dye
- The Size, Scale, and Shape of Cities 769
M. Batty

>> *Editorial p. 697; for related online material, see p. 691 or go to www.sciencemag.org/cities*



NEWS OF THE WEEK

- Kenyan Scientists Endure Violent Unrest, University Closings 708
- Lifting the Veil on Traditional Chinese Medicine 709
- Exotic Disease of Farm Animals Tests Europe's Responses 710

SCIENCESCOPE

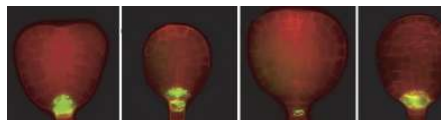
Prizes Eyed to Spur Medical Innovation 711

NEWS FOCUS

- A Science Budget of Choices and Chances 714
 - A Broken Record?
 - Near-Term Energy Research Prospers
 - NIH Hopes for More Mileage From Roadmap
 - Earth Gets a Closer Look
- Can the Upstarts Top Silicon? 718
- MESSENGER Flyby Reveals a More Active and Stranger Mercury 721
- Berkeley Hyenas Face an Uncertain Future 722

Downloaded from <http://science.sciencemag.org/> on May 20, 2019

CONTENTS continued >>



PLANT SCIENCE

TOPLESS Mediates Auxin-Dependent Transcriptional Repression During *Arabidopsis* Embryogenesis

H. Szemenyei, M. Hannon, J. A. Long

A transcriptional co-repressor is part of the protein complex that inhibits developmental gene activation in *Arabidopsis* until the growth hormone auxin triggers its degradation.

10.1126/science.1151461

NEUROSCIENCE

Synaptic Protein Degradation Underlies Destabilization of Retrieved Fear Memory

S.-H. Lee et al.

Upon recollection, mouse memories of fearful situations become labile, as postsynaptic proteins are degraded by proteosomes and are then reconsolidated via protein synthesis.

10.1126/science.1150541

SCIENCE EXPRESS

www.sciencexpress.org

CLIMATE CHANGE

Land Clearing and the Biofuel Carbon Debt

J. Fargione, J. Hill, D. Tilman, S. Polasky, P. Hawthorne

10.1126/science.1152747

Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land Use Change

T. Searchinger et al.

Converting forests and grasslands to biofuel crop production results in a net carbon flux to the atmosphere for decades despite any displacement of fossil fuel use.

10.1126/science.1151861

LETTERS

Creating an Earth Atmospheric Trust *P. Barnes et al.* 724

The Latest Buzz About Colony Collapse Disorder

D. Anderson and I. J. East

Response *D. Cox-Foster et al.*

More Toxin Tests Needed *J. Huff*

The Inimitable Field of Cosmology *L. B. Railsback*

Response *J. Gunn*

CORRECTIONS AND CLARIFICATIONS 726

BOOKS ET AL.

On The Fireline Living and Dying with Wildland 728

Firefighters *M. Desmond, reviewed by E. A. Rosa*

One Time Fits All The Campaigns for Global Uniformity 729

I. R. Bartky, reviewed by T. S. Mullaney

BROWSING 729

POLICY FORUM

Climate Change—the Chinese Challenge 730

N. Zing, Y. Ding, J. Pan, H. Wang, J. Gregg

PERSPECTIVES

Dwarfism, Where Pericentrin Gains Stature 732

B. Delaval and S. Doxsey >> Report p. 816

Amplifying a Tiny Optical Effect 733

K. J. Resch >> Report p. 787

The Right Resident Bugs 734

N. Silverman and N. Paquette >> Research Article p. 777

From Complexity to Simplicity 735

S. Chakravarty

Taking a Selective Bite Out of Methane 736

C. B. Mullins and G. O. Sitz >> Report p. 790

Toward Flexible Batteries 737

H. Nishide and K. Oyaizu

TECHNICAL COMMENT ABSTRACTS

MATHEMATICS

Comment on “Clustering by Passing Messages 726

Between Data Points”

M. J. Brusco and H.-F. Köhn

full text at www.sciencemag.org/cgi/content/full/319/5864/726c

Response to Comment on “Clustering by Passing Messages Between Data Points”

B. J. Frey and D. Dueck

full text at www.sciencemag.org/cgi/content/full/319/5864/726d

BREVIA

PHYSIOLOGY

Experienced Saxophonists Learn to Tune Their 776

Vocal Tracts

J. M. Chen, J. Smith, J. Wolfe

To play the high range of the saxophone, players learn to tune the second resonance of their vocal tract to the desired note.

RESEARCH ARTICLES

IMMUNOLOGY

Innate Immune Homeostasis by the Homeobox Gene 777

Caudal and Commensal-Gut Mutualism in *Drosophila*

J.-H. Ryu et al.

A *Drosophila* gene important in development also inhibits the production of harmful antimicrobial peptides that could kill off beneficial gut microbes.

>> Perspective p. 734

REPORTS

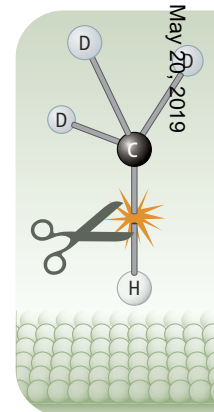
PHYSICS

Quantum Phase Extraction in Isospectral 782

Electronic Nanostructures

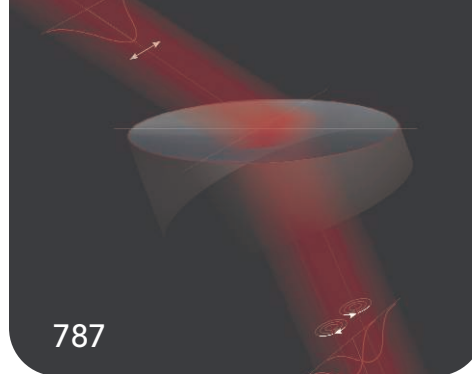
C. R. Moon et al.

Surface electronic states with different shapes but the same spectrum, like two different drums with the same sound, provide an extra handle for extracting the quantum phase.



736

Downloaded from <http://science.sciencemag.org> on May 20, 2019



REPORTS CONTINUED...

PHYSICS

Observation of the Spin Hall Effect of Light via Weak Measurements 787

O. Hosten and P. Kwiat

Displacement of light at an air-glass interface depends on its polarization, showing that photons have a spin Hall effect comparable to that seen for electrons. >> *Perspective p. 733*

CHEMISTRY

Bond-Selective Control of a Heterogeneously Catalyzed Reaction 790

D. R. Killelea, V. L. Campbell, N. S. Shuman, A. L. Utz

Exciting the CH bond in CHD₃ just before it collides with a nickel surface minimizes dissipation of the collision energy throughout the molecule, allowing selective bond scission. >> *Perspective p. 736*

MATERIALS SCIENCE

Colossal Positive and Negative Thermal Expansion in the Framework Material Ag₃[Co(CN)₆] 794

A. L. Goodwin et al.

Like a lattice fence, a silver-based framework material expands greatly in one direction upon heating, while contracting even more in the orthogonal direction.

GEOPHYSICS

Elastic Anisotropy of Earth's Inner Core 797

A. B. Belonoshko et al.

Simulations show that at high pressures sound waves travel through the body-centered cubic structure of iron faster in one direction, explaining seismic data on the inner core.

CLIMATE CHANGE

The Spatial Pattern and Mechanisms of Heat-Content Change in the North Atlantic 800

M. S. Lozier et al.

Warming and cooling in different parts of the North Atlantic since 1950 reflects variable atmospheric circulation, complicating understanding of anthropogenic changes.

ECOLOGY

Direct and Indirect Effects of Resource Quality on Food Web Structure 804

T. Bukovinszky, F. J. F. van Veen, Y. Jongema, M. Dicke

Food webs that contain either Brussels sprouts or a wild *Brassica* relative have surprisingly large differences in structure and complexity, extending to three trophic levels.

BIOPHYSICS

Biomechanical Energy Harvesting: Generating Electricity During Walking with Minimal User Effort 807

J. M. Donelan et al.

A knee-mounted device can generate several watts of power at the end of each leg swing in a process similar to regenerative braking in hybrid cars.

BIOCHEMISTRY

Three-Dimensional Super-Resolution Imaging by Stochastic Optical Reconstruction Microscopy 810

B. Huang, W. Wang, M. Bates, X. Zhuang

Three-dimensional fluorescence images of cellular structures in fixed cells are realized at 20- to 30-nanometer lateral and 50-nanometer axial resolution, without scanning.

GENETICS

An Association Between the Kinship and Fertility of Human Couples 813

A. Helgason et al.

The extensive genealogies of the Icelandic people show that couples who are 3rd or 4th cousins have more children and grandchildren than couples whose relationships are more or less distant.

GENETICS

Mutations in the Pericentriin (*PCNT*) Gene Cause Primordial Dwarfism 816

A. Rauch et al.

In humans, an inherited condition with small brain size and near-normal intelligence is caused by mutations that disrupt chromosome separation during cell division. >> *Perspective p. 732*

MOLECULAR BIOLOGY

Reciprocal Binding of PARP-1 and Histone H1 at Promoters Specifies Transcriptional Outcomes 819

R. Krishnakumar et al.

At certain genes regulated by the nucleosome-binding protein PARP-1, the presence of a linker histone at the promoter prevents PARP-1 binding, inhibiting gene activation.

IMMUNOLOGY

Repression of the Transcription Factor Th-POK by Runx Complexes in Cytotoxic T Cell Development 822

R. Setoguchi et al.

A key cell-fate decision—to become a cytotoxic rather than a helper T cell—is controlled by repression of the helper T cell transcription factor by a second transcription factor.

MEDICINE

A Heme Export Protein Is Required for Red Blood Cell Differentiation and Iron Homeostasis 825

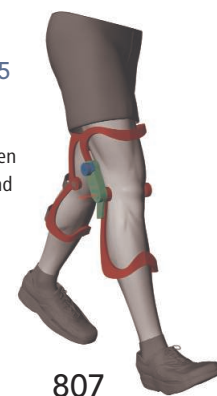
S. B. Keel et al.

A mouse cell-surface protein exports excess heme, which is toxic when free in the cytoplasm, ensuring normal red blood cell maturation and systemic iron balance.



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 © 2008 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): \$144 (\$74 allocated to subscription). Domestic institutional subscription (51 issues): \$770; 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. SCIENCE is printed on 30 percent post-consumer recycled paper. 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.



SCIENCE NOW

www.sciencenow.org DAILY NEWS COVERAGE

Team Uncovers New Evidence of Recent Human Evolution

Adaptation to disparate environments resulted in mutations related to obesity and diabetes.

Don't It Make Your Brown Eyes Blue?

Researchers locate genetic change that leads to baby blues, and it's not where they expected.

Move Over Beavers, Here Come Salmon

The big fish don't just swim upstream—they shape the stream.



Mentoring and your career.

SCIENCE CAREERS

www.sciencereers.org CAREER RESOURCES FOR SCIENTISTS

Special Feature: Mentoring

E. Pain

What makes mentoring relationships successful?

A Gift That Keeps On Giving

S. Webb

An industry mentor helped physicist Joan Hoffmann navigate graduate school and launch her career.

Mentoring Opposites

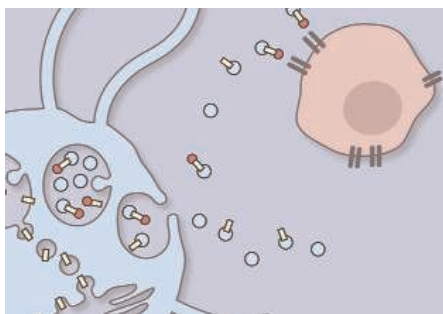
C. Wald

A mentor and student turned their differences into strengths as they became scientific collaborators.

From the Archives: The Commandments of Cover Letter Creation

P. Fiske

A good cover letter highlights your qualifications and guides readers through the most important parts of your work history.



Exosomes spread inflammatory signals.

SCIENCE SIGNALING

www.stke.org THE SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

PERSPECTIVE: Novel Roles for the NF- κ B Signaling Pathway in Regulating Neuronal Function

M. C. Boersma and M. K. Meffert

Components of the NF- κ B pathway may use multiple mechanisms to influence synaptic plasticity, learning, and memory.

PERSPECTIVE: Exosomes Secreted by Bacterially Infected Macrophages Are Proinflammatory

H. C. O'Neill and B. J. C. Quah

The release of bacterial components in vesicles secreted by infected macrophages helps promote inflammation.

SCIENCE PODCAST

Download the 8 February *Science* Podcast to hear about greenhouse emissions from biofuel-dedicated land, the 2009 U.S. science budget, good mentoring relationships, reproducing in cities, and more.

www.sciencemag.org/about/podcast.dtl



SCIENCE ONLINE FEATURE

VIDEO: Cities

An accompaniment to this week's special section exploring the benefits and challenges of urbanization.

www.sciencemag.org/cities

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

Science

319 (5864)

Science **319** (5864), 693-836.

ARTICLE TOOLS

<http://science.sciencemag.org/content/319/5864>

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.