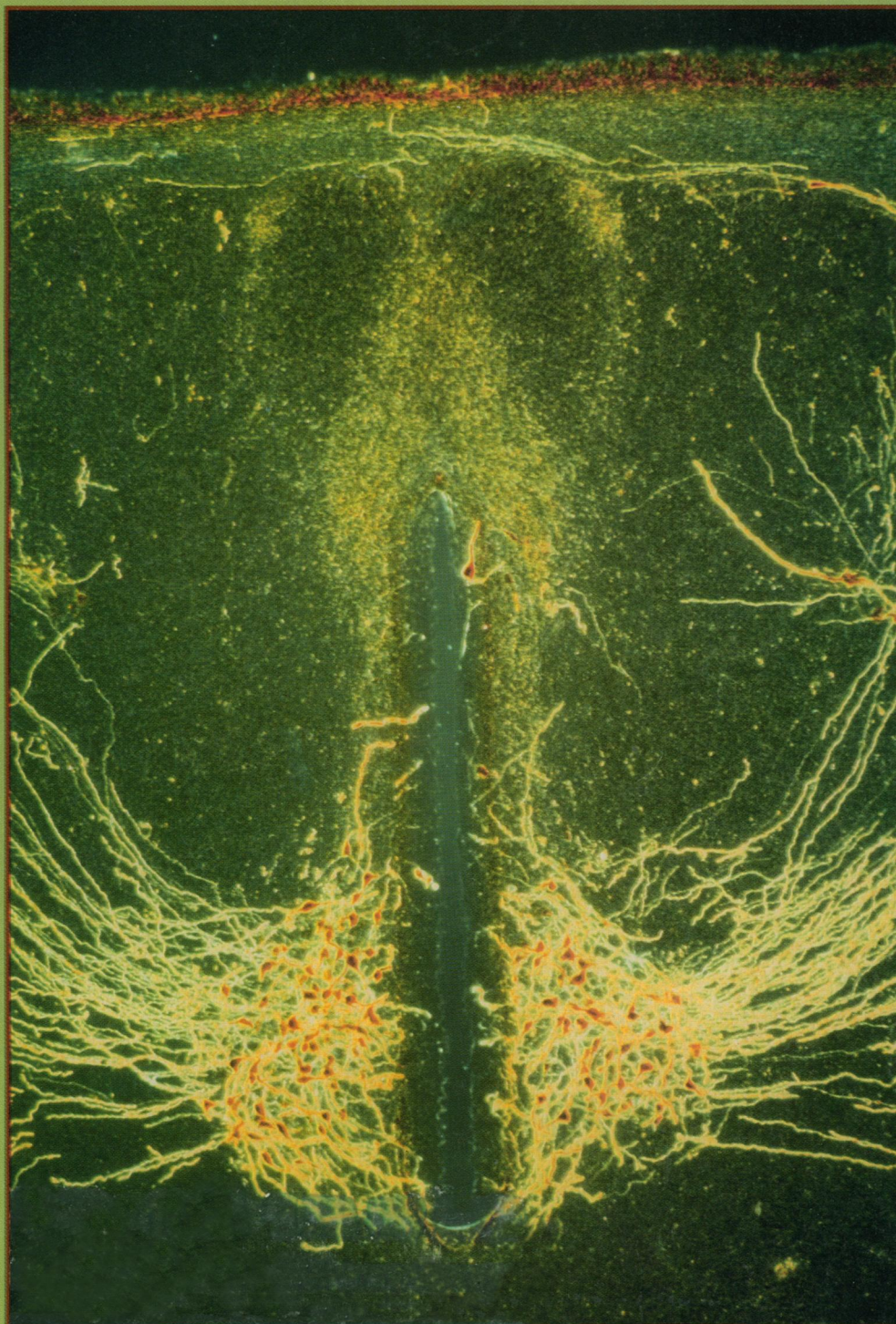


AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

23 FEBRUARY 1990
VOL. 247 ■ PAGES 893-1008

\$3.50



Preliminary Plasmid Screening With the J-System

DNA Mini Preps Fast and Easy

For quick, reliable preliminary screening of plasmid DNA, you can't beat the Beckman system: the **JA-18.1 rotor** in a **J2-21 series high-speed centrifuge**.

You'll appreciate the large capacity, high g -force, quiet operation and refrigerated microcentrifuge capability. And Beckman service and technical support set the standard for the industry.

The J-System. The systematic approach to screening plasmids. Quickly. Efficiently. Only from Beckman. Send for a plasmid DNA preparation protocol. Beckman Instruments, Inc., Spinco Division, 1050 Page Mill Road, Palo Alto, CA 94304. (800) 742-2345. Offices worldwide.

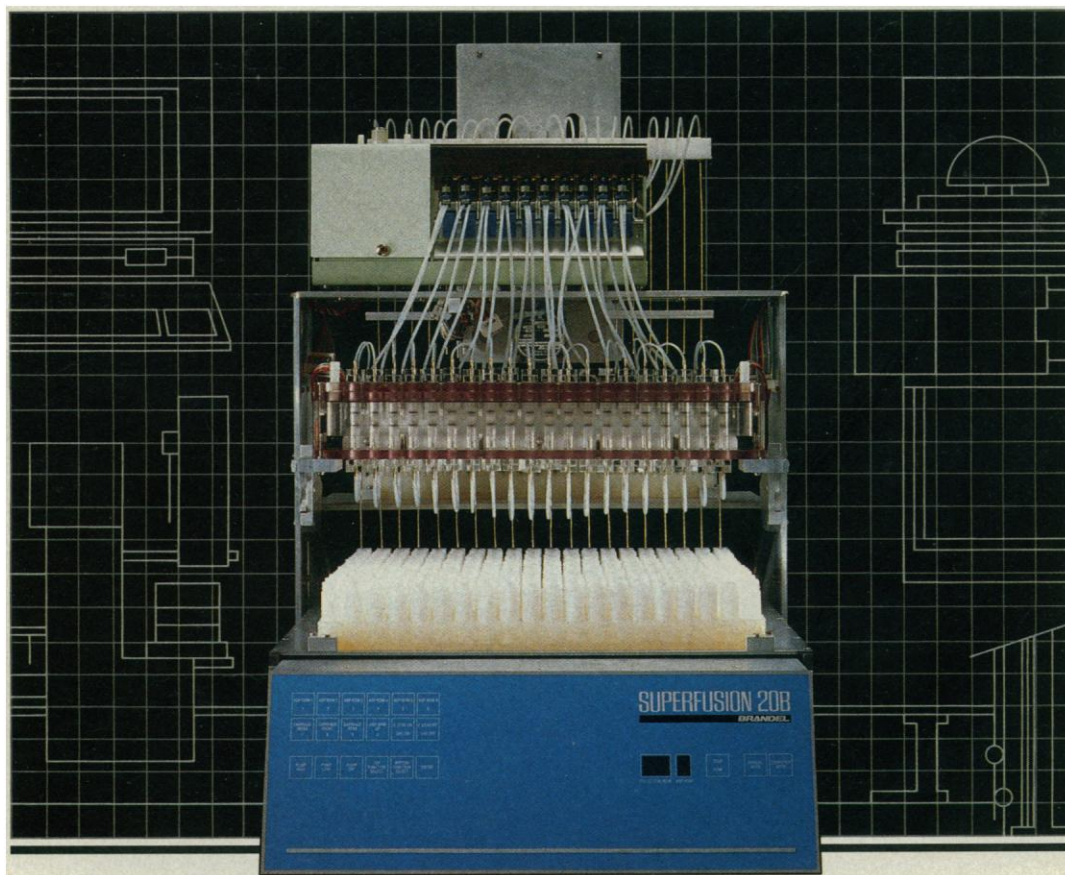
BECKMAN

© 1990 Beckman Instruments, Inc.

Circle No. 114 on Readers' Service Card



Superfusion Revolution!



Introducing the Brandel Superfusion 20—the first fully automated system for radioactive tagged ligand release studies.

■ Multi-channel design allows simultaneous perfusion of up to 20 tissue samples with up to 6 different reagents ■ Stimulation can be chemical only, or chemical/electrical. Optional electrical stimulation is variable from 0-20 milliamps per channel ■ Features computer control, manual operation, or manual interrupt with automatic resume ■ Microprocessor-controlled timing, flow rates, and sequence of events ensure accuracy and consistent procedure ■ Menu-driven software allows easy set-up, modification, verification, storage and retrieval of test parameters. Test status is displayed on-screen, including time left in current event ■ Reagent and reaction environments are water-jacketed for optional temperature control ■ Provision for automatic gassing of reagents ■ Variable pump speeds ■ Optional syringe ports permit injection of additional reagents directly into the reaction chamber ■ Superfusion20A perfuses up to 20 samples for collection into standard 20 × 20 racks of 5-7ml vials ■ Superfusion20B perfuses up to 18 samples for collection into Beckman Scintillation Racks (18 × 18) of 5-7ml vials ■

Orders are now being accepted, and requests for custom capabilities are being considered on an individual basis. Please contact Brandel for further information.

BRANDEL

Harvesters ☐ Automatic Deposit and Dispensing Systems ☐ Beckman Compatibles ☐ Superfusion20 ☐ Supplies
8561 Atlas Drive ☐ Gaithersburg, MD 20877 USA ☐ Phone: (301) 948-6506 ☐ Telex: 898083 ☐ Fax: (301) 869-5570

Orders: (1) 800-678-1558

Circle No. 204 on Readers' Service Card

899 This Week in *Science*

Editorial

901 A National Engineering and Technology Agency: W. F. BRINKMAN

Letters

904 Space Shuttle Advanced Solid Rocket Motor Testing: R. ESTESS; E. MARSHALL ■
Molecule of the Year: C. COVEY; D. E. KOSHLAND, JR.; A. M. GALABURDA;
R. C. BELL ■ Poverty Among U.S. Children: S. DEWHURST ■ Shockley: A
Scholar: J. P. RUSHTON; C. HOLDEN

News & Comment

906 Biotechnology on the Auction Block
908 NIH Goes "Extra Mile" on Gallo
909 U.S. Lags on Birth Control Development
910 The Puzzling Pulsar That Wasn't There
911 Scientists Battle Over Grand Canyon Pollution
912 MIT Picks Biologist as President

Research News

913 Mathematics Untwists the Double Helix ■ All Wound Up in DNA
916 Impact-Geomagnetic Reversal Link Rejected
917 Hurricane Forecasting Shows Promise
918 *Briefings*: Lords Approve Embryo Research ■ The Next "Nobel"? ■ NRC Weighs
in on Precollege Math ■ The Prince and the Forests ■ Yeast Lib ■ Planetary
Portrait Gallery ■ Global Warming Petition ■ Legal Drugs: A View from
Neuroscience ■ Who Gets a New Liver ■ Tritium Production

Articles

920 Learning Curves in Manufacturing: L. ARGOTE AND D. EPPLE
925 Studies of Unusual Simple Molecules by Neutralization-Reionization Mass
Spectrometry: F. W. McLAFFERTY
930 Protein Sorting to Mitochondria: Evolutionary Conservations of Folding and
Assembly: F.-U. HARTL AND W. NEUPERT

Research Article

939 Molecular Switch for Signal Transduction: Structural Differences Between Active
and Inactive Forms of Protooncogenic *ras* Proteins: M. V. MILBURN, L. TONG,
A. M. DEVOS, A. BRÜNGER, Z. YAMAIZUMI, S. NISHIMURA, S.-H. KIM

Reports

946 The MerR Metalloregulatory Protein Binds Mercuric Ion as a Tricoordinate,
Metal-Bridged Dimer: J. D. HELMANN, B. T. BALLARD, C. T. WALSH
949 Predator-Induced Life-History Shifts in a Freshwater Snail: T. A. CROWL AND
A. P. COVICH

- **SCIENCE** is published weekly on Friday, except the last week in December, and with a supplement in March by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005. Second-class Non-profit postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Copyright © 1990 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): \$75. Domestic institutional subscription (51 issues): \$120. Foreign postage extra: Canada \$46, other (surface mail) \$46, air mail via Amsterdam \$85. First class, airmail, school-year, and student rates on request. **Single copy sales**: Current issue, \$3.50; back issues, \$5.00; Biotechnology issue, \$6.00 (for postage and handling, add per copy \$0.50 U.S., \$1.00 all foreign); Guide to Biotechnology Products and Instruments, \$18 (for postage and handling add per copy \$1.00 U.S., \$1.50 Canada, \$2.00 other foreign). 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 the base fee of \$1 per copy plus \$0.10 per page is paid directly to CCC, 27 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 \$1 + .10. **Change of address**: allow 6 weeks, giving old and new addresses and 11-digit account number. **Postmaster**: Send Form 3579 to *Science*, P.O. Box 1723, Riverton, NJ 08077. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.
- The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objectives are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, to advance education in science, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.



COVER Dark-field photomicrograph of the anterior hypothalamus of a hamster immunostained with antibodies to vasopressin, showing the paired suprachiasmatic nuclei (SCN) between the third ventricle and optic chiasm (top) and the magnocellular vasopressin cells (yellow fireworks) of the paraventricular nucleus, above which is the SCN. The SCN, the locus of the mammalian biological clock, can be identified as two oval structures at the base of the brain (toward title). See page 975. [Photographic image by Russell Foster]

- 951 Double Fertilization in *Ephedra*, a Nonflowering Seed Plant: Its Bearing on the Origin of Angiosperms: W. E. FRIEDMAN
- 954 Novel Fluorogenic Substrates for Assaying Retroviral Proteases by Resonance Energy Transfer: E. D. MATAYOSHI, G. T. WANG, G. A. KRAFFT, J. ERICKSON
- 958 Molecular Characterization of a Functional cDNA Encoding the Rat Substance P Receptor: A. D. HERSHEY AND J. E. KRAUSE
- 962 Ligand-Induced Transformation by a Noninternalizing Epidermal Growth Factor Receptor: A. WELLS, J. B. WELSH, C. S. LAZAR, H. S. WILEY, G. N. GILL, M. G. ROSENFELD
- 964 Requirement for Cotolerogenic Gene Products in the Clonal Deletion of I-E Reactive T Cells: D. WOODLAND, M. P. HAPP, J. BILL, E. PALMER
- 967 Mini-Mouse: Disruption of the Pygmy Locus in a Transgenic Insertional Mutant: X. XIANG, K. F. BENSON, K. CHADA
- 969 Atrionatriuretic Peptide Transforms Cardiac Sodium Channels into Calcium-Conducting Channels: L. A. SORBERA AND M. MORAD
- 973 A Family of Three Mouse Potassium Channel Genes with Intronless Coding Regions: K. G. CHANDY, C. B. WILLIAMS, R. H. SPENCER, B. A. AGUILAR, S. GHANSHANI, B. L. TEMPEL, G. A. GUTMAN
- 975 Transplanted Suprachiasmatic Nucleus Determines Circadian Period: M. R. RALPH, R. G. FOSTER, F. C. DAVIS, M. MENAKER
- 978 Regularization Algorithms for Learning That Are Equivalent to Multilayer Networks: T. POGGIO AND F. GIROSI

AAAS Meetings

- 983 15th Annual AAAS Colloquium on Science & Technology Policy: R&D in the FY 1991 Budget ■ Symposia Lectures ■ Group Sessions ■ Publications Advance Registration Form ■ Hotel Registration Form

Book Reviews

- 985 The Michelson Era in American Science, 1870–1930, *reviewed by* J. W. SERVOS ■ Schrödinger, C. W. KILMISTER ■ My Life With the Printed Circuit, C. SUSSKIND ■ Shore Ecology of the Gulf of Mexico, A. J. KOHN ■ Nearshore Sediment Transport, N. C. KRAUS ■ Books Received

Products & Materials

- 989 Custom Hybridoma Cell Line Development ■ Biological Abstracts on Compact Disc ■ Workstations Protect Instruments from Vibrations ■ Mutagenesis System ■ Nucleotide and Protein Analysis Software ■ Chillers Expedite Cooling of Instrumentation ■ Literature

Board of Directors

Richard C. Atkinson
*Retiring President,
Chairman*

Donald N. Langenberg
President

Leon M. Lederman
President-elect

Mary Ellen Avery
Francisco J. Ayala
Eugene H. Cota-Robles
Robert A. Frosch
Joseph G. Gavin, Jr.
John H. Gibbons
Beatrix A. Hamburg
Florence P. Haseltine

William T. Golden
Treasurer

Richard S. Nicholson
Executive Officer

Editorial Board

Elizabeth E. Bailey
David Baltimore
William F. Brinkman
E. Margaret Burbidge
Pierre-Gilles de Gennes
Joseph L. Goldstein
Mary L. Good
F. Clark Howell
James D. Idol, Jr.
Leon Knopoff
Oliver E. Nelson
Yasutomi Nishizuka
Helen M. Ranney
David M. Raup
Howard A. Schneiderman
Larry L. Smarr
Robert M. Solow
James D. Watson

Board of Reviewing Editors

John Abelson
Don L. Anderson
Stephen J. Benkovic
Gunter K-J Blobel
Floyd E. Bloom
Henry R. Bourne
James J. Bull
Kathryn Calame
Charles R. Cantor
Ralph J. Cicerone
John M. Coffin
Robert Dorfman
Bruce F. Eldridge
Paul T. Englund
Fredric S. Fay

Theodore H. Geballe
Roger I. M. Glass
Stephen P. Goff
Corey S. Goodman
Stephen J. Gould
Eric F. Johnson
Stephen M. Kosslyn
Konrad B. Krauskopf
Charles S. Levings III
Richard Losick
Joseph B. Martin
John C. McGiff
Anthony R. Means
Mortimer Mishkin
Roger A. Nicoll
Carl O. Pabo
Yeshayau Pocker

Dennis A. Powers
Erkki Ruoslahti
Thomas W. Schoener
Ronald H. Schwartz
Terrence J. Sejnowski
Robert T. N. Tjian
Virginia Trimble
Emil R. Unanue
Geerat J. Vermeij
Bert Vogelstein
Harold Weintraub
Irving L. Weissman
Zena Werb
George M. Whitesides
Owen N. Witte
William B. Wood

THE NEW STANDARD FOR HIGH PERFORMANCE STATISTICAL SOFTWARE

CSS

**COMPLETE STATISTICAL SYSTEM
WITH DATA BASE MANAGEMENT
AND GRAPHICS**

A powerful, comprehensive, elegant, and super-fast statistical package for IBM (PC, AT, PS/2) and compatible computers. ■ The CSS optimized user interface with fast hierarchical menus incorporates elements of artificial intelligence; even complex analyses require only a few keystrokes (batch processing is also supported). ■ CSS features comprehensive, state of the art implementations of: *Basic statistics, Multi-way frequency tables, Nonparametric statistics, Exploratory data analysis with analytic graphs, Multiple regression methods, Time series analysis with modeling and forecasting (incl. full ARIMA), General ANOVA/ANCOVA/MANOVA, Contrast analysis, Discriminant function analysis, Factor analysis, Principal components, Multi-dimensional scaling, Item analysis/Reliability, Log-linear analysis, Cluster analysis, Non-linear estimation, Logit/Probit analysis, Canonical analysis, Survival and Failure Time analysis (Censored data), Quality Control analysis, and much more.* ■ All statistical procedures are integrated with fast data base management and instant, presentation quality graphics (over 100 types); full support for all mono and color graphics boards (incl. VGA) and over 100 plotters and printers (incl. the HP and Postscript standards). ■ All CSS screen output is displayed via customized Scrollsheets™ (i.e., dynamic, user controlled, multi-layered tables with cells expandable into pop-up windows); all numbers in a Scrollsheet™ can be instantly converted into a variety of presentation quality graphs; contents of different Scrollsheets™ can be instantly aggregated, combined, compared, plotted, printed, or saved. ■ The flexibility of the CSS input/output is practically unlimited: CSS offers an intelligent interface (read/write) to all common file formats (Lotus, Symphony, dBase, dBase III+, dBase IV, SYLK, ...) and special utilities to easily access data from incompatible programs; graphics can be saved in files compatible with desktop publishing programs (Aldus, Ventura). ■ CSS data files can be as large as your operating system (DOS) allows; OS/2 version coming soon. ■ CSS precision exceeds the standards of all common precision benchmarks. ■ *Technical note: The CSS user interface and all I/O were written in Assembler and bypass DOS; graphics and data management were written in Assembler and C; the computational algorithms were written in Assembler and optimized Fortran.* ■ \$495 (plus \$5 sh/h); 14-day money back guarantee.

Circle No. 197 on Readers' Service Card

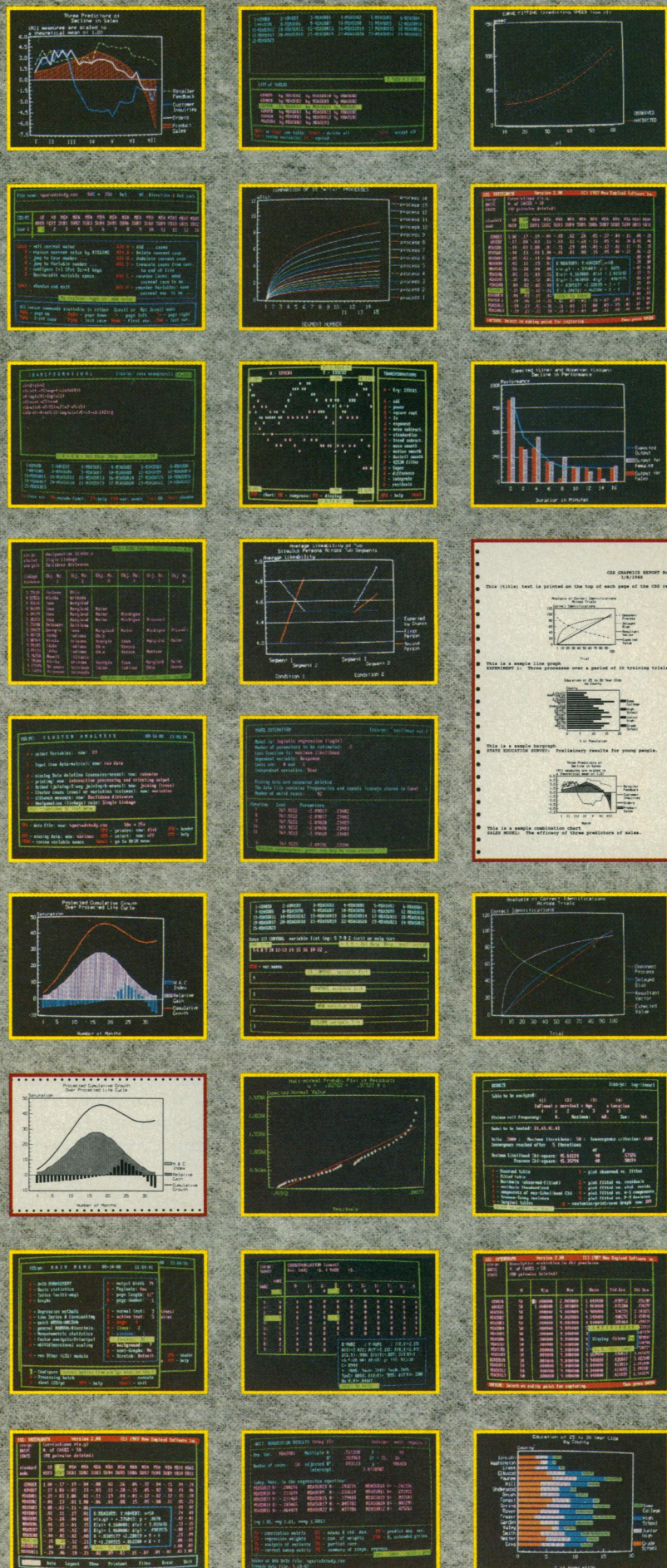


StatSoft

2325 East 13th Street ■ Tulsa, OK 74104 ■ (918) 583-4149

Fax: (918) 583-4376

Overseas Officer: StatSoft of Europe (Hamburg, FRG), ph: 040/4200347, fax: 040/4911310, **StatSoft UK** (London, UK), ph: 0462/482822, fax: 0462/482855, **StatSoft Pacific** (Melbourne, Australia), ph: 613-497-4755, fax: 613-499-7410, **StatSoft Canada-CCO** (Ontario), ph: 416-849-0737, fax: 416-849-0918 **Available From: CORPORATE SOFTWARE** and other Authorized Representatives Worldwide: Holland: Lemax BV 02968-94210; France: **Conceptel** (1) 45669700; Sweden: **AkademiData** 018-240035, Korea: **Geul Bang** (02) 272-1973



This Week in SCIENCE

Tricoordinate mercury complex

THE mercury resistance proteins (MerR) of bacteria have a high affinity binding site for mercury. When they sense excess mercury inside the cell, they activate a number of genes that produce proteins that act to "cleanse" the environment, converting the extremely toxic Hg(II) ion to the less toxic and volatile Hg(0) metal form. Helmann *et al.* found that three highly conserved cysteine residues—those in positions 79, 114, and 123 of the MerR protein of *Bacillus*—are necessary and sufficient for the formation of a protein-Hg(II) ion complex (page 946). The MerR protein is a dimer of two identical polypeptides and has a total of eight cysteine residues; binding studies with a series of proteins in which cysteine residues were changed to alanines showed that an active complex requires that two of the residues—114 and 123—are present on the same subunit while residue 79 can be contributed by the second. Only one Hg(II) ion can bind per dimer, perhaps because the subunits overlap in such a way as to preclude simultaneous binding in each. Although metal complexes that are coordinated by two, four, five, and six sulfur atoms are relatively common, those that are coordinated by three sulfurs are fairly rare.

Predator's cues and snail's pace

THE presence of predatory crayfish in the water dramatically alters life-history characteristics of the freshwater snail *Physella virgata virgata* (page 949). In a predator-free environment, snails reproduce when their shells are about 4 millimeters long; the life-spans of such snails are 3 to 5 months. If, however, the stream is also inhabited by *Orconectes virilis* crayfish, the snails grow bigger (to double the normal size), live longer (11 to 14 months), and reproduce later. Cowl and Covich find that only when actively preying crayfish are nearby do these changes

take place; they attribute the changes to signals from a water-borne chemical, most likely a snail protein that has been degraded by a crayfish enzyme. Allocation of the snail's resources away from reproduction and toward growth and community survival shows that, like plants, these snails can be phenotypically plastic in response to environmental cues.

Double fertilization in seed plants

DDOUBLE fertilization, which was considered to be a unique and defining characteristic of flowering plants (the angiosperms), is in fact also found in a nonflowering seed plant. Friedman reports on its occurrence during sexual reproduction in a low-lying green-stemmed desert shrub of the widely distributed genus *Ephedra* (page 951). The first fertilization in both angiosperms and *Ephedra* involves union of sperm and egg nuclei; this fusion leads to the production of an embryo. In angiosperms, the second fertilization involves a second sperm nucleus and two polar nuclei of the embryo sac (one of which is a sister nucleus to the egg nucleus), and this yields endosperm (nutritive tissue). In *Ephedra*, the sperm's second nucleus fuses with the sister nucleus of the egg nucleus and, although the fate of this nucleus is unclear, it is known that an endosperm does not form. Phylogenetic studies of seed plants have indicated that the order Gnetales, of which *Ephedra* is a member, is more closely related to angiosperms than are other extant orders of seed plants; double fertilization may have been a property of the common ancestor of the Gnetales and the angiosperms.

Channel switching in cell membranes

HORMONES called atrionatriuretic peptides (ANPs) are secreted by the heart's atrial cells. They alter the electrical and contractile

properties of the heart and also affect the functioning of the kidney and the blood volume. ANPs suppress cardiac electrical activity at both sodium and calcium channels. Sorbera and Morad report that sodium ion channels, which are essential for the excitability of not only heart cells but also nerve and muscle cells, show increased permeability to calcium ions when they are exposed to ANPs (page 969). Normally these channels have but little permeability to calcium. It is likely that a conformation change in the channel, induced by the binding of ANPs or by an intermediary protein to an extracellular site, causes repression of the sodium current, enhances calcium permeability, and enhances calcium current conductance. Damping of heart tissue excitability and contractility thus has an impact on many types of cells, including those that secrete the ANPs.

Pace setting brain tissue

PACEMAKER cells that establish circadian rhythms in hamsters reside in the suprachiasmatic nucleus (SCN) of the hypothalamus of the brain (page 975). This has been demonstrated directly by Ralph *et al.* through a series of transplantation experiments; in these studies, SCN tissue was exchanged between three types of hamsters—normal hamsters whose circadian rhythms have 24-hour periodicity, clock mutants whose activity periods cycle every 20 hours, and heterozygous animals with a 22-hour period. The SCN of the host hamster was first functionally destroyed and the animal rendered arrhythmic; some weeks later and within a matter of days after a small block of donor SCN was transplanted, motor rhythmicity resumed. Only a remarkably small (1 microliter) volume of tissue was needed for the establishment of a new rhythmic pattern, and this pattern reflected the period characteristic of the donor. The lack of any host-tissue contribution to the rhythm suggests that, at least in the hamster, the SCN may serve as the key pacemaker.

■ RUTH LEVY GUYER

SORVALL® Ultracentrifuges let you select the speed and automation that's right for you!

Choose from 6 models, including 3 new OTD-B ultraspeeds

The successful OTD-B series of ultraspeed centrifuges now includes speed ranges of 60-, 70-, and 80,000 rpm. This series has proven so reliable that we are increasing the drive warranty to 25 billion revolutions. These models are microcomputer-controlled and have automatic rate control. Also new is an optional Programmer Accessory that increases research versatility through delayed start runs and time-related rotor speed changes (Step Mode).

Our other line of ultraspeeds—the RC-Ultras—does your detail work automatically with such features as a Step Mode that changes rotor speed and time sequentially. A built-in memory enables you to store all run parameters for repetitive runs. The optional printer produces records of run parameters and even logs cumulative rotor usage, all automatically.

You can use any SORVALL® and almost all Beckman ultra rotors, fully warranted, in your SORVALL® RC or OTD-B. Ultraversatility—another example of the edge your research gets from the “working knowledge” built into all Du Pont Biotechnology products.

For a 20-page ultraspeed brochure, call 1-800-551-2121. In Canada, call 1-800-387-2179.

Or write Du Pont Company, Biotechnology Systems, P16-2130, Wilmington, DE 19880-0016.

**Working Knowledge
in Biotechnology**

REG. U.S. PAT. & TM. OFF.

Circle No. 128 on Readers' Service Card

Discover new solutions

This LC pump is a dispenser and diluter, too.

- It's a **smartpump**. Wiz® is more than an ordinary peristaltic pump. Press three keys for initial calibration when you first set it up. From then on, just key in any flow rate you want, directly in ml/hr. The output will be within 1% of your selected value.
- It's a **dispenser, too**. You can key in any volume—that's what you'll get every time you press the button.
- And it's a **diluter**. Push a button to take up any desired volume of sample: push it again to dispense the sample followed by any volume of diluent.

Phone toll free, (800)228-4250.



Isco, Inc.
P.O. Box 5347
Lincoln NE 68505
Tel: (402)464-0231
Fax: (402)464-4543



The Foundation for Advanced Education
in the Sciences, Inc. at the
National Institutes of Health announces

MEDICAL GENETICS: 1990

Bethesda, Maryland – May 17-19, 1990

The three-day course, organized by members of the NIH Interinstitute Medical Genetics Program, will include didactic and problem-oriented sessions.

Topics include: gene structure and expression, chromosome structure, cytogenetics, reverse genetics, gene mapping, recombinant DNA techniques in medical genetics, dysmorphology, inborn errors of metabolism, cancer genetics, endocrine genetics, neurogenetics and the genetics of connective tissue disorders. Also included will be prenatal diagnosis, genetic counseling and new approaches to the treatment of genetic diseases.

The course is intended, in part, as a review for candidates for the examinations of the American Board of Medical Genetics and will stress clinical applications, but will not ignore the excitement of current research.

AMA Category I credit, 24 hours. A fee of \$350 will cover tuition and syllabus (\$395 after April 15).

Further information is available from: **Medical Genetics, c/o FAES, One Cloister Court, Suite 230, Bethesda, Maryland 20814-1460, (301) 496-7975.**

The FAES/NIH is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians. The FAES/NIH designates this continuing medical education activity for 24 credit hours in Category 1 of the Physician's Recognition Award of the American Medical Association.

Women, Work, and Child Welfare in the Third World

Editors: **Joanne Leslie**, international nutrition consultant, and **Michael Paolisso**, anthropologist with the International Center for Research on Women.

Enhancement of women's economic opportunities and raising healthy children in the Third World are two important development priorities dependent upon women balancing productive and reproductive responsibilities. In this volume, a variety of research approaches and methodologies illustrate the multifaceted nature of women's work and child welfare. The authors' carefully drawn conclusions identify key relationships and criteria that must be considered for the development of effective economic and health programs. The book is essential reading for all researchers and policymakers concerned about the relationship between women's work and child welfare in the Third World.

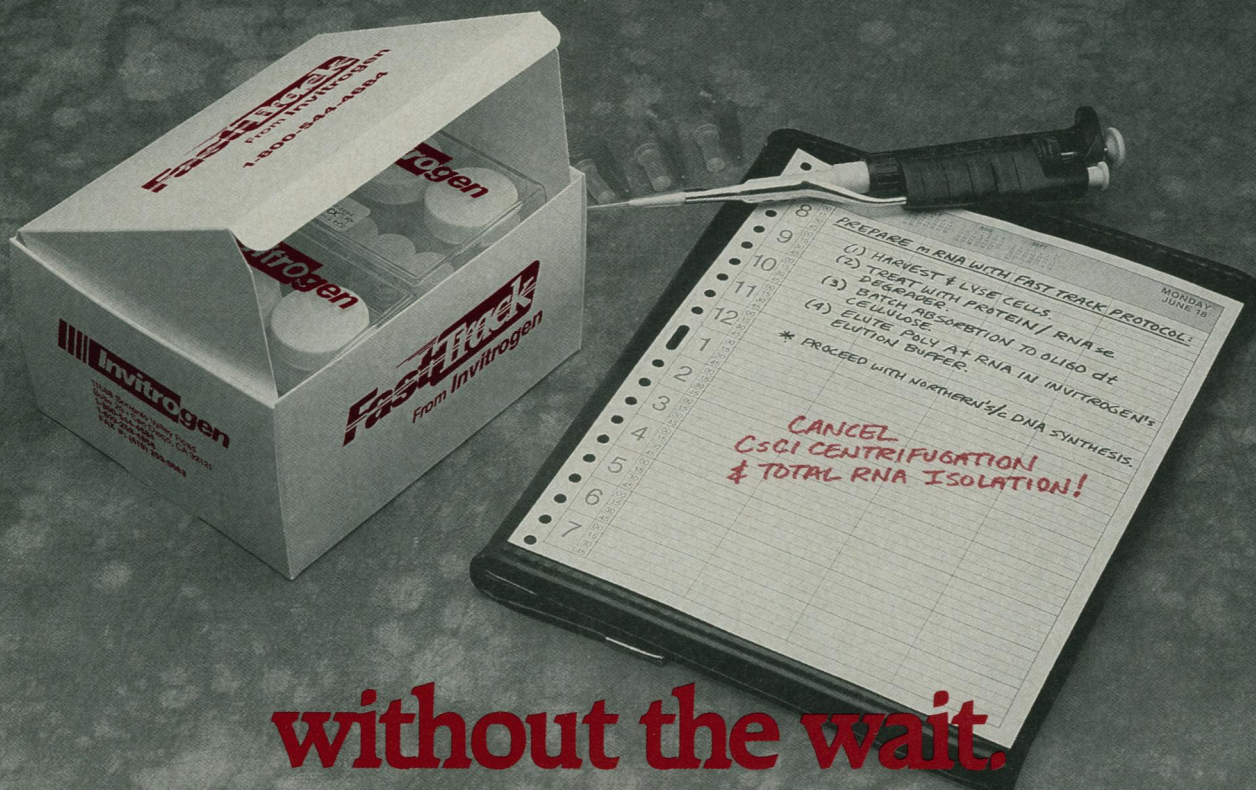
265 pp., 1989.

\$28.50 (\$22.80 for AAAS members who include their membership number from *Science*).

Order from: Westview Press, Dept. AAAS, 5500 Central Avenue, Boulder, CO 80301. Add \$2.50 postage and handling for the first book ordered; 75c for each additional book.

FastTrack™

The highest quality mRNA...



without the wait.

FastTrack is the only system available for the isolation of high quality, intact messenger RNA directly from cells or tissue in four hours or less with double the yield of conventional protocols. The entire procedure can be completed without ultracentrifugation, cesium chloride, toxic chemicals or total RNA isolation.

FastTrack guarantees:

- Higher yields of full length transcripts
- Lower ribosomal contamination
- No need for total RNA isolation
- Speed and simplicity

FastTrack has been designed to provide consistent and improved results during **cDNA synthesis** by eliminating guanidine and phenol which inhibit reverse transcriptase activity, and for **Northern blotting** by removing ribosomal contaminants and providing stronger signals (see fig. 1).

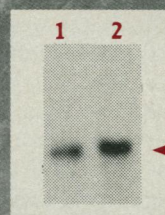


Figure 1.

Lane 1. mRNA isolated using guanidinium, CsCl centrifugation and oligo dT column selection. (30 hrs).

Lane 2. mRNA isolated directly from cells with FastTrack (3 hrs).

For high quality mRNA without the wait, *get the message with FastTrack.*

Call Invitrogen at 1-800-544-4684

Invitrogen
CORPORATION

11588 Sorrento Valley Rd., #20, San Diego, CA 92121

Circle No. 203 on Readers' Service Card

Science & Technology and The Changing World Order

15th Annual AAAS Colloquium on Science & Technology Policy

12-13 April 1990 ♦ The Capital Hilton ♦ Washington, DC

The AAAS Science & Technology Policy Colloquium provides a forum in which federal and industrial policy-makers and members of the scientific and engineering community can participate in an open discussion of S&T policy-related issues.

The Colloquium occurs after the release of the President's budget but before final congressional action, thus allowing

for the timely exchange of information about the budget and the consequences of various policy issues involving science and technology.

Who Should Attend: Scientists, administrators, industrial R&D managers, policymakers, academicians, association officials, federal grant recipients, students, and others with an interest in science and technology policy.

PROGRAM

Thursday, 12 April

Welcome: Richard C. Atkinson, *Chancellor, UC-San Diego* and *Chairman, Board of Directors, AAAS*

Keynote: D. Allan Bromley, *Director, OSTP*, and *Assistant to the President for Science and Technology*

Science and Technology in 1990: Where Have We Been and Where Are We Going? (Panel)

- ♦ Overview of FY 1991 R&D Budget Proposals (AAAS staff)
- ♦ R&D in the Federal Budget: 1976-1990
William D. Carey, *Carnegie Corp. of New York*
- ♦ Perspectives on R&D in the 1990s
Ralph Gomory*, *Sloan Foundation*
- ♦ Science, Technology, and the Future

Reforming the Budget Process (Luncheon address)
Harry S. Havens, *GAO*

The Changing World Order: Implications for Science & Technology (Symposium)

- ♦ Europe 1992
- ♦ Soviet/East European Transformation and S&T
- ♦ Redefining National Security
- ♦ Changing Nature of Military Threat

Major R&D Agency Budgets for FY 1991 (Concurrent small group sessions)

- ♦ DOD
- ♦ NASA
- ♦ NSF
- ♦ DOE
- ♦ NIH

Friday, 13 April

Breakfast Address: Bob Traxler* (D-MI), *Member, U.S. House of Representatives*

Concurrent Symposia

- ♦ Cashing In on Academic R&D
- ♦ Science & Math Education: New Options
- ♦ U.S. Space Policy in the 1990s and Beyond

Policies to Improve U.S. Industrial Competitiveness (Luncheon address)

Closing Remarks: Richard S. Nicholson, *Executive Officer, AAAS*

* Invited

Budget discussions will be based on **AAAS Report XV: Research and Development, FY 1991**, a comprehensive analysis of the proposals for the FY 1991 budget, prepared by AAAS and a group of its affiliated scientific, engineering, and higher education associations. Registrants receive a copy of this report at (or before) the Colloquium, **Proceedings** following the Colloquium, and **Congressional Action on R&D in the FY 1991 Budget** in the fall.

For further information, contact: Directorate for Science and Policy Programs, 1333 H Street, NW, Washington, DC 20005; (202) 326-6600.

Register now! Use form on next page →

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Advance Registration Form

AAAS Colloquium on Science & Technology Policy

12-13 April 1990 ♦ The Capital Hilton, Washington, DC

Please print or type:

Name _____
(last name first)

Institution/Company _____

Mailing Address _____
(number and street)

(city / state / zip) _____ (telephone number) _____

☐ Check here if you need special services due to a disability.

[1] **Deadline for advance registrations is 23 March.** Thereafter, register in person at the Capital Hilton beginning at 8:00 am, 12 April.

[2] **Special Rates:** Nonprofit rates apply only to employees of government, academic, and nonprofit organizations. Student rates apply only to full-time undergraduate and graduate students and retirees.

[3] **Refund Requests** for registration fees and meal tickets must be submitted in writing (to the address or FAX number below) by 6 April 1990, and will be honored after the Colloquium; no refunds will be made on cancellations received after 6 April.

[4] **Publications:** All registrants receive *AAAS Report XV: Research & Development, FY 1991* before (or at) the Colloquium, published *Proceedings* after the meeting, and *Congressional Action on R&D in the FY 1991 Budget*, in the fall.

[5] **Program materials** will be mailed to those who preregister by 23 March.

Mail¹ top half (registration form) to:

Registration
AAAS S&T Policy Colloquium
P.O. Box 23320
Alexandria, VA 22304-9330

OFFICE USE ONLY

AMT PD _____

CHECK # _____

DEP. DATE _____

SOURCE: P

To register by FAX¹ (VISA or MasterCard only), send this top half to 202-289-4021.

To register by phone¹ (VISA or MasterCard only), call 202-326-6600 (9am – 5pm EST).

Registration Fees

Regular (with 3 meals) \$260 \$ _____

Regular (no meals) \$195 \$ _____

Nonprofit ² (with 3 meals) \$200 \$ _____

Nonprofit ² (no meals) \$135 \$ _____

Student ² (no meals) \$ 50 \$ _____

Separate Meal Tickets

Lunch (12 April) \$ 29 \$ _____

Breakfast (13 April) \$ 11 \$ _____

Lunch (13 April) \$ 29 \$ _____

TOTAL AMOUNT \$ _____

Payment ³

☐ Check enclosed ☐ VISA ☐ MasterCard
(no other cards accepted)

☐ Original institutional purchase order attached

Card no. _____

Expiration date _____

Signature _____

The Capital Hilton Hotel Reservation Form

AAAS S&T Policy Colloquium ♦ 12-13 April 1990

(Reservations received after 22 March cannot be guaranteed)

Send confirmation to:

Name _____ Street _____

City _____ State _____ Zip _____ Telephone No. _____

Other occupants of room: Name _____ Name _____

Special housing needs due to disability: _____

Room: ☐ Single (\$135)* ☐ Double (155)* ☐ Twin (155)* *Add 11% DC sales tax and \$1.50 occupancy tax.

Arrival: Date _____ Time _____ **Departure:** Date _____ Time _____

Please list definite arrival and departure dates and times. Check-in time is 3:00 pm; check-out time is 12 noon.

Enclose separate check, made out to **The Capital Hilton**, for first night's room deposit or provide major credit card information:

Credit card name _____ Card no. _____ Exp. date _____

Cardholder's signature _____

Mail bottom half (hotel reservation form) to: Reservations, The Capital Hilton, 16th & K Streets, NW, Washington, DC 20036