SPECIAL SECTION

Cell Signaling

INTRODUCTION
Getting Your Loops Straight 389

REVIEWS
Feedback Loops Shape Cellular Signals in Space and Time 390
O. Brandman and T. Meyer
Optical Switches for Remote and Noninvasive Control of Cell Signaling
P. Gorostiza and E. Y. Isacoff
From Signals to Patterns: Space, Time, and Mathematics in Developmental Biology
J. Lewis

For related online content, see page 339 or go to www.sciencemag.org/cellsignaling08/

EDITORIAL
345 U.S.-Cuban Scientific Relations by Sergio Jorge Pastrana and Michael T. Clegg

NEWS OF THE WEEK
Falsification Charge Highlights Image-Manipulation Standards 356
DNA Test for Breast Cancer Risk Draws Criticism 357
Hawaii Marine Lab Fights to Stay Afloat 358
Two Strikes and You’re Out, Grant Applicants Learn 358
Most Devastating Mass Extinction Followed Long Bout of Sea Sickness 359

SCIENCESCOPE
Skewed Symmetries Net Honors for Particle Theorists 360
Theorist Revolutionized Study of What Gets Made Where 360
Three Scientists Bask in Prize’s Fluorescent Glow 361

NEWS FOCUS
Q&A: China’s Scientist Premier 362
Paradoxical Effects of Tightly Controlled Blood Sugar 365
Biomolecular Archaeology Symposium 368
Tracing the First Tame Horses by Their Milk 368
Old Bones Reveal Signs of Scurvy 368
Hope for the Rhone’s Missing Sturgeon 368
BIOCHEMISTRY
Structure and Molecular Mechanism of a Nucleobase-Cation-Symport-1 Family Transporter
S. Weyand et al.
The structure of a membrane transporter in an open state suggests that in- and out-facing cavities reciprocally open and close coordinated by two transmembrane segments.
10.1126/science.1164440

ASTRONOMY
The Fermi Gamma-Ray Space Telescope Discovers the Pulsar in the Young Galactic Supernova Remnant CTA 1
G. Kanbach et al.
The Fermi Space Telescope has detected a gamma-ray pulsar associated with a young supernova remnant, implying that such stars may be unidentified gamma-ray sources.
10.1126/science.1165572

LETTERS
Quantifying Coauthor Contributions C. H. Sekercioglu 371
Biofuels: Clarifying Assumptions V. Khosla
Response T. D. Searchinger and R. A. Houghton

CORRECTIONS AND CLARIFICATIONS 375

BOOKS ET AL.
Fixing Climate What Past Climate Changes Reveal About the Current Threat—and How to Counter It
W. S. Broecker and R. Kunzig, reviewed by K. Caldeira
Earth: The Sequel The Race to Reinvent Energy and Stop Global Warming F. Krupp and M. Horn, reviewed by F. T. Manheim
Uncle Phil and the Atomic Bomb
J. Abelson and P. H. Abelson, reviewed by C. T. Prewitt
La forêt danse (The Dancing Forest) B. Lainé 378

POLICY FORUM
When Embryonic Stem Cell Lines Fail to Meet Consent Standards
J. Sugarman and A. W. Siegel 379

PERSPECTIVES
It’s the Sequence, Stupid!
H. A. Coller and L. Kruglyak >> Report p. 434
In Praise of Pores
P. Colombo
Toward Pore-Free Ceramics
G. L. Messing and A. J. Stevenson
Transforming Light
V. M. Shalaev
A New Spin on the Doppler Effect
R. D. McMichael and M. D. Stiles >> Report p. 410
RNA Computing in a Living Cell
E. Shapiro and B. Gil >> Report p. 456

CELL BIOLOGY
Detection of GTP-Tubulin Conformation in Vivo Reveals a Role for GTP Remnants in Microtubule Rescues
A. Dimitrov, M. Quesnoit, S. Moutel, I. Cantaloube, C. Poüs, F. Perez
GTP-bound tubulin is found at microtubule ends in living cells and also within microtubules, where it may promote repolymerization and avert microtubule collapse.
10.1126/science.1165401

ASTRONOMY
Observation of Pulsed γ-Rays Above 25 GeV from the Crab Pulsar with MAGIC
The MAGIC Collaboration
The MAGIC telescope has detected higher-energy, pulsed gamma rays from the Crab pulsar and a threshold suggesting that they are emitted from the outer magnetosphere.
10.1126/science.1164718

GEOCHEMISTRY
The Miller Volcanic Spark Discharge Experiment
A. P. Johnson et al.
Reanalysis of archived samples of an experiment simulating production of organic molecules in volcanic gases by lightning shows that they contain many amino acids. >> Science Podcast

GENETICS
Conservation and Rewiring of Functional Modules Revealed by an Epistasis Map in Fission Yeast
A. Roguev et al.
Comparison of genetic wiring in two types of yeast reveals that protein complexes are conserved, but the interactions between them can change radically between species.

PHYSICS
Current-Induced Spin-Wave Doppler Shift
V. Vlaminck and M. Bailleul
A current-induced shift in the frequency of propagating spin waves provides a simple technique to probe spin-polarized currents in engineering spintronic devices. >> Perspective p. 386

APPLIED PHYSICS
Complex Patterning by Vertical Interchange Atom Manipulation Using Atomic Force Microscopy
Y. Sugimoto et al.
Atoms of tin and silicon are reversibly and controllably exchanged between the tip of an atomic force microscope and a substrate, allowing atomic patterning of a surface.

CHEMISTRY
Catalytic Conversion of Biomass to Monofunctional Hydrocarbons and Targeted Liquid-Fuel Classes
E. L. Kunkes et al.
A set of two reactors, one that breaks down biomass sugars and a second that directs chain formation, can synthesize various hydrocarbon fuels.
A Stochastic Single-Molecule Event Triggers Protein

D. M. Wilson et al.

The addition of hydrogen bonding units to two block copolymers leads to a template with square patterns that can be used for manufacturing integrated circuits.

Evolution of Block Copolymer Lithography to Highly Ordered Square Arrays

C. Tang et al.

Two small, weakly bound objects in the outer solar system orbit each other more than 100,000 kilometers apart, a distance that challenges ideas for such binaries form.

Two astronomical objects known as the Extreme Kuiper Belt Binary 2001 QW$_{322}$

J.-M. Petit et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Species-Specific Transcription in Mice Carrying Human Chromosome 21

M. D. Wilson et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Evolution of Block Copolymer Lithography to Highly Ordered Square Arrays

C. Tang et al.

Two small, weakly bound objects in the outer solar system orbit each other more than 100,000 kilometers apart, a distance that challenges ideas for such binaries form.

Two astronomical objects known as the Extreme Kuiper Belt Binary 2001 QW$_{322}$

J.-M. Petit et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Species-Specific Transcription in Mice Carrying Human Chromosome 21

M. D. Wilson et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Evolution of Block Copolymer Lithography to Highly Ordered Square Arrays

C. Tang et al.

Two small, weakly bound objects in the outer solar system orbit each other more than 100,000 kilometers apart, a distance that challenges ideas for such binaries form.

Two astronomical objects known as the Extreme Kuiper Belt Binary 2001 QW$_{322}$

J.-M. Petit et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Species-Specific Transcription in Mice Carrying Human Chromosome 21

M. D. Wilson et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Evolution of Block Copolymer Lithography to Highly Ordered Square Arrays

C. Tang et al.

Two small, weakly bound objects in the outer solar system orbit each other more than 100,000 kilometers apart, a distance that challenges ideas for such binaries form.

Two astronomical objects known as the Extreme Kuiper Belt Binary 2001 QW$_{322}$

J.-M. Petit et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Species-Specific Transcription in Mice Carrying Human Chromosome 21

M. D. Wilson et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Evolution of Block Copolymer Lithography to Highly Ordered Square Arrays

C. Tang et al.

Two small, weakly bound objects in the outer solar system orbit each other more than 100,000 kilometers apart, a distance that challenges ideas for such binaries form.

Two astronomical objects known as the Extreme Kuiper Belt Binary 2001 QW$_{322}$

J.-M. Petit et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Species-Specific Transcription in Mice Carrying Human Chromosome 21

M. D. Wilson et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Evolution of Block Copolymer Lithography to Highly Ordered Square Arrays

C. Tang et al.

Two small, weakly bound objects in the outer solar system orbit each other more than 100,000 kilometers apart, a distance that challenges ideas for such binaries form.

Two astronomical objects known as the Extreme Kuiper Belt Binary 2001 QW$_{322}$

J.-M. Petit et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Species-Specific Transcription in Mice Carrying Human Chromosome 21

M. D. Wilson et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Evolution of Block Copolymer Lithography to Highly Ordered Square Arrays

C. Tang et al.

Two small, weakly bound objects in the outer solar system orbit each other more than 100,000 kilometers apart, a distance that challenges ideas for such binaries form.

Two astronomical objects known as the Extreme Kuiper Belt Binary 2001 QW$_{322}$

J.-M. Petit et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Species-Specific Transcription in Mice Carrying Human Chromosome 21

M. D. Wilson et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Evolution of Block Copolymer Lithography to Highly Ordered Square Arrays

C. Tang et al.

Two small, weakly bound objects in the outer solar system orbit each other more than 100,000 kilometers apart, a distance that challenges ideas for such binaries form.

Two astronomical objects known as the Extreme Kuiper Belt Binary 2001 QW$_{322}$

J.-M. Petit et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Species-Specific Transcription in Mice Carrying Human Chromosome 21

M. D. Wilson et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Evolution of Block Copolymer Lithography to Highly Ordered Square Arrays

C. Tang et al.

Two small, weakly bound objects in the outer solar system orbit each other more than 100,000 kilometers apart, a distance that challenges ideas for such binaries form.

Two astronomical objects known as the Extreme Kuiper Belt Binary 2001 QW$_{322}$

J.-M. Petit et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

Species-Specific Transcription in Mice Carrying Human Chromosome 21

M. D. Wilson et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.
Separate and unequal.

SCIENCE NOW
www.sciencenow.org
HIGHLIGHTS FROM OUR DAILY NEWS COVERAGE

Don’t Judge a Worm by Its Color
Scientists parse four species of earthworm from one, despite similarities in appearance.

Unconscious Brain Still Registers Pain
Some brain-injury patients may be hurting even if they can’t show it.

The Come-Hither Voice
Pitch of a woman’s voice rises during ovulation.

Separate and unequal.

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

RESEARCH ARTICLE: Regulation of P2X2 Receptors by the Neuronal Calcium Sensor VILIP1
S. Chaumont, V. Compan, E. Toulme, E. Richler, G. D. Housley, F. Rassendren, B. S. Khakh
Optics and electrophysiology reveal the dynamics of an ATP-gated ion channel signaling complex.

RESEARCH ARTICLE: BDNF Selectively Regulates GABA\textsubscript{A} Receptor Transcription by Activation of the JAK/STAT Pathway
Brain-derived neurotrophic factor regulates a GABA receptor subunit through the repressor ICER.

PERSPECTIVE: Acetylation of MKP-1 and the Control of Inflammation
H. Chi and R. A. Flavell
Toll-like receptor signaling is inhibited by acetylated MKP-1, a mitogen-activated protein kinase phosphatase.

PREVIEW
Get a sneak peek at articles coming up in the 21 October issue related to this week’s Science special issue on cell signaling.

>> Cell Signaling section p. 389 and www.sciencemag.org/cellsignaling08/

Separate and unequal.

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

Special Feature: Opportunities in Synthetic Biology
E. Pain
Synthetic biology may be in its infancy, but the field is growing rapidly and gaining support. >> Science Podcast

Getting Ready for Synthetic Biology
E. Pain
Synthetic biology offers new opportunities for scientists willing to challenge their ways of thinking and doing research.

A Multidisciplinary Approach to Life
E. Pain
A microbiologist, a mechanical engineer, and a chemist tell Science Careers how they ended up in synthetic biology.

Science Careers Podcast
K. Travis
Hear three scientists talk about their career paths and the future of synthetic biology research.

Separate and unequal.