

AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

25 MARCH 1988
VOL. 239 ■ PAGES 1465-1576

\$3.00



NEW GP SERIES CENTRIFUGES: UNDER, OVER, AND BEYOND!



Presenting the space-saving GP Series from Beckman, with models that fit under as well as on top of a lab bench and provide capabilities beyond those of other general purpose centrifuges.

For high reliability and quality separations, the GP's have a Beckman-designed drive, automatic "soft-start" and two-stage disc brake. These quiet-running centrifuges are available with or without refrigeration.

For fast separations, the horizontal rotor—of corrosion resistant stainless steel—spins 3 Liters at 3750 rpm/3200 *g*. You can spin microplates, blood bag cups, aerosol cannisters, even 250-mL conical-tip plastic bottles. Modular disk adapters accommodate every



popular size tube—as many as 56 15-mL tubes, for example.

There also are two fixed angle rotors—10x 50-mL and 24x 15-mL—rated for 6400 rpm/5642 *g*.

The new GP's—under, over, beyond. And at a great price! In the USA, available through your local VWR Scientific office and Beckman Instruments, Inc., Spinco Division, 1050 Page Mill Road, Palo Alto, CA 94304. Offices worldwide.

BECKMAN

A SMITHKLINE BECKMAN COMPANY

Circle No. 122 on Readers' Service Card



"For Best Acting . . . the EC600 Power Supply!"

You can count on award-winning performance, time after time, from E-C Electrophoresis Power Supplies. Consider the versatile EC600. It gives you a choice of Constant Power, Constant Current, or Constant Voltage with automatic crossover from mode to mode.

The supporting cast includes 17 other E-C Power Supplies, the broadest line in science. Models from 150 to 6,000 Volts, at prices from \$250 to \$2,595.

Bring down the final curtain on power supply problems. Call 1-800-EC RANGE for our complete Power Supply Catalog. In Florida, call 1-813-344-1644. EC-Apparatus Corp., 3831 Tyrone Blvd. N., St. Petersburg, FL 33709, Telex: 51-4736 HALA

EC600 Constant Power Supply
4000 Volts 200 Watts 200 milliAmps



Circle No. 97 on Readers' Service Card

1472 This Week in *Science*

Editorial

1473 Women in Science

Perspective

1475 PRC Science Students and Scholars Abroad: D. S. ZINBERG

Letters

1477 Behavioral Research and AIDS Prevention: W. W. DARROW ■ Significance of Frog in Amber: G. C. MAYER AND J. D. LAZELL, JR.; G. O. POINAR, JR., AND D. C. CANNATELLA

News & Comment

- 1479 Fixing NIH: The 110% Solution
- 1481 Doubts Over Fermat Proof
- 1482 *Briefing*: Estimate of Foreign SSC Funds Draws Fire ■ Fail-Safe Mechanism on NSF Future Funding ■ More Money for Costa Rica's Parks ■ Translation Service Throws in the Towel ■ Bonds Required for Tests ■ Ionson to Leave SDI Organization
- 1483 NAE Elects New Members
- 1484 Report Asks Upgrade of Military R&D Labs
- 1485 A Rebel Without a Cause of AIDS

Research News

- 1489 Stratospheric Ozone Is Decreasing ■ The Latest on the Antarctic Hole ■ A Cautionary Note
- 1491 Calculus: Crisis Looms in Mathematics' Future
- 1493 Symposium Focuses on Genes in Development: Collagen Gene Mutations Cause Brittle Bones ■ Gap Junctions Needed for Development ■ Dissecting Receptor Structures

Articles

- 1501 Formation of the Rocky Mountains, Western United States: A Continuum Computer Model: P. BIRD
- 1508 Evolving Legal Standards for the Admissibility of Scientific Evidence: B. BLACK
- 1513 Dynamic Pattern Generation in Behavioral and Neural Systems: G. SCHÖNER AND J. A. S. KELSO

- **SCIENCE** is published weekly on Friday, except the last week in December, and with an extra issue in February by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005. Second-class postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Now combined with **The Scientific Monthly**®. Copyright © 1988 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): \$65. Domestic institutional subscription (51 issues): \$98. Foreign postage extra: Canada \$32, other (surface mail) \$27, air-surface via Amsterdam \$65. First class, airmail, school-year, and student rates on request. Single copies \$3.00 (\$3.50 by mail); back issues \$4.50 (\$5.00 by mail); Biotechnology issue, \$5.50 (\$6 by mail); classroom rates on request; Guide to Biotechnology Products and Instruments \$16 (\$17 by mail). **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. 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, 21 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 \$1 + .10. **Postmaster:** Send Form 3579 to *Science*, 1333 H Street, NW, Washington, DC 20005. *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 objects 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, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.



COVER Harris' hawk family in the Los Medanos area of New Mexico. These young individuals, atypical of most birds, will remain in their natal area and associate with their parents and siblings for up to 3 years. This social behavior, to some extent, is linked to the formation and success of cooperative hunting "parties." See page 1525. [David A. Ponton, Mountain Route Box 93, Jemez Spring, NM 87025]

Reports

- 1521 Game Depletion Hypothesis of Amazonian Adaptation: Data from a Native Community: W. T. VICKERS
- 1523 Application of Two-Step Laser Mass Spectrometry to Cosmogeochimetry: Direct Analysis of Meteorites: J. H. HAHN, R. ZENOBI, J. L. BADA, R. N. ZARE
- 1525 Cooperative Hunting in Harris' Hawks (*Parabuteo unicinctus*): J. C. BEDNARZ
- 1528 A New Order of Tertiary Zalambdodont Marsupials: M. ARCHER, S. HAND, H. GODTHELP
- 1531 The DNA-Binding Properties of the Major Regulatory Protein $\alpha 4$ of Herpes Simplex Viruses: N. MICHAEL, D. SPECTOR, P. MAVROMARA-NAZOS, T. M. KRISTIE, B. ROIZMAN
- 1534 Reshaping Human Antibodies: Grafting an Antilysozyme Activity: M. VERHOEYEN, C. MILSTEIN, G. WINTER
- 1536 Peroxisomal Membrane Ghosts in Zellweger Syndrome—Aberrant Organelle Assembly: M. J. SANTOS, T. IMANAKA, H. SHIO, G. M. SMALL, P. B. LAZAROW
- 1539 The Elastin Receptor: A Galactoside-Binding Protein: A. HINEK, D. S. WRENN, R. P. MECHAM, S. H. BARONDES
- 1541 Selection of Amino Acid Sequences in the Beta Chain of the T Cell Antigen Receptor: S. M. HEDRICK, I. ENGEL, D. L. MCELLIGOTT, P. J. FINK, M.-L. HSU, D. HANSBURG, L. A. MATIS

Book Reviews

- 1545 The Statue Within, *reviewed by* G. S. STENT ■ Consciousness and the Computational Mind, P. N. JOHNSON-LAIRD ■ The Biology and Evolution of Lungfishes, G. V. LAUDER ■ The Neural and Molecular Bases of Learning ■ Books Received

Products & Materials

- 1551 FTIR Spectrometer ■ Plotting Software ■ Protein G ■ Compact pH Meter ■ Peptide-Synthesis System ■ Citation Index on Compact Disk ■ Culture System for Microscopy ■ Literature

Author Index to Volume 239 is found on pages I–X
Information for Contributors is found on pages XI–XII

Board of Directors

Sheila E. Widnall
Retiring President,
Chairman
 Walter E. Massey
President
 Richard C. Atkinson
President-elect

Harold Amos
 Floyd E. Bloom
 Mary E. Clutter
 Eugene H. Cota-Robles
 Mildred S. Dresselhaus
 Beatrix A. Hamburg
 Donald N. Langenberg
 Frank von Hippel
 William T. Golden
Treasurer
 Alvin W. Trivelpiece
Executive Officer

Editorial Board

Elizabeth E. Bailey
 David Baltimore
 William F. Brinkman
 Philip E. Converse
 Joseph L. Goldstein
 F. Clark Howell
 James D. Idol, Jr.
 Leon Knopoff
 Oliver E. Nelson
 Helen M. Ranney
 David M. Raup
 Howard A. Schneiderman
 Larry L. Smarr
 Robert M. Solow
 James D. Watson

Board of Reviewing Editors

John Abelson
 Qais Al-Awqati
 Don L. Anderson
 Stephen J. Benkovic
 Floyd E. Bloom
 James J. Bull
 Charles R. Cantor
 Ralph J. Cicerone
 John M. Coffin
 Bruce F. Eldridge
 Paul T. Englund
 Theodore H. Geballe
 Roger I. M. Glass
 Stephen P. Goff

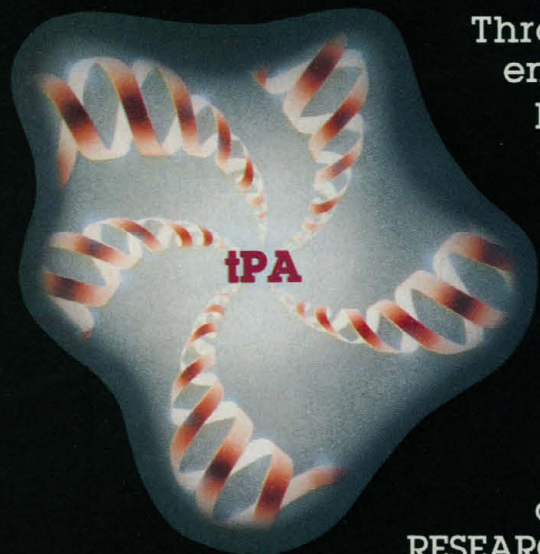
Robert B. Goldberg
 Corey S. Goodman
 Jack Gorski
 Stephen J. Gould
 Richard M. Held
 Gloria Heppner
 Eric F. Johnson
 Konrad B. Krauskopf
 Charles S. Levings III
 Richard Losick
 Karl L. Magleby
 Philippa Marrack
 Joseph B. Martin
 John C. McGiff
 Mortimer Mishkin
 Jiri Novotny
 Gordon H. Orians

Carl O. Pabo
 John S. Pearce
 Yeshayau Pocker
 Jean Paul Revel
 James E. Rothman
 Daniel V. Santi
 Thomas C. Schelling
 Ronald H. Schwartz
 Otto T. Solbrig
 Robert T. N. Tjian
 Virginia Trimble
 Geerat J. Vermeij
 Harold Weintraub
 Irving L. Weissman
 George M. Whitesides
 Owen N. Witte
 William B. Wood

INVITRON RESEARCH PRODUCTS INTRODUCES:

— rtPA —

NEW STANDARDS FOR tPA RESEARCH NOW AVAILABLE IN SINGLE AND 2-CHAIN FORMS



Through the combination of proprietary genetic engineering techniques and patented large-scale perfusion bioreactor technology, Invitron scientists have developed a revolutionary process for manufacturing recombinant human tissue plasminogen activator (tPA). The tPA manufactured by this new process is characterized by very high purity, excellent *in vitro* enzymatic activity and most importantly, very high lot-to-lot consistency. INVITRON

RESEARCH PRODUCTS now offers recombinant human tPA for *in vitro* and laboratory animal research use only.



Product Availability:

- single-chain and 2-chain forms available in the following vial amounts as a liquid or lyophilized (2-chain only) product. All products are carrier protein free:

50 μ g 1 mg 10 mg 50 mg

- customized buffering and aliquotting available for orders ranging in size from one gram to one kilogram
- larger quantities (multi Kg.) available upon request

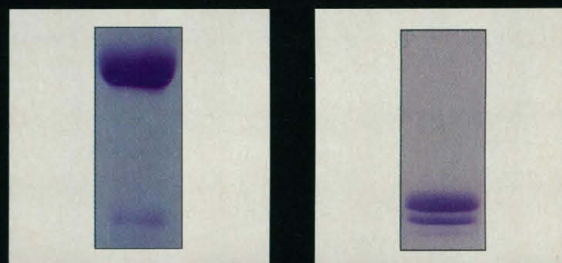
**NOW
AVAILABLE!**



Product Specifications:

- purity >95%
- activity approx. 500,000 IU/mg
- endotoxin <0.5 EU/mg

Representative Reduced 10% SDS-PAGE PROFILES

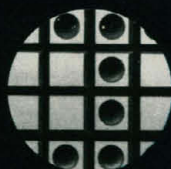


Single-chain

2-chain

**Caution: For research use only in laboratory animals or *in vitro* testing. Not for diagnostic or human use.
Not available for sale in Japan.**

For more information
and ordering call:
Toll Free: 800 323-2752



INVITRON
RESEARCH PRODUCTS
4649 Le Bourget Drive
St. Louis, MO 63134
314-426-5000

Circle No. 134 on Readers' Service Card

This Week in **SCIENCE**

Science and the law

THE plethora of “toxic torts,” legal cases that center around chemicals and other substances in the environment that are suspected of causing diseases, is expanding the interface between the law and science (page 1508). Judges, juries, and lawyers, who usually are not trained in science, are, nonetheless, required to rely on scientific evidence and to evaluate the validity and the fine points of such evidence; resolution of scientific disputes in the context of toxic tort cases requires thorough consideration of such evidence. Black discusses the traditional legal approach to scientific evidence (which developed more in connection with forensic techniques than with medical science) and the evolving situation with respect to the admissibility of scientific evidence. He suggests that more stringent judicial review of scientific evidence and the acceptance of evidence only when it meets established scientific standards should be encouraged.

Game depletion theory discounted

THE Siona-Secoya Indians of the Amazon live in small impermanent communities (page 1521). It has been thought that availability of game and subsequent depletion of game by hunters were the controlling factors for both community size and community dissolution, but this is apparently not so. One Indian community was studied for 10 years, starting around the time that individuals settled near the Aguarico River in northeast Ecuador (40 kilometers from their previous home) until about the time that they abandoned their settlement. The Indians hunted and fished, planted gardens, and built canoes and dwellings. Their main game was peccaries (pig-like ungulates), and these remained in plentiful supply. They also hunted deer, tapir, and various birds, primates, rodents, reptiles, and edentates; except for woolly monkeys, curassows, and trumpeters, supplies of all of these continued to meet demands. Vickers concludes that the

reason the community began to pick up stakes was not because prey was limiting but because migration offered a fresh start, including new close-by agricultural lands, new supplies of building materials, and an escape from decrepit surroundings and pests.

Cooperation among hunting hawks

MORNING dawns in the Los Medanos raptor area in New Mexico, the hunting party assembles and then splits up into small subgroups, the members “leapfrog” from high pillar to high post until prey is sighted, and then a coordinated attack occurs (page 1525). In this way, Harris’ hawks (cover) cooperate as they go after their prey—most often cottontails and jackrabbits. The common strategies—a surprise pounce, a flush-and-ambush, a relay attack—used by the party could not be so successfully employed (if at all) by a solo hunter. The bigger the party (parties observed ranged from two to six members) the greater its success and the more food that became available for use. All members of the party—a breeding couple and other adults as well as young hawks—shared the food. Bednarz describes the significant benefits of team hunting over solo hunting—the ability to capture large prey, to counter defensive attacks by the prey, and to guard meat until all can be eaten—and suggests that such benefits may have helped to both shape and preserve group living among these raptorial birds.

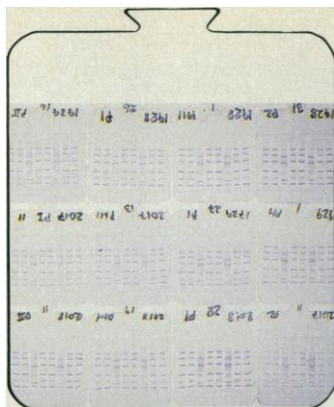
More Australian marsupials

FOSSILS of marsupials in a previously unknown order have been discovered in freshwater limestone deposits in northwestern Queensland, Australia (page 1528). V-shaped molars of members of the new order Yalkaparidontia (the name is taken from the aboriginal word for boomerang) have “come back” to tell of the existence of animals in two species of this now

extinct order. Along with the teeth, jaw and skull bones were also collected. Archer *et al.* review the features of the fossil specimens that mark them as marsupials and describe their distinct characteristics that set them apart from the five other known marsupial orders. The Yalkaparidontia were alive in the middle Miocene (10 to 15 million years ago) and most likely inhabited regions that were lowland rainforests; they and the rainforests may have died off together sometime in the middle to late Tertiary. This discovery adds to the diversity of the Australian marsupial fauna. The marsupial fossils were found in deposits from which more than 200 new fossil species of Tertiary vertebrates have also been recovered.

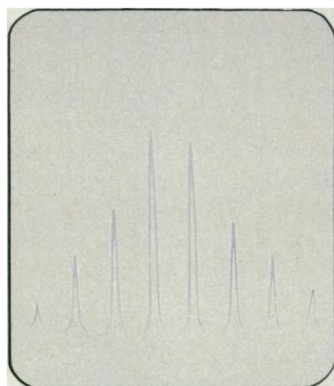
Zellweger syndrome

ZELLWEGER syndrome is a genetic disorder; signs of the syndrome include aberrant development of the brain and a number of abnormalities associated with the kidneys, the liver, and other organs and tissues (page 1536). Many systems function improperly—for example, there are severe neurologic defects—and death occurs usually within the first few months of life. While most of the cellular organelles appear normal in the cells of patients with Zellweger syndrome, one organelle, the peroxisome, is apparently incompletely assembled and is dysfunctional. Santos *et al.* detected only rudimentary peroxisomes (membrane ghosts) within the cells of a Zellweger syndrome patient. The peroxisomes lacked matrix proteins (the proteins that have traditionally been used for detecting peroxisomes, thus explaining why these organelles were thought to be entirely missing in the disease); some enzymes are absent from cells while other enzymes that normally enter the peroxisomes are properly synthesized but float free in the cell sap. The discovery that there is improper assembly of this cellular machinery inside which so many crucial metabolic processes normally take place can account for the occurrence of metabolic deficiencies in Zellweger syndrome.



BANDS

A sample of gels from quality control for function-testing of SDS-PAGE with PhastGel™ Gradient 10–15 gels. Each gel batch is thoroughly tested for reproducibility and reliability. From sample to result: 60 min (for 1 or 2 gels).



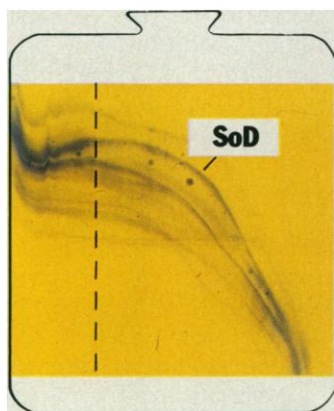
ROCKETS

Immunoelectrophoresis on PhastSystem saves antiserum and time. In this example, human serum proteins are precipitated with anti-albumin. From sample to result: 65 min.



SPOTS

Two-dimensional electrophoresis is fast and easy with PhastSystem. PhastGel IEF media are used in the first dimension, and PhastGel gradient or homogeneous media are used in the second dimension. Here, a cell extract from *E. coli* is analyzed. From sample to result: 2.5 h.



CURVES

Electrophoretic titration curve separations take only 25 minutes to perform with PhastGel IEF media. Information about protein charge characteristics is easily obtained, and can be used to plan protein purification schemes. Here, a clarified cell homogenate in the production of superoxide dismutase is analyzed. From sample to result: 55 min.

All with PhastSystem™, the high resolution electrophoresis system that lets you concentrate on results—not on methods.

Please contact Pharmacia for more information to find out how PhastSystem can work for you!



Pharmacia

UNITED IN SEPARATION

LKB

Pharmacia LKB Biotechnology Inc. Piscataway, New Jersey 08854, Information: (800) 526-3618, In NJ: (201) 457-8000.

Circle No. 62 on Readers' Service Card

American Association for the Advancement of Science

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Publisher: Alvin W. Trivelpiece

Editor: Daniel E. Koshland, Jr.

Deputy Editors: Philip H. Abelson (*Engineering and Applied Sciences*); John I. Brauman (*Physical Sciences*)

EDITORIAL STAFF

Managing Editor: Patricia A. Morgan

Assistant Managing Editor: Nancy J. Hartnagel

Senior Editors: Eleanor Butz, Ruth Kulstad

Associate Editors: Martha Coleman, R. Brooks Hanson, Barbara Jasny, Katrina L. Kelner, Edith Meyers, Phillip D. Szuroni, David F. Voss

Letters Editor: Christine Gilbert

Book Reviews: Katherine Livingston, *editor*; Deborah F. Washburn

This Week in Science: Ruth Levy Guyer

Contributing Editor: Lawrence I. Grossman

Chief Production Editor: Ellen E. Murphy

Editing Department: Lois Schmitt, *head*; Mary McDaniel, Patricia L. Moe, Barbara E. Patterson

Copy Desk: Joi S. Granger, Beverly Shields, Anna Victoreen, Barbara Wittig

Production Manager: Karen Schools

Assistant Production Manager: James Landry

Graphics and Production: Holly Bishop, James J. Olivari

Covers Editor: Grayce Finger

Manuscript Systems Analyst: William Carter

NEWS STAFF

News Editor: Barbara J. Culliton

News and Comment: Colin Norman, *deputy editor*; William Booth, Mark H. Crawford, Constance Holden, Eliot Marshall, Marjorie Sun, John Walsh

Research News: Roger Lewin, *deputy editor*; Deborah M. Barnes, Richard A. Kerr, Jean L. Marx, Leslie Roberts, M. Mitchell Waldrop

European Correspondent: David Dickson

BUSINESS STAFF

Business Staff Manager: Deborah Rivera-Wienhold

Classified Advertising Supervisor: Karen Morgenstern

Membership Recruitment: Gwendolyn Huddle

Member and Subscription Records: Ann Ragland

Guide to Biotechnology Products and Instruments:

Shauna S. Roberts

ADVERTISING REPRESENTATIVES

Director: Earl J. Scherago

Traffic Manager: Donna Rivera

Traffic Manager (Recruitment): Gwen Canter

Advertising Sales Manager: Richard L. Charles

Employment Sales Manager: Edward C. Keller

Marketing Manager: Herbert L. Burkland

Sales: New York, NY 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); Scotch Plains, NJ 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); Chicago, IL 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-337-4973); San Jose, CA 95112: Bob Brindley, 310 S. 16 St. (408-998-4690); Dorset, VT 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581); Damascus, MD 20872: Rick Sommer, 24808 Shrubbery Hill Ct. (301-972-9270); U.K., Europe: Nick Jones, +44(0647)52918; Telex 42513; FAX (0392) 31645.

Information for contributors appears on page XI of the 25 March 1988 issue. Editorial correspondence, including requests for permission to reprint and reprint orders, should be sent to 1333 H Street, NW, Washington, DC 20005. Telephone: 202-326-6500.

Advertising correspondence should be sent to Tenth Floor, 1515 Broadway, NY 10036. Telephone 212-730-1050 or WU Telex 968082 SCHERAGO.

Women in Science

The threat of a serious shortage of scientific personnel looms in the years ahead. Many predictions are, of course, notoriously unreliable. If a shortage is a realistic scenario, however, it is important to find ways to employ underrepresented groups more equitably—for reasons of national interest as well as of equality.

Women are one conspicuously underrepresented group in the higher echelons of academia and industry. Records of their transit through the system may help provide clues to appropriate remedial actions. Some trends in the data are promising. For example, in the 1930s women received 7% of the Ph.D. degrees in mathematics and the physical sciences, 15% of those in the life sciences, and 16% in the social sciences. But by the early 1980s those percentages had all doubled. Recently, however, the figures appear to have leveled off.

Tracing the progress of women through the system shows that the percentages roughly parallel those of men for total percentages in science through high school, college, and entrance into graduate school. The serious differential in participation occurs at the postdoctoral level. For example, 93,000 men and 94,000 women undergraduates were majoring in the biological sciences in 1984; the respective graduate enrollments were 22,000 and 17,000. At the next level, however, women are poorly represented on faculties and on average receive lower salaries than do men in comparable positions. One survey showed that although women had 10% of the doctoral degrees in chemistry, they had only 4% of the faculty jobs. At no stage in the educational process is there an indication that the attrition is caused by lack of academic performance.

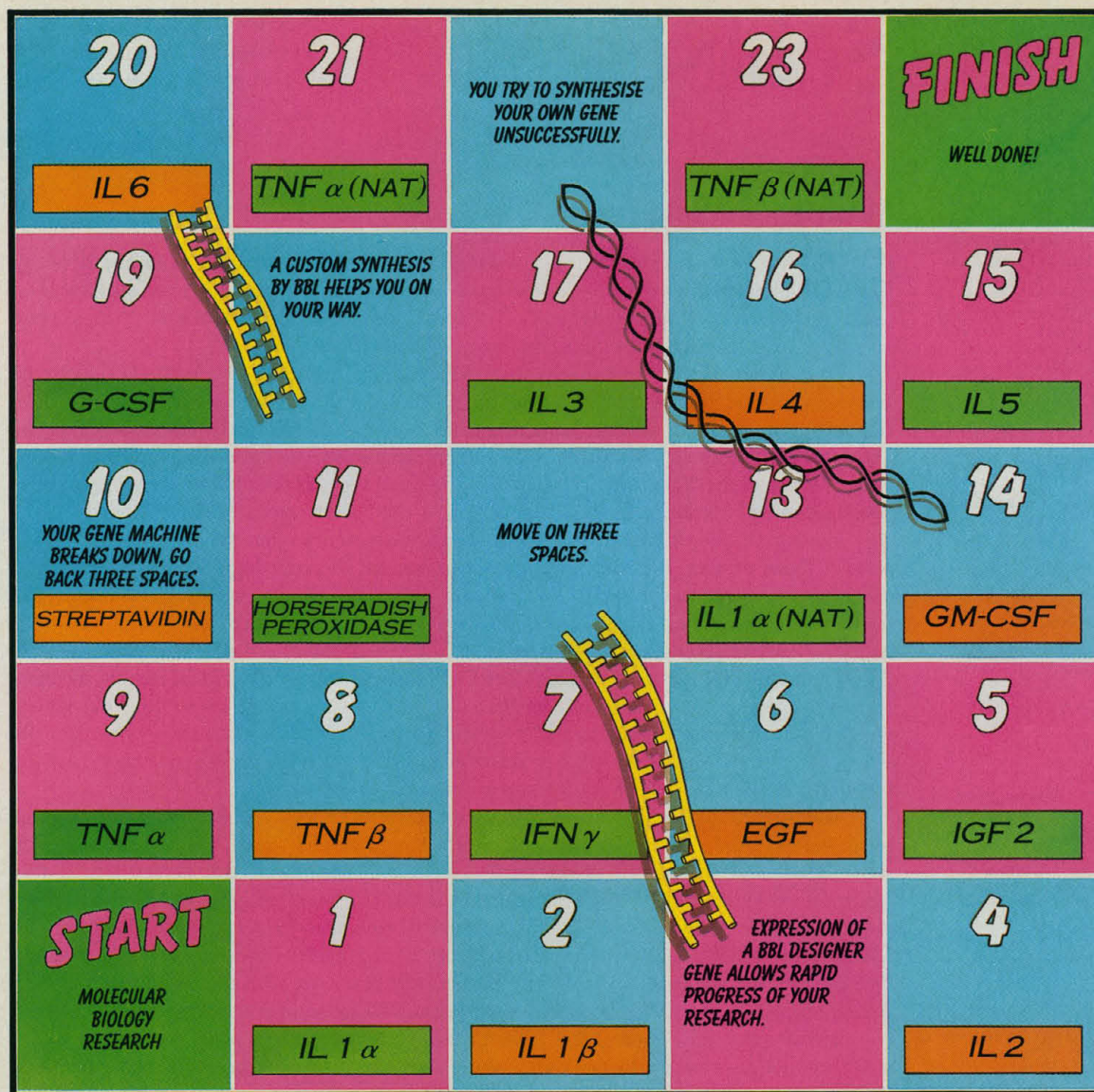
Attempts to understand the attrition have so far been unsuccessful, but some theories seem better than others. In the past, certainly, prejudice from the "old boys" was widespread, and it has only been partly eradicated. Moreover, the perception of this historical prejudice can be a subtle deterrent in today's more enlightened, but imperfect, world. The lack of role models can be a source of insecurity, a point made eloquently by Sheila Widnall in her AAAS presidential address. That situation may change as more women take important roles in our society, and particularly in science. But the insecurity may be a decisive factor during the period between graduate school and tenure, an interval of intense competitive pressure. Those who have pedagogical or administrative roles need to be sensitive to the stress of the pressured student or the untenured assistant professor. The support of a steady friend with encouragement to stay the course and an occasional congratulations for work well done can be crucial in developing the self-confidence that is essential for a research investigator.

Words are important, but actions are more so. Important contributions would be programs to make it easier for women during childbearing years to continue their professional involvements. Several universities have introduced "stop the clock" programs that allow women who are raising children to have tenure decisions postponed. Other programs, such as half-time appointments, "extend the clock" on grants, or on-site and subsidized day care are particularly appropriate (see also Carl Djerassi, *Letters*, 1 Jan., p. 10). Women not only bear the children, they are the prime organizers of their upbringing, and in these years they need a special form of encouragement. Since equality of responsibility is not yet here, not only are the demands on women faculty members greater, but they are more subject to criticism. A man who does less teaching because he serves on editorial boards is excused as normal, whereas a woman who asks to do less teaching to help raise a child is viewed as a burden. Today there is less prejudice at the time of promotion, but obstacles confronted before tenure decisions are sufficient to discourage a significant portion of talented women scientists.

Although the problems for ethnic groups are not the same as those that women face, they have some of the same characteristics. There are relatively few role models, and the need for encouragement of pioneers in potentially hostile territory is real.

As the country expands into an ever-increasing technological base, the need for women and minorities in both academia and industry increases proportionally. It may cost some money, some effort, and some understanding, but the voyage to full equality can be even more exciting and worthwhile than the voyage into space.—DANIEL E. KOSHLAND, JR.

DESIGNER GENES FROM BRITISH BIO-TECHNOLOGY



FOR THE UPS AND DOWNS OF MOLECULAR BIOLOGY



A game for 2 or more Molecular Biologists.

Each player throws a die moving his counter the corresponding number of squares. Any throw bringing a player to the foot of a ladder enables the player to move up that ladder. If a throw brings a player to the top of a double helix, the player must return to the square at the foot of that helix. The first player to reach square 24 is the winner.

Research into Molecular Biology is often like this. A minor setback can easily return you to square 1. But with British Bio-technology, nothing is left to chance. With our range of Designer Genes™ you'll find that your research is always on the up and up.

British Bio-technology genes can be used to express recombinant proteins (and novel variants) and most genes can be used for the production of hybridisation probes.

We will also custom synthesise any form of DNA from the smallest oligonucleotide to the largest double stranded gene.

And our service is cost-effective, rapid and efficient.

For further information on our range of Designer Genes™ and custom gene synthesis service write or phone today.

BBL Designer Genes™ – make the right moves in Molecular Biology.

U.S.A. & CANADA: Beckman Instruments Inc., Bioanalytical Systems Group, 2500 Harbor Boulevard, Fullerton, CA 92634-3100 U.S.A. Tel: 714-871-4848. Fax: 910-592-1260. Tlx: 678413.
SOUTH AMERICA: Biotech S.A., Sheraton Centre T.I. Avenida Niemeyer, 121 Leblon, CEP 22072, Rio de Janeiro, Brazil. Tel: (021) 2599862. Tlx: (021) 32514 ATOZ BR.
JAPAN: Toyobo Company Limited, Biochemical Operations Department, 2-8 Dojima Hama 2-Chome, Kitaku, Osaka, 530 Japan. Tel: (06) 348-3786. Fax: (06) 347-0839. Tlx: J 63465 TOYOB. Sole importer: Mitsubishi Corp. Osaka Branch Industrial Textile Dept.
ITALY: AMS Biotechnology Europe Limited, Via Sansovino, 8, 20133 Milano -1, Italy. Tel: (02) 206251. Fax: (02) 200315. Tlx: 335661 Pilmea -1.
SPAIN: AMS Biotechnology Europe Limited, Argensola, 6 (4.-5), Madrid, Spain. Tel: (91) 208 56 93. Fax: 4103108. Tlx: 41663.
PORTUGAL: AMS Biotechnology Europe Limited, Rua Dos Lusíadas, 5 (5-1), 1300 Lisbon, Portugal. Tel: 01 638788. Tlx: 65311 LUTEJEO P.

Circle No. 103 on Readers' Service Card

British Bio-technology Limited

Brook House, Watlington Road,
Cowley, Oxford OX4 5LY
Telephone (0865) 718817
Fax (0865) 717598
Telex 838083
BIOTEC G

Quality separations demand quality systems

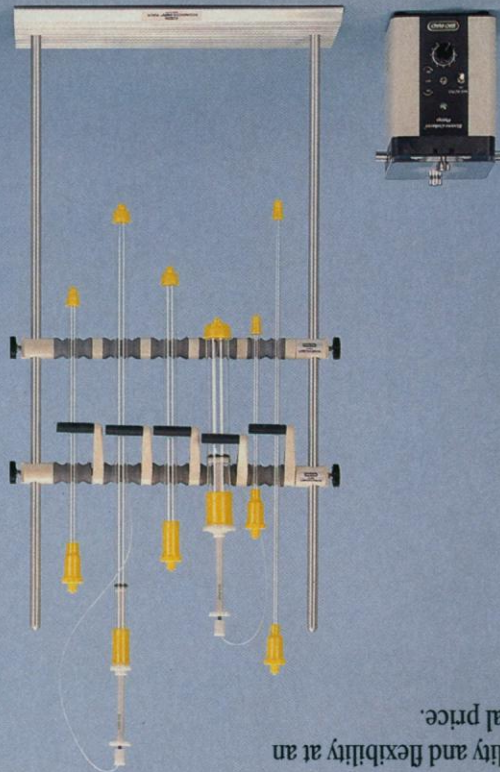
And that means Econo-Column® chromatography systems from Bio-Rad.

Complete systems to meet your specifications

We offer a wide selection of quality columns, peristaltic pumps, detectors, and fraction collectors. That makes it easy to tailor an Econo-Column low pressure system to your application. The components work as a system, and our full range of connectors, adaptors, and tubing makes plumbing a cinch.

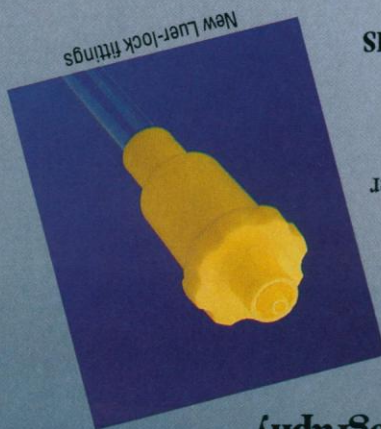
New Updated Column Design

Now we have Luer-lock fittings for convenience and leak free operation. And we've added a new 5.0 cm ID column. As they have for years, the Econo-Column chromatography columns continue to set the standard for reliability and flexibility at an economical price.



- **Econo-Column pump**
channel flow rate is 0.6 to 3.25 ml/hr per suit for most applications.
- **Model 1740 UV/VIS Detector**
Unsurpassed sensitivity, 10 different wavelength filters from 214 to 660 nm, and cold room compatibility add up to an unbeatable package.
- **Model 2100 Fraction Collector**
Collects fractions reliably by either time or drop count with 100 tube capacity. Its compact size and cold room compatibility make it a versatile tool for all types of applications.
- **Chart Recorders, Racks, Fittings, and Adaptors**
Everything you need to customize a low pressure chromatography system.

For details on the most popular line of chromatography columns and accessories in the laboratory today, call your Bio-Rad representative or contact us directly.



Also in Rockville Centre, NY: Hornsby, Australia; Vienna, Austria; Mississauga, Canada; Watford, England; Munich, Germany; Hong Kong; Milan, Italy; Tokyo, Japan; Utrecht, The Netherlands; and Glatting, Switzerland.

1414 Harbour Way South
Richmond, CA 94804
(415) 232-7000
800-843-1412

**Chemical
Division**

Circle No. 96 on Readers' Service Card

It's the Chemistry that Counts.™

BIO-RAD

Your formal invitation



Coulter cordially invites you to see a demonstration
of the latest state-of-the-art technology in:

- Automated cell counting
- Submicron particle sizing
- High-resolution cell size distribution analysis
- Laser-based electrophoretic mobility distribution analysis
- Automated, nondestructive pore size distribution analysis

For the fastest, most reliable results in cell
and particle research...
adorn your lab in **classic black**... from Coulter.

Call today to schedule your demonstration.
800-526-6932; in Florida 800-432-6518.
Ask for extension 2818.

Outside the U.S.A.,
contact your local Coulter representative



COULTER

WORLD HEADQUARTERS

Scientific Instruments Marketing, P.O. Box 2145
Hialeah, Florida 33012-0145 USA



Cell size distribution and cell counting

The COULTER® MULTISIZER is a rapid, accurate, broad range (30:1 by diameter) analyzer that offers the equivalent of 25,600 channels of resolution with patented windowing features. The instrument simultaneously counts and sizes cells or other particles over a range of 0.4 to 1200 μm using the proven Coulter volumetric, one-by-one principle. Linear or log scaling allow easy handling of broad or narrow distributions.

Circle No. 173 on Readers' Service Card



Submicron particle size analysis

The COULTER® Model N4 analyzer series comprises three instrument models that all provide average particle size over a range of 3 nm to 3 μm , molecular weight, standard deviation and diffusion coefficient. They will measure the size of macromolecules, emulsion droplets or other particles in suspension. Features include sizing in 60 seconds, new Multi-Tau software and multi-angle measurements.

Circle No. 174 on Readers' Service Card



Cell counting with microprocessor automation

The COULTER COUNTER® Model ZM offers the user an economical but expandable system that provides the speed (5000 particles/sec) and accuracy (differentiates within 0.05 fL) of Coulter volumetric counting and sizing of cells plus the ease of microprocessor control. Dual thresholds permit direct readout of particle count and size above (or between) preset limits. Suitable for analysis of cells or emulsion droplets from 0.4 to 1200 μm .

Circle No. 175 on Readers' Service Card

Cell size distribution accessory

The COULTER CHANNELYZER® 256 analyzer was specially designed for use with the Model ZM, enhancing that system to allow rapid cell size distribution measurements. Its 16, 64, 128 or 256 real-time channels are expandable to 2,560 channels with windowing feature. Provides resolution to 0.05 fL and a dynamic range of 3:1 by diameter.

Circle No. 172 on Readers' Service Card

Electrophoretic mobility distributions

The COULTER® DELSA measures the mobility of charged particles in liquid suspension such as membrane vesicles, liposomes or lymphocytes in just minutes.

Circle No. 176 on Readers' Service Card

Particle characterization services

The Coulter Scientific Instruments Applications Laboratory offers application troubleshooting and consulting services as well as a calibration service traceable to NBS standards.

Circle No. 177 on Readers' Service Card

The Leader in Benchtop Gel Photography



The FCR-10 CAMERA

Four years ago, FOTODYNE applied its photodocumentation expertise to pioneer a new concept for recording electrophoresis gels - The FCR-10 Camera.

Today, when photographing DNA or protein gels, or even autoradiograms, our FCR-10 is the #1 choice for instant benchtop photography.

It's fast, easy to use, dependable and best of all can be used at the bench without turning off room lights to give you high quality, instant gel photographs. Interchangeable hoods give the versatility you need to photograph different gel sizes.

Add either a FOTODYNE 300nm DNA Transilluminator or a FOTODYNE White Light Transilluminator and you have an instant benchtop gel photographic system second to none.

For more information on the FCR-10 Camera and other FOTODYNE products, call us toll free at 1-800-362-3686 or write for a copy of our current biotechnology instruments catalog.

FOTODYNE, Inc., 16700 W. Victor Road
New Berlin, Wisconsin 53151-4131 U.S.A.
414-785-7000 TELEX 260127

**FOTODYNE, QUALITY AND EXPERTISE YOU
CAN RELY ON.**

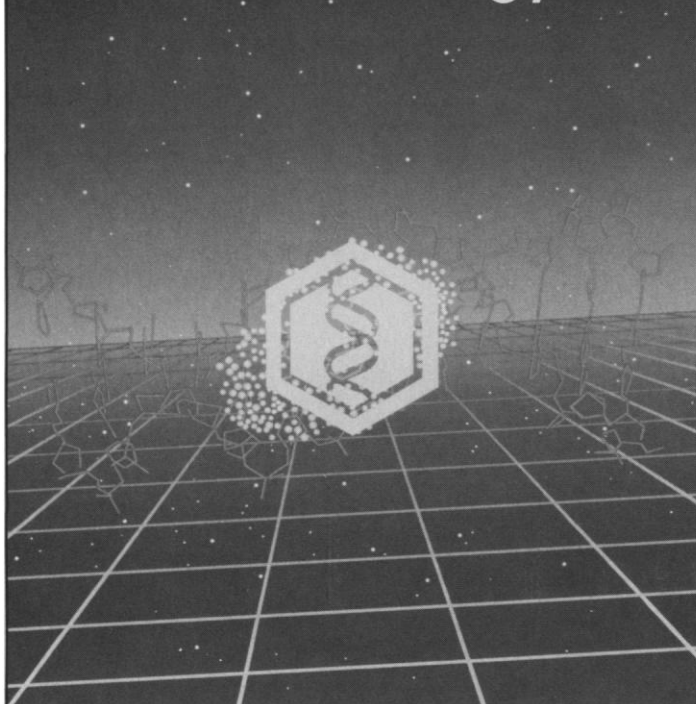
Call 1-800-DNA-FOTO

See us at
FASEB and ASM
May 1988

FOTODYNE
INCORPORATED

Circle No. 214 on Readers' Service Card

Frontiers of Chemistry: Biotechnology



a research conference on the Chemistry of Biotechnology, sponsored by The American Chemical Society's Chemical Abstracts Service in Columbus, Ohio, October 24-25.

- Hear case studies and invited papers presented by leading researchers who've made notable contributions to this crucial area of research
- Discuss current research problems in such areas as protein engineering, diagnostic procedures, recombinant DNA technology, enzyme inhibitors, and drug design and production.
- Meet keynote speaker Dr. Jacqueline K. Barton, winner of the Eli Lilly Award in Biological Chemistry, sponsored by the ACS Division of Biological Chemistry

Conference organizers include experts from: BP America Research and Development, Upjohn Company, National Bureau of Standards, and Chemical Abstracts Service.

Telephone to register, or for more information: Dr. Robert E. Stobaugh, 800-848-6538, extension 2196; or write to him at Chemical Abstracts Service Dept. 30988, P.O. Box 3012, Columbus OH 43210.

Circle No. 143 on Readers' Service Card

If you thought there's nothing new in ion exchange, here's a pleasant surprise...

New molecular biology and biotechnology grade resins.

Until recently, no one gave much thought to using ion exchange resins for molecular biology and biotechnology applications. But now Bio-Rad has developed molecular biology grade and biotechnology grade ion exchange resins. They offer significant advantages for many applications:

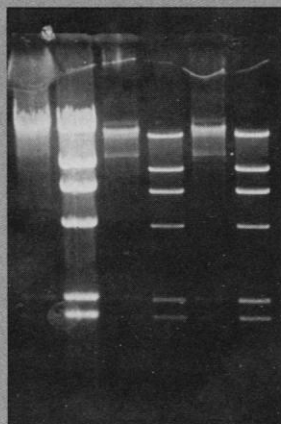
Rapid removal of ethidium bromide

Molecular biology grade ion exchange resins are *certified* nuclease-free and ligase inhibitor free. As such, they will maintain the integrity of your sample during the purification process. Further, you can achieve same day results when you use these resins for rapid removal of ethidium bromide from plasmids and deionization of PEG and formamide.

Fast, easy product purification

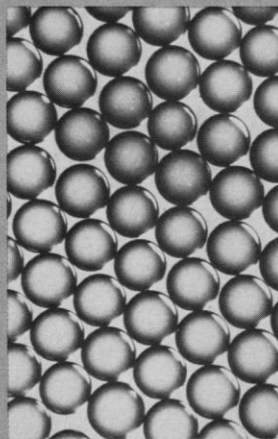
Biotechnology grade resins are of the highest quality and certified to have low microbial levels. Once again, the integrity of your samples is protected and you will save considerable time by using these resins for :

- Detergent removal, heavy metal removal, and deionization of nonionic products. We'll provide technical assistance for scale-up applications.



Molecular biology grade resins are certified to be nuclease-free.

Still the standard for purity



Monosized AG resins.

Analytical grade ion exchange resins from Bio-Rad have set the standard in analytical chemistry for 30 years. We offer a comprehensive line of highly purified and sized analytical grade resins as well as these products for your convenience:

- Prefilled 2 ml columns for sample preparation
- Sample preparation application kits.

Bio-Rad also offers custom-processed resins. As always, we back all products with 30 years of experience and technical support. Yes, bulk pricing is available.

So if you thought nothing much has happened to ion exchange resins, or just never thought they'd be useful for your work, get in touch. You're in for a pleasant surprise.

BIO-RAD**Chemical
Division**

1414 Harbour Way South
Richmond, CA 94804
(415) 232-7000
800-843-1412

Also in Rockville Centre, NY; Hornsby, Australia; Vienna, Austria; Mississauga, Canada; Watford, England; Munich, Germany; Hong Kong; Milan, Italy; Tokyo, Japan; Utrecht, The Netherlands; and Glattpburg, Switzerland.

Circle No. 95 on Readers' Service Card

It's the Chemistry that Counts.™



Pure Simplicity.

Introducing
The new **MASS™**

**Membrane Affinity
Separation System
that takes you from
package to pure MAb
in minutes, not hours!**

Forget all the prep and process steps
of gel columns and matrix packing—
just prime the MASS™ device...
add the sample...wash...and
elute the bound IgG.
And that's it—
Pure Simplicity!

Beyond yields and purity
fully comparable to the best
gel affinity columns, MASS™ gives
you *incomparable* speed and ease of
separation. And, because the unique
covalent bond of ligand to proprietary
membrane is so stable, there's virtually
no leaching and very low non-specific
binding. What's more, flow rates of 1–10
ml/minute are easily attainable.

Circle No. 55 on Readers' Service Card

***For faster results,
call 1-800-622-3280***

NYGENE NYGENE CORP.
6 Executive Plaza
Yonkers, NY 10701

**Risk-free trial offer!
Call now for
details!**

WHEN YOU HAVE THE MOST SOUGHT AFTER BIOMEDICAL INFORMATION, HOW DO YOU GET MORE PEOPLE TO USE IT?

By making our online biomedical information easier to use, we've opened the door for more users.

You, for instance.

If you're a physician or researcher in a medical, clinical, university, or scientific environment, our new Dialog Medical ConnectionSM could very well be the research tool you've been looking for.

Dialog is already the choice of the majority of information specialists.

So you'll be using the most sought after information available.

Now it's easy to have fast access to the major biomedical databases like MEDLINE.

Or BIOSIS PREVIEWS, giving you world wide coverage of research in the life sciences.

Or NEWSEARCH, one of many general reference databases providing a daily index of articles and book reviews from over 1700 of the most important newspapers, magazines and periodicals.

So it's easy to stay well informed on virtually any topic that's important.

Best of all, you don't have to be an online professional to use Dialog Medical Connection. Because it offers an easy to follow menu for new users and a command mode for more experienced searchers.

There's no reason not to have instant access to information you need when you need it. All you need is a personal com-

puter, a modem, and Dialog Medical Connection.

Call Dialog today and ask about our special incentives for first-time users including \$100 free time.

1-800-3-DIALOG. Or write Dialog Marketing, 3460 Hillview Avenue, Palo Alto, CA 94304.

SIMPLE.



D I A L O G
MEDICAL CONNECTIONSM

Part of the world's largest online knowledgebank.

1-800-3-DIALOG

Circle No. 200 on Readers' Service Card

Information for Contributors

THE EDITORS OF *SCIENCE*

Manuscripts should be addressed to the Editor, *Science*, 1333 H Street, NW, Washington, DC 20005. Submit three copies together with a letter of transmittal giving

- 1) the names and telephone numbers of the authors;
- 2) the title of the paper and a statement of its main point;
- 3) three to eight keywords to be used for indexing;
- 4) the names, addresses, telephone numbers, and fields of interest of four to six persons outside your institution who are qualified to referee the paper;
- 5) the names of colleagues who have reviewed the paper;
- 6) the total number of words (including text, references, and figure and table legends) in the manuscript; and
- 7) a statement that the material has not been published and is not under consideration for publication elsewhere.

In addition, include with your manuscript:

- (i) any paper of yours that is in press or under consideration elsewhere and includes information that would be helpful in evaluating the work submitted to *Science*;
- (ii) written permission from any author whose work is cited as a personal communication, unpublished work, or work in press but is not an author of your manuscript;
- (iii) for review of manuscripts based on crystallographic data, two copies of the coordinates.

It is assumed that all those listed as authors of a work have agreed to be so listed, have seen and approved the manuscript, and are responsible for its content.

Before being reviewed in depth, most papers are rated for their interest and overall suitability by a member of the Board of Reviewing Editors. Papers submitted in disciplines for which there is no appropriate member of the Board of Reviewing Editors may be screened by editorial staff members in consultation with outside experts. Papers that are not highly rated are returned to the authors within about 2 weeks; the title page and abstract from one copy are retained for our files. The others are reviewed in depth by two or more outside referees. Authors are

notified of acceptance, rejection, or need for revision, usually within 6 to 10 weeks. Papers cannot be resubmitted, either after initial screening or after in-depth review.

Conditions of Acceptance

When a paper is accepted for publication in *Science*, it is understood by the editors that (i) any materials and methods necessary to verify the conclusions of the experiments reported will be made available to other investigators under appropriate conditions; (ii) sequence and crystallographic data will be offered for deposit to the appropriate data bank; and (iii) the paper will remain a privileged document and will not be released to the press or the public before publication. If there is a need in exceptional cases to publicize data in advance of publication, the AAAS Office of Communications (202-326-6440) must be consulted.

Selection of Manuscripts

In selecting papers for publication, the editors give preference to those of general significance that are well written, well organized, and intelligible to scientists in different disciplines. An attempt is made to balance the subject matter in all sections of *Science*. Membership in the AAAS is not a factor in selection.

Accepted papers are edited to improve the accuracy and effectiveness of communication and to bring them within the specified length limits. When the author's meaning is not clear, the editor may consult the author by telephone; when editing is extensive, the manuscript may be returned for approval and retyping before the type is set.

Categories of signed papers include: general articles, research articles, reports, letters, technical comments, book and software reviews, perspectives, and policy forums.

General Articles. General articles (up to 5000 words) are expected to (i) review new developments in one field that will be of interest to readers in other fields; (ii) de-

scribe a current research problem or a technique of interdisciplinary significance; or (iii) discuss some aspect of the history, logic, policy, or administration of science. Readers should be able to learn from a general article what has been firmly established and what are unresolved questions; speculation should be kept to a minimum.

Many of the general articles are solicited by the editor, but unsolicited articles are welcome. Both solicited and unsolicited articles undergo review.

General articles should include a note giving the authors' names, titles, and addresses; a summary (50 to 100 words); an introduction that outlines for the general reader the main point of the article; and brief subheadings to indicate the main ideas. The reference list should not be exhaustive; a maximum of 50 references is suggested. Figures and tables should occupy no more than one printed page.

Research Articles. A research article (up to 4000 words) is expected to contain new data representing a major breakthrough in its field. The article should include an author note, abstract, introduction, and sections with brief sideheads. A maximum of 40 references is suggested. Figures and tables together should occupy no more than one printed page.

Reports. Reports (up to 2000 words) are expected to contain important research results. They should include an abstract (no more than 100 words) and an introductory paragraph. A maximum of 30 references is suggested. Figures and tables together with their legends should occupy no more than one printed page.

Letters. Letters are selected for their pertinence to material published in *Science* or because they discuss problems of general interest to scientists. Letters pertaining to material published in *Science* may correct errors; provide support or agreement; or offer different points of view, clarifications, or additional information. Personal remarks about another author are inappropriate. Letters may be reviewed by outside consultants. Letters selected for publication are intended to reflect the range of opinions received. The author of the paper in question is usually given an opportunity to reply.

All letters are acknowledged by postcard; authors are notified if their letters are to be published. Preference is given to letters that do not exceed 250 words. Letters accepted for publication are frequently edited and shortened in consultation with the author.

Technical Comments. Technical comments (up to 500 words) may criticize articles or reports published in *Science* within the previous 6 months or may offer useful additional information. Minor issues should

be resolved by private correspondence. The authors of the original paper are asked for an opinion of the comment and are given an opportunity to reply in the same issue if the comment is published. The comments, and sometimes the reply, are subject to the usual review procedures. Priority disputes undergo extensive review and are published only when action is recommended.

Book and Software Reviews. The selection of books and software packages to be reviewed and of reviewers is made by the editors. Instructions and length specifications accompany items to be reviewed when they are sent to reviewers.

Manuscript Preparation

Typing. Use double-spacing throughout the text, tables, figure legends, and references and notes and leave margins of at least 2.5 centimeters. Put your name on each page and number the pages starting with the title page.

Titles. Titles should be short, specific, and amenable to indexing. For general articles the maximum length is 80 characters and spaces; for research articles and reports the maximum is 100 characters.

Summaries or abstracts. These should include a sentence or two explaining to the general reader why the research was undertaken and why the results should be viewed as important. The abstract should convey the main point of the paper and outline the results or conclusions.

Text. A brief introduction should indicate the broad significance of the paper. The whole text should be intelligible to readers in different disciplines. Technical terms should be defined. All tables and figures should be cited in the text in numerical order.

Symbols and abbreviations. Define all symbols, abbreviations, and acronyms.

Units of measure. Use metric units. If measurements were made in English units, give metric equivalents.

References and notes. Number references and notes in the order in which they are cited, first through the text and then through the table and figure legends. List a

reference only one time. References that are *always* cited together may be grouped under a single number. Use conventional abbreviations for well-known journals; provide complete titles for other journals. For references with up to five authors provide all the names; for more than five, provide the name of the first author only. See issues of the journal for examples.

Unpublished observations. Reference to unpublished data should be given a number in the text and placed, in correct sequence, in the references and notes.

Acknowledgments. Gather all acknowledgments into a brief statement at the end of the references and notes.

Informed consent. Investigations on human subjects must include a statement indicating that informed consent was obtained after the nature and possible consequences of the studies had been fully explained.

Animal welfare. Authors using experimental animals must state that their care was in accordance with institutional guidelines. For animals subjected to invasive procedures, the anesthetic, analgesic, and tranquilizing agents used, as well as the amounts and frequency of administration, must be stated.

Figures. For each figure submit three high-quality glossy prints or original drawings of sufficient size to permit relettering but not larger than 22 by 28 centimeters (8½ by 11 inches). On the back of every figure write the first author's name and the figure number and indicate the correct orientation. *Manuscripts with oversized figures will be returned to the author without review.* Photocopies of figures are not acceptable; transparencies, slides, or negatives cannot be used because they cannot be sent to reviewers.

On acceptance of a paper, authors requesting the use of color will be asked to supply slides or negatives of the color artwork and to pay \$600 for the first color figure or figure part and \$300 for each additional figure or figure part as a contribution toward printing costs.

Illustrations reprinted from other publications must be credited. It is the author's responsibility to obtain permission to re-

print such illustrations in *Science*.

Tables. Tables should supplement, not duplicate, the text. They should be numbered consecutively with respect to their citation in the text. Each table should be typed, with its legend (double-spaced), on a separate sheet. Give each column a heading with units of measure indicated in parentheses. Do not change the unit of measure within a column.

Equations and formulas. Use quadruple-spacing around equations and formulas that are to be set off from the text. Define all symbols.

Uncertainties and reproducibility. Evidence that the results are reproducible and the conditions under which this reproducibility (replication) was obtained should be explicitly stated. The effect of limitations in experimental conditions on generalizability of results should be discussed. Uncertainties should be stated in terms of variation expected in independent repetitions of the experiments; they should include an allowance for possible systematic error arising from inadequacies in the assumed model and other known sources of possible bias. Probabilities from statistical tests of significance should be subordinated to the reporting of results and associated uncertainties.

Printing and Publication

Proofs and reprints. One set of galley proofs is sent to the authors. An order blank for reprints accompanies the proofs.

Scheduling. Papers are scheduled for publication after *Science* has received corrected galley proofs from the authors. Papers with tables or figures that present problems in layout, or with color figures or cover pictures, or that exceed the length limits may be subject to delay.

Cover Photographs

Particularly good photographs that pertain to a paper being submitted will be considered for use on the cover. Submit prints (not slides, negatives, or transparencies) with the manuscript.

tebrate phylogeny are present in these papers. The controversy on lungfish phylogeny that has resurfaced in the last ten years after being dormant for most of this century is thus well represented in this volume.

What is disappointing about the papers on phylogeny is the near total lack of quantitative methods in the analysis of characters. Only Marshall makes an attempt to develop a taxon-by-character data matrix and to analyze it using parsimony algorithms. All the other authors present unconvincing qualitative analyses of their data that suffer from the unjustified a priori exclusion of characters, and even Marshall concludes by adducing ad hoc reasons for not believing the results of his analysis. Schultze explicitly ignores all soft-tissue characters derived from the study of living lungfishes, claiming that because such characters are not discernible in fossil material they should not be included in a phylogenetic analysis. In contrast, other authors such as Northcutt (writing on neural characters of lungfishes), Bemis (analyzing the morphology of the skull and feeding mechanisms), Wake (who sum-

marizes urogenital morphology), and Burggren and Johansen (who evaluate the circulatory and respiratory systems of lungfishes) all present data that have important implications for the phylogenetic position of lungfishes and the relationships of the three living genera.

Continuing the practice of qualitative data analysis and authoritarian a priori exclusion of characters will only lead to continued confusion over the pattern of historical diversification in lower vertebrates. A summary data matrix of all characters known in both living and fossil clades is needed, and a parsimony analysis of this matrix should be executed to produce the best overall branching diagram available from current data.

Another strength of this volume is the information provided on the natural history and ecology of the living genera. Greenwood reviews the biology of African species, Kemp provides data on the Australian lungfish, and Fishman and his co-authors describe the process of estivation in *Protopterus*. Relatively little information is given on the South American genus, *Lepidosiren*,

owing primarily to the surprising lack of knowledge about its biology. These papers emphasize the clear distinctions among the three lungfish genera and the remarkable diversity of ecology in what is often taken to be a relatively homogeneous group. Finally, Conant provides a useful indexed bibliography of over 2200 references from 1811 to 1985 on all aspects of lungfish biology and evolution.

Given the extensive research on vertebrate phylogeny over the last century, there is still a remarkable lack of agreement on principal features of the historical record. Lungfishes, which have played a central role in generating controversy in vertebrate phylogeny, will likely play an equally crucial role in ultimately resolving it. Volumes such as this which present new data and interpretations contribute significantly to progress in understanding the pattern of vertebrate evolution.

GEORGE V. LAUDER
School of Biological Sciences,
University of California,
Irvine, CA 92717

Lysyl Endopeptidase (*Achromobacter* Protease I)

for analysis of peptide/protein primary structure and enzymatic synthesis of Lys-X compounds

- Lysyl Endopeptidase specifically cleaves all of the Lys-X bonds including Lys-Pro.
- Lysyl Endopeptidase also hydrolyzes the carboxy-terminal end of S-aminoethylcysteine residues at about the same rate as for lysine residues.
- Complete activity is retained after incubating the enzyme in 4M urea or 0.1% SDS solution for up to 6 hours at 30°C.

Source.....*Achromobacter lyticus* M497-1

Specific Activity.....Approximately 4.5 AU/mg

Purity.....Homogeneous on SDS-PAGE

Optimum pH.....9.0 ~ 9.5 (amidase activity)

Stability of pH.....4.0 ~ 11.0

Wako's catalogue of products for biomedical research is available on request.

Wako

Wako Pure Chemical Industries, Ltd.

10 Doshomachi 3-Chome, Higashi-Ku, Osaka 541, Japan
Telephone: (06) 203-3741 Telex: 65188 wakoos J Facsimile: (06) 222-1203

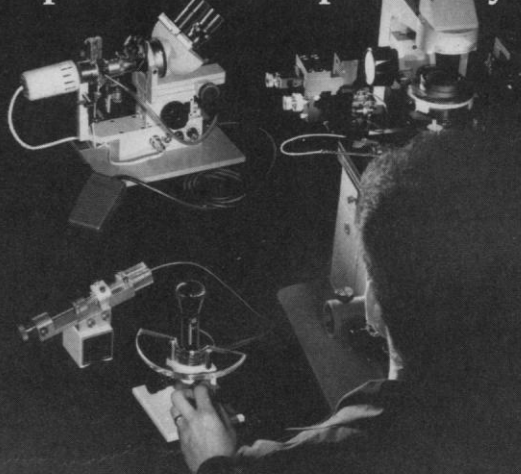
Wako Chemicals USA, Inc.

12300 Ford Road, Suite 130
Dallas, Texas 75234, U.S.A.
Telephone: (214) 484-7518
Telex: 293208 wako ur
Facsimile: (214) 484-7243

Wako Chemicals GmbH

Nissanstr. 2, 4040 Neuss 1
West Germany
Telephone: (02101) 35011
Telex: 8517001 wako d
Facsimile: (02101) 39879

INTRODUCING NARISHIGE USA's Complete Micromanipulation System



Narishige USA is the exclusive USA source for Narishige Co., Japan. We sell and service the newest Narishige products through a select group of dealers across the country.

The advantage to you is:

- Immediate Delivery • Local Sales and Service • Exceptional Values • One-Year Warranty

For the name of your local dealer or more information call:



NARISHIGE USA, INC.

One Plaza Road, Greenvale, NY 11548 • (516) 621-4588
(800) 445-7914

Circle No. 9 on Readers' Service Card

Circle No. 20 on Readers' Service Card

Activity-Dependent Learning

The Neural and Molecular Bases of Learning.

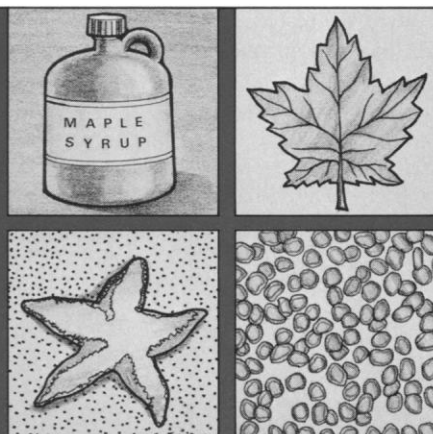
J.-P. CHANGEUX and M. KONISHI, Eds. Wiley-Interscience, New York, 1987. xiv, 559 pp., illus. \$110. Life Sciences Research Reports, 38. From a workshop, Berlin, F.R.G., Dec. 1985.

Mechanisms of learning and memory have preoccupied neurobiology for decades, since before neurobiology was recognized as a distinct discipline, and the Hebb synapse will be 40 next year. What has changed over the decades is not so much the basic issues as the way we look at them, and this is changing very rapidly. *The Neural and Molecular Bases of Learning* is timely because it is devoted to some of the currently popular ways of viewing the problem. The book places the traditional questions about learning and memory in the context of control of gene expression, second messenger systems, activity-dependent developmental changes, and neuronal network properties.

Reflecting the organizational principles of the Dahlem Workshop on which it is based, the book consists of four group reports on assigned topics along with the position papers that served as the basis for each group's deliberations. Three of four group reports stress the role of neuronal activity in learning and memory (although the exact meaning of "activity" differs from group to group).

The first group report ("Activity-dependent regulation of gene expression") is the most molecular one. It examines examples of how cellular activity can alter gene expression and focuses mainly on the way in which a particular cell's activity pattern can alter which genes that cell expresses. For example, the type of myosin muscle cells express depends on how frequently the muscle is instructed by motoneurons to contract. Although the types of activity effects discussed in this section are interesting, probably more relevant to learning is the phenomenon of transsynaptic control of gene expression, a rich topic, unfortunately mostly neglected in this volume, that includes more than a cell's "activity."

The second group report ("Activity-dependent regulation of synaptic transmission and its relationship to learning") covers the phenomena of long-term potentiation and long-term depression and includes several cellular analyses of invertebrate learning and a description of synaptic plasticity in the cerebellum and cerebral neocortex. The third report ("Activity-dependent modification of functional circuitry as a possible basis for learning") deals with possible structural changes underlying learning and the potential relationship between memory mecha-



Why researchers prefer the Wescor vapor pressure osmometer.

If your work requires determination of osmolality, there are basically two methods you can use—freezing point depression or vapor pressure depression. Aside from the fact that the Wescor vapor pressure osmometer (VPO) employs the most up-to-date technology, it has many other advantages over the freezing point depression method:

- The VPO does not require alteration of the physical state of the specimen—freezing point depression does.
- The VPO can be calibrated to accept sample volumes as small as 2 microliters.
- The VPO accepts any biological sample, including all body fluids and complex specimens such as tissue samples.
- The VPO avoids measurement artifacts that arise in the freezing point method due to elevated viscosity, particulate matter, inhomogeneities, and other physical characteristics of the sample.
- The VPO offers superior reliability because it is basically an electronic rather than a mechanical instrument.



If your work concerns studies of fluid and electrolyte balance in any form of life, it will pay to investigate the vapor pressure osmometer. We think you'll agree with those who already use the VPO—and prefer it.

Contact Wescor, Inc., 459 South Main Street, Logan, UT 84321 USA. (801) 752-6011 or (800) 453-2725. Telex 4930393 WESC UI

WESCOR®

Innovative instrumentation since 1970.