

3 December 2010 | \$10

# Science

Metabolism



## SPECIAL SECTION

# Metabolism

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- 1349 Circadian Integration of Metabolism and Energetics  
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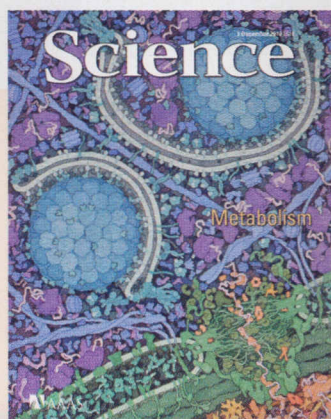
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### GE PRIZE ESSAY

- 1334 A New Approach to Fluorescence Microscopy  
M. Bates

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### COVER

Autophagy, the process by which cells digest their own components, takes place in vesicles called autophagosomes (white membrane structures), the size of which are determined by the amount of a protein called Atg8. Basal amounts of Atg8 (small membrane-associated spheres) generate a small vesicle (middle left), whereas larger amounts cause formation of a full-fledged autophagosome (upper right). Autophagy provides fuel for cellular metabolism, the topic of the special section beginning on page 1337.

Painting: David S. Goodsell; Scientific Design: Zhou Du and Daniel J. Klionsky

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## RESEARCH ARTICLE

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S. Dehaene et al.  
Reading changes the mind.

## REPORTS

- 1364** Carbon Nanotubes with Temperature-Invariant Viscoelasticity from  $-196^{\circ}$  to  $1000^{\circ}\text{C}$   
M. Xu et al.  
A dense carbon-nanotube network shows nearly constant viscoelastic properties over an exceptionally wide temperature range.  
>> *Perspective p. 1332*
- 1368** Video-Rate Molecular Imaging in Vivo with Stimulated Raman Scattering  
B. G. Saar et al.  
Raman spectra can be acquired rapidly from samples that otherwise would scatter the usable signal.  
>> *Science Podcast*
- 1371** The Role of Particle Morphology in Interfacial Energy Transfer in CdSe/CdS Heterostructure Nanocrystals  
N. J. Borys et al.  
Single-particle spectroscopy suggests that non-uniform geometries favor efficient charge separation for light harvesting.
- 1375** A Cryptic Sulfur Cycle in Oxygen-Minimum-Zone Waters off the Chilean Coast  
D. E. Canfield et al.  
Bacterial sulfur reduction and oxidation accompanies nitrogen cycling where oxygen levels at depth are low.  
>> *Perspective p. 1326*
- 1378** Dynamical Response of the Tropical Pacific Ocean to Solar Forcing During the Early Holocene  
T. M. Marchitto et al.  
Enhanced solar activity caused the tropical Pacific to cool into a La Niña-like state during the mid-Holocene.
- 1381** Plasticity of Animal Genome Architecture Unmasked by Rapid Evolution of a Pelagic Tunicate  
F. Denoeud et al.  
A metazoan genome departs from the organization that appears rigidly established in other animal phyla.
- 1385** Rewiring of Genetic Networks in Response to DNA Damage  
S. Bandyopadhyay et al.  
A network comparison of genetic interactions mapped at two conditions reveals genetic responses to DNA damage in yeast.  
>> *Perspective p. 1327*

- 1390** BID, BIM, and PUMA Are Essential for Activation of the BAX- and BAK-Dependent Cell Death Program  
D. Ren et al.  
Proapoptotic proteins act directly on mitochondrial "gatekeeper" proteins to initiate apoptotic events during mouse development.  
>> *Perspective p. 1330*

- 1393** *Arabidopsis* Type I Metacaspases Control Cell Death  
N. S. Coll et al.  
An ancient link between cell death control and innate immune receptor function has been discovered in plants.

- 1397** An Antagonistic Pair of *FT* Homologs Mediates the Control of Flowering Time in Sugar Beet  
P. A. Pin et al.  
A homolog of a *flowering time* gene has evolved a flowering repression function, affecting the seasonal cold response in beets.

- 1400** Alleviating Neuropathic Pain Hypersensitivity by Inhibiting PKM $\zeta$  in the Anterior Cingulate Cortex  
X.-Y. Li et al.  
Nerve injury increases the activity of an enzyme in the brain and contributes to chronic pain-related cortical sensitization.

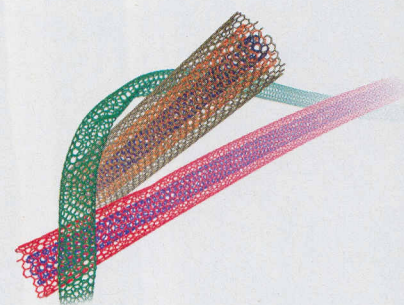
- 1404** Micro-Optical Sectioning Tomography to Obtain a High-Resolution Atlas of the Mouse Brain  
A. Li et al.  
Acquisition of light microscopic data at 1-micrometer resolution for an entire mouse brain has been developed.

- 1408** Paradoxical False Memory for Objects After Brain Damage  
S. M. McTighe et al.  
Impaired recognition may be due to treating novel objects as familiar, rather than treating familiar objects as novel.  
>> *Perspective p. 1331*

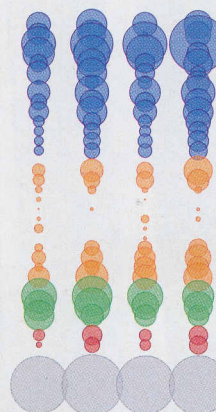
- 1410** Frequent Mutation of *BAP1* in Metastasizing Uveal Melanomas  
J. W. Harbour et al.  
A gene implicated in the control of protein degradation is mutated at high frequency in a metastatic eye cancer.

- 1413** Direct Exchange of Electrons Within Aggregates of an Evolved Syntrophic Coculture of Anaerobic Bacteria  
Z. M. Summers et al.  
Direct cell-to-cell electron transfer occurs between two related species of bacteria.

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## SCIENCEONLINE

## SCIENCEEXPRESS

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

### A Bacterium That Can Grow by Using Arsenic Instead of Phosphorus

*F. Wolfe-Simon et al.*

A bacterium has been found that can swap a toxic metalloid for a key molecular building block in its nucleic acids and enzymes.

10.1126/science.1197258

>> *News story p. 1302; Science Podcast*

### Cytoplasmic Partitioning of P Granule Components Is Not Required to Specify the Germline in *C. elegans*

*C. M. Gallo et al.*

Germ granules do not need to be segregated asymmetrically during cell division to specify germ cell fate.

10.1126/science.1193697

### Vernalization-Mediated Epigenetic Silencing by a Long Intronic Noncoding RNA

*J. B. Heo and S. Sung*

Spring flowering enabled by a winter chill is regulated by interplay between protein-coding and noncoding RNA transcripts.

10.1126/science.1197349

### Large Variations in Southern Hemisphere Biomass Burning During the Last 650 Years

*Z. Wang et al.*

Large variations in the degree of biomass burning in the Southern Hemisphere occurred during the past 650 years.

10.1126/science.1197257

### SPORE SERIES WINNER

#### Science 101: Building the Foundations for Real Understanding

*A. Thanukos et al.*

10.1126/science.1186994

## SCIENCENOW

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

Highlights From Our Daily News Coverage

### Black Hole May Offer Clues to Extra Dimensions

Controversial idea relies on string theory and warping of spacetime.

### The Curious Case of the Backwardly Aging Mouse

Restoring chromosome caps reverses signs of aging in rodents.

### Earth Oceans Were Homegrown

New model suggests that our seas did not come from comets and asteroids.

## SCIENCE SIGNALING

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

The Signal Transduction Knowledge Environment

### RESEARCH ARTICLE: The Extracellular Domain of Fibroblast Growth Factor Receptor 3 Inhibits Ligand-Independent Dimerization

*L. Chen et al.*

The extracellular domain of a receptor tyrosine kinase has opposing effects on dimerization, depending on whether ligand is present or not.

### PERSPECTIVE: Compartment-Specific Control of Signaling from a DNA-Sensing Immune Receptor

*A. Engel and G. M. Barton*

The endosomal compartment in which TLR9 is activated determines which cytokines are produced.

## GLOSSARY

Find out what BAPTA, CaSR, and DOCK mean in the world of cell signaling.

## NETWATCH: Peptide Atlas

Access a database of peptides identified in mass spectrometry analyses; in Protein Databases.

## NETWATCH: BioInteractive

Take advantage of online videos and interactive lessons for teaching and learning about biology; in Educator Sites.

## SCIENCE CAREERS

[www.sciencereers.org/career\\_magazine](http://www.sciencereers.org/career_magazine)

Free Career Resources for Scientists

### Battling Cyber Threats

*S. Carpenter*

A critical shortage of highly skilled cybersecurity technicians and engineers means wide-ranging opportunities for scientists.

### Becoming 'MacGyvers'

*S. Carpenter*

For University of Tulsa Cyber Corps students, homework means picking through Dumpsters and hacking computer systems.

### Taken for Granted: Choosing Between Science and Caring?

*B. L. Benderly*

Research suggests that many able women view careers in hard science as inimical to important values.

## SCIENCE TRANSLATIONAL MEDICINE

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

Integrating Medicine and Science

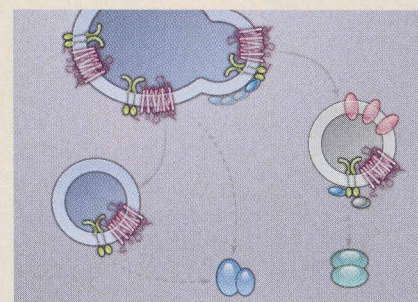
### REVIEW: The Role of JNK Proteins in Metabolism

*S. N. Vallerie and G. S. Hotamisligil*

To combat metabolic diseases, therapeutic c-Jun N-terminal kinase (JNK) inhibitors must target multiple cell types.

>> *Metabolism section p. 1337 and*

[www.sciencemag.org/special/metabolism/](http://www.sciencemag.org/special/metabolism/)



## SCIENCE SIGNALING

Trafficking inflammation.

### RESEARCH ARTICLE: IL-22<sup>+</sup> CD4<sup>+</sup> T Cells Are Associated with Therapeutic *Trichuris trichiura* Infection in an Ulcerative Colitis Patient

*M. J. Broadhurst et al.*

Infection with a nematode worm decreases inflammation in an ulcerative colitis patient.

### RESEARCH ARTICLE: Replacing the Enzyme $\alpha$ -L-Iduronidase at Birth Ameliorates Symptoms in the Brain and Periphery of Dogs with Mucopolysaccharidosis Type I

*A. D. Dierenfeld et al.*

Replacing  $\alpha$ -L-iduronidase at birth ameliorates symptoms in dogs with a lysosomal storage disorder.

## SCIENCE PODCAST

[www.sciencemag.org/multimedia/podcast](http://www.sciencemag.org/multimedia/podcast)

Free Weekly Show

Download the 3 December *Science* Podcast to hear about a bacterium that uses arsenic instead of phosphorus, imaging the skin in vivo, science in Brazil, and more.

## SCIENCE INSIDER

[news.sciencemag.org/scienceinsider](http://news.sciencemag.org/scienceinsider)

Science Policy News and Analysis

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