

SCIENCE

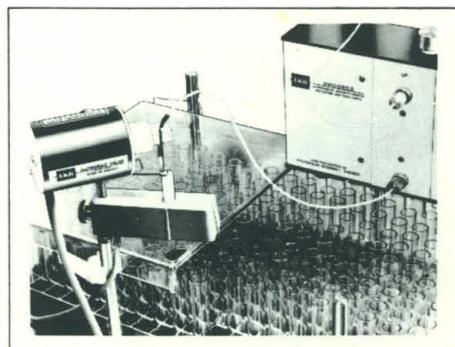
1 May 1970

Vol. 168, No. 3931

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



The LKB UV Analyzer,
the Uvicord is completely compatible with the UltroRac.
The Uvicord detector unit is here shown incorporated,
with the UltroRac, in a separation system.



IN THE SERVICE OF SCIENCE

LKB INSTRUMENTS INC. 12221 PARKLAWN DRIVE, ROCKVILLE MD. 20852
12330 SANTA MONICA BLVD. LOS ANGELES CALIF. 90025.

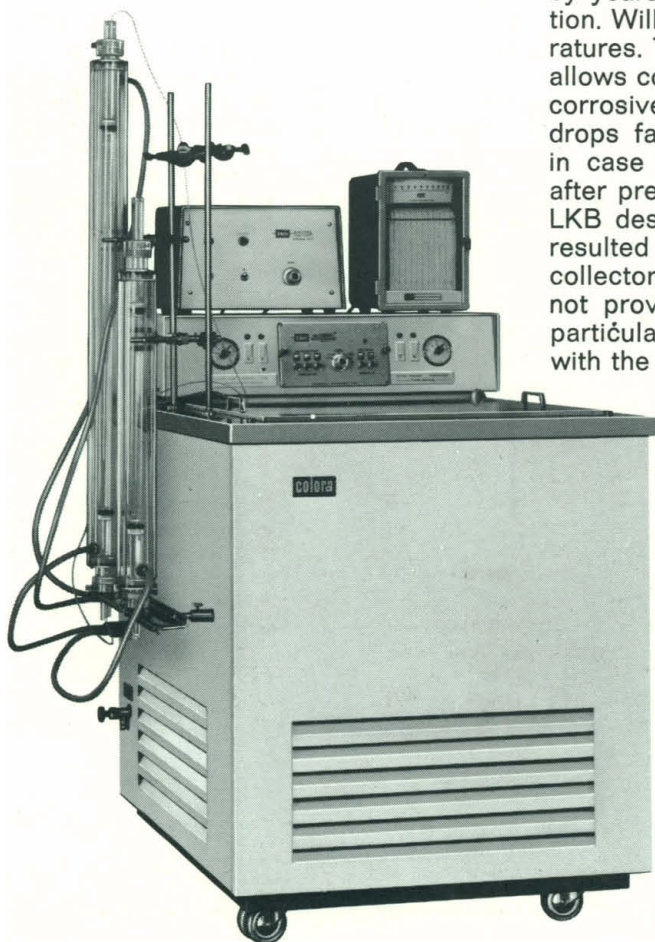
NOW! Refrigerated ***The ULTRORAC is an even better answer***

The LKB 7000 ULTRORAC now the most advanced, reliable, practical, complete fraction collector on the market today.

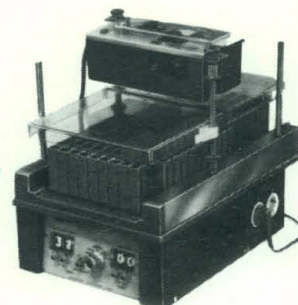
Compact, yet takes 200 tubes — Modern, yet backed by years of experience. Drop, time or volume collection. Will operate as well at $\pm 0^{\circ}\text{C}$ as at normal temperatures. The new "flowstop" prevents loss of samples, allows collection of acids, radioactive substances and corrosives in perfect safety (by positively preventing drops falling between tubes), protects the UltroRac in case of power failure and shuts down collection after pre-determined number of tubes are served.

LKB design — LKB precision — LKB know-how has resulted in LKB making and marketing more fraction collectors than any other Company in the World — why not prove LKB reliability by writing TODAY for full particulars of the LKB 7000 UltroRac Fraction Collector with the LKB 7017A UltroRac Valve.

Sales and Service in USA: New York, Boston, Washington, Chicago, St. Louis, Atlanta, Houston, Los Angeles; in Europe: Stockholm, The Hague, Copenhagen, Rome, Vienna, London; and throughout the world.



IT FITS IN THERE



Saunders Biotexts

With a Reputation for Excellence

Guyton: 3rd Edition

FUNCTION OF THE HUMAN BODY

The thoroughly revised New 3rd Edition of this basic text of human physiology explains the principles behind the body's regulatory mechanisms. It includes an expanded section on cell physiology, and discusses body fluids and the major functional systems. By Arthur C. Guyton, M.D. 475 pp. 363 illust. \$8.50. Jan. 1969.

Gerking:

BIOLOGICAL SYSTEMS

This new textbook in elementary biology is designed specifically for the undergraduate who is not a science major. It encompasses the subject matter that the student can be expected to master in one semester. Biological principles and the history of scientific ideas are emphasized. By Shelby D. Gerking, Ph.D. 480 pp. 269 illust. \$8.50. May 1969.

Goodheart:

AN INTRODUCTION TO VIROLOGY

In this new textbook for microbiology courses, basic virology is covered from the standpoint of the interaction between viruses and cells. This work considers the viruses of plants, animals and bacteria together in order to show their basic similarities. By Clyde R. Goodheart, M.D. 432 pp. 153 illust. \$10. Mar. 1969.

Arey: 3rd Edition

HUMAN HISTOLOGY

In this concisely written and lavishly illustrated guide, Dr. Arey discusses cells, tissues and organs, noting the correlations between structure and function. He uses a compact outline form that points up the important facts in an orderly, logical manner. By Leslie Brainerd Arey, Ph.D., Sc.D., LL.D. 328 pp. 459 illust., 398 in color. \$9. June 1968.

Barnes: 2nd Edition

INVERTEBRATE ZOOLOGY

This fine text has been comprehensively revised with the aid of 16 renowned consultants. The author presents a balanced treatment of the taxonomic, anatomical, physiological, embryological, and ecological aspects of the invertebrates in phylogenic sequence. By Robert D. Barnes, Ph.D. 743 pp. 581 figs. \$10.50. July 1968.

Gardner: 5th Edition

FUNDAMENTALS OF NEUROLOGY

This revised 5th Edition offers up-to-date analysis of the structure and function of the human nervous system. The text incorporates the latest information on neurochemistry, microscopic anatomy, synaptic transmission, and sensory mechanisms. By Ernest Gardner, M.D. 367 pp. 161 illust. \$7.50. June 1968.

Villee, Walker & Smith: 3rd Edition

GENERAL ZOOLOGY

This up-to-date illustrated text gives the student a sound basic understanding of zoology. Revised chapters include such topics as genetics and evolution, animal behavior, and ecology. By Claude A. Villee, Warren F. Walker, Jr. and Frederick E. Smith. 844 pp. 568 illust. \$9.75. Apr. 1968.

Giese: 3rd Edition

CELL PHYSIOLOGY

In this revised book, Dr. Giese gives a complete picture of the functioning of the single cell. The New 3rd Edition incorporates the recent discoveries concerning cell processes and functions. New chapters have been added on biosynthesis and regulation of cell activities. By Arthur C. Giese, Ph.D. 671 pp. 375 illust. \$11.75. May 1968.

Frobisher: 8th Edition

FUNDAMENTALS OF MICROBIOLOGY

This New 8th Edition provides a solid introduction to college-level microbiology. The author presents an especially detailed discussion of the procaryons. Genetic phenomena and mutation, chemotherapy, and immunology receive special consideration. By Martin Frobisher, Sc.D. 629 pp. 411 figs. \$9. Apr. 1968.



For further information or 30-day approval copies of these texts, write:

W. B. SAUNDERS COMPANY

West Washington Square, Philadelphia, Pa. 19105

1 May 1970
Vol. 168, No. 3931

SCIENCE

LETTERS	More Views on College Admissions: <i>L. G. Burk; G. Lester, G. A. Corser; W. O. Romine, Jr.; W. M. Woods</i> ; Opposition to TIAA-CREF Bill: <i>W. B. Harman, Jr.</i> ; Scientific Muckraker's Role: <i>H. Orlans</i> ; DDT Observations: <i>A. M. Reiner; P. F. Torrence</i>	521
----------------	---	-----

EDITORIAL	Troubled Times for Academic Science	525
------------------	---	-----

ARTICLES	Gel Permeation Chromatography: <i>D. D. Bly</i>	527
	Biochemical Differentiation during Amphibian Metamorphosis: <i>P. P. Cohen</i>	533
	Ecological Effects of the War in Vietnam: <i>G. H. Orians</i> and <i>E. W. Pfeiffer</i>	544

NEWS AND COMMENT	Recession in Science: Ex-Advisors Warn of Long-Term Effects	555
	National Academy of Engineering Selects New Members	556
	Earth Day: A Fresh Way of Perceiving the Environment	558
	Discrimination: Women Charge Universities, Colleges with Bias	559

BOOK REVIEWS	<i>Hans Berger on the Electroencephalogram of Man</i> , reviewed by <i>J. L. O'Leary</i> ; other reviews by <i>H. C. Wilson, R. Stuckenrath, Jr., K. Kojima, D. J. Struik, B. W. Batterman, D. D. Brown, C. B. Kimmel, W. R. Horsfall</i>	562
---------------------	---	-----

REPORTS	Superconductivity in Layered Structure Organometallic Crystals: <i>F. R. Gamble et al.</i>	568
	Radiation Effects and Oxygen Vacancies in Silicates: <i>A. Chatelain, J. L. Kolopus, R. A. Weeks</i>	570
	Solar Activity Index: Validity Supported by Oxygen Isotope Dating: <i>J. R. Bray</i>	571
	Coincidence of Climatic and Faunal Fluctuations in Pleistocene Bermuda: <i>S. J. Gould</i>	572
	Dentary-Squamosal Joint and the Origin of Mammals: <i>H. R. Barghusen</i> and <i>J. A. Hopson</i>	573
	Radioactivity Induced in Apollo 11 Lunar Surface Material by Solar Flare Protons: <i>H. R. Heydegger</i> and <i>A. Turkevich</i>	575
	Periphyton: Autoradiography of Zinc-65 Adsorption: <i>F. L. Rose</i> and <i>C. E. Cushing</i>	576

BOARD OF DIRECTORS

H. BENTLEY GLASS
Retiring President, Chairman

ATHELSTAN SPILHAUS
President

MINA REES
President-Elect

DAVID BLACKWELL
RICHARD H. BOLT

LEWIS M. BRANSCOMB
BARRY COMMONER

VICE PRESIDENTS AND SECTION SECRETARIES

MATHEMATICS (A)
R. P. Boas
F. A. Ficken

PHYSICS (B)
R. G. Sachs
Albert M. Stone

CHEMISTRY (C)
Herman S. Bloch
Leo Schubert

ASTRONOMY (D)
Helmut A. Abt
Arlo U. Landolt

ANTHROPOLOGY (H)
Margaret Mead
Anthony Leeds

PSYCHOLOGY (I)
Frank W. Finger
William D. Garvey

SOCIAL AND ECONOMIC SCIENCES (K)
Robert M. Solow
Harvey Sapolsky

HISTORY AND PHILOSOPHY OF SCIENCE (L)
George Wald
Raymond J. Seeger

PHARMACEUTICAL SCIENCES (Np)
Don E. Francke
Joseph A. Oddis

AGRICULTURE (O)
T. C. Byerly
Michael A. Farrell

INDUSTRIAL SCIENCE (P)
Sherwood L. Fawcett
Burton V. Dean

EDUCATION (Q)
Frederic B. Dutton
J. Myron Atkin

DIVISIONS

ALASKA DIVISION

Victor Fischer
President
Irma Duncan
Executive Secretary

PACIFIC DIVISION

William C. Snyder
President
Robert C. Miller
Secretary

SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION

Newell A. Younggren
President
Marlowe G. Anderson
Executive Secretary

SCIENCE is published weekly on Friday and on the fourth Tuesday in September by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Now combined with *The Scientific Monthly*. Second-class postage paid at Washington, D.C. Copyright © 1970 by the American Association for the Advancement of Science. Annual subscription \$12; foreign postage: Americas \$3; overseas \$5; single copies, 50¢ (back issues, \$1) except *Guide to Scientific Instruments* and the 30 January issue, which are \$3 each. School year subscription: 9 months, \$9; 10 months, \$10. Provide 4 weeks notice for change of address, giving new and old address and zip codes. Send a recent address label. SCIENCE is indexed in the *Reader's Guide to Periodical Literature*.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Hominid Phylogeny and Immunology: A Critical Appraisal: <i>D. W. Read and P. E. Lestrel</i>	578
Thoracic Temperature Stabilization by Blood Circulation in a Free-Flying Moth: <i>B. Heinrich</i>	580
DDT Metabolism: Oxidation of the Metabolite 2,2-bis(<i>p</i> -Chlorophenyl)Ethanol by Alcohol Dehydrogenase: <i>J. E. Suggs et al.</i>	582
Phenolic Aldehydes: Generation from Fossil Woods and Carbonaceous Sediments by Oxidative Degradation: <i>R. F. Leo and E. S. Barghoorn</i>	582
Mutagenicity of Trimethylphosphate in Mice: <i>S. S. Epstein et al.</i>	584
Aerial Vision: Unique Adaptation in an Intertidal Fish: <i>J. B. Graham and R. H. Rosenblatt</i>	586
Formation of Virus-like Particles by Bone Cells in Mice with a High Incidence of Spontaneous Leukemia: <i>B. H. Schofield et al.</i>	588
Antennal Receptors: Reactions to Female Sex Attractant in <i>Periplaneta americana</i> : <i>J. Boeckh, H. Sass, D. R. A. Wharton</i>	589
Maize Leaf Elongation: Continuous Measurements and Close Dependence on Plant Water Status: <i>T. C. Hsiao, E. Acevedo, D. W. Henderson</i>	590
Vitamin B ₁₂ Binders of Chicken Serum and Chicken Proventriculus Are Immunologically Similar: <i>D. W. Sonneborn and H. J. Hansen</i>	591
<i>p,p'</i> -DDT: Effect on Calcium Metabolism and Concentration of Estradiol in the Blood: <i>D. B. Peakall</i>	592
DDT-Induced Inhibition of Avian Shell Gland Carbonic Anhydrase: A Mechanism for Thin Eggshells: <i>J. Bitman, H. C. Cecil, G. F. Fries</i>	594
Human Glomerular Basement Membrane: Chemical Alteration in Diabetes Mellitus: <i>P. J. Beisswenger and R. G. Spiro</i>	596
L-Glutamic Acid Decarboxylase: A New Type in Glial Cells and Human Brain Gliomas: <i>B. Haber, K. Kuriyama, E. Roberts</i>	598
Clutch Size in Birds: Outcome of Opposing Predator and Prey Adaptations: <i>R. E. Ricklefs</i>	599
Circadian Clock in Insect Photoperiodism: <i>D. S. Saunders</i>	601
Terrestrial and Aquatic Orientation in the Starhead Topminnow, <i>Fundulus notti</i> : <i>C. P. Goodyear</i>	603
Retinoscopy and Eye Size: <i>M. Glickstein and M. Millodot</i>	605
<i>Technical Comments</i> : Quicklime: Effects on Soft-Bodied Marine Organisms: <i>R. L. Turner</i> ; Initiation of the Breakdown to Turbulence: <i>R. C. Wanta</i> ; Birth Control for Economic Development? <i>C. W. F. Bock</i> ; Origin of Glass Deposits in Lunar Craters: <i>J. Green</i> ; <i>E. D. Dietz and P. J. Vergano</i> ; <i>W. R. Greenwood and G. Heiken</i> ; <i>T. Gold</i>	606
MEETINGS Hepatic Microsomal Mixed Function Oxidase: <i>J. B. Schenkman</i> ; Transplant Donation Procedures: <i>R. E. Stevenson, A. M. Sadler, Jr., B. L. Sadler</i> ; Courses	612

GERALD HOLTON
PHYLLIS V. PARKINS

LEONARD M. RIESER
KENNETH V. THIMANN

WILLIAM T. GOLDEN
Treasurer

DAEL WOLFLE
Executive Officer

GEOLOGY AND GEOGRAPHY (E)
Richard H. Mahard
William E. Benson

ZOOLOGICAL SCIENCES (F)
David Bishop
Richard J. Goss

BOTANICAL SCIENCES (G)
William A. Jensen
Arthur W. Cooper

ENGINEERING (M)
Newman A. Hall
Raynor L. Duncombe

MEDICAL SCIENCES (N)
Leon O. Jacobson
F. Douglas Lawrason

DENTISTRY (Nd)
Robert C. Likins
Richard S. Manly

INFORMATION AND
COMMUNICATION (T)
R. M. Hayes
Scott Adams

STATISTICS (U)
Douglas Chapman
Ezra Glaser

ATMOSPHERIC AND HYDROSPHERIC
SCIENCES (W)
Robert M. White
Louis J. Battan

COVER

Defoliated forest trees along Vietnam-Cambodia border. See page 544 [E. W. Pfeiffer, University of Montana]

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 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.



How to get involved in Hasselblad wide angle photography. For under \$1,000. Or over \$1,000.

For under \$1,000 you can buy a Hasselblad Super Wide C. The whole camera. Body. Lens. Magazine and all.

The lens is a 38mm Zeiss Biogon f/4.5, and you couldn't buy it separately for any money. Because it comes permanently attached to the camera body.

The Super Wide C is the only Hasselblad that isn't a reflex camera. It couldn't be. To take advantage of its optical properties, a true wide-angle lens such as the 38mm Biogon had to be placed less than 3/4" from the film plane. Which didn't leave much room for a mirror.

So we gave up a mirror to gain some unique advantages.

Like superb corner to corner sharpness and distortion-free images that only a true wide angle lens can give. (Verticals and horizontals emerge as straight lines, not distorted curvatures from edge to edge.)

And a sweeping 90° angle of view (a normal lens covers about 52°) that lets you take in a wide area without having to back away from your subject.

And enormous depth of field (at f/22, everything is sharp from 12" to infinity) which makes the Super-Wide C a great camera for grabbing quick shots when there isn't time to focus.

And a very compact camera for one that provides 2 1/4" x 2 1/4" photographs.

The Super Wide C employs an

38mm Biogon	Comparison of lenses	40mm Distagon
f 4.5	Aperture	f 4
38mm	Focal length	40mm
90°	Angle of view	88°
8	Number of lens elements	10
12" to ∞	Focusing range	19" to ∞
B, 1-1/500 sec	Synchro Compur Shutter	B, 1-1/500 sec
4.5-22	Diaphragm	4-32
63	Filters—Hasselblad Series	104
Optical	Viewing system	Reflex
No	Interchangeable?	Yes
Under \$1,000 (including body)	Price	Over \$1,000 (including body)

optical viewfinder. But should you ever require reflex viewing and focusing, you can remove the film magazine and attach a ground glass back in its place. Then when you're ready to shoot, just take it off and put the film magazine back.

The magazine might be any one of the five interchangeable film magazines of The Hasselblad System, because the Super Wide C accepts them all. So you can work in a variety of film formats and exposures per roll, all the way up to 70.

The Super Wide C was one of the Hasselblads chosen by NASA for use in space. During Gemini 9, it was taken on a two hour space walk where it recorded fifty remarkable photographs, working in total vacuum.

For over \$1,000 you can buy our 40mm Zeiss Distagon f/4.5 lens, and a camera to go with it.

The lens alone costs about as much as the entire Super Wide C camera, and you still need a body

and film magazine.

It costs what it does because the Distagon is a very remarkable lens.

It had long been thought that 50mm was the practical limit in building a fast, wide angle lens for a 2 1/4" reflex camera. Which limited the angle of view to 75°.

The Distagon broke the rules. It added another 13° to the angle of view, and proved to be as distortion-free as our 38mm Biogon.

But the biggest advantage of the Distagon lens is that it fits the Hasselblad 500 C and 500 EL cameras. So you can look through the large ground glass and see what's in and what's out of focus, how vertical the verticals are and what kind of perspective the

finished picture will have.

The Distagon lens also interchanges with nine other Carl Zeiss lenses, up to 500mm telephoto.

And allows you to utilize all the backs and accessories of The Hasselblad System.

Both the 38mm Biogon and 40mm Distagon lenses are very much alike in terms of quality. Both lenses have built-in Compur shutters, so you can shoot at any shutter speed with any type of flash. Which is only possible when the shutter is in the lens—instead of in the camera.

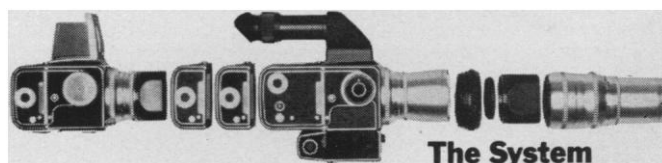
The big difference between these two wide angle lenses is that one permits reflex viewing and one doesn't.

And it's up to you to decide how much that's worth to you.

For information, see your Hasselblad dealer. For his name, and a free 48-page catalog on The Hasselblad System, write to address below.

H A S S E L B L A D

Paillard Incorporated,
1900 Lower Road, Linden, N.J. 07036.
Other products: Bolex movie equipment,
Hermes typewriters and figuring machines.



Concepts from Union Carbide:

Cryogenic freezing of red blood cells

Probably no single problem has received more attention from cryobiologists than the preservation of the human red cell. And with good reason. Procedures that extend the supply of erythrocytes for transfusion have meaning in terms of human lives.

The prospect of a frozen blood reserve has been a matter of intensive interest to the blood banking agencies for the past twenty years; some have played a major role in the scientific attack on the problem. It has not been easy. It was observed in 1941 that red cells (suitably protected with additive substances) could survive the drastic environmental changes induced by freezing. Since then, processes have been sought for the preservation of blood in the frozen state that would provide a useful and acceptable product for transfusion. As evidenced over the past decade by the successful transfusion of thousands of units of blood preserved in the frozen state, that goal seems to have been reached.

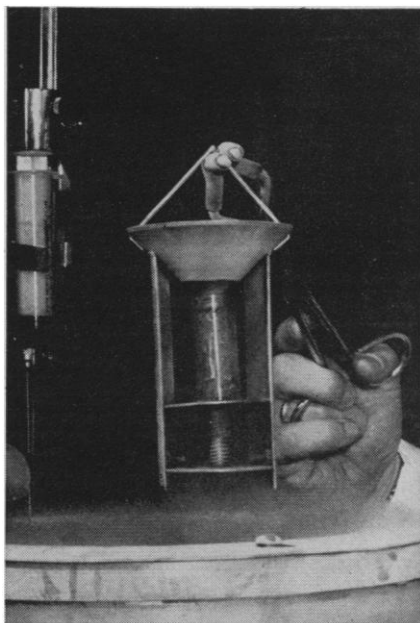
The current limitation of twenty-one to twenty-eight days for blood preserved by conventional methods in the liquid state has often taxed the resources of the organizations that undertake to provide our communities with supplies of this indispensable agent. The relatively short shelf life of the cellular components of blood adds to the problem of coordinating supply with demand. The less common blood types sometimes are difficult to procure, but even the more common types may vary in supply at any given time.

Red cell wastage is an inevitable consequence of the dating period necessarily imposed on blood stored at 4°C. A primary objective of agencies interested in preserving blood at low temperatures is to prevent this wastage. Another, of course, is to assure adequate reserves of all types of blood at all times for each community. Conceivably then, as frozen blood banks become established in various parts of the country, an integrated and computerized inventory system could be developed that would result in an effective national reserve.

Several practical approaches to the preservation of blood at low temperatures have evolved. All have some elements in common. A solution of additives, often called cryoprotective agents—glycerol is the outstanding example—is combined with the red cells from which most of the plasma and much of the other cellular components of blood (leukocytes and thrombocytes) have been removed. This is done in special containers in which the erythrocytes are cooled and placed in long-term storage. When needed, the erythrocytes are withdrawn from storage, warmed, and subjected to a washing procedure to remove the protective agent before transfusion.

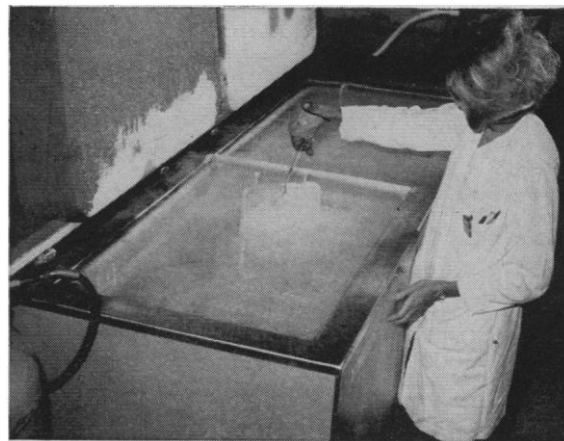
The heart of a frozen blood reserve is the storage facility. Storage equipment is of two general types: cryogenic and noncryogenic. The latter provides temperatures down to about -85°C and depends on electric power. The cryogenic equipment is independent of a power source and provides lower storage temperatures—down

to -196°C—with liquid nitrogen, the most commonly used refrigerant. Associated with such storage equipment are cryogenic shipping units that permit transport of blood in the frozen state without danger of a destructive rise in temperature that might render the blood cells unfit for transfusion.



Small quantities of blood are instantly frozen for long-term storage in the drop-let freezer. A mechanically vibrated syringe releases droplets into a revolving drum of liquid nitrogen. The frozen droplets are collected in the base. Thousands of droplets can be collected from each sample for use as reference specimens.

The banking of frozen blood with longer shelf life should considerably enhance the ability of the blood supply agencies to meet demand and might influence current procurement practices. The use of cryogenic storage equipment would provide a margin of safety for autologous blood banking in which individuals of rare blood type would establish a reserve of their own blood in anticipation of later need. Probably most important in terms of medical need, the availability of banks of frozen red cells would seem likely to lead to the development of banks of the other cellular components of blood. With current liquid state storage procedures, platelets and leukocytes—far less stable than the red cell—are without transfusion value within about three days or less after donation. At present, the only prospect for establishing a large-scale reserve of these invaluable components is to preserve them in the frozen state. Although low temperature preservation procedures for these cells are not technically as far advanced as for the red cell, several blood laboratories are fully aware of the need and are attacking the problem vigorously.



The refrigerator shown here stores red blood cells for transfusions. No other cryogenic refrigerator provides as much storage capacity in as little space as the LINDE LR-1000.

LINDE cryogenic refrigerators come in all shapes and sizes

Union Carbide Corporation produces a full line of cryogenic refrigerators, dewars, and controlled-rate freezers. These low-temperature liquid nitrogen units can solve your preservation problems. Until recently, blood could only be stored for about twenty-one days. Now, it can be stored for a century or more and, when thawed, be as viable as it was the day it was taken from the donor.

Union Carbide Corporation
Linde Division
Dept. SC-8
P.O. Box 264
Radio City Station, New York, N.Y. 10019

I would like additional information:

- ☐ LN₂ refrigerators ☐ Temperature/level controllers
☐ LN₂ dewars ☐ Liquid nitrogen storage and supply

Name _____
(Please Print or Type)

Street _____

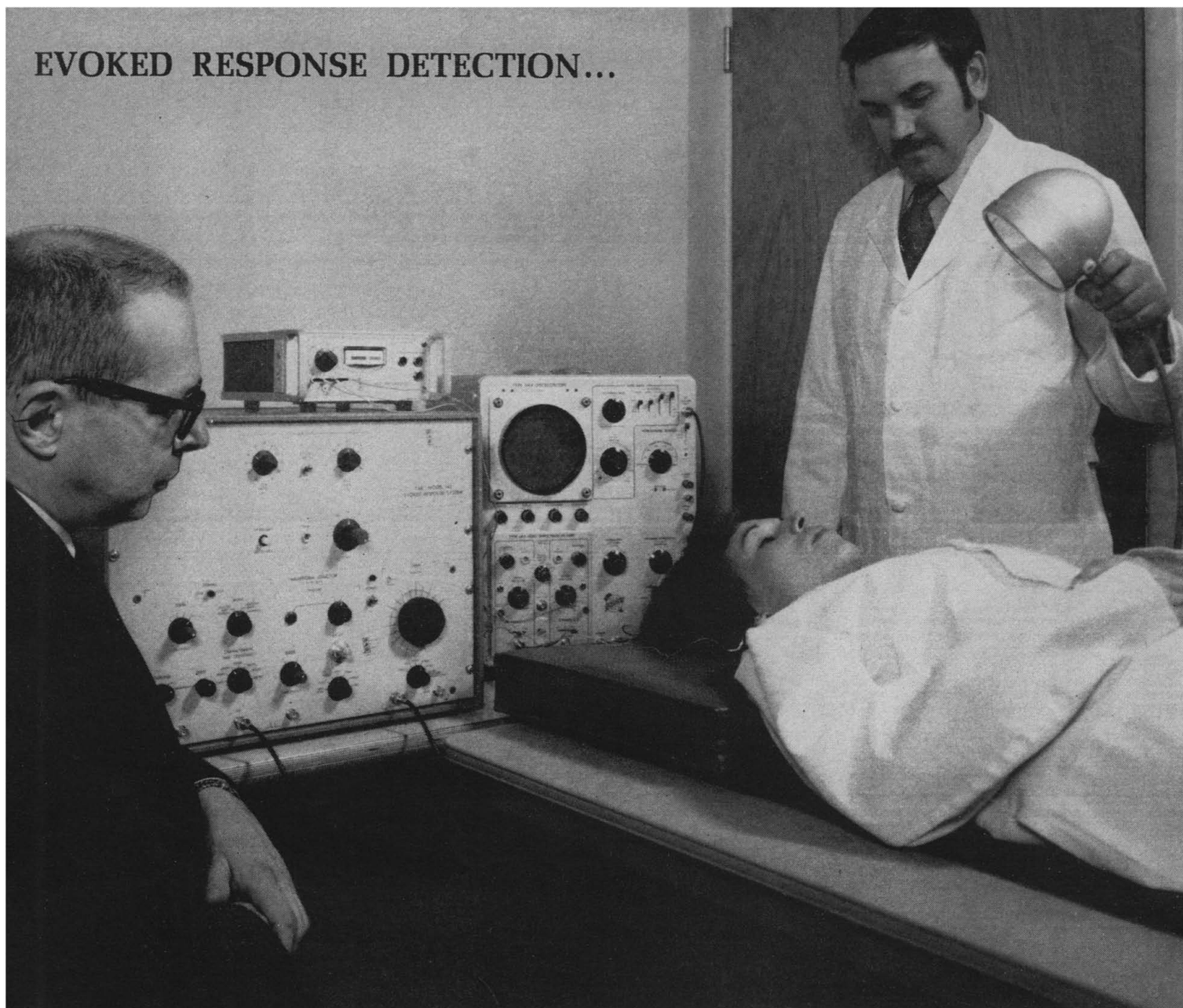
City _____ State _____ Zip Code _____

UNION CARBIDE **CRYOGENIC PRODUCTS**

UNION CARBIDE CORPORATION, LINDE DIVISION,
270 PARK AVENUE, NEW YORK, N.Y. 10017

LINDE and UNION CARBIDE are registered trademarks of Union Carbide Corporation.

EVOKED RESPONSE DETECTION...



Three new P.A.R. systems detect response to aural, photic or tactile stimuli.

Now, detect evoked response to aural, photic or tactile stimuli with one of three new systems from P.A.R. Each system includes an amplifier, EEG preamplifier, and a signal averager. And each is packaged in a convenient-to-use, attractive cabinet.

The EEG preamplifier minimizes noise and pick-up, and operates satisfactorily with electrode contact resistances as high as 50,000 ohms. Amplifier features include continuously variable gain to $\times 100,000$, a broad selection of roll-off points for improved signal definition, and a notch filter to attenuate the effects of line-frequency interference.

The heart of these new instrument systems is the signal averager section which extracts the evoked cortical response from on-going EEG activity. One 50 point or two 100 point averagers are available — one of the latter being the widely used PAR Waveform Educator™.

Prices of the three systems range from \$4,000 to \$5,450 including electrodes and cables. The only additional equipment required is a stimulus generator and an oscilloscope or chart recorder for display of information obtained. For complete details call (609) 924-6835, or write Princeton Applied Research Corporation, P.O. Box 565, Princeton, New Jersey 08540.



PRINCETON APPLIED RESEARCH CORPORATION

We want to be useful ...and even interesting

Kodak

Dehydrobenzene

While pondering spatial arrangements of electron clouds and nuclei that might modify our poly(ethylene terephthalate) the better to support the photographic image as film base, or your feet as carpeting, we have been much impressed with the intermediate benzyne, C_6H_4 , or to state it better, C_6H_4 . Such electron configuration and such steric strain result in an avid aromatic electrophile. It lasts 10^{-4} sec at best. Therefore it wasn't recognized as an intermediate in the commercial chemical sense during all the years it was unwittingly generated by the thousands of tons in the course of manufacturing phenol by alkali fusion of arenesulfonates or alkaline hydrolysis of aryl chlorides.

Wittingly to generate it, there are routes for various temperatures, as given by literature references in a Letter to the Editor from the Kodak Research Laboratories (*J.A.C.S.* 91:510 (1969)).

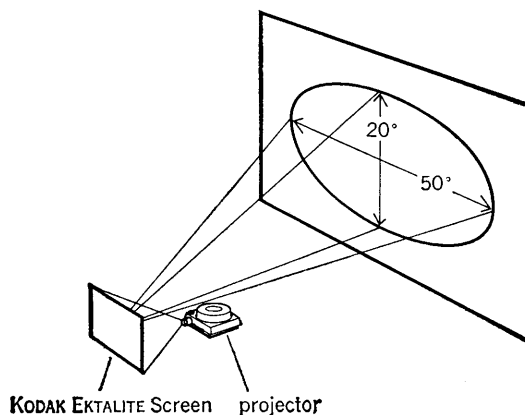
Wherewithal such as Anthranilic Acid (EASTMAN 29), iso-Pentyl Nitrite (EASTMAN P436), Propylene Oxide (EASTMAN 2068), Diphenyliodonium-2-carboxylate (EASTMAN 10707), Diglyme (EASTMAN P6843), o-Aminobenzenesulfonic Acid Sodium Salt (EASTMAN 10861), and the diagnostic probe 1,4-Dimethoxyanthracene (EASTMAN 10863) can be ordered from leading lab suppliers.

A pertinent monograph is R. W. Hoffmann's *Dehydrobenzene and Cycloalkynes*, Academic Press, New York (1967).

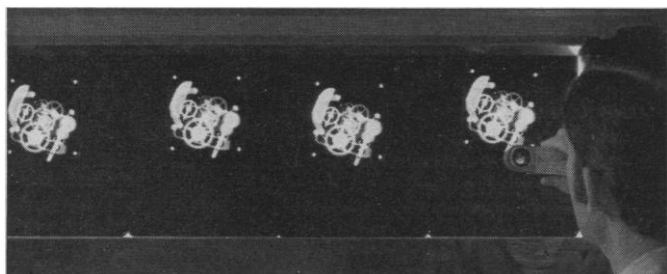


Light delivery

The big screen in the above demonstration is a conventional one. It is simply showing you the light distribution pattern from an unconventional 40" x 40" screen facing it. Call the unconventional one KODAK EKTALITE Projection Screen, Model 2, when ordering it from a dealer listed in the Yellow Pages under "Audio Visual Equipment." As compared with



a non-directional screen, it delivers 6 to 8 times as much light into the viewing space, at the expense of light sent outside the space, where there are no eyes to receive the picture being shown. Classrooms that use it need never be darkened to keep the sunlight from diluting slides and films. Other uses are conceivable.



X-rays of mass-produced goods?

Nonsense. But what if no people were needed to look at the film?

Take an item a bit more advanced than a windup alarm clock, like a bill-changing machine. Even that kind of merchandise can't carry too heavy a cost load for inspection—radiographic or whatever is technically required—and survive in the marketplace. The public has to accept the facts of life: scientists discover new principles, engineers apply the principles with great ingenuity, but the resulting gadget will not

necessarily work literally *every* time someone fumbles around with it on a dark night. Accept it, even if you don't like it.

This bothers certain idealists, some of whom work in the Kodak Research Laboratories on automatic pattern recognition. They are so hypnotized by the subject that the Medical Department doesn't always like the hours they insist on keeping.

While the human nervous system is hard to beat at pattern recognition, it falls prey to boredom and ambition. Machines have been taught to inspect millions of bubble pattern photographs for indications of interesting nuclear physics. Discovering poorly seated screws may be no harder. That inanimate inspectors would still be using film may surprise you. Though concocted from silver, bones, and a little chemical magic, it is still far from fully exploited for information-packing density, which correlates strongly with economy. If every alarm clock or every nozzle for a steam-driven automobile is to require a bit of film, it will have to be a rather *small* bit of film.

It's a little in the future. Don't write yet.

For more of a look at little worlds



Dialux®

Please send me your catalog
describing the remarkable new
Dialux Laboratory Microscope.

Name _____

Address _____

Zip _____

Dialux is the latest member of our new generation of Leitz trend-setting microscopes. The maximum in laboratory microscopes...in looks, in refinements, in capability.

Whether your daily work load demands visual observation or photomicroscopy in dark-field, fluorescence, polarized light, phase contrast, or conventional bright-

field, this remarkable instrument handles it with competence...and handles it day in, day out with ease.

Microscopy of the 70s will look even brighter through the lenses of your Dialux, the last word in future microscopes.

76570

Leitz®

E. Leitz, Inc.
Rockleigh, New Jersey 07647

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.

Editorial Board

1970

GUSTAF O. ARRHENIUS	RICHARD C. LEWONTIN
FRED R. EGGAN	ALFRED O. C. NIER
HARRY F. HARLOW	FRANK W. PUTNAM
MILTON HARRIS	

1971

THOMAS EISNER	NEAL MILLER
AMITAI ETZIONI	BRUCE MURRAY
EMIL HAURY	JOHN R. PIERCE
DANIEL KOSHLAND, JR.	

Editorial Staff

Editor

PHILIP H. ABELSON

Publisher

DAEL WOLFE

Business Manager

HANS NUSSBAUM

Managing Editor: ROBERT V. ORMES

Assistant Editors: ELLEN E. MURPHY, JOHN E. RINGLE

Assistant to the Editor: NANCY TEIMOURIAN

News Editor: JOHN WALSH

Foreign Editor: DANIEL S. GREENBERG*

News and Comment: LUTHER J. CARTER, PHILIP M. BOFFEY, ANDREW HAMILTON, NANCY GRUCHOW, SCHERRAINE MACK

Research Topics: ROBERT W. HOLCOMB

Book Reviews: SYLVIA EBERHART

Editorial Assistants: JOANNE BELK, ISABELLA BOULDIN, ELEANORE BUTZ, GRAYCE FINGER, NANCY HAMILTON, CORRINE HARRIS, OLIVER HEATWOLE, ANNE HOLDSWORTH, MARSHALL KATHAN, PAULA LECKY, KATHERINE LIVINGSTON, MARGARET LLOYD, VIRGINIA NUESSELE, PATRICIA ROWE, LEAH RYAN, LOIS SCHMITT, BARBARA SHEFFER, RICHARD SOMMER, YA LI SWIGART, ALICE THEILE, MARIE WEBNER

* *European Office:* 22 Mulberry Walk, London, S.W.3, England (Telephone: 352-9749)

Advertising Staff

Director

EARL J. SCHERAGO

Production Manager

KAY GOLDSTEIN

Advertising Sales Manager: RICHARD L. CHARLES

Sales: NEW YORK, N.Y. 10036: Robert S. Bugbee, 11 W. 42 St. (212-PE-6-1858); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); MEDFIELD, MASS. 02052: Richard M. Ezequille, 4 Rolling Lane (617-444-1439); CHICAGO, ILL. 60611: Herbert L. Burkland, Room 2107, 919 N. Michigan Ave. (312-DE-7-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772)

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. See also page xviA, *Science*, 27 March 1970. ADVERTISING CORRESPONDENCE: Room 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE-6-1858.

Troubled Times for Academic Science

Conversation with academic scientists these days is often a depressing experience. Almost all of them have been affected by one or more of four major adverse developments—student riots, financial problems, job insecurity, and loss of prestige.

Student disorders and faculty dissension have shaken the Ivory Tower. Some professors have begun to question whether real scholarship will ever again be possible at their universities. They speak of the time wasted in numerous and endless faculty meetings and the divisive effects of controversy on professional relations among faculty.

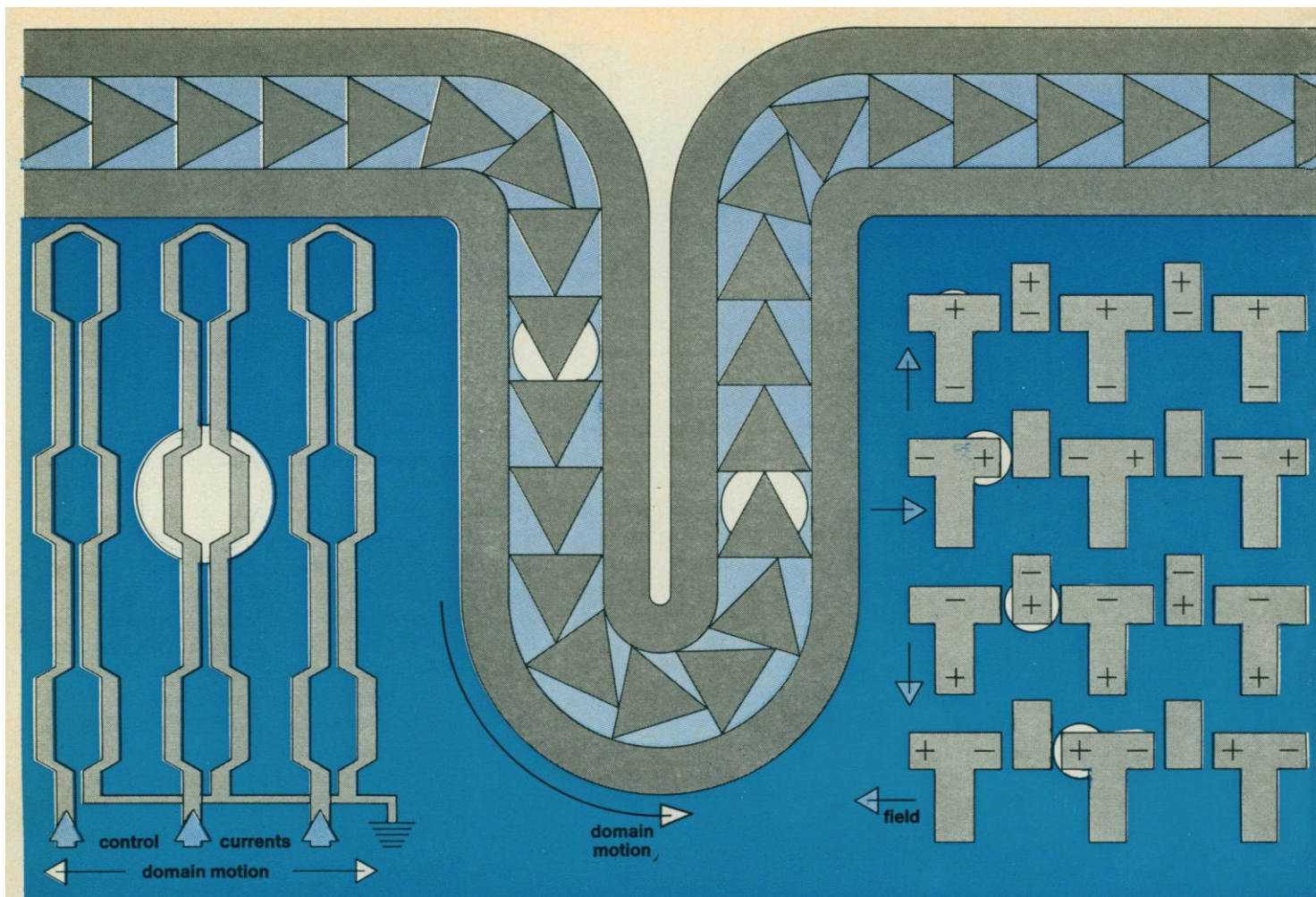
Student disorders have had sequelae in the form of smaller alumni contributions or unfavorable action by state legislatures. Universities have also incurred added expenses for enlarged security forces. Costs of fire insurance on campus have jumped. These financial burdens have come at a time when many universities were straining their resources, even incurring deficits, to support disadvantaged minorities. In consequence, the financial blows that have been coming from Washington have been keenly felt. Worst hit are those institutions that asked tenured staff to obtain part of their salaries from grants and contracts. However, almost all universities find themselves in a tight financial bind. Few are in a position to give substantial help to the professor who has lost his support from Washington.

The financial problems of universities have adversely affected job opportunities and job security. Some institutions have found it necessary to curtail sharply the filling of vacancies and have not been able to create new positions. Those looking for situations find keen competition for jobs in industry and in community colleges.

To many engaged in research the worst blow has been a decline in the prestige of science. For nearly two decades after World War II scientists enjoyed especially high public esteem. In part this was related to the Cold War and to competition with the U.S.S.R. In part it arose from the belief that science and technology were bringing an increasingly affluent society. Now the public has turned its attention away from the Russians and it is bored with, even critical of, affluence.

The scientists who earned high prestige through their efforts in World War II were initially surprised and mildly pleased. Later they and others came to accept their status as some kind of vested right. Many young people questing for personal significance were attracted to the glamor of science. They did not always bring with them an equal hunger for insight or enthusiasm for the humble search for truth. Thus, the loss of prestige is keenly felt by most scientists but especially by the young, whose current experiences conform so poorly with expectations.

Academic scientists will somehow manage to find ways of dealing with most of the problems currently troubling them. University administrations will implement reforms, and students and faculty will grow weary of disruptions. Ultimately the day must come when industry and government will recognize that in self-interest they must support academic science financially and politically. That day will be hastened if scientists do their part. Regaining prestige is another matter. Those whose value system places glamor first probably will find it desirable to leave science. With time, however, there will be new dramatic manifestations of the nation's long-term dependence on the scientific enterprise, and society will acknowledge that it needs science to survive.—PHILIP H. ABELSON



The magnetic abacus

Scientists at Bell Laboratories have invented ways to create, erase, and propel tiny cylindrical magnetic "bubbles" (domains) in sheets of orthoferrite—rare-earth iron oxide. Because the presence or absence of the bubbles at specific positions can represent binary numbers, they can perform many functions in digital data processing.

Bubbles are areas whose magnetic field is opposite to that in the rest of the material; their size and shape depend on the material and on an external magnetic "bias" field. In samarium terbium ferrite, for instance, 42 Oersteds maintains 0.0008-inch diameter bubbles. A bubble can be moved its own diameter in 0.01 microsecond, promising a data rate of over a million bits per second. We've invented three basic ways to move them:

In the first (above left), thin-film

conductor loops are deposited onto the orthoferrite sheet. Currents through the loops move the bubbles from under one loop to an adjacent one. With a second pattern of loops at right angles to the first, the bubbles can move all over the sheet, like checkers.

In a second scheme (center), high permeability thin-film permalloy triangles are deposited on the sheet. A bubble "adheres" to any triangle it contacts. But, if the overall bias field is reduced, the bubble expands, and contacts the side of the next triangle. If the field is then strengthened, the bubble contracts, holding to the triangle it has contacted and sliding "downhill" off the original one. A bubble moves one step with each cycling (between 38 and 44 Oersteds) of the bias field; the permalloy "rails" confine the bubbles to the path.

A third scheme (right), a "T-and-

bar" system, also uses a thin-film permalloy pattern on the sheet. Here, the bubbles are propelled by a field rotating in the plane of the sheet. The rotating field (arrows) causes changing polarities on the T's and bars; the bubbles shift in response. Rotation in the opposite direction reverses the movement.

In practical devices, we must be able to create and to detect the bubbles. We do the first by fission, from existing bubbles. We detect them by their external magnetic effects or optically.

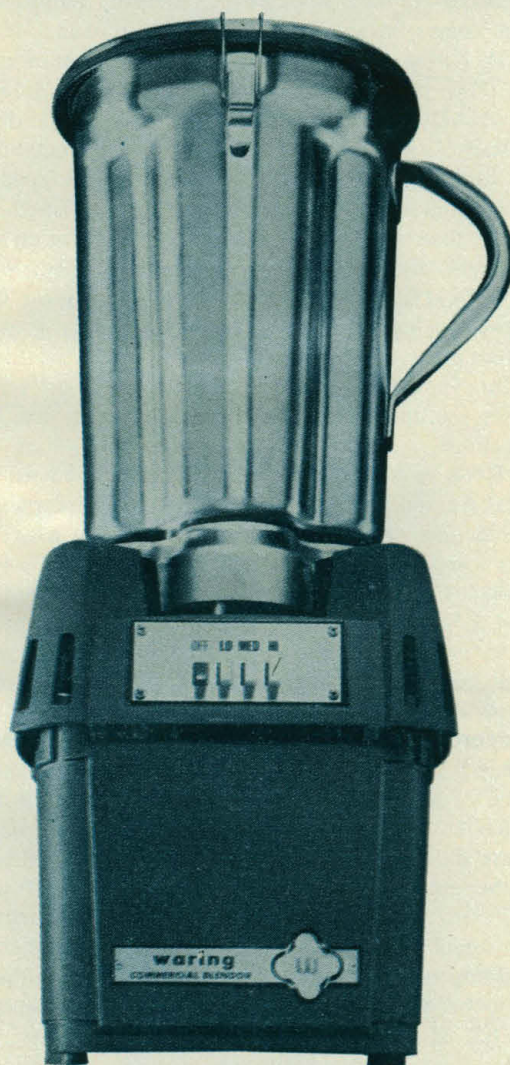
A product of fundamental research in magnetism, the bubbles may provide compact and inexpensive data storage and processing for tomorrow's computers and telephone switching systems.

From the Research and Development Unit of the Bell System:



Bell Labs

Only Waring makes Blendors®



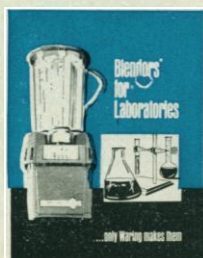
just for laboratories

... with the one-gallon Waring's exclusive cloverleaf shape, hydrodynamically designed for perfect blending action ... with a solid one-piece cover plus molded gasket for a perfect seal ... and with our 3-speed, 1725-watt motor — you can grind, emulsify, disintegrate, homogenize, shred, blend, or mix with power to spare, and in seconds!

Waring's one-gallon container, cover, and blending assembly are stainless steel, easy to clean and trouble free. There's a marvelous adapter that lets you use the smallest container on a one-gallon motor base.

There are explosion-proof models ... one-quart models, some with timers, some with 7-speed controls ... and accessories from 12 ml "Mini Containers" to ice crusher attachments. All are heavy duty construction and warranted for one year of commercial use.

Waring Blendors are unique — no wonder we copyrighted the name!



**Write
for our
new catalog
and
see for
yourself.**

waring

Waring Products Division
Dynamics Corporation of America
New Hartford, Conn. 06057

UNIFORM DONOR CARD

OF _____
Print or type name of donor

In the hope that I may help others, I hereby make this anatomical gift, if medically acceptable, to take effect upon my death. The words and marks below indicate my desires.

I give: (a) _____ any needed organs or parts
 (b) _____ only the following organs or parts _____

Specify the organ(s) or part(s) _____
 for the purposes of transplantation, therapy, medical research or education;
 (c) _____ my body for anatomical study if needed.

Limitations or special wishes, if any: _____

Signed by the donor and the following two witnesses in the presence of each other:

Signature of Donor _____
Date of Birth of Donor

Date Signed _____
City & State

Witness _____
Witness

This is a legal document under the Uniform Anatomical Gift Act or similar laws.
 For further information consult your physician or
NK National Kidney Foundation
 315 Park Ave., South, New York, N.Y. 10010

Fig. 1. Uniform Donor Card (sample).

The card, when completed by anyone 18 years of age or more and witnessed by two persons, serves as a legally valid document to make a gift of organs or tissues under the provisions of the Uniform Anatomical Gift Act or similar laws. The card need not be filed or recorded, and further validation is not required for the donor's wishes to be honored. The card may be used to donate any needed organs or parts, a specific organ or part, or the body for anatomical study according to the donor's wishes. Provision for special directions or conditions concerning the gift are included.

In the past year, 44 states have adopted the Uniform Anatomical Gift Act, most with little or no modification. The remaining jurisdictions, three of which had no legislative sessions in 1969, are expected to review and adopt the law in 1970. In three of these states, existing legislation appears to permit the use of this Uniform Donor Card at this time.

An earlier meeting which informed key medical groups of the drafting of the Uniform Anatomical Gift Act was held on 30 September 1968. At that meeting about 160 representatives of state medical societies, medical school deans, and relevant national medical, legal, and professional societies from 35 states heard a discussion of the provisions of the Act by its chief draftsman, E. Blythe Stason, former dean of the University of Michigan Law School. Other achievements of the conference were to bring about exchanges of pro-

gram information between those who require organs and tissue for clinical and research purposes, to discuss examples of cooperative local and regional donation programs, and to define the needs for further efforts in order to make the program practicably feasible.

Implementation of the Act by the use of simplified instruments of donation (the donor card) and by the coordination and establishment of national, regional, and local groups to provide information and an organizational framework for matching recipient need and donor availability have been the major concerns in the past year.

The Ad Hoc Committee consisted of Dr. R. E. Stevenson, Union Carbide Corporate Research Department, chairman; and Drs. J. E. Murray, Peter Bent Brigham Hospital; W. J. Burdette, M.D. Anderson Hospital; M. Head, George Washington University; K. W. Sell, Naval Medical Research Institute; and A. M. Sadler, Jr., and Mr. B. L. Sadler, National Institutes of Health.

ROBERT E. STEVENSON
ALFRED M. SADLER, JR.
BLAIR L. SADLER

Public Health Service,
National Institutes of Health,
Bethesda, Maryland 20014

Courses

Disorders of Lipid Peroxidation, Indianapolis, Ind., 10-12 June. Is intended for medical research workers, chemists, and biologists. The basic goal is to present an overview into the significance of lipid peroxidative changes in medicine and biology. Lectures will be presented on peroxidative changes seen in vivo and in vitro, molecular lesions induced by free radicals, induction of lipofuscin in laboratory animals, pigment accumulation and aging, chemical and enzyme properties of lipofuscin and ceroid isolated by subcellular techniques, disease models for aging. The demonstration portion of the course will involve techniques for following lipid peroxidation and measurement of changes in biological molecules. Specific techniques for inducing lipopigments, automatic scanning microscope techniques for tissues, isolation techniques for lipopigments, discussion of diseases involving lipopigment accumulation, and current approaches to therapy in neuronal ceroid lipofuscinosis. *Registration fee: \$150.* (Dr. A. N. Siakotos, Department of Pathology, Indiana University Medical Center, Indianapolis 46202)

Dynamical Astronomy, Austin, Tex., 8 June-3 July. The first 2 weeks will be dedicated to introductory and advanced courses in general celestial mechanics and dynamical astronomy. The third week is dedicated to orbit determination and the fourth week to optimization and guidance.

1 MAY 1970

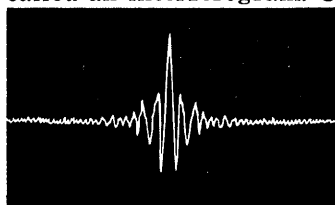
Number 3 of a Series

Signal Averaging...

Principles and Practices

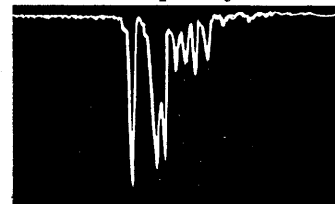
Exploiting Fellgett's Advantage!

Fourier transform spectroscopy, when combined with signal averaging, has applications that range from petroleum geology to astronomy. A description of an interference spectrometer may serve to illustrate some of the basic advantages of Fourier transform techniques. Light entering such a spectrometer will experience constructive or destructive interference at a beam splitter before reaching the detector. If the light is monochromatic and if a mirror is moved linearly in time, the output of the detector will be a sinusoidal function whose frequency is proportional to the wave number of the original light. If the incoming light is polychromatic, the output of the detector will be a mixture of sinusoids usually called an interferogram. Usually interferograms must be averaged to improve the signal-to-noise ratio. Although the averaged interferogram contains all the information of a conventional scanning spectrophotometer, the presentation of the data is not in a form from which spectral lines are easily recognized.



A mathematical transformation of this interferogram data into the frequency domain is clearly called for. This is where Fourier transform techniques come in. A recently developed algorithm for computing this transformation is called the FAST FOURIER TRANSFORM and has made handling large amounts of data economically feasible, both from a cost and time viewpoint. Once data are transformed into the frequency domain via this technique they are easily interpreted by the spectroscopist. Overall quantum efficiencies of 25% are possible at visual wave lengths using this technique.

On the other hand, a grating or prism type spectrometer measures the intensity of only one frequency element at a time. Consequently, if the resolution is to be 1%, 99% of the light is wasted and the overall quantum efficiency becomes only 0.25%. The gain in efficiency, called Fellgett's advantage for interference spectrometry, can be used to improve the speed and/or sensitivity of measurements.

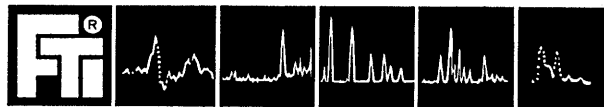


This same line of reasoning can be extended to other spectroscopic techniques. In NMR, for example, the sample being studied can be exposed to all RF frequencies simultaneously and the resulting free induction decay curve is then the analogous "interferogram".

Fabri-Tek Instruments offers a complete system for Fourier Transform analysis. The Fabri-Tek system can be connected directly to an experiment, data gathered and the results computed almost immediately. This allows the experimenter to interact directly with his experiment which can be very important. The accuracy and resolution of the Fabri-Tek Fourier system compares very favorably with older, more expensive, and slower methods.

Write or phone to discuss your specific application.

FABRI-TEK INSTRUMENTS, INC.



5225 VERONA ROAD • MADISON, WIS. 53711 • PHONE: 608/271-3333

Sales and Service: In Canada by Ahearn & Soper, Limited, 844 Caladonia Road, Toronto 19, Ont. Tel. (416) 789-4325 — Telex 02-2757. Branches in Montreal, Vancouver, and Ottawa . . . In Europe by Fabri-Tek Instruments, Inc., 6000 Frankfurt 1, Eschersheimer Landstr. 34, West Germany