COVER
Ordovician sedimentary rocks at
Presqu’île de Crozon, Brittany, France.
These rocks show high-frequency cycles
of less than 500,000 years between bay
and open marine conditions. This and
similar records allow reconstruction of
global sea level from 550 to 250 million
years ago. The pink boulder at the bottom
is about 15 centimeters across. See page 64.

Photo: Bilal U. Haq

NEWS OF THE WEEK
New Malaria Plan Called Ambitious by Some,
Unrealistic by Others
26
NAS Study May Fail to Settle Anthrax Case
27
Europeans Think Big for Particle Detectors
29

SCIENCESCOPE
Adding a Turn to the Roadmap, Zerhouni to Step Down
30
7-Year Wake
U.S. Oceans Chief Leaves a Mixed Legacy in His
Minerals Suggest Water Once Flowed on Mars—
But Where?
Quantum Network Set to Send Uncrackable Secrets
Winds, Not Just Global Warming, Eating Away at the
Ice Sheets
Biochemist Robert Tjian Named President of
Hughes Institute
An International Plan to Hatch Scientist-Entrepreneurs

NEWS FOCUS
The Peanut Butter Debate
Patents: A Recipe for Problems?
>> Science Podcast
Culture Wars Over How to Find an Ancient Niche
for Life on Mars
Edward Buckler: Romping Through Maize Diversity

LETTERS
Keeping an Eye on the Prize R. A. Sedjo
R. A. Sedjo
43
Epigenomics: A Roadmap, But to Where?
H. D. Madhani et al.
Protecting Aggregate Genomic Data
E. A. Zerhouni and E. G. Nabel
Closing A Loophole in the FDA Amendments Act
E. H. Turner, N. J. Moaleji, B. L. Arnold
Response D. A. Zarin and T. Tse
Big Payoffs Possible for Small-Molecule Screening
J. H. Toney

CORRECTIONS AND CLARIFICATIONS
44

BOOKS ET AL.

Dissent over Descent Intelligent Design’s Challenge
to Darwinism S. Fuller, reviewed by M. Ruse
47

Physics for Future Presidents The Science Behind the
Headlines R. A. Muller, reviewed by K. R. Foster

POLICY FORUM
Sustainable Biofuels Redux
G. P. Robertson et al.

PERSPECTIVES
The Shining Make-Up of Our Star
M. Asplund

Bugs’ Bugs
M. R. Berenbaum and T. Eisner
>> Brevia p. 63

From Ocean to Stratosphere
R. Deckert and M. Dameris

A Light Touch Catalyzes Asymmetric Carbon-Carbon
Bond Formation
P. Renaud and P. Leong >> Report p. 77

Not Comparable, But Complementary

CONTENTS continued >>
ECOLOGY
Natal Homing and Connectivity in Atlantic Bluefin Tuna Populations
J. R. Rooker et al.
Isotopes in the ear bones of tuna reveal that two populations—from the Gulf of Mexico and the Mediterranean—mingle in the Atlantic as adolescents but return home to breed.  >> Science Podcast
10.1126/science.1161473

CHEMISTRY
Molecular Confinement Accelerates Deformation of Entangled Polymers During Squeeze Flow
H. D. Rowland, W. P. King, J. B. Pethica, G. L. W. Cross
When polymers are squeezed at nanometer scales, the longest chains unexpectedly flow more easily, even though in theory they should be the most entangled.
10.1126/science.1157945

CELL BIOLOGY
Ubiquitin-Like Protein Involved in the Proteasome Pathway of Mycobacterium tuberculosis
A prokaryotic version of ubiquitin, a eukaryotic tag for protein degradation, is linked to lysines in prokaryotic proteins destined for destruction, a process called pupylation.
10.1126/science.1163885

ASTROPHYSICS
A Large Excess in Apparent Solar Oblateness Due to Surface Magnetism
M. D. Fivian, H. S. Hudson, R. P. Lin, H. J. Zahid
Satellite measurements indicate that the sun is more oblate than previous measurements suggested, a shape resulting from the combined effects of rotation and magnetism.
10.1126/science.1160863

BIOCHEMISTRY
The 2.6 Angstrom Crystal Structure of a Human A2A Adenosine Receptor Bound to an Antagonist
V.-P. Jaakola et al.
The ligand binding pocket of the caffeine-binding human adenosine receptor has a different position and orientation than that of other G protein–linked receptors.
10.1126/science.1164772

REVIEW
PSYCHOLOGY
The Origin and Evolution of Religious Prosociality
A. Norenzayan and A. F. Shariff
58

RESEARCH ARTICLE
GEOLOGY
A Chronology of Paleozoic Sea-Level Changes
B. U. Haq and S. R. Schutter
The marine sedimentary rock record shows that sea level rose from the Early Cambrian to the Ordovician and then fluctuated through the Permian, partly in response to glaciations.
64

APPLIED PHYSICS
Time Reversal and Negative Refraction
J. B. Pendry
Optically active materials with nonlinear optical properties are predicted to mimic negatively refractive materials but without losses associated with true negative refraction.
71

CHEMISTRY
Surface-Modified Carbon Nanotubes Catalyze Oxidative Dehydrogenation of n-Butane
J. Zhang, X. Liu, R. Blume, A. Zhang, R. Schlögl, D. S. Su
Carbon nanotubes decorated with phosphate groups can catalyze the partial oxidation of alkanes, a process that has normally required complex metal oxides.
73
REPORTS CONTINUED...

CHEMISTRY
Merging Photoredox Catalysis with Organocatalysis: The Direct Asymmetric Alkylation of Aldehydes
D. A. Niewcz and D. W. C. MacMillan
When irradiated by light, a ruthenium-organic catalyst creates intermediates with unpaired electrons that undergo otherwise intractable asymmetric reactions. >> Perspective p. 55

CHEMISTRY
Temperature-Induced Hydrophobic-Hydrophilic Transition Observed by Water Adsorption
H.-J. Wang, X.-K. Xi, A. Kleinhammes, Y. Wu
The insides of single-walled carbon nanotubes repel water at 22°C but absorb it at 8°C, showing that temperature finely controls the dynamics of confined water nanodroplets.

CLIMATE CHANGE
Atmospheric CO₂ and Climate on Millennial Time Scales During the Last Glacial Period
J. Ahn and E. J. Brook
A detailed gas record from the Byrd ice core from 90,000 to 20,000 years ago shows that warming episodes tracked high CO₂ levels in Antarctica but lagged by several thousands of years in Greenland.

EVOLUTION
Rates of Molecular Evolution Are Linked to Life History in Flowering Plants
S. A. Smith and M. J. Donoghue
A phylogenetic analysis shows that long-lived trees and shrubs have lower rates of molecular evolution than short-lived herbaceous plants.

DEVELOPMENTAL BIOLOGY
Chemokine Signaling Controls Endodermal Migration During Zebrafish Gastrulation
S. Nair and T. F. Schilling
During zebrafish gastrulation, chemokines are required for integrin-dependent adhesion of endodermal cells to mesoderm, a role distinct from their action as chemoattractants.

STRUCTURAL BIOLOGY
Molecular Architecture of the "Stressosome," a Signal Integration and Transduction Hub
J. Marles-Wright et al.
The stressosome, a huge multiprotein complex, has a virus capsid–like core and variable extensions that detect and integrate signals to activate the stress response.

NEUROSCIENCE
Internally Generated Reactivation of Single Neurons in Human Hippocampus During Free Recall
H. Gelbard-Sagiv et al.
The firing patterns of brain neurons recorded from people watching a video episode were the same as those recorded during later recall of the same show.

PLANT SCIENCE
A Physical Map of the 1-Gigabase Bread Wheat Chromosome 3B
E. Paux et al.
A physical map of the largest chromosome of wheat provides the first step toward sequencing the huge, 17-billion base pair genome of this critical food crop.

CELL BIOLOGY
High-Quality Binary Protein Interaction Map of the Yeast Interactome Network
H. Yu et al.
Comparison of existing methods for mapping protein-protein interactions in yeast cells shows that the high-throughput approaches are complementary to one another. >> Perspective p. 56

CELL BIOLOGY
Ceramide Biogenesis Is Required for Radiation-Induced Apoptosis in the Germ Line of C. elegans
X. Deng et al.
In worms, lipid signaling at the mitochondria is necessary for the germ cell death that follows radiation damage, but not for normal developmental cell death.

PSYCHOLOGY
Lacking Control Increases Illusory Pattern Perception
J. A. Whitson and A. D. Galinsky
When subjects receive false feedback in lab tests and so feel a loss of control, they are more apt to perceive patterns in random visual static and imagine conspiracies.

>> Science Podcast
Purinergic receptor antagonists inhibit inflammation.

SCIENCE SIGNALING
www.sciencesignaling.org
THE SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

RESEARCH ARTICLE: Purinergic Control of T Cell Activation by ATP Released Through Pannexin-1 Hemichannels
Pannexin hemichannel-mediated release of ATP provides an autocrine, costimulatory signal for T cell activation.

RESEARCH ARTICLE: Kinome siRNA Screen Identifies Regulators of Ciliogenesis and Hedgehog Signal Transduction
M. Evangelista, T. Y. Lim, J. Lee, L. Parker, A. Ashique, A. S. Peterson, W. Ye, D. P. Davis, F. J. de Sauvage
Cdc2l1 is a component of the Hh signaling pathway and opposes the activity of the negative regulator Sufu.

PERSPECTIVE: A Wnt-fall for Gene Regulation—Repression
N. P. Hovrerter and M. L. Waterman
Recognition of a nonclassical Wnt-response element by the transcription factor TCF results in β-catenin acting as a transcriptional repressor of certain Wnt target genes.

PRESENTATION: Somatic Cell Genetics for the Study of NF-κB Signaling in Innate Immunity
R. Krumbach, S. Bloor, G. Ryzhakov, F. Randow
A forward genetic screen in immortalized cells identifies NF-κB signaling components required to transduce signals from Toll-like receptors.

Help climbing out of a rut.

SCIENCE CAREERS
www.sciencemag.org/career_development
FREE CAREER RESOURCES FOR SCIENTISTS

Mind Matters: Getting Out of a Rut
I. S. Levine
If you are bored at work, talk to people and try something new.

Taken for Granted: A Big Idea About Fostering Innovation
B. L. Benderly
An unorthodox program helps young innovators turn inspiration into reality.

In Person: Ich bin Postdoctorin in Berlin
V. Maneeratana
The biggest challenges in moving abroad are not always scientific.

October 2008 Funding News
J. Fernández
Learn about the latest in research funding, scholarships, fellowships, and internships.

SCIENCEPODCAST
www.sciencemag.org/multimedia/podcast
FREE WEEKLY SHOW

Download the 3 October Science Podcast to hear about illusory pattern perception, trans-Atlantic bluefin tuna movements, relieving malnutrition with high-calorie rations, and more.

SCIENCE
VOL 322 3 OCTOBER 2008
www.sciencemag.org
Published by AAAS
Science

322 (5898)

Science 322 (5898), 12-118.

ARTICLE TOOLS http://science.sciencemag.org/content/322/5898

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.