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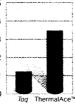


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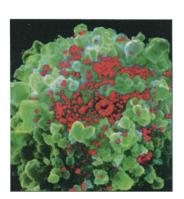
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**COVER** Regularly layered rocks such as these seen in western Candor Chasma (6.5°S, 77.2°W) are among the best examples of sedimentary rocks on Mars. This image was acquired in March 1999, shortly after the Mars Global Surveyor spacecraft attained its final, mapping orbit. The area shown is ~1300 m by 1600 m; layers are ~10 m thick. The spacing of ripples at far right averages 8 m. Layering attests to a dynamic sedimentary environment of global scale. [Image: NASA/JPL/Malin Space Science Systems]





**1876** What HIV does inside the cell

#### DEPARTMENTS

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1866	MIDDLE SCHOOL ACHIEVEMENT: Asia Stays on Top, U.S. in Middle in New Global
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**NEWS OF THE WEEK** 

- 1867 TOXICOLOGY: Panel Urges Further Study of Biotech Corn
- 1867 INFECTIOUS DISEASES: Polio Outbreak Raises Questions About Vaccine

NEWS

- 1869 MOLECULAR BIOLOGY: EMBL Rescued From the Financial Brink
- 1870 EASTERN EUROPEAN SCIENCE: Program for Elites Draws Praise, Fire
- ▼ 1870 HEPATITIS C: New 'Replicon' Yields Viral 1972 Proteins
- 1871 PALEONTOLOGY: Tiny, Feathered Dino Is Most Birdlike Yet
- 1872 JAPAN: Human Cloning Ban Allows Some Research

- 1873 RESEARCH ETHICS: Studies Trace Patchwork of Conflict Policies
- 1873 MARINE ENVIRONMENT: Clinton Creates Huge Hawaiian Coral Haven
- 1875 CHEMISTRY: Crystals Branch Out Into Exotic Shapes

#### **NEWS FOCUS**

- 1876 VIROLOGY: Probing HIV's Elusive Activities Within the Host Cell Capitalizing on HIV's Talents for Gene Therapy
- ▼1879 PLANETARY SCIENCE: A Dripping Wet Early
   1927 Mars Emerging From New Pictures
- 1881 INFECTIOUS DISEASES: Has Leishmaniasis Become Endemic in the U.S.?
- 1883 MATHEMATICS: Taking the Measure of the Wildest Dance on Earth
- 1884 AAS HIGH-ENERGY ASTROPHYSICS DIVISION: X-rays Hit the Spot for Astrophysicists

#### **RESEARCH ARTICLE**

RESEARCH

<b>▼1927</b> 1879	Sedimentary Rocks of Early Mars M. C. Malin and K. S. Edgett
	REPORTS
1937	Planar Hexacoordinate Carbon: A Viable Possibility K. Exner and P. von R. Schleyer
1940	Geodynamic Evidence for a Chemically Depleted Continental Tectosphere A. M. Forte and H. K. C. Perry
1944	Teleconvection: Remotely Driven Thermal

- Convection in Rotating Stratified Spherical Layers K. Zhang and G. Schubert
- ▼1947 Rapid Changes in the Hydrologic Cycle of the Tropical Atlantic During the Last
   <sup>1951</sup> Glacial L. C. Peterson, G. H. Haug, K. A. Hughen, U. Röhl

#### 1955

Fossil feathers



▼ 1951 Synchronous Radiocarbon and Climate
 1905 Shifts During the Last Deglaciation
 1947 K. A. Hughen, J. R. Southon, S. J. Lehman, J. T. Overpeck

1955 A Primitive Enantiornithine Bird and the Origin of Feathers F. Zhang and Z. Zhou



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#### SCIENCE'S COMPASS

#### **EDITORIAL**

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#### LETTERS

1895 How Much Does One Vote Count in an Election? J. F. Bunnett. "Kyoto Forests" and a Broader Perspective on Management J. H. Borden; G. Marland, B. Schlamadinger, R. Matthews. Response E.-D. Schulze, C. Wirth, M. Heimann. Safety Data Crucial for Biological Control Insect Agents R. W. Pemberton and D. R. Strong. Ritalin Tests for Preschoolers L. L. Greenhill. Corrections and Clarifications

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1898 PUBLIC HEALTH: Surveillance and Privacy R. Bayer and A. L. Fairchild

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- 1900 EVOLUTIONARY BIOLOGY: George Gaylord Simpson Paleontologist and Evolutionist L. F. Laporte, reviewed by N. Eldredge
- 1900 Browsings
- 1901 **ENVIRONMENT:** State of the Planet D. Attenborough, Director

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- 1902 CELL BIOLOGY: Actin' Up with Rac1 N. J. Colley
- 1903 **COMPUTING: Screen Savers of the** World Unite! M. Shirts and V. S. Pande
- **v**1904 **DEVELOPMENT: Hear, Hear, for the Inner** Ear A. Graham
- **v**1905 PALEOCLIMATE: Glacial Climate Instability L. Labeyrie
- 1907 **OPTICS: The Internet of Tomorrow** S. Joiner
- **v**1908 **NEUROSCIENCE:** Noise Makes Sense in 1968 Neuronal Computing M. Volgushev and U.T. Eysel

#### REVIEW

**GEOPHYSICS:** Subduction and Slab 1910 Detachment in the Mediterranean-Carpathian Region M. J. R. Wortel and W. Spakman



**Piecing Together the Biggest Puzzle** of All M. J. Rees

In this month's essay, the last in the Pathways of Discovery series, Martin J. Rees celebrates the way astronomers and cosmologists have systematically uncovered the biography of the universe. Rife with neutron stars, black holes, and multiple universes that emerge from quantum fluctuation, it's a story as grand as it is strange.

- **Glucose-Dependent Insulin** 1959 **Release from Genetically** Engineered K Cells A. T. Cheung, B. Dayanandan, J. T. Lewis, G. S. Korbutt, R. V. Rajotte, M. Bryer-Ash, M. O. Boylan, M. M. Wolfe, T. J. Kieffer
- 1962 Response to RAG-Mediated V(D)J Cleavage by NBS1 and Y-H2AX H.T. Chen, A. Bhandoola, M. J. Difilippantonio, J. Zhu, M. J. Brown, X. Tai, E. P. Rogakou, T. M. Brotz, W. M. Bonner, T. Ried, A. Nussenzweig
- **1965** Identification of Synergistic Signals 1904 Initiating Inner Ear Development R. K. Ladher, K. U. Anakwe, A. L. Gurney, G. C. Schoenwolf, P. H. Francis-West
- **v**1968 The Contribution of Noise to Contrast 1908 Invariance of Orientation Tuning in Cat Visual Cortex J. S. Anderson, I. Lampl, D. C. Gillespie, D. Ferster

- **Efficient Initiation of HCV RNA 1972** Replication in Cell Culture K. J. Blight, A. A. Kolykhalov, C. M. Rice
  - 1975 **Multigenerational Cortical** Inheritance of the Rax2 Protein in Orienting Polarity and Division in Yeast T. Chen, T. Hiroko, A. Chaudhuri, F. Inose, M. Lord, S. Tanaka, J. Chant, A. Fujita
- **v** 1978 **Rescue of Photoreceptor** 1902 Degeneration in Rhodopsin-Null Drosophila Mutants by Activated Rac1 H.-Y. Chang and D. F. Ready

#### 1898 Balancing privacy

and public health

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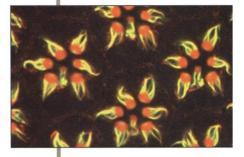
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1978 Photoreceptor rescue

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#### THIS WEEK IN SCIENCE edited by PHIL SZUROMI

#### **COLLISION IN THE MEDITERRANEAN**

The collision of the European and African plates has helped to create six curved mountain belts-the Betics, the Maghrebides, the Apennines, the Alps, the Carpathians, and the Dinarides-Hellenides. In the midst of all of this compression, there are also several regions of extension such as the Alboran Sea and the Pannonian Basin. Wortel and Spakman (p. 1910) review the possible processes that could lead to complex regions of compression and extension in the Mediterranean Sea region. They primarily focus on the threedimensional images of the velocity structure of the upper mantle to show that subduction and detachment of the subducting slab are key components that create the tectonic complexity along the Mediterranean coast.

#### SEDIMENTARY ROCKS ON MARS?

Sedimentary rocks on Earth form by erosion of igneous and metamorphic rocks by wind, water, and ice. Malin and Edgett (p. 1927; see the cover and the news story by Kerr), using images from the Mars Orbiter Camera and topography from Mars Orbiter Laser Altimeter from the Mars Global Surveyor mission, document laterally extensive and, in some cases, vertically thick layered units that may be sedimentary rocks on Mars. These layered units are concentrated between 30°N and 30°S on relatively old martian surfaces, which would favor rock formation by wind and water early in martian history. Although more work is needed to interpret the genesis of martian features, the influence of water on the martian landscape continues to gain support from detailed mapping.

#### DEPLETED MANTLE

The uppermost 300 kilometers of mantle beneath ancient continental crust, called the tectosphere, may be distinct from the

#### **CONVECTIVE COMMUNICATIONS**

The interiors of planets and stars are dominated by convective fluid motions that are thought to influence such processes as magnetic dynamos and the transfer of heat from the interior to the surface. Zhang and Schubert (p. 1944) have added another dimension to computer models of convective processes by considering convection in a rotating layered spherical body. Their simulations suggest that a thermal instability in the inner layer can be transferred and concentrated into a convective instability in the corotating outer layer. This phenomenon, termed teleconvection, may explain the source of the convective instability on Earth's outer core that produces the geodynamo. Thus, thermal instabilities initiated elsewhere can create convective instabilities in outer layers.

rest of the mantle. Anomalies in geophysical data, such as gravity and seismic velocities, suggest that the tectosphere is different in its temperature, composition, or both. Forte and Perry (p. 1940) translated anomalies in shear-wave velocity into density anomalies and developed a mantle-flow model that couples rigidplate motions with mantle convection. This model indicates that the tectosphere is depleted in iron relative to the rest of the mantle. The chemically distinct nature of the tectosphere may be related to the growth of continental crust.

#### CLIMATE CLUES FROM THE CARIACO BASIN

The sediment record in the Cariaco Basin off of Venezuela exhibits annual layering that occurred during anoxic episodes that spanned periods of tens of thousands of years. This record is now providing new clues to climate change (see the Perspective by Labeyrie). The abundance ratio of radioactive <sup>14</sup>C to stable <sup>12</sup>C in the atmosphere is a function of the strength of the exchange of CO<sub>2</sub> between the atmosphere and the ocean because more vigorous exchange better mixes the atmospheric inventory of "younger" carbon with the "older" carbon in the ocean. Thus, estimates of atmospheric <sup>14</sup>C/<sup>12</sup>C can provide important information about the strength of ocean circulation in the past. Hughen et al. (p. 1951) analyzed Cariaco Basin sediments to create a high-resolution <sup>14</sup>C record for the period between 10,000 and 15,000 years ago that extends the radiocarbon calibration curve thousands of years beyond the upper limit possible using tree rings. They show that the climate cooling event called the Younger Dryas was primarily the result of a sudden change in ocean circulation. Ice cores from Greenland contain a

record of large and abrupt periods of local warming (called "interstadials") that lasted for thousands of years during the last glacial period, but additional evidence is needed to determine if these changes were regional or global. Peterson et al. (p. 1947) show that the sedimentary record from the Cariaco Basin contains evidence of sudden, dramatic changes in the hydrologic cycle of the tropical Atlantic during the last 90,000 years. Their record, which is tightly coupled to the record of climate reversals found in Greenland ice, supports the idea that the tropics played an important role in forcing climate change during the last glacial cycle, and helps reinforce the case that interstadials were global in extent.

#### CARBON SURPRISES

Saturated carbon is usually tetrahedrally coordinated, but recent experimental studies have demonstrated that planar four-coordinate carbon species, which had been predicted theoretically, can be synthesized. Exner and Schleyer (p. 1937) now make similar predictions of molecules in which carbon is bound to six other atoms in a planar arrangement. They predict that molecules containing carbon and boron, such as  $CB_6H_2$  or  $CB_3B_4$ , may form metastable planar structures and that the activation barriers for rearrangement to more stable isomers would be sufficiently high to enable experimental observation.

#### EARLY BIRDS OF A FEATHER

Feathers likely evolved from reptilian scales through a series of intermediate structures. Zhang and Zhou (p. 1955) describe the most primitive known enantiornithine bird, *Protopteryx*, from early Cretaceous deposits in northern China. Unlike other known avian fossils (including *Archeopteryx*), this specimen exhibits feathers with visible intermediacy between reptilian scales and true bird feathers. The specimen also exhibits novel skeletal features clearly distinguishing early birds from the theropod dinosaurs. The authors interpret their finding as evidence for the aerodynamic function of early feathers, rather than heat insulation.

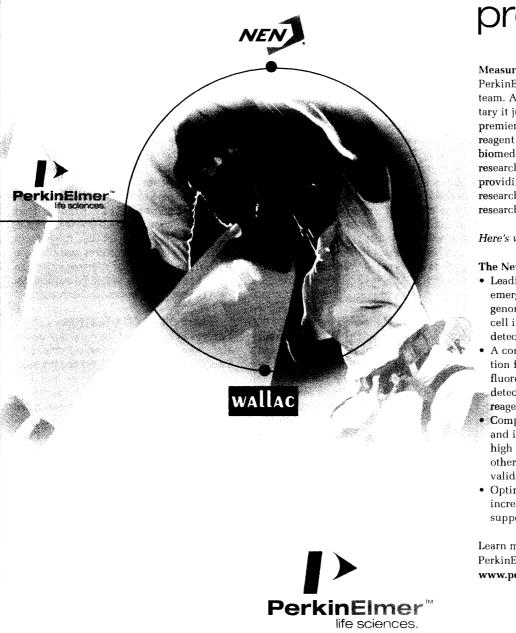
#### SECOND-SOURCING OF INSULIN

Diabetes, resulting either from decreased levels of insulin production from pancreatic  $\beta$  cells or a lack of insulin altogether, affects more than 100 million people. One approach to treatment would be to induce insulin production from other cells. However, it has not been possible to achieve proper regulation of insulin release from nonpan-CONTINUED ON PAGE 1855

#### Life Sciences

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#### THIS WEEK IN SCIENCE

**CONTINUED FROM PAGE 1853** 

creatic cells. Cheung et al. (p. 1959) programmed specialized endocrine cells in the gut, K cells, to coexpress a human precursor of insulin and the regulatory region of glucose-dependent insulinotropic peptide (GIP), a hormone that normally promotes insulin release. Mice transgenic for the insulin-GIP combination produced human insulin and were protected from diabetes induced by the  $\beta$  cell toxin streptozotocin. Despite destruction of  $\beta$  cells, these mice could tolerate an oral glucose challenge.

#### FOCUSING ON BROKEN DNA

The formation of double-strand breaks (DSB) in DNA leads to the localization of DNA damage sensors such as  $\gamma$ -H2AX and NBS1 within the nucleus. Extensive DSB occur during the process of somatic V(D)J recombination required for the generation of T cell and B cell receptors. H. T. Chen et al. (p. 1962), using antibody staining and confocal microscopy, observed that foci of  $\gamma$ -H2AX and NBS1 localized at sites corresponding to V(D) recombination in developing thymocytes. Such foci were not detected in cells in which recombination had ceased or that lacked the enzymatic machinery necessary for DNA recombination. DNA sensors mit THIS WEEK IN SCIENCE be recruited to sites of V(D)J recombinati as a means of preventing unwanted and p tentially oncogenic translocations that could occur during these recombination events.

#### **GETTING AN EARFUL**

Classical embryological experiments suggested that the vertebrate inner ear is initially specified by signals both from mesoderm and neuroectoderm. Ladher et al. (p. 1965; see the Perspective by Graham) have now identified some of the molecular signals involved in the chick. A new variant of the FGF family, FGF-19, is responsible for signaling from the mesoderm to promote development of the otic placode. FGF-19 is present in the right place for only a brief period of time-just long enough to set up the next steps, such as activating Wnt-8c signaling from the neuroectoderm. Together, these signals direct formation of the otic placode and induce appropriate expression of a variety of ear-specific genes.

#### PERMANENT RECORD

In many cellular systems, polarity is critical for further development. Diploid yeast cells exhibit a distinctive and predictable pattern of budding at their poles that requires a sort of memory for previous bud site usage. T. Chen et al. (p. 1975) now describe the identity of a long-lived marker of polarity

that is deposited at the bud site and remains there through many generationsthe Rax2 protein.

#### **ABOVE-AVERAGE PERFORMANCE**

The models of orientation selectivity in the primary visual cortex that have been developed are still incomplete. The observed invariance of orientation tuning for different stimulus contrasts has been repeatedly pointed out as one of the unsolved problems for the dominant so-called feedforward model of information flow. Anderson et al. (p. 1968; see the Perspective by Volgushev and Eysel) show that averaged membrane potentials of nerve cell recordings, which contain high-frequency stochastic components, do not provide a consistent relation between these averages and the average spike probability of a neuron's output. Instead, the high-frequency components present in the recordings are of such amplitude and steepness that they force the nerve cell to generate action potentials even if the average level remains clearly subthreshold.

#### **CULTURAL ADAPTATION** Hepatitis C virus (HCV) infection has

CONTINUED FROM PAGE 1853

new therapies has been the absence of a reliable cell-culture system for studying viral RNA replication. In a study of a previously described replication system, Blight et al. (p. 1972; see the news story by Marshall) have discovered a constellation of adaptive mutations in the HCV nonstructural protein NS5A that confer greatly increased replicative capacity to HCV RNA in vitro. These mutations have been used as tools to establish a more robust system for genetic and functional analyses of HCV.

#### **MORE THAN LIGHT WORK**

Rhodopsin, one of the proteins responsible for sensing light in the eye, is also important in the generation of photoreceptor cellsphotoreceptors that lack rhodopsin degenerate. Chang and Ready (p. 1978; see the Perspective by Colley) managed to prevent photoreceptor degeneration in Drosophila lacking rhodopsin by expressing a constitutively active form of a Rho guanosine triphosphatase, Drac1. It appears that Drac1 organizes the actin cytoskeleton in the developing photoreceptor cells. Rhodopsin appears to play an additional role beyond sensory perception in that it activates a signal transduction pathway to stimulate morphogenesis during development.

#### INTERNATIONAL ETHICS SURVEY

Hosted on the World Wide Web by Science's Next Wave (www.nextwave.org)

You are invited to participate in an international Web-based survey of scientists and engineers being conducted by the American Association for the Advancement of Science (AAAS) and UNESCO's World Commission on the Ethics of Scientific Knowledge and Technology (COMEST). The survey seeks to identify the ethical issues that advances in science and technology are likely to raise in the 21st century. Whatever your discipline or stage of your career, your participation will help COMEST and AAAS develop programs and activities that address these issues.

The core of the survey consists of the following four questions:

- **B**riefly describe the ethical ۲ issues you believe your discipline faces because of emerging areas of research or technology.
- What advances in . communication and information technologies do you believe will pose the greatest ethical challenges for scientists, engineers and society at large?
- If ethics were to be taught as • part of the formal curriculum in your discipline, which issues would it be essential to cover?
- In your opinion, what specific actions could be taken to improve the ethics education and training of scientists and engineers?

Survey results will be reported later this year on the Next Wave Web site.

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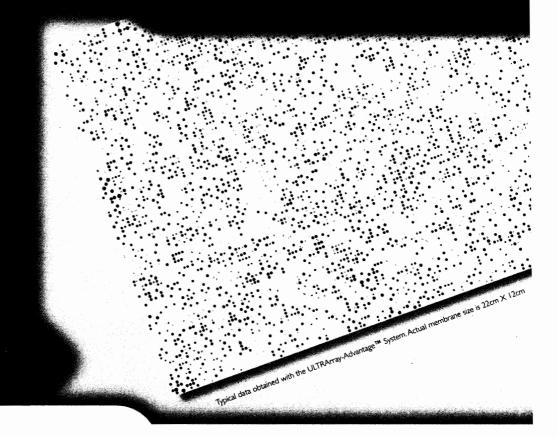
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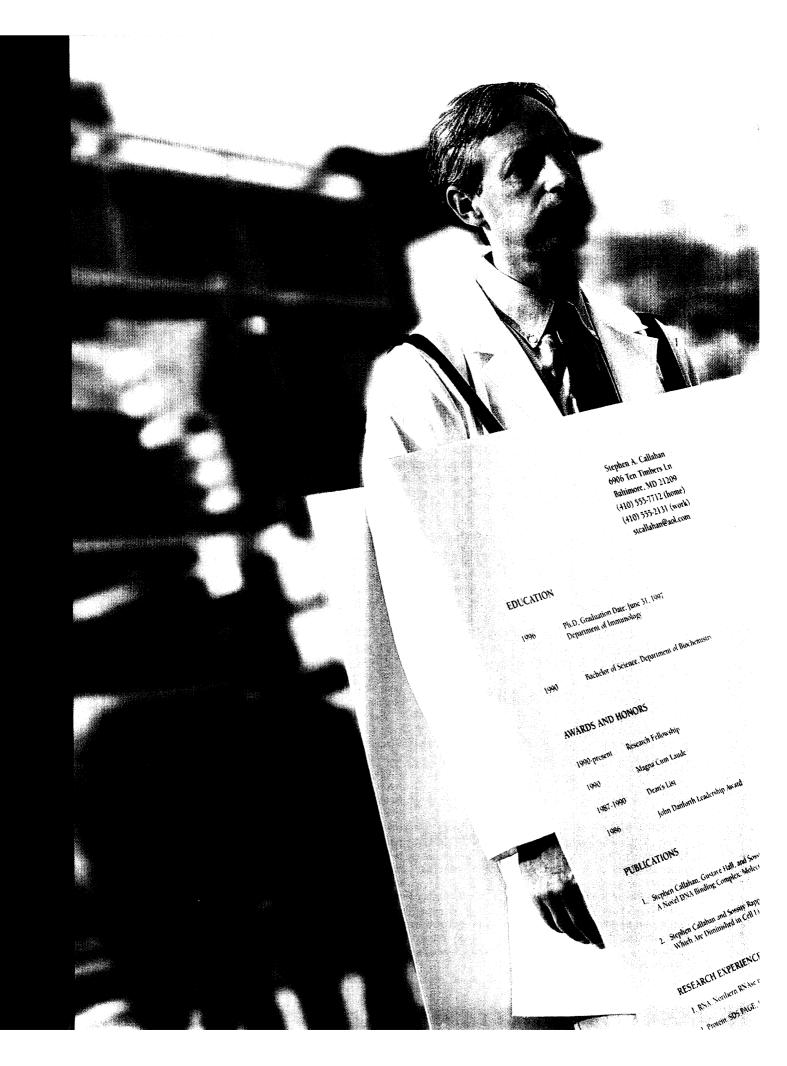
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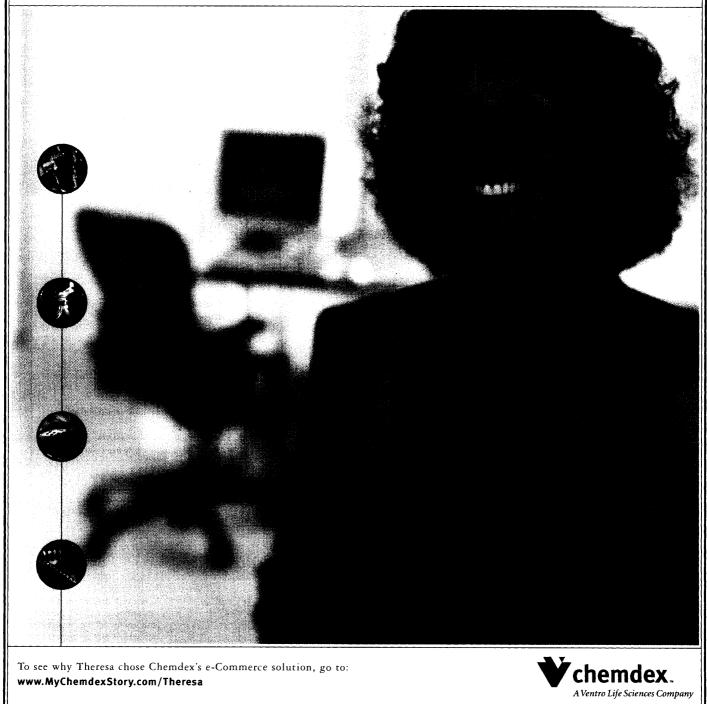
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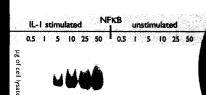
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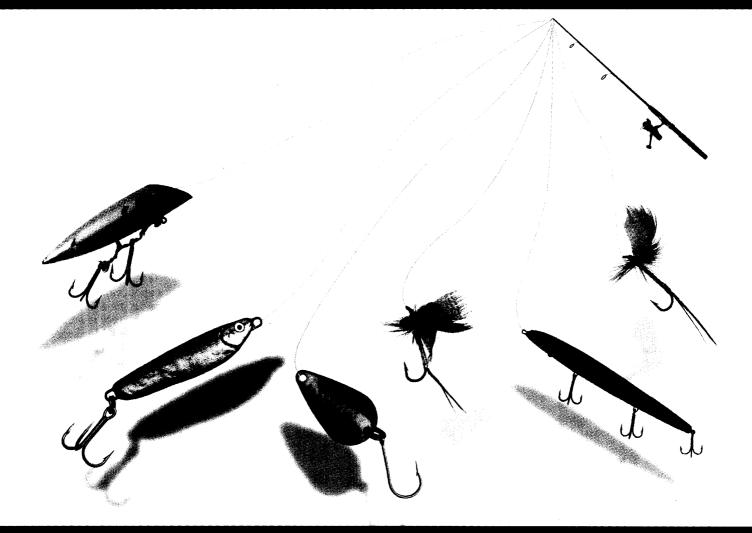
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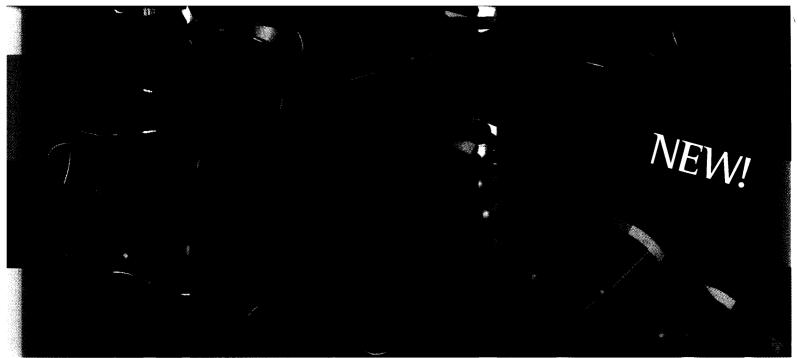
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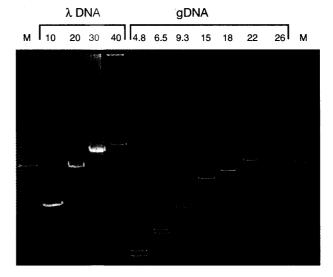
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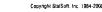
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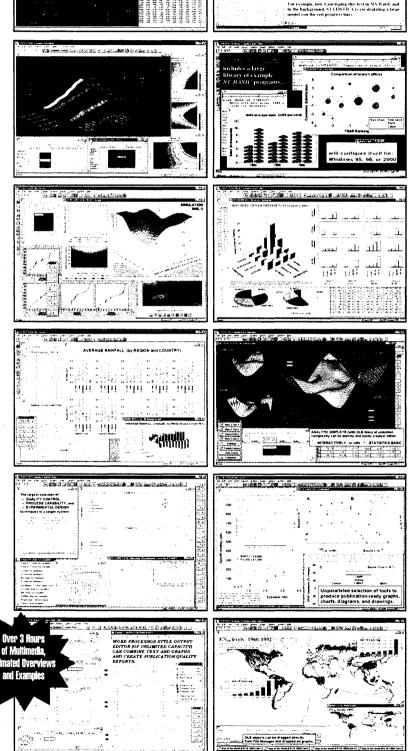


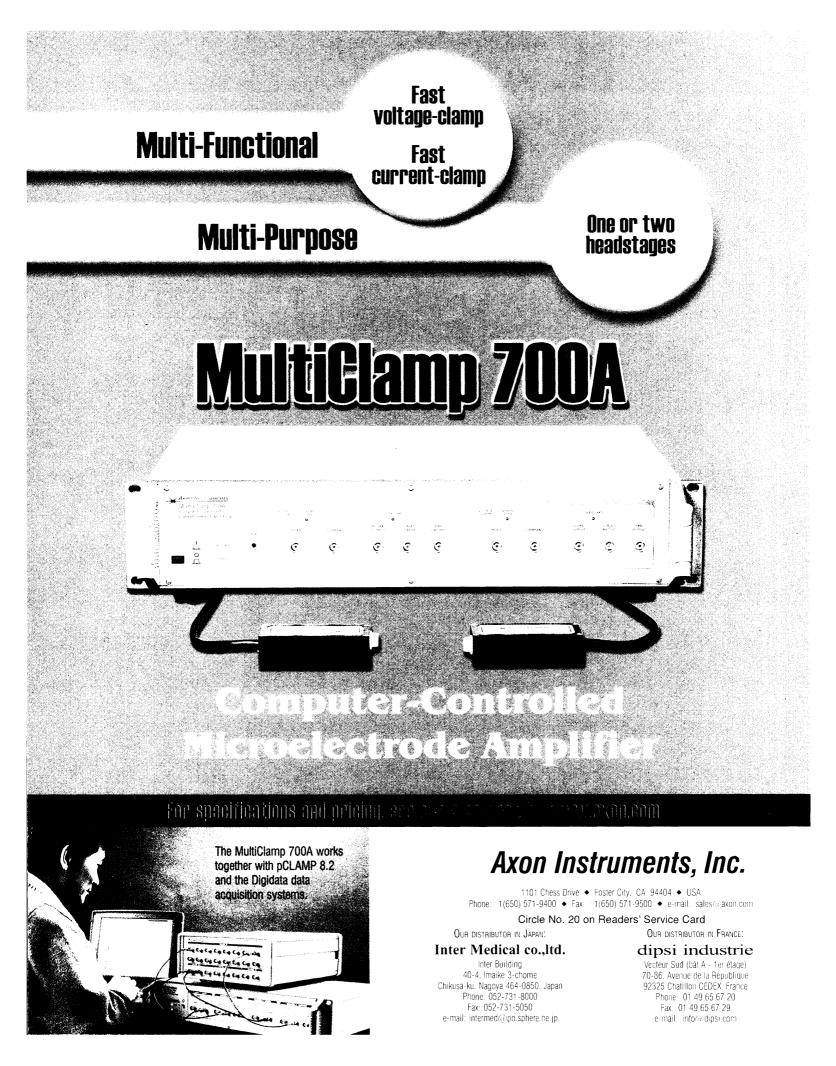


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December 2000

The AAAS Annual Meeting is always one of the year's premier scientific events, and we expect the 2001 meeting to be truly exciting. The program is diverse, comprehensive and showcases some of the most exciting, cutting edge work in science and engineering. We are assembling lectures, symposia, seminars and other events that will challenge and inform you on a wide array of emerging issues in science, engineering and technology.

Many remarkable advances in science and engineering hold great promise for the future. With completion of the human genome, attention turns now to the application of this massive body of information. The 2001 Genome Seminar will examine many of the issues, including drug development, proteomics, data management and ethics that this new frontier presents. Equally exciting are the startling potentials that will be presented in a special seminar on nanotechnology. Leading researchers will present the opportunities and challenges of nanotechnology in materials science, medicine, electronics, and computing.

In addition to the outstanding sessions on cutting edge science and engineering, the meeting will provide the unusual opportunity to hear in-depth discussions on a wide range of issues that confront us all—from how to best educate our children to the role of science in government to international environmental initiatives.

With meeting co-chairs, Michael Bishop of the University of California at San Francisco and Goéry Delacôte of the Exploratorium, I invite you to be a part of a most exciting and intellectually stimulating week.

I look forward to seeing you in San Francisco!

Sincerely,

Man & Ard

Mary L. Good AAAS President, University of Arkansas at Little Rock and Venture Capital Investors, L.L.C.

#### Thursday, February 15

#### **Student Science Convocation**

5:00PM-6:30PM

American Junior Academy of Sciences Poster Displays

#### AAAS President's Lecture and Reception

6:30PM-9:00PM

Mary L. Good, President, AAAS, Venture Capital Investors and University of Arkansas at Little Rock

#### Friday, February 16

#### Plenary Lecture

6:30PM-7:30PM Karen Stephenson, Chair and CEO, NetForm and Anderson School of Management, UCLA

#### Saturday, February 17

#### **Plenary Lecture**

6:30PM-7:30PM

Francis Collins, National Center for Human Genome Research, National Institutes of Health

#### Sunday, February 18

#### **Plenary Lecture**

6:30PM-7:30PM J. Craig Venter, President and CSO, Celera Genomics

#### Monday, February 19

#### **Plenary Lecture**

8:00AM-9:00AM

Alfred Berkeley,\* President, The NASDAQ Stock Exchange, Inc.

#### **Plenary Lecture**

#### 6:30PM-7:30PM

David Malin, Photographic Scientist and Astronomer, Anglo Australian Observatory

\*Invited, not yet confirmed

#### **Topical Lectures**

#### Friday, February 16

Morning Lectures (8:00AM-8:45AM)

Daniel Kleppner, Massachusetts Institute of Technology Two Hundred Years of Quantum Physics

Luis Villarreal, University of California-Irvine Role of Persisting DNA Viruses and Retroviruses in Host Evolution

#### ■ Special Lecture (12:30PM-1:15PM)

Philippe Busquin, Commission for Research-European Union Towards a European Research Area Opened to the World

#### ■ Afternoon Lectures (1:30PM-2:15PM)

Troy Duster, University of California-Berkeley Human Genetic Technologies and Taxonomies: Old Wine in New Bottles and New Wine in Old Bottles

Judy Kegl, University of Southern Maine Language Emergence in a Language-Ready Brain

Norman Neureiter, U.S. Department of State

Lisa Randall, Massachusetts Institute of Technology New Dimensions to Einstein's Gravity

#### Saturday, February 17

#### Morning Lectures (8:00AM-8:45AM)

Lewis Branscomb, John F. Kennedy School of Government, Harvard University Setting the Standard for Scientific Integrity: 100 Years of NBS/NIST

Charles Groat, U.S. Geological Survey Natural Hazard Reduction: Is Our Science Bold Enough?

Maria Elena Zavala, California State University-Northridge Molecular Signals in Plants

#### Afternoon Lectures (2:00PM-2:45PM)

Donald Kennedy, Stanford University and Science Magazine New Tests for Science

Isaiah Warner, Louisiana State University Diversity: A Necessary Component of Science

## Lectures

JOHN P. MCGOVERN AWARD LECTURE: Brenda Milner, Montreal Neurological Institute, McGill University

#### Sunday, February 18

Morning Lectures (8:00AM--8:45AM)

Susan Quinn, Author Marie Curie

Mark Yim, Xerox PARC Rethinking Robotics: A Modular Reconfigurable Approach

Alison Gopnik, University of California-Berkeley The Scientist in the Crib

Special Lecture (1:00PM-1:45PM)

Rita Colwell, National Science Foundation

#### ■ Afternoon Lectures (2:00PM-2:45PM)

Margaret Johnston, National Institute for Allergy and Infectious Diseases, National Institute of Health Progress in HIV/AIDS Vaccine Development

Jerry Nelson, University of California-Santa Cruz Astronomy and Adaptive Optics

GEORGE SARTON AWARD LECTURE: David A. Hollinger, University of California-Berkeley Why Are Jews Preeminent in Science and Scholarship? The Veblen Thesis of 1919 Reconsidered

Cynthia Kenyon, University of California-San Francisco The Regulation of Aging in C. elegans

#### Monday, February 19

Afternoon Lectures (2:00PM-2:45PM)

Goéry Delacôte, The Exploratorium Apoptosis: The Way for Science Centers to Thrive

Paul Sereno,\* University of Chicago, Dinosaurs

\*Invited, not yet confirmed

Science Innovation

The emerging field of nanotechnology provides new

opportunities to transform wide areas of science and

engineering. The unique behavior of nanoscale mate-

rials enables them to serve as catalysts and to take

advantage of giant magnetic resistance they afford.

Further, new instrumentation is providing the tools

#### NANOTECHNOLOGY

A New Frontier for Science and Engineering

Thursday, February 15 12:00NOON-5:30PM

Friday, February 16 9:00AM–12:00NOON 2:30PM–5:30PM

Organized by Philip H. Abelson, AAAS, Charles W. Clark, National Institute of Standards and Technology, James Ellenbogen, Mitre Corporation, Paul Alivisatos, University of California-Berkeley and Michael S. Strauss, AAAS

2001 GENOME SEMINAR

Beyond the Human Genome

Organized by J. Craig Venter, Celera Genomics.

Claire Fraser, TIGR and Barbara Jasny, AAAS and Science

Science Magazine and The Institute for Genomic Research

The 2001 Genome Seminar is cosponsored by AAAS,

Saturday, February 17

9:00AM-12:00NOON

Sunday, February 18

9:00AM-12:NOON

3:00PM-6:00PM

(TIGR)

3:00PM-6:00PM

#### for exploration and manipulation of the nanoscale environment. As a successor to the current technology employed in silicon and other semiconductor devices, nanoscale materials promise a new "computer revolution." Laboratories and research institutes in the U.S. have been increasingly active in studies related to nanotechnology and nanoengineering. However, these face a rapidly increasing global competition. To this end, recent government initiatives provide promise of much-needed funding for this work. This seminar will examine important opportunities presented by nanotechnology for engineering, technology, science and society. It will encompass several areas where this technology promises transforming innovations showcasing the work of leading scientists and engineers in this emerging field.

The recent sequencing of the human genome, although it represents an enormous landmark in the history of science, is not the end but the beginning of a new era of research. From microarray technology to DNA vaccines to taking the first steps into the new frontier of proteomics—this two-day seminar explores the new kinds of research that will be possible and the new technologies being developed.

Among the topics to be addressed are whole genome sequencing, comparative genomics regulatory regions, proteomics, microarrays, SNPs, functional genomics, genetic networks, pharmacogenomics, artificial chromosomes, DNA patenting and genetic discrimination. Speakers include:

Paul Alivisatos, UC-Berkeley Phaedon Avouris IBM-Yorktown Charles Clark, NIST Harold G. Craighead, Cornell Univ Mildred Dresselhaus, MIT Donald Eigler, IBM Almaden Rech Cntr lames Ellenbogen, MITRE Franz J. Himpsel, Univ of WI Phil Kuekes and Stan Williams, Hewlett-Packard Ilzi Landman, GA Tech Neal Lane,\* Asst. to President for Sci and Tech James Meindl, GA Tech Pierre Petroff, Univ of CA-Santa Barbara Mara Prentiss, Harvard Univ Mark Reed, Yale Univ Michael L. Roukes, Caltech Samuel Stupp, Northwestern Univ George Whitesides,\* Harvard Univ Ellen Williams, Univ of MD Bernard Yurke, Bell Lab, Lucent

\* Invited, not yet confirmed

Speakers include:

Adam Arkin,\* Stanford Univ Aravinda Chakravarti,\* John Hopkins Univ Andrew Clark, Celera Genomics John Doll, U.S. Pat Off Bernard Dujon, CNRS Michael Eisen, Lawrence Berkeley Nat'l Lab Eric Green, NHGRI/NIH Leroy Hood,\* Univ of WA Dennis Hochstrasser, Geneva Univ Hosp Mike Hunkapiller, Appl Byosyst Barbara Jasny, AAAS and Science Stuart Kim, Stanford Univ Med Cntr Gavin Macbeath, Harvard Univ Joe Nadeau, CWR Univ Greg Petsko, Brandeis Univ Wendell Weber, Univ MI Hunt Willard, CWR Univ Barbara Wold, Caltech J. Craig Venter, Celera Genomics

\* Invited, not yet confirmed

## 2001 FORUM FOR SCHOOL SCIENCE AND MATHEMATICS

Addressing Critical Issues in K-12 Science, Mathematics and Technology Education: What Can Urban School Districts Do?

#### Monday, February 19 9:30AM—6:30PM

Organized by Shirley Malcom, Madeline Long and Betty Calinger, AAAS

The 2001 Forum for School Science and Mathematics will be devoted to issues identified by urban school districts in California and across the nation as critical to the teaching and learning of science and mathematics. These include: (1) strategic uses of technology to support children's cognitive development, (2) what mathematics should be taught to all students, (3) literacy and K-12 science education, and (4) recruiting, preparing, and retaining K-12 teachers of mathematics and science. Participants will discuss these topics in multi-hour sessions organized by practitioners and researchers. In addition to group discussions, a panel of superintendents from large urban districts will address these issues and others that they have faced while leading system-wide programs to improve mathematics and science education. Among those organizing panels and speaking are:

Louis Gomez, Northwestern University Elizabeth Stage, University of California System Jerry Valadez, Fresno Unified School District Maria Lopez-Freeman, California Science Project Martin Friedman, National School and Community Corps, Woodrow Wilson National Fellowship Foundation Santiago Wood, Fresno Unified School District

#### Brain, Mind and Behavior

FRI	AM	Reading & Dyslexia: The Brain
FRI	РМ	Addiction Is a Brain Disease
Fri	PM	Statistics in Natural Language
SAT	AM	Origin of Mathematical Thinking
Sat	РМ	Many Languages-One Grammar
SUN	AM	The Human Brain After Injury
SUN	AM	Wine & Conversation
SUN	РМ	Precursors to Human Communication
Mon	АМ	Modality Effects on Language
Mon	PM	Language Learning in Infancy

#### **Communicating Science**

FRI	АМ	Juggling, Magic, Sports and Combinatorics
FRI	AM	Who Should Write the Story of Science?
FRI	РМ	Communicating the Future
SAT	AM	Science & the News Media
SAT	PM	Science Is Fun!
SUN	AM	Science & Conflicts of Interests
SUN	РМ	Communicating Sustainability
Mon	AM	Biotechnology Communications
Mon	РМ	What Makes a Science Book Become a Best
		Seller?
TUE	АМ	Science Fiction & Science

#### **Doing Science Globally**

FRI	AM	Int'l Efforts to Stop Invasive Species
Fri	РМ	Science & Health Disparities
Fri	РМ	Int'l Efforts to Stop Invasive Species
SAT	AM	Science at the Earth's Poles
SAT	AM	Drug Abuse Research: Latin America
Sat	PM	Science at the Earth's Poles
Sat	РМ	Science & Technology in Latin America
SUN	РМ	Pollutants Without Borders
SUN	PM	Agr Biotech & the Public Sector
Mon	AM	Globalization of Science
	D14	Clobal Developtions on Emproing Poson

Global Perspectives on Emerging Research MON PM MON PM Capital, Innovation & the Pacific Rim

#### Education and Public Understanding of Science

Fri	AM	Science Education as a Subversive Activity?
FRI	PM	Policy for Pre-College Science Education
Sat	AM	Minority Outreach in Science & Math
Sat	PM	Technological Literacy
SUN	AM	Beyond TIMSS: Professional Development
SUN	AM	Making Active Learning Successful
Sun	PM	Journey Beyond TIMSS: New Insights
Sun	РМ	"Antievolutionism": What Changed?
Mon	AM	Computerized Adaptive Testing
Mon	AM	Collaboration of Scientists & Museums

- MON PM The Literacy Crisis in Deaf Education
- MON PM Bringing Space Science to Earth
- Historical Sciences & Science Education MON PM
- Genetically Modified Foods THE AM

#### **Environment, Food and Natural** Resources

- Fri AM Prospects for Feeding 10 Billion People PM The Livestock Revolution FRI SAT AM Food Safety & the Tech Revolution SAT AM Subglacial Lakes: Planetary Perspective SAT PM Carbon Mgmt, Energy & Environment SAT PM Natural Disasters Along the Pacific Rim
- SUN AM Pre-European Landscapes of the West
- SUN PM Advances in Wine & Cheese
- SUN PM The Aquaculture Paradox
- MON AM Archaeology & Sustainable Development
- TUE AM Science & Water Issues of Northern CA

#### Life Science and the Science of Life

Deep-Sea Hydrothermal Vents: Life FRI AM Phylogeny, Evolution & Genomics of Plants FRI PM SAT AM Understanding Domestication SAT PM The Scientific Role of National Parks SUN AM Biology Into Space: Gravity The Future of Plant and Animal Biotech SUN AM SUN PM Earth System Science: Quiet Revolution SUN PM Life is Complex MON PM Influences on Biol Community Structure Looking Beyond Earth Assembling the Universe: Star Formation Fri AM

#### From Gas and Gravity to Galaxies SAT AM SAT PM Rebuilding the Galactic Neighborhood SUN AM A Telescope the Size of Earth Infrared Astronomy: Molecules of Life MON AM MON PM Human Exploration of Space MON PM Planetary Systems: Origin and Evolution

#### Medicine and Public Health

FRI	AM	Bioactive Lipids & Drug Discovery
FRI	PM	Non-Injectable Insulin-A Reality?
Fri	PM	Stem Cell & Parkinson's Disease
FRi	РМ	The Rebirth of Tetracyclines
SAT	AM	Malaria in Africa
SAT	AM	Screening for Inborn Diseases
SAT	РМ	The Autoimmune Diseases-Why Women?

AM Support During Pregnancy & Birth

- Stress & Health SUN AM
- SUN PM How Long Can Humans Live?

FRI

- MON AM Mathematics & Medicine
- MON PM Obesity: Causes & Solutions

#### Science and Society

- Fri AM Cultivating the Civic Scientist
- Language & the Criminal Law FRI AM
- FRI PM Visual Symbiosis of Art & Math
- Fri PM Statistics & Human Rights
- Bio-Technology & Bio-Weapons SAT AM
- SAT PM Recruiting & Retaining Minorities
- SAT PM Technology & Cultural Heritage Materials Native American Human Remains SUN AM
- SUN AM Music & Statistical Models
- SUN PM Science for the Community
- SUN PM The Return of 'Collegiality' to Science
- MON AM
- To Pledge or Not to Pledge
- Mathematics in Pricing & Hedging Mon AM
- MON PM The Research Museum

## mposia

#### Science and the Biosphere

Fri	AM	Sustainable Coasts: Counting the Costs
SAT	AM	The Scientific Theory of Marine Reserves
Sat	РМ	Science & Policy of Marine Reserves
Sun	AM	Extinction Vulnerability
SUN	PM	Humans & High Altitude Environments
Mon	AM	Coral Reefs in Crisis

#### Science, Engineering and Public Policy

Fri	AM	The Comprehensive Test Ban Treaty
FRI	РМ	Arms Control & Proliferation Concerns
SAT	AM	Standards & Rate of Technology Development
SAT	AM	Math of Apportionments
SAT	РМ	Math Aspects of Intellectual Property
Sun	РМ	Shaping the Genetic Future of Man
Mon	AM	Government's Role in the Commercialization
Mon	AM	Bench Scientists & Science Policy
Mon	РМ	Patenting Genes & Business Methods
TUE	AM	Implications of Minimal Genomes

#### Technology Impacts on Society and Engineering

Sat	РМ	Simulations, Complexity & Ethics
Мон	AM	Functional Genomics
Mon	PM	Networking Technologies & Research

#### Science Innovation

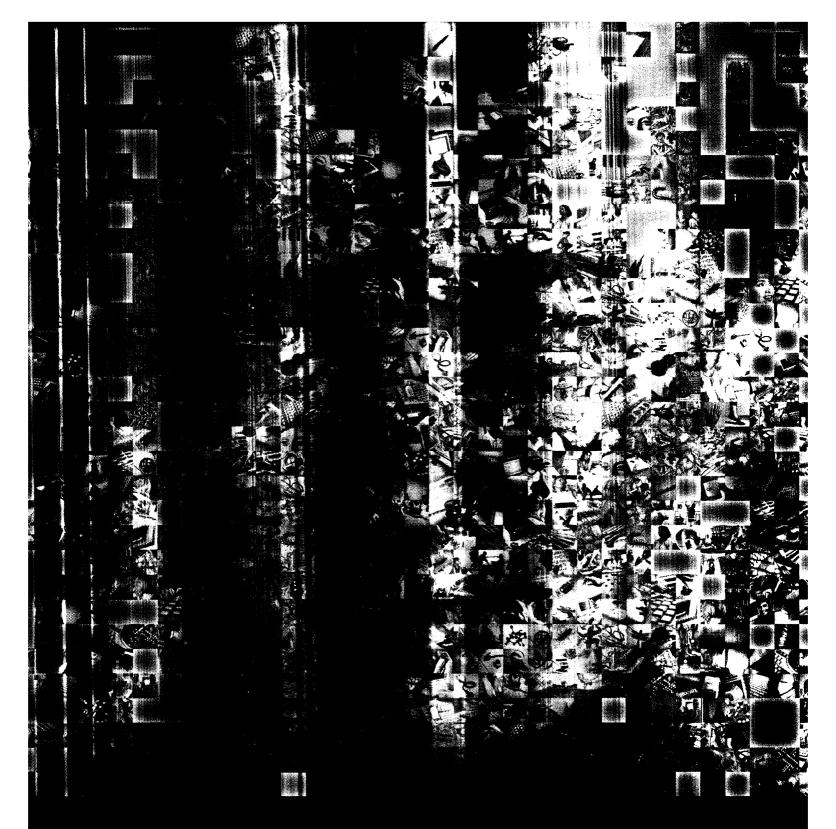
Fri	AM	Matter and Antimatter: Not Quite Opposites
Fri	PM	Accelerating Discovery: Supercomputers
Fri	РМ	Coming Revolutions in Particle Physics
Sat	AM	Learning and Plasticity in the Brain
Sat	РМ	Signal Transduction
Sun	PM	Mathematics & Visual Cortex
Mon	AM	Managing the Sea of Data
Mon	РМ	Quantum Computing & Communication

#### Seminars

THUR PM Fri AM	Nanotechnology Seminar Nanotechnology Seminar
Fri PM	Nanotechnology Seminar
SAT AM	2001 Genome Seminar
SAT PM	2001 Genome Seminar
SUN AM	2001 Genome Seminar
SUN PM	2001 Genome Seminar
Mon AM	2001 Forum for School Science
Mon PM	2001 Forum for School Science

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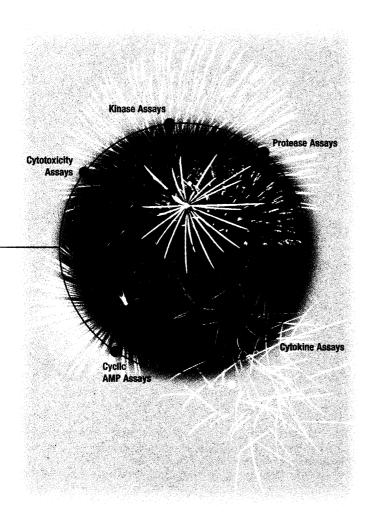


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Clinical Screening

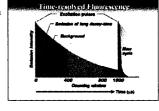
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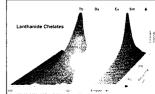


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Comparable to radioactive and traditional non-radioactive systems.

Promega's new FluoroTect<sup>™</sup> Green<sub>us</sub> in vitro Translation Labeling System is the first of a new generation of protein labeling systems that eliminates the use of radioactivity and the additional steps associated with other nonradioactive methods.

The system is based on a lysine charged tRNA that is labeled at the epsilon position of the lysine with the fluorophore BODIPY®. Fluorescent lysine residues will be incorporated into synthesized proteins during in vitro translation reactions, eliminating the need for radioactivity. Fluorescently labeled proteins are resolved by SDS-PAGE electrophoresis. Detection of the labeled proteins is accomplished in 2-5 minutes directly 'in-gel' by a laser based fluorescent gel scanner.

For more information or to place an order, call us toll free in the USA at 800-356-9526 or contact your local branch or distributor. For additional technical information visit Promega's web site at

www.promega.com/exp/fluorotect/



Merent sized products expressed using the  $TNT^{\otimes}$ 7 Quick for PCR DNA System and FluoroTect™ reen<sub>Lys</sub> in vitro Translation Labeling System. The gel was visualized using a Hitachi FMBIO® II scanner. Lane 1. no DNA, Lane 2. Luciferase control DNA (61kDa), Lanes 3-6, APC (adenomatous polyposis coli) locus PCR products, 40-80kDa.

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BODIPY is a registered trademark of Molecular Probes. FMBIO is a registered trademark of Hitachi Software Engineering Company, Ltd.

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Products may be covered by pending or issued patents. Please visit our web site for more information. The PCR process is covered by patents issued and applicable in certain countries. Promega does not encourage or support the unauthorized or unlicensed use of the PCR process. Use of this product is recommended for persons that either have a license to perform PCR or are not required to obtain a license



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