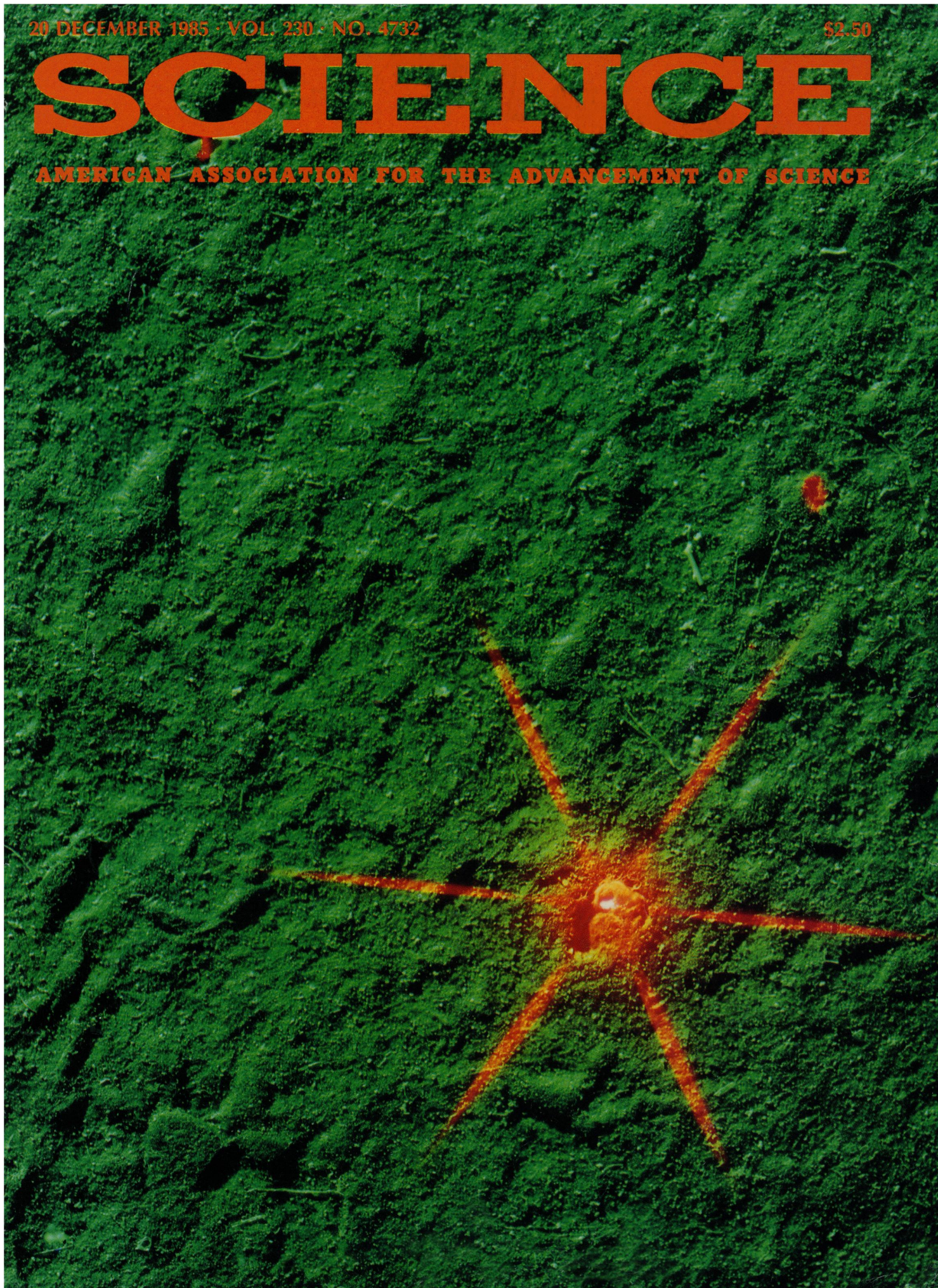


20 DECEMBER 1985 · VOL. 230 · NO. 4732

\$2.50

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Just Captured: The World of Ultracentrifugation With the SpinPro™ Expert System

Beckman proudly presents SpinPro—the first Expert System on Ultracentrifugation for the Personal Computer. Not a simulation, this truly advanced software program can shorten run times, improve the quality of separations, make more efficient use of your ultracentrifuge.

Designed for use with the IBM-PC-XT, SpinPro uses three state-of-the-art conveniences—the Mouse Cursor, Pop-Up Menus, and a Browser—to move you through the program with no keyboarding.

Consults, Informs, Calculates

Consultation: Designs detailed run plans through a question-and-answer dialogue. Produces an Optimal Plan—the

best possible procedure with no limits on equipment—and a Lab Plan based on the rotors and centrifuges you have. Increases efficiency. Maximizes productivity!

Information: Gives access to the most complete compendium of ultracentrifugation data ever compiled including sample materials, separation methods, density gradients. Contains hundreds of references. A Glossary too! Simplifies data retrieval. Updates lab procedures.

Calculation: Performs a variety of calculations—rotor speed reductions, pelleting times, k factors, and more. Saves time. Eliminates errors!

Now you can have a knowledgeable advisor at your command in your own lab—the SpinPro Expert System!

For SpinPro Brochure SB-664, write Beckman Instruments, Inc., Spinco Division, 1050 Page Mill Road, Palo Alto, CA 94304, or call (800) 362-2248. Offices in major cities worldwide.



BECKMAN

Circle No. 312 on Readers' Service Card

Cut your serum needs in half with SerXtend.TM

SerXtend* serum extender is a totally defined combination of cell growth factors that makes ordinary fetal bovine serum go twice as far or more.

It's a consistent, quality-controlled supplement for your cell culture growth media—tested for endotoxin, mycoplasma, adventitious bovine viruses, hepatitis B antigen, *and* cell growth.

With SerXtend, there's less need for lot-to-lot serum testing, fewer endogenous interfering factors, and lower total protein concentration (to simplify purification).



DuPont/Hana Biologics: Serving you together

SerXtend is manufactured for DuPont and its quality is guaranteed by Hana Media, Inc., the leaders in cell culture technology.

*SerXtend is a trademark of Hana Biologics, Inc., Berkeley, CA 94710.

Circle No. 338 on Readers' Service Card

Call 1-800-237-8400
Ext. 305 (In Florida
1-800-282-1469)

Find out how SerXtend can save you time, trouble, and money in preparing your cell culture growth media. Call today toll free, or write Du Pont-NEN, Room 5000A, 595 Colonial Park Drive, Roswell, GA 30075.

For immediate technical information or to place your order, call 1-800-225-1572 (in Mass. and international, 617-482-9595).



NEN Research Products



This Week in *Science* 1321

LETTERS Nutrition Report and the Academy: *H. Kamin; R. E. Olson; F. Press;*
 Understanding Science: *M. Goran; W. J. Haas; D. F. Cox* 1324

EDITORIAL 1986: A Vintage Year for Space Science: *A. J. Dessler* 1327

ARTICLES Fluid Beds: At Last, Challenging Two Entrenched Practices: *A. M. Squires,*
M. Kwauk, A. A. Avidan 1329

Peptide Neurotoxins from Fish-Hunting Cone Snails: *B. M. Olivera et al.* 1336

The 3' Splice Site of Pre-Messenger RNA Is Recognized by a Small Nuclear
 Ribonucleoprotein: *B. Chabot, D. L. Black, D. M. LeMaster, J. A. Steitz* 1344

Enzymatic Amplification of β -Globin Genomic Sequences and Restriction Site
 Analysis for Diagnosis of Sickle Cell Anemia: *R. K. Saiki et al.* 1350

NEWS AND COMMENT AIDS Therapy: New Push for Clinical Trials 1355

AIDS Virus Presents Moving Target 1357

An Avalanche of New Cash 1358

Fight Over South African Ban Intensifies 1359

Briefing: Agencies Brace for Cuts in FY-86 Program Budgets; Congressmen
 Seek Delay in X-ray Laser Test; Credit for University R&D Offered
 in Tax Reform Bill; GAO Finds Errors in A-Bomb Test Data 1360

Britain Pulls Out of Unesco 1362

Britain Joins SDI Research 1362

Beggs Takes a Leave of Absence at NASA 1363

RESEARCH NEWS Plate Tectonics Goes Back 2 Billion Years 1364

New Sickle Cell Test 1365

BOARD OF DIRECTORSDAVID A. HAMBURG
Retiring President, ChairmanGERARD PIEL
PresidentLAWRENCE BOGORAD
President-ElectROBERT McC. ADAMS
ROBERT W. BERLINERMILDRED DRESSELI
DONALD N. LANGEN**CHAIRMEN AND
SECRETARIES OF
AAAS 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 COMMUNICATIONS (T)**
Karen B. Levitan
Elliot R. Siegel**DIVISIONS****ARCTIC DIVISION**Richard Bushey
PresidentGunter E. Weller
Executive Secretary**CARIBBEAN DIVISION**Juan A. Bonnet, Jr.
PresidentLucy Gaspar
Secretary-Treasurer**PACIFIC DIVISION**Geoffrey G. E. Scudder
PresidentAlan E. Le
Executive I

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1333 H Street, 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*, 1333 H Street, 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

	Burst of Publicity Follows Cancer Report	1367
BOOK REVIEWS	The Origins of Individual Differences in Infancy, reviewed by R. S. Wilson; No Sacrifice Too Great, R. D. Cuff; Adaptive Mechanisms in Gaze Control, R. A. Andersen; Prehistoric Europe, M. A. Jochim; Books Received	1369
REPORTS	Platinized Chloroplasts: A Novel Photocatalytic Material: E. Greenbaum	1373
	A New Class of Steroids Inhibits Angiogenesis in the Presence of Heparin or a Heparin Fragment: R. Crum, S. Szabo, J. Folkman	1375
	Promoter Region of the Human Harvey <i>ras</i> Proto-oncogene: Similarity to the EGF Receptor Proto-oncogene Promoter: S. Ishii, G. T. Merlino, I. Pastan	1378
	Sequence of the Immunodominant Epitope for the Surface Protein on Sporozoites of <i>Plasmodium vivax</i> : T. F. McCutchan et al.	1381
	Systematic Variation in DNA Length Yields Highly Ordered Repressor-Operator Cocystals: S. R. Jordan, T. V. Whitcombe, J. M. Berg, C. O. Pabo	1383
	Brain-Derived Acidic Fibroblast Growth Factor: Complete Amino Acid Sequence and Homologies: G. Gimenez-Gallego et al.	1385
	A Model for Fibrinogen: Domains and Sequence: J. W. Weisel, C. V. Stauffacher, E. Bullitt, C. Cohen	1388
	Repression of the Immunoglobulin Heavy Chain Enhancer by the Adenovirus-2 E1A Products: R. Hen, E. Borrelli, P. Chambon	1391
	Gene Expression in Mice After High Efficiency Retroviral-Mediated Gene Transfer: M. A. Eglitis, P. Kantoff, E. Gilboa, W. F. Anderson	1395
	Hematopoietic Histoincompatibility Reactions by NK Cells in Vitro: Model for Genetic Resistance to Marrow Grafts: C. Bordignon, J. P. Daley, I. Nakamura	1398
	Detection of DNA Sequences in Nuclei in Suspension by in Situ Hybridization and Dual Beam Flow Cytometry: B. Trask, G. van den Engh; J. Landegent, N. J. in de Wal, M. van der Ploeg	1401
	A Human Y-Linked DNA Polymorphism and Its Potential for Estimating Genetic and Evolutionary Distance: M. Casanova et al.	1403
	Technical Comments: Rapid Mutations in Mice?: F. M. Johnson, C. F. Aquadro, L. C. Skow, C. H. Langley, S. E. Lewis; M. C. Green, D. W. Bailey, E. L. Green, T. H. Roderick, E. S. Russell; W. M. Fitch and W. R. Atchley	1406

JOSEPH NELKIN
J. E. SAWYER

SHEILA E. WIDNALL
LINDA S. WILSON

WILLIAM T. GOLDEN
Treasurer

WILLIAM D. CAREY
Executive Officer

GEOLOGY AND GEOGRAPHY (E)
John H. Matthews III
William M. McCammon

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

ANTHROPOLOGY (H)
Albert C. Spaulding
Priscilla Reining

CAL SCIENCES (N)
I. P. Fishman
William E. Rhoads

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

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

STATISTICS (U)
Robert Hunter
Richard J. Wegman

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

SOCIETAL IMPACTS
OF SCIENCE
AND ENGINEERING (X)
Harold P. Green
Rodney W. Nichols

UTHWESTERN AND ROCKY MOUNTAIN DIVISION

Donald J. Nash
President

M. Michelle Balcomb
Executive Director

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

Colloidal platinum precipitated onto photosynthetic membranes and entrapped on filter paper viewed in reflected and transmitted light (about $\times 8$). This moistened material is capable of the simultaneous photoevolution of hydrogen and oxygen when irradiated at any wavelength in the chlorophyll absorption spectrum. The bright orange spots are punctures used to drain excess fluid from the clogged filter paper. See page 1373. [B. K. Norris and J. P. Eubanks, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831]



The fast way to get active proteins

As simple and friendly as soft gel chromatography. Powerful and productive as HPLC. Now uniquely combined into one totally new and radically different system. ULTRO-CHROM GTi. To separate, purify, quantitate and recover proteins, peptides, nucleic acids and even carbohydrates. With biological activity that can reach 100%. And in runs that only take minutes.

From pump heads to fraction collector, GTi means glass, titanium and inactive polymers. Giving you biocompatibility for complex protein mixtures. Replacing stainless steel at every liquid interface. Securing protection against buffers. Against corrosion by halide ions. Against denaturation by organic solvents. But with all the performance of a truly advanced and highly proven HPLC pump.

Meeting all your needs for multi-dimensional separation. Beginning with GFC. Switching columns for Ion Exchange, and then again for Hydrophobic Interaction Chromatography. Getting you higher resolution and in-

creased purity all the way. With rapid analysis of sample complexity, continuously progressive purification and successful isolation of your important biomolecules. Completing separation strategies in hours instead of days. Solving particular problems with the most appropriate chromatography. Even reversed phase including microbore and fast LC. On



just one system with unlimited potential. Giving you the most versatile chromatography in the world. Already being used by hundreds of biochemists. Getting them more results.

Much faster.
Much simpler.
More reliably. One word says it all. GTi. You'll find it solving problems faster and better than any other separation system available. Get in touch with LKB. You're in for a winner.



LKB-Produkter AB, Box 305, S-161 26 Bromma, Sweden. Tel. +46(8)98 00 40, telex 10492
Antwerp (03) 218 93 35 · Athens-Middle East +30 (1) 894 73 96 · Copenhagen (01) 29 50 44 · Hongkong (852) 5-555555
London (01) 657 88 22 · Lucerne (041) 57 44 57 · Madras (044) 45 28 74 · Moscow (095) 255-6984 · Munich (089) 85 830
Paris (01) 64.46.36.36 · 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.

Fluid bed technology dormant no longer

Burning coal for generating electricity and heat and catalytic conversion of methanol to gasoline can be accomplished efficiently on an industrial scale with fluid bed reactor technology (page 1329). Fluid bed reactors, first designed in the 1920's, consist of particles that are levitated, caused to boil, and thus "fluidized" by a rising current of gases. The particles, ranging from coarse to fine, are catalysts and sometimes reactants for conversion of solid and gaseous materials to energy or gasoline. Squires *et al.* expect fluid bed reactors to replace most pulverized coal boilers (over which they have advantages: lower emissions of pollutants, lower likelihood of explosion, quicker start-up time, and lower construction costs) and many fixed bed reactors for catalytic conversion of gases. Although fluid bed reactors are not expected to explode, the technology is about to—both for burning coal and for converting low-grade fuels (municipal waste, peat, and wood) ecologically to needed energy.

Prenatal diagnosis for sickle cell anemia

With perhaps as little as 20 nanograms of DNA, prenatal screening for sickle cell anemia can now be accomplished in a matter of hours (page 1350). In sickle cell anemia, unusual hemoglobin molecules in red blood cells cause the cells to take on a sickle shape, become leaky and inflexible, and occlude vessels. As a result, severe abdominal pains, leg ulcers, and arthritic symptoms occur. Normal and sickle cell molecules of globin (the protein portion of hemoglobin) differ only by a single amino acid in one of two protein chains, and this difference derives from a single base substitution in the corresponding gene. The technique developed by Saiki *et al.* combines amplification of the globin gene sequences in cells (yielding hundreds of thousands of identical copies of the globin DNA) with analysis of the gene sequence by hybridization and digestion processes that distinguish normal from abnormal genes. In a Research News article, Marx discusses the mode of inheritance of sickle cell anemia, the power of the new procedures to expedite testing for this disease (and for others that are heritable), and the new technique's applicability to general problems in molecular biology (page 1365).

Steroids stop growth of capillaries

A function has been recognized for a class of steroid metabolites for which none was known (page 1375). The unusual steroids inhibit the important process of angiogenesis or growth of new capillaries. Inhibition depends on exposing capillary beds to both steroids and heparin (or a non-anticoagulant fragment of it) and does not occur when either is tested alone. Crum, Szabo, and Folkman defined—by removing or adding substituents to the basic steroid four-ring structure—the minimum structure effective in inhibiting angiogenesis. Because

substances with other variations on the basic steroidal structure can be synthesized, angiostatic steroids even more potent than the naturally occurring and synthetic ones identified to date may eventually be available for clinical use for treating diseases in which angiogenesis contributes to the pathologic process.

Crystals of a DNA-protein complex

A piece of DNA (the lambda operator site) and the protein molecule that binds to it to regulate gene activity (the lambda repressor protein) have been co-crystallized (page 1383). Jordan *et al.* describe the variables explored—including systematic variations in the length of the DNA molecules—in the search that led to the right experimental conditions under which co-crystals reproducibly formed. The best co-crystals diffracted to high resolution. They are expected to provide detailed molecular data on how the two molecules recognize and interact with each other, the types of conformation changes that occur as the complex forms, and the role of water in the complex—all data that may be applicable generally to DNA-protein interactions.

Brain and other growth factors alike

Growth-promoting substances made by brain tissue and other sources have significant structural homologies (page 1385). Gimenez-Gallego *et al.* determined the complete amino acid sequence of a growth factor from bovine brain (aFGF) and compared the data with data from other growth promoters. Sequence homology with interleukin-1 was particularly striking, fitting well with the earlier observation that these two molecules share certain three-dimensional features. Both factors can stimulate fibroblasts to divide. A stretch of ten amino acids within aFGF had sequence homology with several biologically active neuropeptides, some of which also stimulate cell division. This likeness among growth factors illustrates how, in nature, structures that work may appear more than once, perhaps packaged each time in a slightly different way.

3-D model of fibrinogen

A three-dimensional model of fibrinogen has been generated from data obtained from electron microscopic images and low resolution x-ray crystallography (page 1388). Fibrinogen is the protein in blood that forms a fibrin clot when cleaved by thrombin. Although native fibrinogen does not crystallize, crystals retaining most structural features of the native molecule form after limited enzymatic cleavage. Weisel *et al.* used computer technology to integrate new data from old; the resulting 3-D model accounts for the folding of the protein chains of fibrinogen into major domains (globular regions) and for the molecular interactions that result in clot formation.

Now KODAK Acrylamide and *N,N'*-Methylenebisacrylamide are produced by an improved method of purification and thoroughly tested to meet the ultracritical standards associated with high-sensitivity electrophoresis staining of proteins.

Such exceptionally high purity can add confidence to your research, and save you time and steps in gel preparation. Extremely low water insolubles and acrylic acid levels eliminate the need for filtering. And no refrigeration is necessary either.

Compare our standards. Then order these two electrophoresis-grade products, and bring a new level of confidence to your testing. To order, call toll free 1 800 225-5352. In New York State call 716 458-4014.

KODAK ANNOUNCES

>99.9%

PURE

ACRYLAMIDE & 'BIS'



Electrophoresis-Grade Acrylamide

Assay	> 99.9%
Acrylic Acid	0.001% max
Water Insolubles	0.005% max
Conductivity (35% solution)	< 2.5 μ mhos
pH (10% in 0.1M NaCl)	6.5 $\pm$ 0.5
Size and prices	100 gm \$30.80 CAT No. 117 8813
	500 gm \$108.50 CAT No. 181 2270

Electrophoresis-Grade *N,N'*-Methylenebisacrylamide

Assay	> 99.9%
Acrylic Acid	0.01% max
Water Insolubles	0.005% max
pH (1% in 0.1M NaCl)	$\geq$ 5.5
Size and prices	25 gm \$18.65 CAT No. 119 8373
	100 gm \$29.80 CAT No. 119 8381
	500 gm \$49.50 CAT No. 116 4524



Laboratory and Research Products Division
Eastman Kodak Company
Rochester, New York 14650

Write today for a free brochure, *KODAK Products for Gel Electrophoresis* (JJ-11), or call toll free, 1 800 44KODAK (1 800 445-6325), Ext 502.

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

QAIS AL-AWQATI, JAMES P. ALLISON, LUIS W. ALVAREZ, DON L. ANDERSON, KENNETH J. ARROW, C. PAUL BIANCHI, ELIZABETH H. BLACKBURN, FLOYD E. BLOOM, MICHAEL S. BROWN, CHARLES R. CANTOR, JAMES H. CLARK, BRUCE F. ELDRIDGE, STANLEY FALKOW, NINA V. FEDOROFF, GARY FELSENFELD, DOUGLAS J. FUTUYMA, THEODORE H. GEBALLE, ROGER I. M. GLASS, STEPHEN P. GOFF, ROBERT B. GOLDBERG, PATRICIA S. GOLDMAN-RAKIC, RICHARD M. HELD, GLORIA HEPPNER, JOHN IMBRIE, ERIC F. JOHNSON, KONRAD B. KRAUSKOPF, PAUL E. LACY, JOSEPH B. MARTIN, JOHN C. MCGIFF, ALTON MEISTER, 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, GEERAT 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), DEBORAH M. BARNES, RICHARD A. KERR, GINA KOLATA, JEAN L. MARK, 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, CAITLIN 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, MARY MCDANIEL, SHARON RYAN, BEVERLY SHIELDS
Covers, Reprints, and Permissions: GRACEY FINGER, **Editor:** GERALDINE CRUMP, CORRINE HARRIS
Guide to Scientific Instruments: RICHARD G. SOMMER
Manuscript System Analyst: WILLIAM CARTER
EDITORIAL CORRESPONDENCE: 1333 H Street, NW, Washington, D.C. 20005. Telephone: 202-326-6500. For "Information for Contributors" see page xi, *Science*, 20 December 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. BURKUND
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).

1986: A Vintage Year for Space Science

If all goes as planned, it appears that the coming year will be an extraordinarily good one for space science. In addition to the ongoing program of space research, a number of major space events that were started years ago will, largely by chance, all come together during 1986.

Mankind's first encounter with the planet Uranus will take place on 24 January. The Voyager 2 spacecraft, now 3 billion kilometers into its grand tour of the solar system, will pass within about three planetary radii of the Uranus cloud tops. Various telescopic observations show remarkable things happening at Uranus. The planet is tipped on its side with its south pole now pointing toward the sun; it is surrounded by a series of threadlike rings that demonstrate a surprising stability; and Uranus fluctuates brightly in ultraviolet light by means of a power source that is not understood. Our experience with Jupiter and Saturn has convincingly demonstrated both the inadequacy of research limited to observations from Earth and the superiority of nature's imagination over that of even the more inventive researcher. We may see another such demonstration at Uranus.

The next major event is a flyby of Comet Halley by six spacecraft from four nations. Although the spacecraft were launched months apart, all but one will pass Halley during an 8-day interval in March. The Soviet spacecraft Vega 1 will pass close to the comet on Thursday, 6 March. On Saturday, Suisei, the first of two Japanese spacecraft arrives. The second Vega will fly by on Sunday. The week continues with a distant encounter on Tuesday by Sakigake, the second Japanese spacecraft. Then, on Thursday, 23 March, the European probe Giotto will make a daring attempt to pass close to Halley's nucleus. The International Comet Explorer, an American spacecraft and veteran comet chaser that 6 months earlier flew through the tail of Comet Giacobini-Zinner, is the last. Because it arrives 2 weeks later than the others, it will pass only in the distant vicinity of Halley. Comet Halley will also be observed from Earth orbit by the Astro 1 telescope assembly and by the Spartan-Halley experiment. Although Halley's comet may well disappoint the general population, most of whom will not even be able to find it in their night sky, space scientists look forward to this brief period in March with justified anticipation.

Launches of several important new spacecraft are scheduled for 1986. These hold the promise of years of fruitful data acquisition for whole communities of space scientists. In May, there are two: the first is Ulysses, which will first go to Jupiter and then roam through the as yet unexplored regions over the poles of the sun. The second is Galileo, which will go to Jupiter, there to split into two spacecraft. One section will plunge through the clouds to explore Jupiter's dense atmosphere below, while the other section orbits the planet to examine in detail its moons, planetary magnetic field, and radiation belts. On its way to Jupiter, Galileo may be sent near the asteroid Amphitrite in December, thus closing the year with a first close-up look at one of the large bodies in the asteroid belt.

In terms of its potential scientific value, the launch of the Hubble Space Telescope by the space shuttle is perhaps the grand event of the year. The space telescope is expected to be the most influential astronomical instrument ever put into space. It will operate for years, examining selected portions of the universe with such clarity and precision that it is regarded by some astronomers as an advance rivaling Galileo's first use of the telescope for astronomy nearly 400 years ago.

The science of space is still in an early phase in which much of the solar system is yet to be explored and understood. We have not reached a level of predictive understanding that enables us to solve distant astrophysical mysteries by application of knowledge obtained from solar-system research. Our capability to generalize and extrapolate in space science is bound to be improved by the events of 1986.—A. J. DESSLER, *Director, Space Science Laboratory, NASA Marshall Space Flight Center, Huntsville, Alabama 35812*

World's 1st TEM Specially for the Biological Sciences

The conventional transmission electron microscope (TEM) often overlooks the importance of high image contrast and other features essential to the microscopic examination of biological specimens. Now, there's a new transmission electron microscope specially designed with the biological sciences in mind—the Hitachi H-7000.

High Image Contrast and Superb Resolution

An exceptionally fine image contrast and superb resolution bring a specimen into crystal clear, sharp focus with extraordinary detail and precise image orientation. A unique stray-electron absorbing device and an auto-positioning anode for optimum beam brightness at all accelerating voltages provide well-illuminated images with vivid definition.

A Hitachi First — an Optional Fully Integrated TV Camera

The world's first fully integrated high-sensitivity TV

camera provides simple, real-time, large-screen display of ultra-fine specimen details; easy, high-quality image photography; recording of moving images onto video tape; as well as special image-processing capability using a variety of optional video equipment.

Low Beam Illumination Reduces Beam Damage to Specimen

The low beam intensity of the advanced illumination system helps reduce the potential of beam damage. By using the optional high-sensitivity TV camera, images may be projected onto a CRT screen requiring much less illumination than the standard TEM viewing chamber. Together, these features combine to reduce beam damage to an absolute minimum.

The Clear Choice for Biological Scientists

Additional features such as an image rotation system, precision image-focusing wobbler, dual EDX detector system for light element analysis, and many, many more, are all designed to provide the biological scientist with the most advanced analytical tools.

The Hitachi H-7000 electron microscope is *clearly* the ONLY serious choice for the biological researcher.



NISSEI SANGYO AMERICA, LTD.

460 E. Middlefield Road, Mountain View, California
94043, U.S.A. Tel: (415) 969-1100

NISSEI SANGYO CO., LTD.

Mori 17th Bldg., 26-5, Toranomon 1-chome, Minato-ku,
Tokyo 105, Japan Tel: (03) 504-7685

HITACHI, LTD., INSTRUMENT DIVISION

New Marunouchi Bldg., 5-1, Marunouchi 1-chome,
Chiyoda-ku, Tokyo 100, Japan Tel: (03) 214-3123

Circle No. 289 on Readers' Service Card

Princeton

Richard P. Feynman

QED

The Strange Theory of Light and Matter

Richard Feynman, one of the world's leading theoretical physicists, here presents the forbiddingly-named theory of quantum electrodynamics for the general public with the clarity, accuracy, and completeness that have made his lectures famous. Assuming little scientific background of his readers, he describes the interaction of light and electrons—absurd, he points out, from the point of view of common sense, yet underlying almost everything we observe in the physical world. \$18.50

Alix G. Mautner Memorial Lectures

Leviathan and the Air-Pump

Hobbes, Boyle, and the Experimental Life
Steven Shapin and Simon Schaffer

This book is about a series of controversies in England during the 1660s and 1670s over the status and value of experimental methods in natural philosophy. The protagonists were Thomas Hobbes, author of *Leviathan* and a vehement critic of experimental practices, and Robert Boyle, the major English advocate of experimentalism and an inventor of the air-pump. The issues at stake in these disputes ranged from the physical integrity of the air-pump to the intellectual integrity of the knowledge it yielded. The authors see the confrontation between Hobbes and Boyle as a conflict over what Wittgenstein called "forms of life." \$60.00

New in Paperback

The Quantum World

J. C. Polkinghorne

"The author's life as well as his oeuvre, especially this lovely little book, bear testimony to the fact that...science and religion can coexist in harmonious complementarity."

—Abraham Pais, *Nature*
\$6.95

At your bookstore or

Princeton University Press

41 William Street, Princeton, NJ 08540

LETTERS

(Continued from page 1326)

pendent scientific experts and any professional unit that oversees the work of the panel. It was the judgment of these reviewers that the RDA panel's suggestions for modifying the recommended levels for certain nutrients were not justified by the scientific evidence presented. The panel was apprised of these detailed criticisms—over 130 pages in all. However, the panel's responses satisfied neither its parent unit—the Food and Nutrition Board—nor the officers of the National Research Council.

Regrettably, the flexibility claimed in Kamin's letter was not apparent during lengthy discussions between him and various representatives of the Research Council in intensive efforts to resolve certain differences of scientific opinion. The suggestion that the RDA's for vitamins A and C were the pivotal points for my decision is misleading. At one stage, focus was indeed placed on vitamins A and C on the *assumption* that all other major issues had been resolved. Resolution of the RDA's on vitamins A and C was part of a series of major subjects that needed attention to bring the draft up to the standards considered acceptable for NRC reports. The crux of the matter is not whether the RDA's proposed by the panel were higher or lower than the current ones, but whether these proposals were based on strong scientific evidence and sound logic. It was the latter that gave the Research Council and its reviewers serious cause for concern.

Robert Olson was neither a part of the panel nor party to the review process. His letter contains unverified assertions about the NRC's decision, selective citations, faulty characterization of the review process, and unjustified attacks on members of the Food and Nutrition Board. All Research Council professional units are periodically examined for balance of expertise and viewpoints. The current Food and Nutrition Board is a broadly constituted, well-balanced group of experts from academia and the public and private sectors.

Kamin, Olson, and others who take issue with the Research Council's process of decision-making appear to reject the most basic tenet of American science—the peer review process. Despite months of deliberation and discussion, the panel's draft did not pass the scientific peer review and achieve the standards expected of Research Council reports. Under these circumstances, it is in the best interest of the scientific community and the public for the Research

Council to establish a new panel charged with producing a report that can, like all our reports, withstand a rigorous scientific review.

FRANK PRESS

Office of the Chairman, National Research Council, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, D.C. 20418

Understanding Science

Daniel E. Koshland Jr.'s eloquent call for "Scientific literacy" (Editorial, 25 Oct., p. 391) is testimony that the AAAS has not done enough with the old *Scientific Monthly*, the new *Science* 85, the radio broadcasts, the internship program with the media, the congressional fellowships, the museum displays, and so forth. Why not try organizing and financing a cadre of retired scientists and educators to advance the understanding of the scientific enterprise? There are many willing and able to capture attention and motivate and sustain interest. They are ready; working scientists are probably too busy.

MORRIS GORAN

Roosevelt University,
430 South Michigan Avenue,
Chicago, Illinois 60605

The scientific illiteracy described so cogently by Koshland in his 25 October editorial is really a general and massive failure of our public education system. An adequate understanding of logical thinking and methods of inquiry does not require specialized scientific and mathematical training per se. The concepts of the scientific method, experimental design, nature of risk, and even chance, probability, and statistical inference are essential elements of any reasonable education. They were so regarded (as part of Natural Philosophy) right through the last century. All are best grasped in the early formative years of elementary and secondary school.

The concepts do, however, have to be communicated by committed and dedicated teachers, a "species" in real danger of extinction. In addition to inadequate remuneration (elementary and secondary school salary scales are well below those of clerical, laboring, and service occupations), psychic and status recognition awards from society are also generally at an all-time low. Would any of our modern-day social-hero role models (entrepreneur, financier, engineer, or scientist) advise their children to be public school teachers?

SCIENCE

News Department Reprint Series

Artificial Intelligence

This collection of articles from *Science* by M. Mitchell Waldrop explores the newly emerging field of artificial intelligence, AI. What AI has really accomplished, where might it plausibly be expected to go, and what are its limits? In particular, the articles focus on the foundations of AI—the effort to understand the phenomenon of intelligence. Included are such topics as expert systems, natural language understanding, computer vision, and parallel processing. This series is available now.

Single copies \$3.00; twenty or more \$1.50 each.
Orders must be prepaid.

Write to AAAS, Dept. AI, 1333 H Street, N.W.,
Washington, D.C. 20005.

WANTED

NEW COMPOUNDS

POTENTIAL NEW DRUGS

DEBIOPHARM, a Swiss-based independent financial group will consider the development of novel biological or chemical compounds with a promising pharmacologic profile. If you are an independent investigator with such compounds, please write to us.

DEBIOPHARM S.A.
Rue du Petit-Chêne 38
1003 LAUSANNE, SWITZERLAND

Circle No. 318 on Readers' Service Card

FASTER THAN ALL THE REST.

IgGsorb® is the IgG adsorbing agent that won't keep you waiting. It removes antibody and antibody-complexed antigen from solution in a mere 15 minutes!

Highly specific for binding the FC portion of IgG antibodies, IgGsorb is a lyophilized preparation

of Protein A fixed to the cell walls of inactivated *Staphylococcus aureus*.

IgGsorb has more than speed too. It has long storage life. Its homogeneity can be assured. And it serves a variety of applications, in some cases replacing charcoal, double antibody, and other cumbersome methods of separation.

Plus, it's available in both liquid and dry form.

Try IgGsorb yourself and see how fast it really is. Because two hour waits you really don't need!

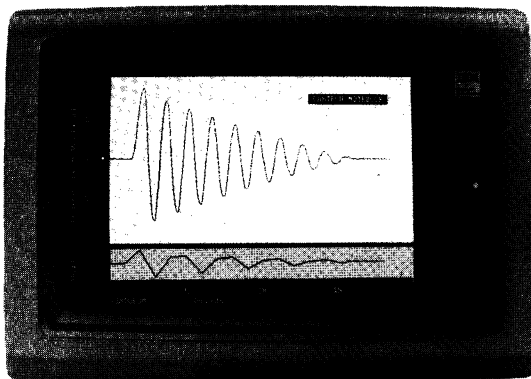
TOLL-FREE 1-800-343-2170

THE ENZYME CENTER, INC.
36 Franklin Street, Malden MA 02148
(617) 322-4885

© The Enzyme Center, Inc., 1985 IgGsorb is a Registered Trademark of The Enzyme Center, Inc.

LABTECH[®] NOTEBOOK

Now the
Accepted
Standard* in
Data Acquisition
Software



LABTECH NOTEBOOK is the remarkable lab software package that performs real-time acquisition, control, analysis and printout of data on your PC—*without programming*. Now you can go from raw data to final report in minutes!

LABTECH NOTEBOOK has proved so popular that it can now be used with *virtually any instrumentation interface and analysis software*. For information on a *30-day free trial*, write Laboratory Technologies today or call (617) 657-5400.

*** LABTECH NOTEBOOK is compatible with:**

Personal Computers: IBM PC, XT, AT or compatibles: AT&T, COMPAQ, Data General, Leading Edge, Sperry, Tandy, Zenith

Instrumentation Interfaces from Acrosystems, Action Instruments, Advanced Peripherals, Burr-Brown, Coulbourn Instruments, Cyborg (ISAAC), Data Translation, Datel, IBM, Interactive Microware, Keithley, Metrabyte, National Instruments, Scientific Solutions, Taurus



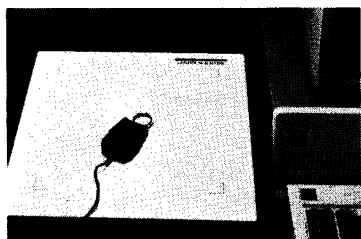
Analysis Software like: 1-2-3[®], NWStatpak[™], RS/1[™], Scientific Plotter-PC[™], Symphony[™]

LABORATORY TECHNOLOGIES CORPORATION
255 Ballardvale St., Wilmington, MA 01887 • (617) 657-5400

RS/1 is a trademark of BBN Software Products Corporation. 1-2-3 and Symphony are trademarks of Lotus Development Corporation. NWStatpak is a trademark of Northwest Analytical. Scientific Plotter-PC is a trademark of Interactive Microware.

Circle No. 259 on Readers' Service Card

AUTOMATE^{NEW} MEASUREMENT ON YOUR IBM PC



**New digitizing tablet with
Sigma-Scan[™] measurement
software. \$1195**

Cat #3011 — 12" x 12" system

Resolution of .025 mm, accuracy of at least .25 mm. Comes with state-of-the-art software for area, linear, perimeter, length of curvy line, and angular measurements. X, Y point or stream digitizing. Descriptive statistics. Transfer data to other programs in standard ASCII or DIF format.

This and other new Microcomputer Tools for the Scientist. Call or write today for FREE catalog.

JANDEL SCIENTIFIC
2656 Bridgeway, Sausalito, CA 94965
800-874-1888
(In Calif. call 415-331-3022)

Circle No. 323 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 November 1979, 10 April 1981.

Price is \$5 each (prepaid).

Write to AAAS, Department POST,
1333 H Street, NW, Washington,
D.C. 20005.

Although some local community and state actions are under way to redress this situation, more than token national leadership is needed. At the very least it should be equivalent to the kind demonstrated in the formation of the U.S. Public Health Corps during that crisis in U.S. history.

Why doesn't the AAAS itself take the lead by sponsoring an adequately prestigious Teaching Corps, with high status and recognition, for exactly this service in our public schools?

WARD J. HAAS

768 Sasco Hill,
Fairfield, Connecticut 06430

Koshland's editorial describes the problems related to scientific literacy accurately and well. The logic behind randomized, replicated experiments deserves more recognition as a major step in the progress of science. R. A. Fisher (1), an architect in the field, wrote that these concepts were ones involving "questions of the right use of human reasoning power, with which all intelligent people, who hope to be intelligible are equally concerned"; scientists obviously need to know about the principles of scientific inference, but also "equally no other thinking man can avoid a like obligation."

The thought that the models we use are approximations could be incorporated into the teaching of science from the start. Not only nonscientists but scientists themselves need to become more aware that we make only successive approximations of the Truth, and we never arrive at it.

The arguments for proper controls and the need for replication seem almost obvious. The principles, however, are not always appreciated. Unfortunately, the example used in Koshland's excellent editorial proves the point. Dividing students into two classes, one to be taught the new math, one the old math, leaves us with two units—classes—one assigned to each treatment—method of instruction. There is no way to estimate experimental error, no replication of units treated alike. The people who denounced this plan because it was a "lottery with students' lives" did the right thing for the wrong reason. It was not good science.

D. F. Cox

*Statistical Laboratory and Department
of Statistics, Snedecor Hall,
Iowa State University, Ames 50011*

References

1. R. A. Fisher, *The Design of Experiments* (Hafner, New York, 1960), pp. 1 and 2.