

28 June 1985 • Vol. 228 • 4707

\$2.50

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



NEW FROM BECKMAN:

*Digital accuracy
in a tabletop centrifuge*



The AccuSpin™ centrifuge from Beckman. It brings today's technology to tabletop centrifugation.

Controls are digital for accuracy that can't be matched by analog models. Flashing diagnostics and digital displays let you know run conditions at a glance. A digital speed control system maintains set speed with no overshoot—accurate to 10 rpm.

Programmed acceleration gives you a gentle start to protect gradients. Dual braking lets

you select a gentle stop. And the AccuSpin is so quiet, it's hard to believe it's running.

High Speeds for Rapid Throughput

The AccuSpin centrifuge reaches 5900 rpm and 4800 g with fixed angle rotors, 4200 rpm and 3200 g with the horizontal rotor. Maximum capacity is one full liter.

Designed for Convenience

The AccuSpin FR has an advanced, frost-free refrigeration system so there's never ice or water in the rotor chamber. Both models have an easy-to-clean, removable bowl and front motor access for fast brush changes and minimal down time.



Safety Features

Like all Beckman centrifuges, the AccuSpin is designed for UL listing and CSA approval. It's equipped with self-seating rotor buckets, steel barrier ring and automatic door interlock. To protect against tube breakage, the tube holders are rubber-based. Clear plastic covers provide aerosol protection—with no special tools or adapters required.

The digital AccuSpin centrifuge. It's setting new standards for tabletop centrifuges. For details ask your Beckman representative, or write: Beckman Instruments, Inc., P.O. Box 10200, Palo Alto, CA 94304.

BECKMAN

Circle No. 347 on Readers' Service Card

For higher RNA transcript yields, use Du Pont RNase-free SP6 RNA Polymerase.



Because Du Pont NEN Products SP6 RNA Polymerase is so free from contaminating ribonuclease, you can now synthesize many more full-length RNA transcripts than otherwise possible.

This high purity also means more reproducible results, shorter processing times, and lower costs.

Clearly the kind of performance you'd expect from NEN Products, pioneers in using this enzyme for preparing labeled RNA.

For extra convenience, we offer our SP6 RNA Polymerase either by itself (NEE-151) or in packform with pSP62-PL gene cloning vector (NEE-151A).

Compare your present RNA labeling techniques with ours. Ask your Du Pont NEN Research Products representative for our free SP6 Information Kit.

Or call toll-free today: 800-225-1572.

(In Mass. and international: 617-482-9595.)

NEN Research Products



Circle No. 331 on Readers' Service Card

SCIENCE

	This Week in <i>Science</i>	1478
LETTERS	Fusion Program: <i>M. McCormack</i> ; Trichinosis Test: <i>K. D. Murrell</i> ; On Objectivity: <i>D. C. Stolinsky</i> ; Solitary Grazers: <i>J. B. McClintock</i>	1484
EDITORIAL	Electric Power from the North	1487
ARTICLES	The Sociogenesis of Insect Colonies: <i>E. O. Wilson</i>	1489
	The Unusual <i>var1</i> Gene of Yeast Mitochondrial DNA: <i>R. A. Butow</i> , <i>P. S. Perlman</i> , <i>L. I. Grossman</i>	1496
	Organization of Ion Channels in the Myelinated Nerve Fiber: <i>S. G. Waxman</i> and <i>J. M. Ritchie</i>	1502
NEWS AND COMMENT	Italian Science and the "Rubbia Effect"	1508
	Slowdown Urged in High Energy Physics	1509
	A Guarded Endorsement for Shock Therapy	1510
	New Directions for the Smithsonian	1512
	IOM Elects New Members	1513
	<i>Briefing</i> : U.S.-India Science Accords Renewed; Plans for Big Science Facilities Scrutinized; Cyclamate's Safety Still Unresolved; Comings and Goings; Gore Seeks to Resurrect Bioethics Commission	1514
RESEARCH NEWS	Making Mutant Mice by Gene Transfer	1516
	How Do Proteins Find Mitochondria?	1517
	<i>Geophysical Briefing</i> : Magnetospheric Workings: AMPTE Draws a Blank; Were North Pacific Waters Sinking 18,000 Years Ago?; Antarctic Meteorites: Are They a Breed Apart?; Suture Between North America and Africa Found	1519

BOARD OF DIRECTORS

DAVID A. HAMBURG
Retiring President, Chairman

GERARD PIEL
President

LAWRENCE BOGORAD
President-Elect

ROBERT W. BERLINER
MILDRED DRESSERHAUS

DONALD N. LANGENB
DOROTHY NELKIN

CHAIRMEN AND SECRETARIES OF AAS SECTIONS

MATHEMATICS (A)
Daniel Zelinsky
Lynn Arthur Steen

PHYSICS (B)
Ralph O. Simmons
Rolf M. Sinclair

CHEMISTRY (C)
Rustum Roy
Jean'ne M. Shreeve

ASTRONOMY (D)
David Morrison
John E. Gaustad

PSYCHOLOGY (J)
John I. Lacey
William N. Dember

SOCIAL, ECONOMIC, AND POLITICAL SCIENCES (K)
David Mechanic
David L. Sills

HISTORY AND PHILOSOPHY OF SCIENCE (L)
Edward Grant
Arthur L. Norberg

ENGINEERING (M)
Henry McGee
W. Edward Lear

EDUCATION (Q)
John F. Schaff
Joseph D. Novak

DENTISTRY (R)
Gordon H. Rovelstad
Harold M. Fullmer

PHARMACEUTICAL SCIENCES (S)
Edward G. Rippie
Betty-ann Hoener

INFORMATION, COMPUTING, AND COMMUNICAT
Karen B. Levitan
Elliot R. Siegel

DIVISIONS

ARCTIC DIVISION

Robert White
President

Gunter E. Weller
Executive Secretary

CARIBBEAN DIVISION

Juan A. Bonnet, Jr.
President

Lucy Gaspar
Secretary-Treasurer

PACIFIC DIVISION

Walter Gardner
President

Alan E. Levit
Executive Dir

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with *The Scientific Monthly*: Copyright © 1985 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): \$60. Domestic institutional subscription (51 issues): \$98. Foreign postage extra: Canada \$24, other (surface mail) \$27, air-surface via Amsterdam \$65. First class, airmail, school-year, and student rates on request. Single copies \$2.50 (\$3 by mail); back issues \$3 (\$3.50 by mail); Biotechnology issue, \$5 (\$5.50 by mail); classroom rates on request. 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 0036-8075/85 \$1 + .10. Postmaster: Send Form 3579 to Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Science is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

BOOK REVIEWS	Rio Grande Rift, reviewed by K. Burke; Application of Field Theory to Statistical Mechanics, A. S. Wightman; The Pain System, H. L. Fields; Corals and Coral Reefs of the Galápagos Islands, E. A. Chornesky; Books Received	1521
REPORTS	Zinc Deposition in Acid Lakes: The Role of Diffusion: R. Carignan and A. Tessier	1524
	Brachiopods versus Mussels: Competition, Predation, and Palatability: C. W. Thayer	1527
	Authigenic Potassium Feldspar in Cambrian Carbonates: Evidence of Alleghanian Brine Migration: P. P. Hearn, Jr., and J. F. Sutter	1529
	Expression of the <i>pX</i> Gene of HTLV-I: General Splicing Mechanism in the HTLV Family: M. Seiki et al.	1532
	HTLV <i>x</i> -Gene Product: Requirement for the <i>env</i> Methionine Initiation Codon: W. Wachsmann et al.	1534
	Predisposition to Hookworm Infection in Humans: G. A. Schad and R. M. Anderson	1537
	Analysis of T-Cell Receptor Gene Rearrangement and Expression in Human Natural Killer Clones: J. Ritz et al.	1540
	Imaging Elemental Distribution and Ion Transport in Cultured Cells with Ion Microscopy: S. Chandra and G. H. Morrison	1543
	Dissociation of Antitumor Potency from Anthracycline Cardiotoxicity in a Doxorubicin Analog: B. I. Sikic et al.	1544
	Localization of the Gene Encoding the Human Interleukin-2 Receptor on Chromosome 10: W. J. Leonard et al.	1547
	Malignant Transformation of Erythroid Cells in Vivo by Introduction of a Nonreplicating Retrovirus Vector: L. Wolff and S. Ruscelli	1549
	Technical Comments: Acid Rain: Statistical Analysis of Ionic Correlations Questioned: R. J. Charlson and B. R. Kowalski; E. Gorham, F. B. Martin, J. T. Litzau	1552
PRODUCTS AND MATERIALS	Liposome Apparatus; Cell Sorter; Assay for Carcinoembryonic Antigen; Clinical Chemical Analyzer; Density Gradient Formers; Laboratory Data System; Automated Carbon Analyzer; Literature	1554

COVER

Articulate brachiopods (three *Terebratalia transversa*, curved gapes) and other suspension-feeding marine benthos on steep 70 degree rock, Turn Rock, San Juan Channel, Washington (depth, 70 feet). Yellow scallop (*Chlamys*) with marginal eyes; six edrioasteroid-like plated holothurioids (*Psolus chitonoides*, salmon color), three with crimson feeding podia extended; single orange solitary coral (*Balanophyllia elegans*) and branched bryozoan, both above the scallop. Purple crust is coralline alga *Lithothamnion*. (Field of view about 10 centimeters wide). See page 1527. [Charles W. Thayer, Department of Geology, University of Pennsylvania, Philadelphia 19104]

SAWYER
E. WIDNALL

LINDA S. WILSON

WILLIAM T. GOLDEN
Treasurer

WILLIAM D. CAREY
Executive Officer

PHY AND GEOGRAPHY (E)
H. Matthews III
L. McCammon

BIOLOGICAL SCIENCES (G)
Betty M. Twarog
Judith P. Grassle

ANTHROPOLOGY (H)
Albert C. Spaulding
Priscilla Reining

IL SCIENCES (N)
J. Fishman
n E. Rhoads

AGRICULTURE (O)
Roy G. Creech
Ralph J. McCracken

INDUSTRIAL SCIENCE (P)
Robert H. Pry
Robert L. Stern

TICS (U)
Hunter
J. Wegman

ATMOSPHERIC AND HYDROSPHERIC (W)
F. Kenneth Hare
Bernice Ackerman

GENERAL (X)
Harold P. Green
Rodney W. Nichols

WESTERN AND ROCKY MOUNTAIN DIVISION

onald J. Nash
ssident

M. Michelle Balcomb
Executive Director

merican Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects
rther the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility,
ve the effectiveness of science in the promotion of human welfare, and to increase public understanding and
ition of the importance and promise of the methods of science in human progress.

Social insects

Ants, bees, wasps, and termites live cooperatively in colonies that often are very large (one ant "supercolony" had 306 million workers and 1 million queens) (page 1489). Wilson describes survival strategies that may contribute to the ecologic success enjoyed by social insects. Numerous individuals concentrate on performing single tasks, thus increasing the probability that the task will be accomplished. Each individual has specialized skills. Each belongs to a caste, determined by a series of environmental factors acting during development. Silent capabilities can, however, be restored in emergencies, even in adults. During its lifetime, an individual may perform a number of tasks, each taking it farther from the center of the nest until, in old age, it moves outside the nest to forage or to defend the colony. An understanding of insect colonial life may help clarify organizational principles of developmental and physiological processes in higher organisms.

Mussels and brachiopods

When given a choice in the laboratory, fish, starfish, snails, and crabs all preferred mussels "on the half-shell" to brachiopods that, served the same way, caused convulsions and regurgitation (page 1527). These shelled organisms face common predators in the sea. Thayer studied the survival of brachiopods in trays planted underwater. Some trays also contained mussels. When predators were excluded, mussels overgrew and smothered brachiopods. When predators were given access (see cover), brachiopod survival improved because the mussels were eaten. Brachiopods were one of the most abundant marine organisms in the Paleozoic era, but mussels predominated later, in the Mesozoic. The mobility of mussels may have given them an advantage during the Mesozoic, and the "bad taste" of the brachiopods may then have evolved as protection from increasing numbers of predators.

Clues from feldspar

The discovery of 300-million-year-old potassium feldspar in 500-million-year-old limestones in the Appalachian mountains provides evidence for a migration of fluids during the time this mountain chain was forming (page 1529). The age of the feldspar, a common mineral of Earth's outer crust, was determined by measuring an argon isotope that forms during radioactive decay. Hearn and Sutter suggest that the feldspar formed when potassium-rich salt solutions (brines) were forced out of nearby sedimentary rocks and reacted with sand and clay in the limestones. These results could help explain how and when nearby deposits of zinc and lead formed, because these elements may have been dissolved in the same brines and deposited when conditions were favorable.

Hookworm

The most economical and effective control for hookworm in endemic areas may be intensive drug therapy for heavily infected individuals rather than blanket therapy for the community (page 1537). Schad and Anderson studied hookworm in a village in India before and after a community-wide drug treatment program. Certain individuals were particularly susceptible, becoming heavily loaded with worms at every reinfection. Ten percent of the villagers had 60 percent of the worm burden. In India, monsoon seasons create conditions favorable for infections. Larvae hatch from eggs in moist, feces-contaminated soil. They penetrate the skin, usually through the feet. The worms hook onto the host's intestinal lining, suck blood, cause anemia, and produce eggs that are excreted in the feces. It is not known whether such factors as genetic predisposition, hygiene, or socioeconomic status contribute to the special susceptibility of certain individuals to this infection.

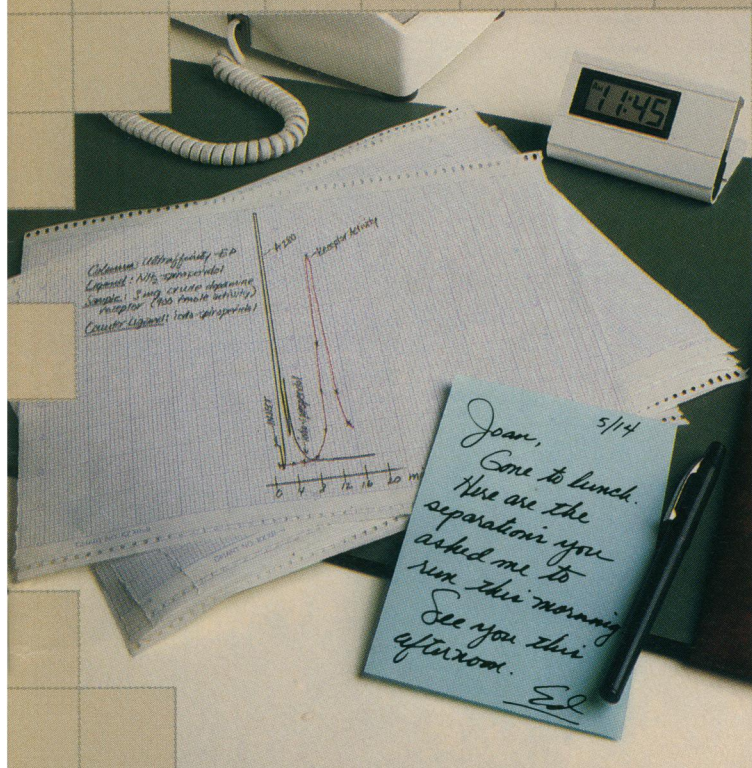
Ion microscopy

The distribution of simple ions (such as sodium, calcium, phosphorus, and magnesium) that are crucial for regulating biochemical processes inside cells can be studied by ion microscopy (page 1543). Chandra and Morrison describe the distributions of sodium and potassium ions in cultured rat cells in a prototype experiment. Freeze-dried samples were bombarded by a beam of ions; through a process called sputtering, atoms at the surface of the sample were emitted as secondary ions. The emitted ions passed through a mass spectrometer, where they were identified. The final visual image provided a picture of their distribution in the cells, because spatial relationships among ions were retained. Cells expend enormous amounts of energy maintaining the appropriate balance of ions, and this technique should be useful for defining ionic relationships in a range of physiological conditions.

New cancer drug

A new drug, MRA-CN, is 150 to 1600 times more potent in killing tumor cells in culture than is doxorubicin, a major anticancer agent from which it is derived; and some tumor cells that resist doxorubicin can be killed by MRA-CN (page 1544). These two anticancer drugs are anthracyclines, a class of agents known to disrupt DNA. A ring structure inserted in MRA-CN in place of an amino group in doxorubicin may, in addition, cross-link strands of DNA. Sikic *et al.* found that both drugs caused similar cardiotoxicity (a major liability in doxorubicin use) in a model system. However, because MRA-CN is so much more potent, lower doses might be used and toxic effects minimized. The new drug is being evaluated for use in targeted rather than systemic therapies, which would further reduce toxicity.

Now, affinity separations...



In minutes.

Introducing Fast Affinity Chromatography. 50X faster than soft gels.

Beckman's new Ultrafinity™-EP column makes it all possible. With Fast Affinity Chromatography (FAC), you can purify large quantities of virtually any protein in a few minutes, instead of several hours—or even many days.

In most cases, you'll have analysis results 50 to 200 times faster than with conventional soft gel columns.

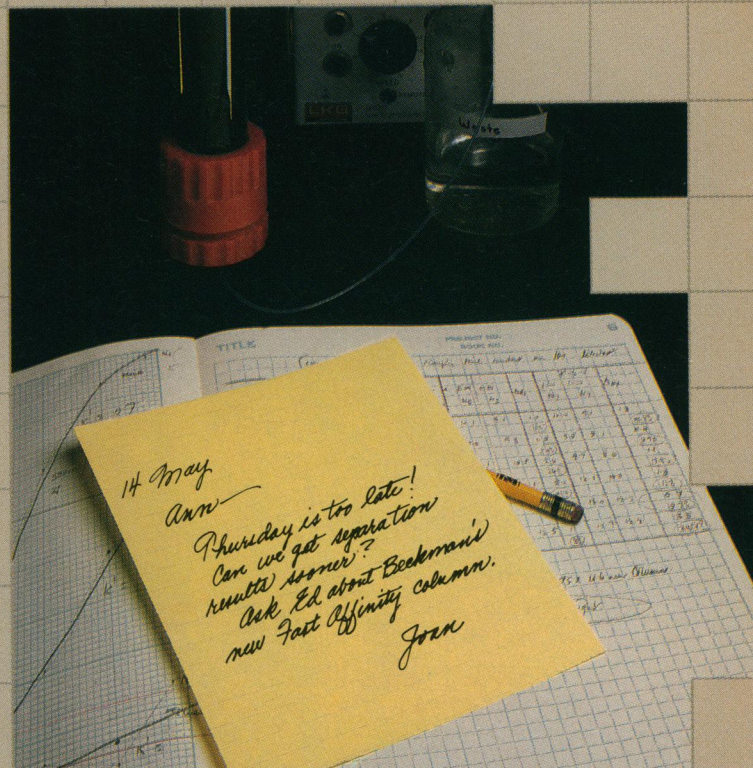
Everything a soft gel does and more.

Because the Ultrafinity-EP column allows a wider range of ligand-to-macromolecule interactions, you'll be able to isolate everything from weakly binding proteins to strongly bound moieties. You can even immobilize enzymes with high activity.

In short, you'll get capability you never had with soft gels.

Easier to use.

Fast Affinity Chromatography simplifies each affinity step... from derivatization through load, wash and elute. What's more, Ultrafinity-EP columns overcome the problems of ligand leakage and microbial degradation that are often associated with agarose and other affinity supports.



Not hours.

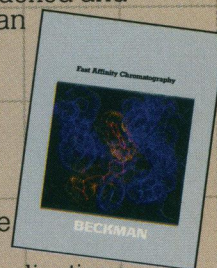
These unique columns come pre-packed and ready to derivatize. Also they provide an excellent environment for biologically active molecules.

Free booklet on Fast Affinity Chromatography.

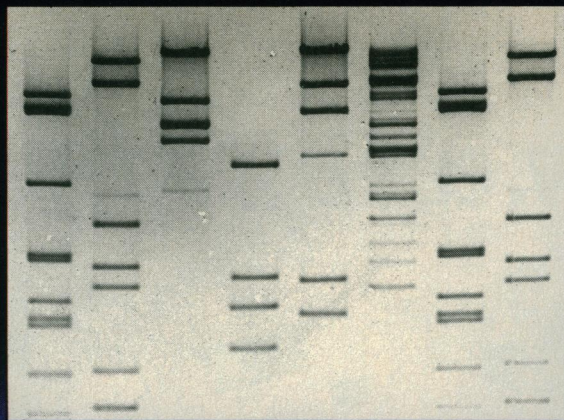
Write us to get your free copy of *Fast Affinity Chromatography*. This detailed booklet explains the complete methodology of FAC including step-by-step procedures for six practical applications.

To bring Fast Affinity Chromatography into your lab, see your local Beckman representative today. If the Ultrafinity-EP column doesn't live up to the claims made here, return it within 30 days of purchase for your money back.

Beckman Instruments, Inc., Altex Scientific Operations, 1716 Fourth Street, Berkeley, CA 94710. (415) 527-5900. Offices in major cities worldwide.



BECKMAN

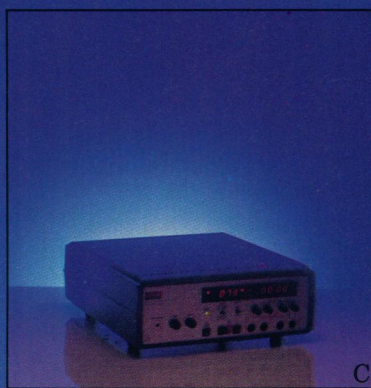


A better way to get uniform band spacing

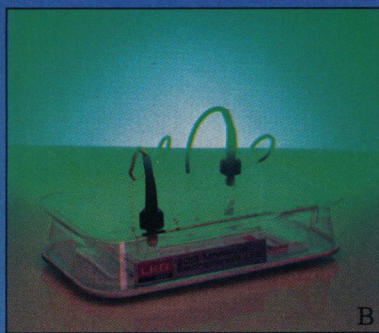
Wedge-shape



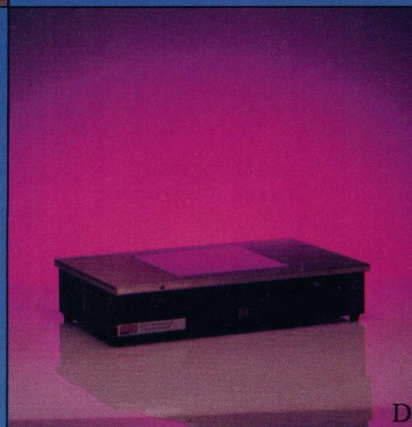
A



C



B

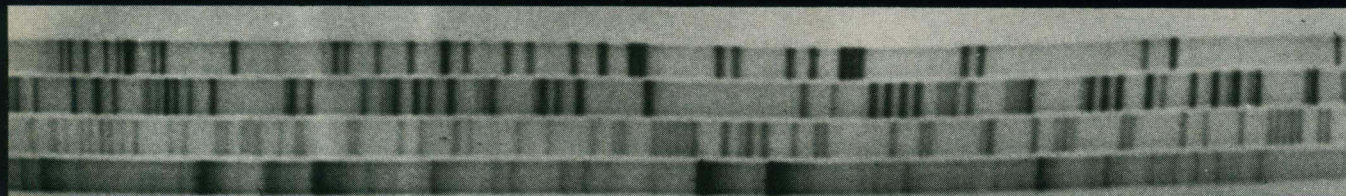


D

No longer need you resort to multiple loading with its increased time and greater required sample volumes. Whether for nucleotide separations in agarose gels or sequencing in acrylamide gels, the technique of wedge-shaped field strength gradients lets you get linearly spaced bands for maximum resolution and ease of reading. Two new instrument systems from LKB render the technique rapid, reliable and above all, reproducible.

In the Maxiphor™ horizontal electrophoresis unit (A), it is the simplest thing in the world to pour wedge-shaped agarose bridge gels directly on the central platform when adjustable legs beneath the cathode dam are extended. Gels can be run rapidly at high power even without external buffer circulation, the half-litre reservoir providing enough internal cooling capacity even at 500 volts. Want to use the Maxiphor for constant thickness bridge or submarine gels? Just as easily done. And you can run up to 40 samples every time.

For greatest economy and speed in fragment separations, the sibling Miniphor™ unit (B) with its integral cooling jacket lets you run submarine gels at very high power. Companion to both units is the LKB constant power supply (C) that permits regulation to 1 volt or 1 milliamp with 1 minute precision for automated runs. And completing the system is the MacroVue™ transilluminator (D) whose optical design permits you to detect as little as 1 ng DNA in a single band. This instrument makes publication grade photography easy.

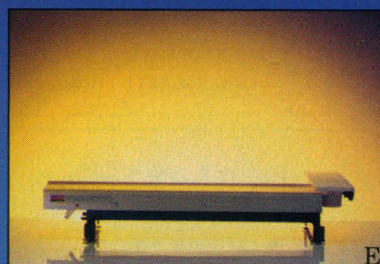


casting in DNA/RNA electrophoresis and gradient gels

In the Macromould™ unit (E), you can cast wedge-shaped acrylamide gels that are covalently bonded to a glass plate for maximum support. (If you are interested in constant thickness gels, you can cast them as thin as 0.1 mm, allowing much greater use of ³⁵S labeling with its attendant virtues of lower scattering and better resolution – without wrapping or refrigeration – as well as longer half-life and improved safety.)

When gels are run in the Macrophor™ vertical electrophoresis unit (F), the unique thermostatic plate ensures constant high temperature, letting you use every millimeter of width to run a full 36 samples – without smiling. Consorts to the Macromould and Macrophor are the compact MultiTemp™ II thermostatic circulator (G) and the Macrodrive™ 5 high capacity power supply (H) with its digital display. And just as with the horizontal electrophoresis units, you can get here a full complement of chemicals, accessories and technical literature.

Two informative illustrated bulletins are waiting for you. Request them today.



LKB-Produkter AB, Box 305, S-16126 Bromma, Sweden. Tel +46(8)980040, telex 10492

Antwerp (03)218 93 35 · Athens-Middle East +30(1)894 73 96 · Copenhagen (01)29 50 44 · London (01)657 88 22

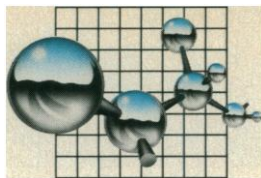
Lucerne (041)55 44 57 · Madras (044)45 28 74 · Moscow (095)256-9002 · Munich (089)85 830 · Paris (6)928 65 07

Rome (06)39 90 33 · Stockholm (08)98 00 40 · Tokyo (03)293-5141 · Turku (021)678 111

Vienna +43(222)92 16 07 · Washington (301)963 3200 · Zoetermeer (079)31 92 01

Over 60 qualified representatives throughout the world.

Circle No. 9 on Readers' Service Card



Symposium
of
American
Protein
Chemists

September 30–October 2, 1985
San Diego, California

Sessions I and II: Techniques of Protein Structural Analysis

Chair—Ruth Angeletti, University of Pennsylvania, Philadelphia, PA
Co-Chair—Don Capra, University of Texas, Dallas, TX

Session III: Amino Acid Analysis/PTH Amino Acid Analysis

Chair—George Tarr, University of Michigan, Ann Arbor, MI
Co-Chair—Michael Hunkapiller, Applied Biosystems, Inc., Foster City, CA

Session IV: Micropurification Methodology

Chair—Robert Heinrikson, Upjohn Co., Kalamazoo, MI
Co-Chair—James L'Italien, Molecular Genetics, Minnetonka, MN

Session V: HPLC of Biologically Active Proteins and Peptides

Chair—Stanley Stein, Schering-Plough Corporation, Bloomfield, NJ
Co-Chair—Ralph Bradshaw, University of California, Irvine, CA

Session VI: Applications and Interpretations of Protein Sequence

Chair—Mark Hermodson, Purdue University, West Lafayette, IN
Co-Chair—Murray Summers, Beckman Instruments, Inc., Palo Alto, CA

Sessions VII and VIII: Post Translational/Active Site Studies

Chair—Fred Hartmann, Oakridge National Laboratory, Oakridge, TN
Co-Chair—Ken Walsh, University of Washington, Seattle, WA

Special Session: Applications of Site Directed Mutagenesis

Chair—John H. Richards, California Institute of Technology, Pasadena, CA
Co-Chair—John E. Shively, Beckman Research Institute of City of Hope, Duarte, CA

Workshop: Presentation and Discussion of Results of Distributed Peptide

Chair—Joachim Spiess and Jean Rivier, Salk Institute, La Jolla, CA
Co-Chair—Rusty Kutney, DuPont Experimental Station, Wilmington, DE

For registration information contact:

Shirley E. Schlessinger,
Symposium Manager
400 East Randolph,
Chicago, Illinois 60601
312-527-2011

Circle No. 351 on Readers' Service Card

The first volume in the AAAS Series on Issues in Science and Technology

SCIENCE AS INTELLECTUAL PROPERTY

Who Controls Scientific Research?

DOROTHY NELKIN, *Cornell University*

Who controls research? This controversial question raises critical issues of professional sovereignty, scientific secrecy, and proprietary rights. And as the scale and structure of contemporary American research has changed, the debate over these issues has intensified.

To whom does data belong: the scientist who does the research or the federal agency that pays for it? Does public funding mean public access and public control? Does the Freedom of Information Act apply to research in progress? Can scientists use their data and ideas in whatever way they choose?

In *Science as Intellectual Property*, Dorothy Nelkin examines varying points of view and offers examples

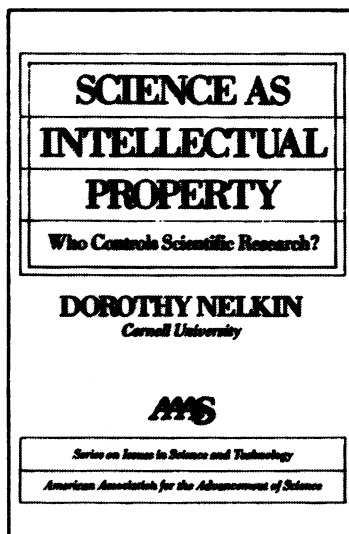
and cases to illustrate the problems and dilemmas scientists, administrators, and the public face—and will continue to face—as the interests of scientists, the rights of citizens, and the security needs of government and industry come into increasing conflict.

144 pp. 949080-4 cloth \$15.95

144 pp. 949090-1 paper \$7.95

About the author: Associated with Cornell University since 1963, Dorothy Nelkin is now Professor in the Program on Science, Technology, and Society and in the Department of Sociology.

To order, contact: Macmillan Publishing Company, 866 Third Avenue, New York, N.Y. 10022.
Attn.: Eileen Kennedy



Did you say "QVECs"?

"Have you heard about QVECs?"

"Q-Vecks? That's the new mathematical theory developed by that fellow from Cambridge."

"Kuvecs? Of course. Those small Russian game birds."

"Cuevecs? You mean those things you use to polish the ends of cue sticks?"

"Que-vecques? Oh, sure. They're little French pastries oozing with whipped cream."

"Cuvecs? I think it has something to do with wine."



Try it yourself. Take any half-dozen well-informed staff members and say knowingly, "Of course, you've heard about these new QVECs." You'll be treated to at least five different versions of precisely what QVECs are *not*.

What no one will admit to—especially at the Dean's annual reception—is that they have no idea whether QVECs are a cream-filled French pastry or the focus of the latest microchip research.

A pity. Because for many of your people, TIAA-CREF's QVECs (short for *Qualified Voluntary Employee Contributions*) represent an intelligent, convenient and highly competitive *tax-deferred* alternative to an IRA.

In fact, if any members of your staff are considering buying IRAs, your institution should be offering them TIAA-CREF QVECs—for these important reasons.

- ☐ QVECs provide a lifetime income, unlike most IRAs.
- ☐ QVECs currently offer attractive rates of return.
- ☐ QVECs offer the investment choice between two funds—TIAA and CREF.
- ☐ QVECs are portable—when staff move to another institution that offers QVECs, their QVECs can go right along.

So sooner or later you can expect to be interrogated on the subject of QVECs by the head of business studies or the rising star of the history department. And you'll want to have the facts at your command.

We can provide them. For a full briefing, simply return the form below or write us at QVECs, TIAA-CREF, 730 Third Avenue, New York, New York 10017. Then, when the subject comes up, as it's sure to do, you'll be ready to set the record straight.

QVECs. The educated alternative to an IRA.



Teachers Insurance and Annuity Association
College Retirement Equities Fund
730 Third Avenue
New York, New York 10017

Yes. Please send me *free* all I need to become an instant expert on QVECs, so I can pass the word on to my staff members.

Name _____

Title _____

Institution _____

Address _____

City _____ State _____ Zip _____

SCI-6-28-85

IBM-PC OWNERS*

(A DIGITIZER AND INTEGRATED
SCIENTIFIC GRAPHICS SYSTEM
FOR ONLY \$495.)

A versatile digitizing pen;
accurate, reliable and rugged.

A Turnkey Measurement System

Linear • perimeter • area • x, y
coordinates • scaling • statistics:
standard deviations, correlations,
regression lines, transforms.

A Pocket Drafting System Multiple
CAD-like aids auto lines, boxes,
ellipses, 3-d, enlarge, shrink, invert •
color lift-off • symbol libraries •
many type fonts.

A Quick-Slide System Bar-graphs •
line graphs • all from numbers, with
auto-edit • auto-scaling • sizing •
conversion • labeling • coloring •
programmed for Polaroid Palette.

Display and Printout "Slide-Show"
on screen • Printout on dot matrix or
color printers • choice of size, shape.

We're the scientist's friend. Try
the system for 15 days. Absolutely
free. Call toll-free 1-800-874-1888 or
in California 415-331-3022.

The Computer Colorworks, 3030
Bridgeway, Sausalito, CA 94965.

*Apple version \$299

Circle No. 319 on Readers' Service Card

SCIENCE

Posters

The following posters of *Science*
covers are available:

30 March 1979, Tropical flowering
tree;

23 February 1983, Landsat photo
of Detroit, Michigan;

29 July 1983, Cheetah;

2 December 1983, Snowshoe
hare;

23 December 1983, Cathedral
window/DNA molecule.

Combination of space covers in
scroll format: 1 June 1979, 23 No-
vember 1979, 10 April 1981.

Price is \$5 each (prepaid).

Write to AAAS, Department POST,
1515 Massachusetts Avenue, NW,
Washington, D.C. 20005.

LETTERS

Fusion Program

The article "Hard times in magnetic fusion" by Mark Crawford (News and Comment, 31 May, p. 1069) states that I am "... gone." This letter is to observe that my "goneness" (to paraphrase Mark Twain) has been somewhat exaggerated. In particular, my interest in the magnetic fusion program remains strong, and I have attempted, as a private citizen, to contribute to it.

This year I suggested to congressional committees that the Department of Energy (DOE) be requested to study the concept of a magnetic fusion research facility at a DOE site with remoteness, security, Nuclear Regulatory Commission and DOE supervision, tritium handling capability, available hot labs, waste disposal facilities, low-cost electric power, and scientific and engineering support.

The rationale for this suggestion is based partially on the now generally accepted realization that the future of the magnetic fusion program probably lies in any of several machines which are much smaller than today's large mainline experimental devices and which could be tested much more cheaply and quickly.

Because some small machine concepts may evolve into competitive devices for the production of electricity, it is my opinion that private industry could be drawn into R&D programs for them, if there were a facility where they could be tested with deuterium-tritium burns. (The production of 14 mev neutrons and the resultant induced radioactivity precludes such testing at a university campus or at a conventional industrial laboratory.)

A DOE fusion research facility, which could be on-line 5 to 7 years after commitment, would be easily affordable, even with a reduced fusion budget. It could give life and meaning to a program that may otherwise be in great danger.

The United States will need all the electric generating capacity it can get, starting before the year 2000 and for an indefinite period thereafter. With luck and prudent leadership now, fusion power could enter the generation market early in the 21st century. Citizen involvement from within the scientific community could help make that possible.

MIKE McCORMACK*

McCormack Associates, Inc.,
508 A Street, SE,
Washington, D.C. 20003

*Former member of Congress.

Trichinosis Test

I am pleased that the ELISA (enzyme-linked immunosorbent assay) test developed for swine trichinosis by the U.S. Department of Agriculture received attention in *Science* (News and Comment, 8 Feb., p. 621). Because the eventual application of this important control strategy by private industry will depend upon a realistic understanding of its capabilities and its potential cost-benefit features, several points mentioned in Gina Kolata's article should be clarified.

It is implied in the article that the "window of vulnerability" of the ELISA, that is, the discrepancy in time between development of infective muscle larvae and detection of antibody, is insignificant. However, there is evidence that the muscle larvae may reach the infective stage as early as 16 to 17 days after initial infection, rather than 24 days (1, p. 42). In contrast to heavily infected hogs, many with light infections (one larvae per gram of muscle or less) may not produce antibody levels detectable by the ELISA until 4 to 5 weeks or longer after infection; this provides an interval of 2 weeks or more in which infectious hogs may go undetected (2). Epidemiological investigations reveal that the majority of naturally infected hogs have such light infections (3, 4). How frequently this situation may arise under natural conditions is at present conjectural, and many authorities in this field feel that such lightly infected hogs are not an important public health hazard. Still, it is not clear that serological tests can provide complete detection.

Because ELISA testing of market hogs is not the only potential inspection procedure now being given serious consideration in the United States, the statement in the article that the pooled digestion test has the disadvantage of not allowing convenient tracking of individual muscle samples should be clarified. The procedure as developed in Denmark (and now officially sanctioned by the European Economic Community) easily allows testing of individuals in a positive pool. Given the very low prevalence of infected swine in the United States (about 1 hog in 1000), the probability of finding a positive pool requiring individual testing is only 1 in 50. Recent epidemiological investigations show that most infected hogs are marketed through smaller slaughterhouses (5), many of which will require relatively unsophisticated inspection techniques. Therefore the pooled digestion test could prove to be a successful alternative.

Several other points require comment. The number of deaths from trichinosis

reported to the Centers for Disease Control is *not* several per year; such deaths occur infrequently. Also, it is not correct that pigs from southeastern farms have a high incidence of trichinosis. Except for occasional cases of swine and human trichinosis in Louisiana, the south as a whole appears to have one of the lowest incidence rates for trichinosis of any region of the United States.

Finally, it should be noted that Ruitenbergh and Van Knapen and their associates in the Netherlands first published the basic ELISA method for swine trichinosis and provided a scheme for its application for large-scale testing (6).

K. DARWIN MURRELL

*Helminthic Diseases Laboratory,
Animal Parasitology Institute,
U.S. Department of Agriculture,
Agricultural Research Institute,
Beltsville Agriculture Research Center,
Beltsville, Maryland 20705*

References

1. J. B. Villella, in *Trichinosis in Man and Animals*, S. E. Gould, Ed. (Thomas, Springfield, Ill., 1970), chapter 11, pp. 19-60.
2. F. Van Knapen, *Vet. Parasitol.* 7, 109 (1980); H. R. Gamble, W. R. Anderson, C. E. Grahm, K. D. Murrell, *ibid.* 13, 349 (1983); G. L. Seawright, D. Despommier, W. Zimmermann, R. S. Isenstein, *Am. J. Trop. Med. Hyg.* 32, 1275 (1983).
3. W. J. Zimmermann and P. J. Brandly, *Publ. Health Rep.* 80, 1061 (1965).
4. G. A. Schad, *Prev. Vet. Med.*, in press.
5. G. A. Schad *et al.*, *ibid.*
6. E. J. Ruitenbergh, P. A. Steerenberg, J. M. Brosi, J. Buys, *Bull. W. H. O.* 51, 108 (1974); E. J. Ruitenbergh, I. Lungstrom, P. A. Steerenberg, J. Buys, *Wiad. Parazytol.* 21, 747 (1975).

On Objectivity

The mind tends to categorize things as "good" or "bad" and then to become relatively impervious to information that runs counter to these initial impressions. For example, disarmament proposals are "good." Some of them would weaken us to the point that war would become more likely, but anyone saying so is called a "hawk," at the very least. Automotive pollution-control devices are "good." Cars equipped with three-way catalysts emit from 20 to 150 times more sulfuric acid than older cars, but to discover this one must read an obscure Environmental Protection Agency paper. Acid rain is "bad," but it is caused by industrial pollution, so one need not worry about cars. Removing lead from gasoline is "good." Older cars need a small amount of lead to lubricate their exhaust valves and prevent worsening of both performance and emissions, but one learns this from car magazines, not scientific journals. Moreover, the composition of unleaded gasoline must be altered to restore antiknock properties. What long-

term health effects this alteration causes are unknown, but to my knowledge the question has not been raised.

It is as though doing something "good" absolves one from the responsibility of knowing about, much less preventing, any foreseeable bad results of such action. This mode of thinking is all too human, but it should be guarded against by scientists and particularly by editorial boards.

DAVID C. STOLINSKY

*University of Southern California,
School of Medicine, Los Angeles 90033*

Solitary Grazers

Roger Lewin's recent article on increased foraging efficiency in gregarious grazers (*Research News*, 3 May, p. 567) indicates it is "theoretically" possible for a solitary grazer to maintain a grazing lawn on its own and therefore reap the benefits of enhanced food quality. However, Lewin suggests that predation would select against such solitary grazing patterns. In fact, there are solitary vertebrate grazers that increase feeding efficiency by maintaining "grazing plots." Bjorndal (1) found that the green turtle *Chelonia mydas* maintained grazing plots of young leaves of the abundant turtle grass *Thalassia testudinum* by consistent recropping. The result was consumption of significantly more digestible forage (11 percent higher in protein and 100 percent lower in lignin) than ungrazed older leaves. Therefore, enhanced nutrition through maintenance of a grazing lawn is not only selected for in some cases of gregarious grazing vertebrates, but also in some solitary grazers. In contrast to gregarious grazers, solitary grazers can avoid concomitant costs associated with increased resource competition while still enjoying enhanced foraging efficiency.

JAMES B. MCCLINTOCK

*Center for Marine Studies,
University of California,
Santa Cruz 95064*

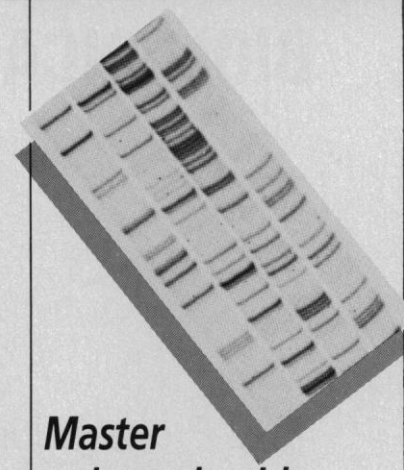
References

1. K. A. Bjorndahl, *Mar. Biol.* 56, 147 (1980).

Erratum: In the article, "Generics, Roche joust for Valium market" (*News and Comment*, 26 Apr., p. 472), a word was inadvertently omitted from a quote by Wallace Mendelson, a researcher at the National Institute of Mental Health. The quote should have read that there is "no established way to predict from Valium's effects on a normal person's EEG's, its ability to relieve anxiety, relax muscles, or treat convulsions."

Erratum: The authors of the Research Article "Chromatin structure and de novo methylation of sperm DNA: Implications for activation of the paternal genome" (31 May, p. 1061) were Mark Groudine and Kathleen F. Conklin. Conklin's name was misspelled in the Table of Contents and in the by-line.

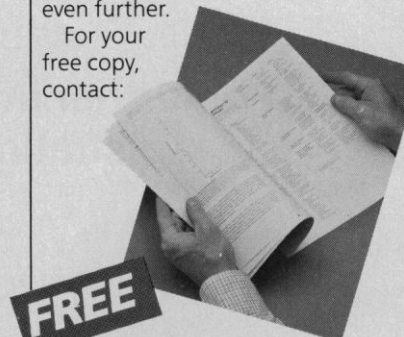
**Page
after page
on
PAGE.**



Master polyacrylamide gel electrophoresis.

You don't need to be a polymer chemist to master polyacrylamide gel electrophoresis (PAGE). At least not if you have Bio-Rad's new Technical Bulletin 1156, "Acrylamide Polymerization—A Practical Approach." It includes page after page of useful information on such topics as • critical parameters • polymerization protocols • polymerization analysis • handling of gel reagents. Also a section on troubleshooting! With this document to help, the novice can master PAGE and the experienced user can optimize separations even further.

For your
free copy,
contact:



FREE

BIO-RAD

Bio-Rad Laboratories—
Chemical Division
2200 Wright Avenue
Richmond, CA 94804
(415) 234-4130

Circle No. 288 on Readers' Service Card

ANNOUNCING . . .

**THE THIRD ANNUAL CONGRESS ON
AUTOMATION, SCALE-UP,
AND THE ECONOMICS OF
BIOLOGICAL PROCESS ENGINEERING[©]***

Chairman: Dr. Gerald Hawk, Zymark Corp.

**JANUARY 30-31, 1986
Baltimore, Maryland**

Subjects Will Include:

Cell Propagation • Fermentation • Cell Optimization • Cell Characterization • Cell/Tissue Culture • Process Monitoring and Control • Automated Immunoassay • Purification • Biosensors • Quality Assurance and Quality Control with Respect to GMP & GLP • Regulation • Economic Issues • Packaging Technology • Data Reduction & Documentation

**DEADLINE FOR SUBMISSION OF
COMPLETED ABSTRACTS: SEPTEMBER 15, 1985**

Organized by Scherago Associates, Inc.
And
Genetic Engineering News

**For further information concerning abstract forms,
registration, and accommodations, contact:**

Edward B. Ruffing
Scherago Associates, Inc.
1515 Broadway
New York, NY 10036
(212) 730-1050

**Copyright © 1984 Scherago Associates, Inc.*

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: WILLIAM D. CAREY

Editor: DANIEL E. KOSHLAND, JR.

Deputy Editors

PHILIP H. ABELSON (*Engineering and Applied Sciences*), JOHN I. BRAUMAN (*Physical Sciences*), GARDNER LINDZEY (*Social Sciences*)

Editorial Board

PHILIP W. ANDERSON, DAVID BALTIMORE, ANSLEY J. COALE, JOSEPH L. GOLDSTEIN, LEON KNOPOFF, SEYMOUR LIPSET, WALTER MASSEY, OLIVER E. NELSON, ALLEN NEWELL, RUTH PATRICK, VERA C. RUBIN, HOWARD E. SIMMONS, SOLOMON H. SNYDER, ROBERT M. SOLOW

Board of Reviewing Editors

JAMES P. ALLISON, LUIS W. ALVAREZ, DON L. ANDERSON, KENNETH J. ARROW, C. PAUL BIANCHI, ELIZABETH H. BLACKBURN, FLOYD E. BLOOM, MICHAEL S. BROWN, NINA V. FEDEROFF, GARY FELSENFELD, DOUGLAS J. FUTUYMA, THEODORE H. GEBALLE, STEPHEN P. GOFF, PATRICIA S. GOLDMAN-RAKIC, RICHARD M. HELD, GLORIA HEPPNER, ERIC F. JOHNSON, KONRAD B. KRAUSKOPF, PAUL E. LACY, JOSEPH B. MARTIN, JOHN C. MCGIFF, MORTIMER MISHKIN, JOHN S. PEARSE, YESHAYAU POKER, FREDERIC M. RICHARDS, JAMES E. ROTHMAN, RONALD H. SCHWARTZ, OTTO T. SOLBRIG, ROBERT T. N. TJIAN, VIRGINIA TRIMBLE, GERAT J. VERMEIJ, MARTIN G. WEIGERT, GEORGE M. WHITESIDES, WILLIAM B. WOOD, HARRIET ZUCKERMAN

Editorial Staff

Managing Editor: PATRICIA A. MORGAN
Assistant Managing Editors: NANCY J. HARTNAGEL, JOHN E. RINGLE
Production Editor: ELLEN E. MURPHY
News Editor: BARBARA J. CULLITON
News and Comment: COLIN NORMAN (deputy editor), MARK H. CRAWFORD, CONSTANCE HOLDEN, ELIOT MARSHALL, R. JEFFREY SMITH, MARJORIE SUN, JOHN WALSH
European Correspondent: DAVID DICKSON
Research News: ROGER LEWIN (deputy editor), RICHARD A. KERR, GINA KOLATA, JEAN L. MARX, ARTHUR L. ROBINSON, M. MITCHELL WALDROP
Administrative Assistant, News: SCHERRAINE MACK; **Editorial Assistant, News:** FANNIE GROOM
Senior Editors: ELEANORE BUTZ, RUTH KULSTAD
Associate Editors: MARTHA COLLINS, SYLVIA EBERHART, CAITILIN GORDON, WILLIAM GREAVES, BARBARA JASNY, STEPHEN KEPPLE, EDITH MEYERS, LOIS SCHMITT
Assistant Editor: LISA MCCULLOUGH
Book Reviews: KATHERINE LIVINGSTON, **Editor:** LINDA HEISERMAN, JANET KEGG
Letters Editor: CHRISTINE GILBERT
Contributing Editor: RUTH L. GUYER
Production: JOHN BAKER, HOLLY BISHOP, KATHLEEN COSIMANO, ELEANOR WARNER, ISABELLA BOULDIN, SHARON RYAN, BEVERLY SHIELDS
Covers, Reprints, and Permissions: GRACE FINGER, **Editor:** GERALDINE CRUMP, CORRINE HARRIS
Guide to Scientific Instruments: RICHARD G. SOMMER
Manuscript System Analyst: WILLIAM CARTER
EDITORIAL CORRESPONDENCE: 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Telephone: 202-467-4400. For "Information for Contributors" see page xi, *Science*, 29 March 1985.

Business Staff

Chief Business Officer: WILLIAM M. MILLER III
Business Manager: HANS NUSSBAUM
Assistant to Chief Business Officer: ROSE LOWERY
Business Staff Supervisor: DEBORAH JEAN RIVERA
Membership Recruitment: GWENDOLYN HUDDLE
Member and Subscription Records: ANN RAGLAND

Advertising Representatives

Director: EARL J. SCHERAGO
Production Manager: DONNA RIVERA
Advertising Sales Manager: RICHARD L. CHARLES
Marketing Manager: HERBERT L. BURKLUND
Sales: NEW YORK, N.Y. 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); CHICAGO, ILL. 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-337-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772); SAN JOSE, CALIF. 95112: Bob Brindley, 310 S. 16 St. (408-998-4690); DORSET, VT. 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581).
ADVERTISING CORRESPONDENCE: Tenth floor, 1515 Broadway, New York 10036 (212-730-1050).

Electric Power from the North

Six Canadian provincial utilities export electricity to the United States: New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, and British Columbia.* It is now technically and economically feasible to transmit power over long distances. British Columbia has sold hydroelectricity to Los Angeles for about 2 cents per kilowatt hour, roughly half the local cost of generation from oil. New England, New York, and some upper Midwest states have also been the beneficiaries of bargain-rate Canadian power. Thus far, the imports have largely involved interruptible power, but negotiators are talking about long-term contracts for "firm" power. The Canadians possess the necessary engineering experience, managerial skill, and hydropotential to develop large additional power supplies. With benefits to both countries, Canada could ultimately replace a large fraction of the U.S. electricity currently generated from oil. The barriers are regulatory and political.

Utilities did not foresee the oil crisis of the early 1970's and its major effects on the economy. Now, in both the United States and Canada, there is excess generating capacity. The Canadians have not experienced so much of the costly regulatory delays and litigation common in the United States. Many of their plants were built within budget. Exporting surplus power to the United States is profitable. Quebec, Manitoba, and British Columbia deliver hydropower; New Brunswick supplies nuclear power; Ontario provides nuclear, hydro-, and coal-derived power. Saskatchewan depends on cheap coal.

Utilities in the United States that burn oil or natural gas must guess about prices of these fuels in 1995 and beyond. Estimates are that costs will be higher—perhaps much higher—than they are now.

The potential hydropower of Canada is large. Total stream flow there is about 1.5 times that in the United States. Undeveloped power is on the order of 100,000 megawatts. Most of the rivers discharge to the north. Many of the important sites for plants are in sparsely settled areas far from the U.S. border. Some of the choice sites are in British Columbia, Manitoba, and Quebec. In Quebec, Robert Bourassa, former premier of the province and current leader of the Liberal Party, has made export of electricity a major campaign issue. He has recently published a book designed to influence opinion in the province and in the United States.† In it, he advocates a 12,000-MW expansion of hydroelectricity for export purposes. He states that, after providing for Quebec's needs, there is a total of 20,000- to 30,000-MW potential in the contiguous Quebec-Labrador landmass. He refers to engineering achievements that have already earned Hydro-Quebec an outstanding international reputation. He emphasizes the hazards and environmental damage arising from nonrenewable sources of electricity while extolling the value of clean, renewable hydropower.

Quebec would reap many benefits from exploiting a resource that is now wasted. Construction would provide many jobs. The electricity would be sold at a profit. After fulfilling a long-term contract for delivery of firm power, the facilities would be available for local needs or for additional sales. The cost of electricity to U.S. utilities would depend on their contribution to financing the project as well as on interest rates.

Expansion of power from the north will occur, but probably slowly. Rules of state regulatory commissions discourage movement of surplus power even within the United States. Installation of transmission lines is vigorously opposed. People and politicians here and in Canada will find reasons to delay action. However, renewable hydropower carries with it minimal environmental consequences, and for the long haul it is in many instances the least expensive source of electricity.—PHILIP H. ABELSON

*See Northwest-Midwest Institute and Canadian Institute of International Affairs, *Trading in Power: The Potential for U.S.-Canadian Electricity Exchange* (Northwest-Midwest Institute, Washington, D.C., 1984).

†R. Bourassa, *Power from the North* (Prentice-Hall, Scarborough, Ontario, 1985).

Make Stat Magic

Now for the IBM PC/AT*
with hard disk

Statistics, reports and plots happen magically with SPSS/PC™ —the Statistical Package for IBM PC/XTs.*

SPSS/PC is the most comprehensive statistical package for performing simple or complex tasks, regardless of data size. It maintains feature and language compatibility with mainframe SPSS[®], while optimizing for the PC environment.

Statistics range from simple descriptive to complex multivariate, including Multiple Regression, ANOVA, Factor and Cluster analysis. Loglinear and nonparametric procedures are also included.

Simple facilities allow transfer of files between

SPSS/PC and programs like Lotus 1-2-3, dBase II and SAS. A complete Report Writer, Plotting facilities and a Communications program for mainframes round out a fully integrated product.

For more information, contact our Marketing Department without further ado. And see what a little stat magic can do for you.

SPSS Inc., 444 N. Michigan Avenue, Chicago, IL 60611, 312/329-3500.

In Europe: SPSS Benelux B.V., P.O. Box 115, 4200 AC Gorinchem, The Netherlands, Phone: +31183036711 TWX: 21019.

VISA, MasterCard and American Express accepted.



SPSS inc. PRODUCTIVITY RAISED TO THE HIGHEST POWER™

*SPSS/PC runs on the IBM PC/XT or AT with 320K memory and a hard disk. An 8087 co-processor is recommended. Contact SPSS Inc. for other compatible computers.

IBM PC/XT and AT are trademarks of International Business Machines Corporation. dBase II is a trademark of Ashton-Tate. 1-2-3 is a trademark of Lotus Development Corporation. SAS is a registered trademark of SAS Institute, Inc. SPSS and SPSS/PC are trademarks of SPSS Inc. for its proprietary computer software.

© Copyright 1985, SPSS Inc.

Circle No. 224 on Readers' Service Card