

27 November 2009 | \$10

# Science

Programa de  
Biotecnología  
004

**Spatial Cell Biology**

INTI-Extensión y Desarrollo  
División Bibliotecas

1975

04 ENE 2010

**AAAS**

## SPECIAL SECTION

# Spatial Cell Biology

### INTRODUCTION

- 1205 Location, Location, Location

### PERSPECTIVE

- 1206 Anatomic Demarcation of Cells: Genes to Patterns  
*H. Y. Chang*

### REVIEWS

- 1208 Actin, a Central Player in Cell Shape and Movement  
*T. D. Pollard and J. A. Cooper*

- 1212 Subcellular mRNA Localization in Animal Cells and Why It Matters  
*C. E. Holt and S. L. Bullock*

- 1216 The Extracellular Matrix: Not Just Pretty Fibrils  
*R. O. Hynes*

- 1220 Cell Signaling in Space and Time: Where Proteins Come Together and When They're Apart  
*J. D. Scott and T. Pawson*

- 1225 Why and How Bacteria Localize Proteins  
*L. Shapiro et al.*

### EDITORIAL

- 1163 On Incentives for Innovation  
*Bruce Alberts*

### NEWS OF THE WEEK

- 1172 Bankruptcy Won't Stop deCODE, Says Its Founder, Stefánsson  
1172 Schedule Concerns Delay ITER's Go-Ahead  
1173 Farm Fungicides Linked to Resistance in a Human Pathogen  
1174 Asia Grapples With Unexpected Wave of HIV Infections  
1175 Carlos Minc Pushes a Bold Agenda as Brazil's Environment Chief

### NEWS FOCUS

- 1176 Science and the Stimulus  
*>> Science Podcast*  
1177 Shovel-Ready Science Drives DOE Decisions  
1179 NIH Hopes Stimulus Isn't a Roller-Coaster Ride

- 1181 NSF Boosts Success Rates, But at What Price?  
1183 Medicine Under the Microscope  
*A User's Guide to Cancer Treatment*

### LETTERS

- 1187 Retraction  
*Z. Zhang et al.*  
Where Are the Parasites?  
*S. J. Kutz et al.*  
Still Vulnerable to Killer Tsunamis  
*A. D. Ziegler et al.*  
Teaching Strategies Based on Research  
*P. D. Boersma and L. Zurfluh*

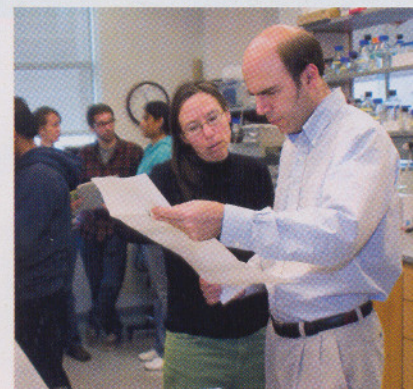
### 1189 CORRECTIONS AND CLARIFICATIONS

### BOOKS ET AL.

- 1190 Social Structures  
*J. L. Martin, reviewed by G. D. S. Sood*  
1191 The Strangest Man  
*G. Farmelo, reviewed by M. J. Nye*

### EDUCATION FORUM

- 1193 Educating Scientists About Dual Use  
*J. L. Sta. Ana et al.*



page 1179

### PERSPECTIVES

- 1194 Calcite Biocomposites Up Close  
*M. D. Hollingsworth*  
*>> Report p. 1244*  
1195 Nuclear Export of Small RNAs  
*M. Stewart*  
*>> Report p. 1275*  
1196 Moving Forward in HIV Vaccine Development  
*N. L. Letvin*  
1198 Variety—The Splice of Life—in Microbial Communities  
*J. F. Banfield and M. Young*  
1200 Excavating the Functional Landscape of Bacterial Cells  
*H. Ochman and R. Raghavan*  
*>> Research Article p. 1235; Reports pp. 1263 and 1268*  
1201 What Can Virtual Worlds and Games Do for National Security?  
*V. S. Subrahmanian and J. Dickerson*

CONTENTS continued >>



### COVER

Liver cells possess a well-defined morphology and interact in time and space with their neighbors, with the extracellular matrix, and with the bloodstream. A special section starting on page 1205 describes some of the basic tenets of spatial cell biology.

Image: Frank Geisler/Alamy (liver cells);  
iStockphoto.com (compass rose)

### DEPARTMENTS

- 1159 This Week in *Science*  
1164 Editors' Choice  
1168 Science Staff  
1171 Random Samples  
1203 AAAS News & Notes  
1287 New Products  
1288 Science Careers

## BREVIA

- 1230** Induced Chromosomal Proximity and Gene Fusions in Prostate Cancer  
R.-S. Mani et al.  
Androgen signaling facilitates the formation of an oncogenic fusion gene in prostate cancer cells.

## RESEARCH ARTICLES

- 1231** Haploid Genetic Screens in Human Cells Identify Host Factors Used by Pathogens  
J. E. Carette et al.  
A method identifies human factors required for successful microbial pathogenesis.
- 1235** Proteome Organization in a Genome-Reduced Bacterium  
S. Kühner et al.  
The simplified proteome of a bacterium provides insight into the organization of proteins into molecular machines.  
>> *Perspective p. 1200;*  
*Reports pp. 1263 and 1268*

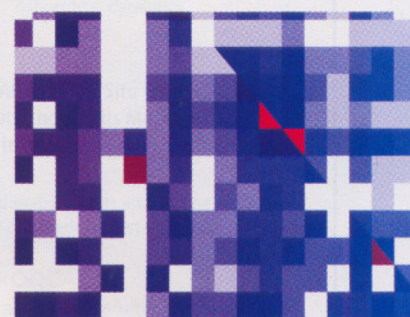
## REPORTS

- 1241** Directed Transport of Atoms in a Hamiltonian Quantum Ratchet  
T. Salger et al.  
A quantum ratchet, which operates without dissipation, is created with a Bose-Einstein condensate and optical potentials.
- 1244** Visualizing the 3D Internal Structure of Calcite Single Crystals Grown in Agarose Hydrogels  
H. Li et al.  
Electron tomography shows that physical interactions may be sufficient to incorporate macromolecules into a calcite crystal.  
>> *Perspective p. 1194*
- 1247** Formation of Compositionally Abrupt Axial Heterojunctions in Silicon-Germanium Nanowires  
C.-Y. Wen et al.  
A solid alloy catalyst is used to synthesize atomically sharp interfaces in silicon-germanium nanowires.
- 1250** Selective Phenol Hydrogenation to Cyclohexanone Over a Dual Supported Pd-Lewis Acid Catalyst  
H. Liu et al.  
The cooperation of two common catalysts unexpectedly facilitates selective synthesis of a commodity chemical compound.

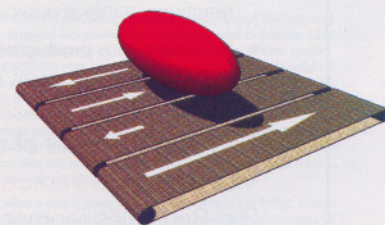
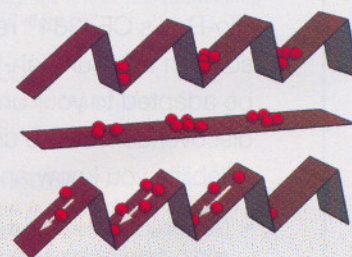
- 1253** Climate-Driven Basin-Scale Decadal Oscillations of Oceanic Phytoplankton  
E. Martinez et al.  
Satellite data show that upper ocean chlorophyll and sea surface temperatures are connected on a multidecadal time scale.
- 1256** Global Signatures and Dynamical Origins of the Little Ice Age and Medieval Climate Anomaly  
M. E. Mann et al.  
The global pattern of warming that characterized the Medieval Climate Anomaly was a dynamical response to solar forcing.  
>> *Science Podcast*
- 1260** Extensive, Recent Intron Gains in *Daphnia* Populations  
W. Li et al.  
Interpopulation genome polymorphisms in the water flea, *Daphnia*, indicate multiple recent intron gains.
- 1263** Impact of Genome Reduction on Bacterial Metabolism and Its Regulation  
E. Yus et al.  
Reconstruction of a bacterial metabolic network reveals strategies for metabolic control with a genome of reduced size.  
>> *Perspective p. 1200; Research Article p. 1235*
- 1268** Transcriptome Complexity in a Genome-Reduced Bacterium  
M. Güell et al.  
Sequencing of a tiny bacterium's RNA reveals many noncoding RNAs and complex gene regulation reminiscent of eukaryotes.  
>> *Perspective p. 1200; Research Article p. 1235*
- 1271** Crystal Structure of the Catalytic Core of an RNA-Polymerase Ribozyme  
D. M. Shechner et al.  
The structure of a ligase ribozyme suggests how RNA might be able to replicate itself.
- 1275** A High-Resolution Structure of the Pre-microRNA Nuclear Export Machinery  
C. Okada et al.  
Exportin-5:RanGTP surrounds microRNAs to protect them from degradation as it exports them from the nucleus.  
>> *Perspective p. 1195*
- 1279** Crystal Structure of a Nucleocapsid-Like Nucleoprotein-RNA Complex of Respiratory Syncytial Virus  
R. G. Tawar et al.  
In negative-strand RNA viruses, viral RNA wraps around a nucleocapsid helix with the bases accessible to the viral polymerase.



pages 1194 &amp; 1244



pages 1200, 1235, 1263, &amp; 1268



page 1241

CONTENTS continued &gt;&gt;

## SCIENCEONLINE

## SCIENCEEXPRESS

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

### Modulated High-Energy Gamma-Ray Emission from the Microquasar Cygnus X-3

*The Fermi LAT Collaboration*

Gamma-ray emission from the jet of an accreting binary star system is correlated with the jet's radio emission.

10.1126/science.1182174

### Ligand-Enabled Reactivity and Selectivity in a Synthetically Versatile Aryl C–H Olefination

*D.-H. Wang et al.*

A palladium-based catalyst eliminates the need for halogenated compounds for the formation of carbon-carbon bonds.

10.1126/science.1182512

### On the Origin of Species by Natural and Sexual Selection

*G. S. van Doorn et al.*

Modeling demonstrates how speciation occurs due to sexual selection.

10.1126/science.1181661

>> *Science Podcast*

### Tetrathiomolybdate Inhibits Copper Trafficking Proteins Through Metal Cluster Formation

*H. M. Alvarez et al.*

Complex formation between a copper chaperone and a metallo-drug prevents copper transfer to target enzymes.

10.1126/science.1179907

## SCIENCENOW

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

Highlights From Our Daily News Coverage

### Want to Stop AIDS? Spend Big

A new model argues that a massive cash infusion could halt the spread of the disease.

### Slideshow: Ancient Crocs With a Dog-Like Walk

Scientists find a strange collection of fossils in the African desert.

### Birth of a (Magnetic) Heavyweight

Observations show how magnetic fields guide the emergence of a massive new star.

## SCIENCE SIGNALING

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

The Signal Transduction Knowledge Environment

### RESEARCH ARTICLE: mTOR Regulation and Therapeutic Rejuvenation of Aging Hematopoietic Stem Cells

*C. Chen et al.*

Rapamycin reverses aging-related declines in hematopoietic stem cell function.

### RESEARCH ARTICLE: Eukaryotic Protein Domains as Functional Units of Cellular Evolution

*J. Jin et al.*

Clustering proteins into groups on the basis of their domain compositions provides insight into protein evolution.

### RESEARCH ARTICLE: Ca<sup>2+</sup> Puffs Originate from Pre-Established Stable Clusters of Inositol Trisphosphate Receptors

*I. F. Smith et al.*

Localized calcium signals called Ca<sup>2+</sup> puffs arise at pre-established clusters of IP<sub>3</sub>Rs.

### PERSPECTIVE: Maintaining Diplomatic Relations Between Mammals and Beneficial Microbial Communities

*D. A. Hill and D. Artis*

The adaptive immune system compensates if innate mechanisms fail to contain microbes in the mammalian intestine.

## PODCAST

*T. Pawson and A. M. VanHook*

Bioinformatics analysis reveals how protein domain composition correlates with evolutionary change.

## SCIENCE CAREERS

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

Free Career Resources for Scientists

### Careers in Climate Change Research: Feature Index

*E. Pain*

Opportunities are expanding for natural scientists willing to tackle climate change.

### Climate Science Broadens to Meet New Challenges

*S. Carpenter*

New programs help prepare scientists for the interdisciplinary nature of climate change research.

### On-the-Ground Training for Climate Change Researchers

*E. Pain*

Climate change scientists need a unique blend of skills that often must be acquired informally.

## SCIENCE TRANSLATIONAL MEDICINE

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

Integrating Medicine and Science

### COMMENTARY: Use of Forensic Methods Under Exigent Circumstances Without Full Validation

*S. E. Schutzer et al.*

In emergency situations, forensic methods need preliminary validation to ensure accurate interpretation.

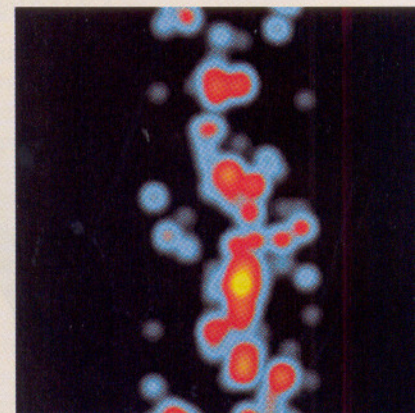
### RESEARCH ARTICLE: Efficacy of Cetuximab in the Treatment of Ménétrier's Disease

*W. H. Fiske et al.*

### PERSPECTIVE: Ménétrier's Disease Therapy: Rebooting Mucosal Signaling

*S. C. Nalle et al.*

A new study offers insight into the causes of a rare stomach disorder and describes a promising targeted therapeutic approach.



## SCIENCE SIGNALING

Visualizing the molecular environments of protein dynamics.

### RESEARCH ARTICLE: In Situ Regulation of DC Subsets and T Cells Mediates Tumor Regression in Mice

*O. A. Ali et al.*

An implanted matrix elicits an immune response network that can eradicate established tumors in mice.

## SCIENCE PODCAST

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

Download the 27 November *Science* Podcast to hear about speciation by sexual selection, a medieval climate anomaly, the fate of stimulus funding for science, and more.

## ORIGINS BLOG

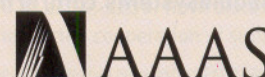
[blogs.sciencemag.org/origins](http://blogs.sciencemag.org/origins)  
A History of Beginnings

## SCIENCE INSIDER

[blogs.sciencemag.org/scienceinsider](http://blogs.sciencemag.org/scienceinsider)  
Science Policy News and Analysis

**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 © 2009 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): \$146 (\$74 allocated to subscription). Domestic institutional subscription (51 issues): \$835; 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. 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.



ADVANCING SCIENCE. SERVING SOCIETY