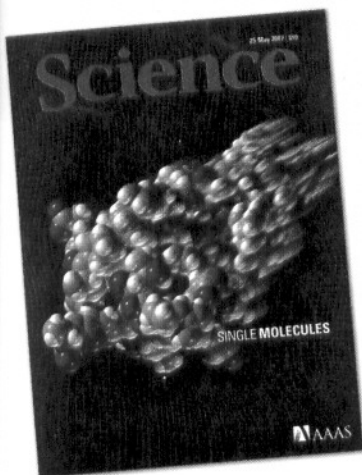




COVER

Artist's rendition of a model protein, trypsin, experiencing a force. Experimental and computational techniques that apply force to single biological macromolecules provide insight into molecular properties and suggest how mechanical forces may transduce signals in cells. See the special section on single molecules beginning on page 1143.

Image: Christopher Bickel/Science

DEPARTMENTS

- 1091 *Science Online*
- 1093 *This Week in Science*
- 1099 *Editors' Choice*
- 1102 *Contact Science*
- 1105 *Random Samples*
- 1107 *Newsmakers*
- 1140 *AAAS News & Notes*
- 1217 *New Products*
- 1218 *Science Careers*

EDITORIAL

- 1097 *New Life for Systematics*
by S. D. Hopper

SPECIAL SECTION

Single Molecules

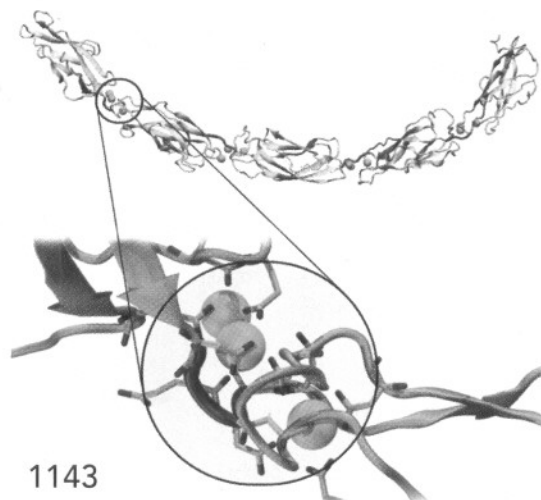
INTRODUCTION

- Lights, Camera, Action 1143

REVIEWS

- Single-Molecule Experiments in Vitro and in Silico 1144
M. Sotomayor and K. Schulten
- Forces and Bond Dynamics in Cell Adhesion 1148
E. A. Evans and D. A. Calderwood
- Far-Field Optical Nanoscopy 1153
S. W. Hell

See also *Science's STKE* material on page 1091
or at www.sciencemag.org/sciext/singlemolecules/



1143



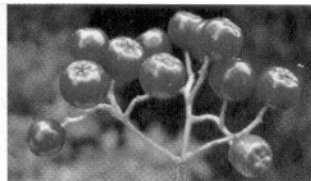
NEWS OF THE WEEK

- Indonesia Earns Flu Accord at World Health Assembly 1108
- Resurgence of Yellow Fever in Africa Prompts a Counterattack 1109
- Isotopes Suggest Solar System Formed in a Rough Neighborhood 1111
>>> Report p. 1178
- SCIENTESCOPE 1111
- Nobel Eyes Minnesota Senate Seat 1112
- Gloomier Prospects for Indo-U.S. Nuclear Pact 1112
- Working the (Gene Count) Numbers: Finally, a Firm Answer? 1113

NEWS FOCUS

- A Growing Threat Down on the Farm 1114
>>> Report p. 1185
- Glyphosate—The Conservationist's Friend?
- Antonio Giordano: 'Dr. Hustle' Sells His Dream for Italian Medical Research 1118
- A New Window on How Genomes Work 1120

CONTENTS continued >>



SCIENCE EXPRESS

www.sciencexpress.org

EVOLUTION

Genetic Properties Influencing the Evolvability of Gene Expression

C. R. Landry, B. Lemos, S. A. Rifkin, W. J. Dickinson, D. L. Hartl

Levels of gene expression evolve more rapidly if they are controlled by certain nearby regulatory sequences or by a large number of more distant regulators.

10.1126/science.1140247

CHEMISTRY

Engineering Complex Dynamical Structures: Sequential Patterns and Desynchronization

I. Z. Kiss, C. Rusin, H. Kori, J. L. Hudson

Weak, nonlinear delayed feedback among up to 64 simple electrochemical oscillators can switch them between unstable states or desynchronize all of them.

10.1126/science.1140858

EVOLUTION

Evolution and Development of Inflorescence Architectures

P. Prusinkiewicz, Y. Erasmus, B. Lane, L. D. Harder, E. Coen

A combination of modeling and experiments explains why certain types of flower clusters are likely to be found in nature while others are absent.

10.1126/science.1140429

GEOCHEMISTRY

The Structure of Ferrihydrite, a Nanocrystalline Material

F. M. Michel et al.

Analysis of x-ray scattering data reveals the crystal structure of ferrihydrite, a ubiquitous nanometer-sized iron phase, and shows that it is a single compound, not a mixture.

10.1126/science.1142525

PERSPECTIVE: Is Ferrihydrite a Mineral?

R. L. Penn

10.1126/science.1144002

LETTERS

Lessons from Science Communication Training

1122

D. R. Warren et al.

Establishing Rights over the Arctic Ocean

R. Macnab; T. Dahl-Jensen and K. Sørensen

The March of HIV Vaccines

A. Mahmoud

CORRECTIONS AND CLARIFICATIONS

1124

BOOKS ET AL.

I Am a Strange Loop

1125

D. Hofstadter, reviewed by C. C. Adami

Epigenetics

1126

C. D. Allis, T. Jenuwein, D. Reinberg, Eds.,

reviewed by A. Corpet and G. Almouzni

BROWSING

1127

EDUCATION FORUM

Cognitive Supports for Analogies in the Mathematics Classroom

1128

L. E. Richland, O. Zur, K. J. Holyoak

PERSPECTIVES

One Electron Makes Current Flow

1130

S. Giblin >> Report p. 1169

The Direct Approach

1131

J. A. Ellman >> Report p. 1172

Dark Matter in Galactic Collisional Debris

1132

B. G. Elmegreen >> Report p. 1166

Hydrogel Cell Cultures

1133

M. C. Cushing and K. S. Anseth

Proteasomes Keep the Circadian Clock Ticking

1135

D. Gatfield and U. Schibler

Assessing Landslide Hazards

1136

D. K. Keefer and M. C. Larsen

A Touching Response to Damage

1138

J. H. J. Petrini

>> Research Article p. 1160; Reports pp. 1194, 1198, and 1202

TECHNICAL COMMENT ABSTRACTS

MICROBIOLOGY

Comment on "Dispersal Limitations Matter for Microbial Morphospecies"

1124

J. Pither

full text at www.sciencemag.org/cgi/content/full/316/5828/1124b

Response to Comment on "Dispersal Limitations Matter for Microbial Morphospecies"

R. J. Telford, V. Vandvik, H. J. B. Birks

full text at www.sciencemag.org/cgi/content/full/316/5828/1124c

BREVIA

PSYCHOLOGY

Visual Language Discrimination in Infancy

1159

W. M. Weikum et al.

Before they are 8 months old, infants can tell whether someone is speaking French or English just by watching the speaker's face, but afterward they lose this ability.

RESEARCH ARTICLE

CELL BIOLOGY

ATM and ATR Substrate Analysis Reveals Extensive Protein Networks Responsive to DNA Damage

1160

S. Matsuoka et al.

A proteomic analysis reveals that DNA damage induces phosphorylation of hundreds of proteins, many of which were not previously associated with this response.

>> Perspective p. 1138; Reports pp. 1194, 1198, and 1202

REPORTS

ASTROPHYSICS

Missing Mass in Collisional Debris from Galaxies

1166

F. Bournaud et al.

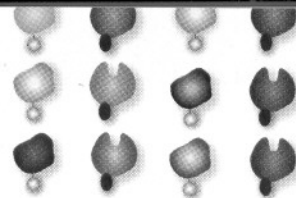
The motion of gas clouds in dwarf galaxies shows that they surprisingly contain dark matter, perhaps unseen cold molecular gas that could be more common than thought.

>> Perspective p. 1132



1126

CONTENTS continued >>



REPORTS CONTINUED...

PHYSICS

- An On-Demand Coherent Single-Electron Source** 1169
G. Fève et al.

A quantum dot coupled to a two-dimensional electron gas yields single electrons on demand for use in quantum electronics and as an alternating current standard. >> *Perspective p. 1130*

CHEMISTRY

- The Catalytic Cross-Coupling of Unactivated Arenes** 1172
D. R. Stuart and K. Fagnou

A palladium complex can directly couple two aromatic molecules, an important step in many industrial reactions that usually requires separate modification of each molecule. >> *Perspective p. 1131*

GEOCHEMISTRY

- Chondrite Barium, Neodymium, and Samarium Isotopic Heterogeneity and Early Earth Differentiation** 1175

R. W. Carlson, M. Boyet, M. Horan

Neodymium and barium isotopes in meteorites reveal nucleosynthetic anomalies in the early solar system but not enough to rule out early differentiation of Earth's mantle.

GEOCHEMISTRY

- Evidence for a Late Supernova Injection of ^{60}Fe into the Protoplanetary Disk** 1178

M. Bizzarro et al.

Anomalous iron isotopes in meteorites from early planetesimals suggest that material from a nearby supernova polluted our solar system 1 million years after its formation.

>> *News story p. 1111*

ATMOSPHERIC SCIENCE

- Model Projections of an Imminent Transition to a More Arid Climate in Southwestern North America** 1181

R. Seager et al.

A collection of 19 climate models predict that southwestern North America will dry significantly in the coming century, a transition that may already be under way.

PLANT SCIENCE

- Dicamba Resistance: Enlarging and Preserving Biotechnology-Based Weed Management Strategies** 1185

M. R. Behrens et al.

Soybean and other crops engineered to be resistant to dicamba, an environmentally friendly herbicide, will be useful as weeds become resistant to other herbicides. >> *News story p. 1114*

BIOCHEMISTRY

- A Manganese(IV)/Iron(III) Cofactor in *Chlamydia trachomatis* Ribonucleotide Reductase** 1188

W. Jiang et al.

A pathogenic bacterium makes DNA precursors via an enzyme with a high-valent metal center; this helps it elude the human immune system and may mimic the RNA world.

BIOCHEMISTRY

- Probing Transcription Factor Dynamics at the Single-Molecule Level in a Living Cell** 1191

J. Elf, G.-W. Li, X. S. Xie

A repressor protein in *Escherichia coli* spends about 90 percent of its time diffusing along DNA, falling off and trying again if it does not find its specific binding site within 5 ms.

MOLECULAR BIOLOGY

- Abraxas and RAP80 Form a BRCA1 Protein Complex Required for the DNA Damage Response** 1194

B. Wang et al.

The breast cancer tumor suppressor BRCA1 is recruited to sites of DNA damage by partner proteins that help it to recognize ubiquitinated proteins.

>> *Perspective p. 1138, Research Article p. 1160*

MOLECULAR BIOLOGY

- RAP80 Targets BRCA1 to Specific Ubiquitin Structures at DNA Damage Sites** 1198

B. Sobhian et al.

- Ubiquitin-Binding Protein RAP80 Mediates BRCA1-Dependent DNA Damage Response** 1202

H. Kim, J. Chen, X. Yu

A ubiquitin-binding protein targets the breast cancer tumor suppressor BRCA1 to sites of DNA damage and is required for the subsequent arrest of the cell cycle.

>> *Perspective p. 1138, Research Article p. 1160*

CELL BIOLOGY

- How Synaptotagmin Promotes Membrane Fusion** 1205

S. Martens, M. M. Kozlov, H. T. McMahon

A synaptic vesicle protein completes the final steps of membrane fusion by causing membrane curvature when triggered by a pulse of calcium.

BIOPHYSICS

- Myosin V Walks by Lever Action and Brownian Motion** 1208

K. Shiroguchi and K. Kinosita Jr.

As a two-headed molecular motor walks along actin, the bound leading head biases the rotational Brownian motion of the unbound head so that it lands on a forward site.

NEUROSCIENCE

- Hardwiring the Brain: Endocannabinoids Shape Neuronal Connectivity** 1212

P. Berghuis et al.

Endocannabinoids can inhibit the growth of axons; mice without one type of cannabinoid receptor have more inhibitory neuronal inputs to cortical areas of the brain.



ADVANCING SCIENCE. SERVING SOCIETY

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 © 2007 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): \$142 (\$74 allocated to subscription). Domestic institutional subscription (51 issues): \$710; 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 \$18.00 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.

CONTENTS continued >>