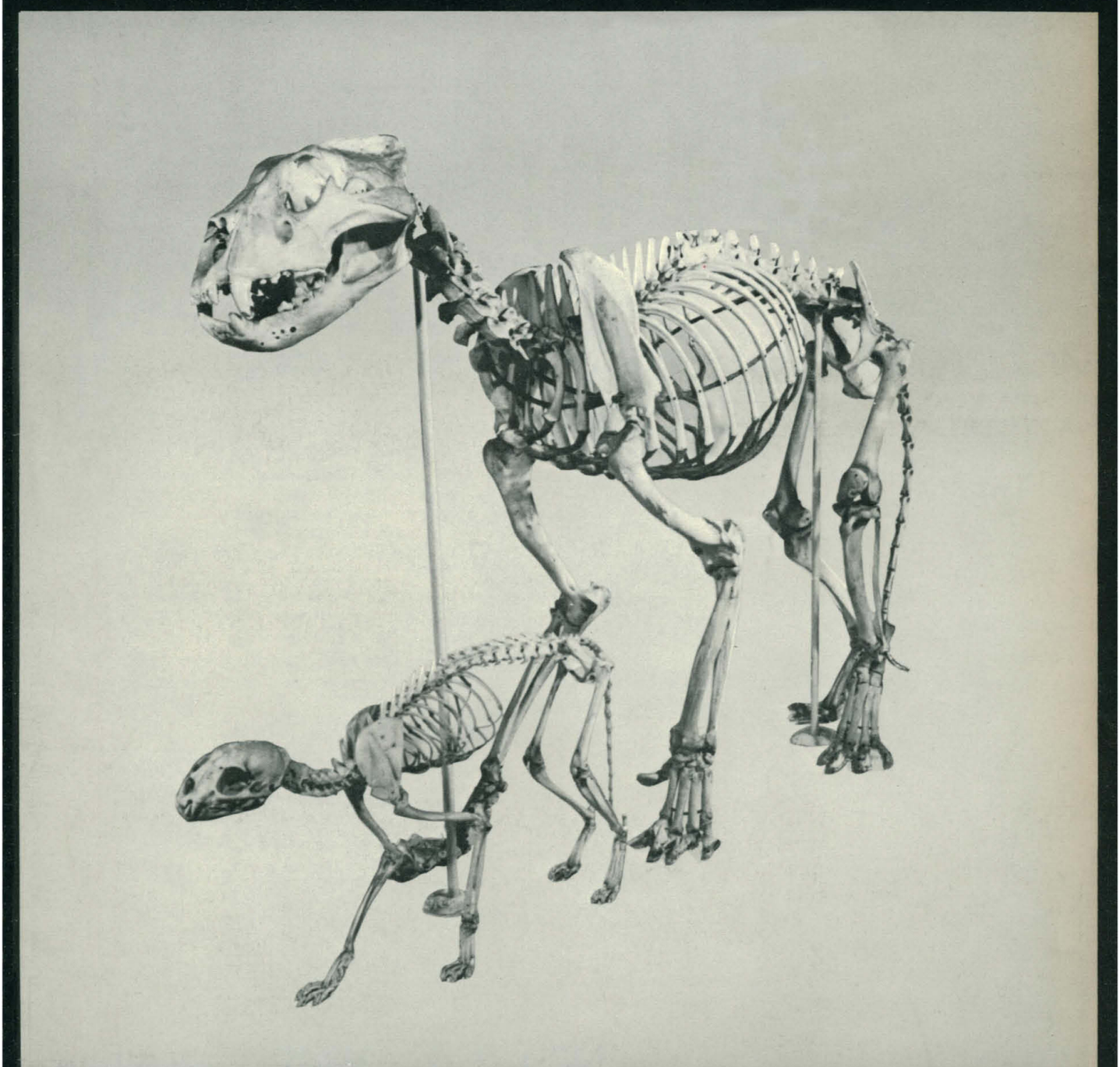
SCIENCE

23 March 1973

Vol. 179, No. 4079

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



New Beckman J-21B Centrifuge

The technical superiority is there—as you would expect from the people who make most of the world's ultracentrifuges. But that's not all the new J-21B Refrigerated Centrifuge offers.

The first thing you'll notice is the relative quiet. This 21,000 rpm centrifuge cuts down amazingly on the whine and noise you've had to live with before. Sound tests in a laboratory environment showed that lab personnel were subjected to only a fraction as much noise from the J-21B as from its major competitor.

Of course, the J-21B's clean styling is immediately apparent. But the good looks have a purpose, too. This design gives you free working space on the instrument itself to load or unload rotors. Now we've made it stainless steel for added utility.

One thing you don't see is the J-21B's partial vacuum which cuts wind friction dramatically. J-21B rotors don't have to fight their way to top speed—they get there quickly. And they can spin more sample volume at higher forces to get your work done faster.

For even larger volume separations, there is the remarkable JCF-Z rotor with interchangeable cores for separations by continuous flow, zonal and reorienting gradient techniques. It gives ultracentrifuge-like results, but is simpler to use.

The touches of color that you'll discover we added just for you to enjoy—like the quiet that surrounds this superior machine.

Brochure SB-366C describes the new J-21B. Send for your copy to Beckman Instruments, Inc., Spinco Division, 1117 California Avenue, Palo Alto, Calif. 94304.

Its superiority is something you also see and hear

Beckman®
INSTRUMENTS, INC.

Circle No. 24 on Readers' Service Card

THE NEXT GENERATION OF CO_2 INCUBATORS IS HERE

National Appliance Company's AUTOMATIC CO_2 CONTROL Water-Jacketed Incubators

National Appliance pioneered the water-jacketed incubator and, with these latest models, ushers in a new era of control never before attainable.

Check these all-new features:

- Automatic control of CO_2 concentration
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- CO_2 consumption dramatically reduced
- Direct dialing of desired CO_2 level
- Direct meter readout of CO_2 percentage
- Automatic purge control
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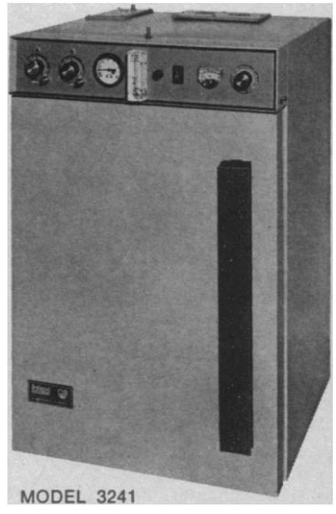
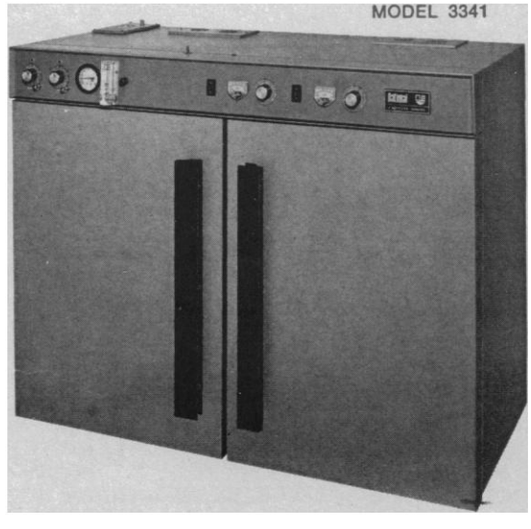


MODEL 3241

A new "closed-loop" CO_2 control system is the heart of the new series of National incubators. It permits a stable air/CO_2 environment; CO_2 is injected only when the concentration falls below the set level, thus reducing consumption and its attendant logistics problems.

MODEL 3636

Convert your current incubator into an automatic CO_2 control incubator with National's new CO_2 Control Master. It fits many makes of incubators and offers all the advantages of automatic CO_2 injection control and operation.



MODEL 3341

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R NA-13-1

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23 March 1973

Vol. 179, No. 4079

SCIENCE

SCIENCE is published weekly, except the last week in December, but with an extra issue on the fourth Tuesday in November, 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. Annual subscription $20; foreign postage: Americas $3; overseas $5; air freight to Europe, North Africa, Near East $16; single copies $1 (back issues, $2) except **Guide to Scientific Instruments** which is $4. School year subscription: 9 months, $15; 10 months, $16.75. Member rates on request. New rates effective 1 May 1973: Annual subscription $30; foreign postage: Americas $4, overseas $6, air lift to Europe $18. 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

COVER

Comparison of the skeletons of the lion (*Felis leo*) and bobcat (*Lynx rufus*) to the same scale. Although corresponding bones in the two animals are grossly similar, each bone of the bobcat (foreground) is relatively more slender than that of the lion. See page 1201. [T. A. McMahon, Harvard University]

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For the fourth year, the |A|A|A|S| Audiotapes program is offering a wide selection of recorded scientific symposia. Available as 5-in. reels (3¾ in. per sec. for standard machines) or cassettes. Price: single-session symposium, $15; multi-sessions, $15 first session, $12 each additional session of same symposium. Check box and circle numeral(s) for session(s) you wish to order.

Is There an Optimum Level of Population?: S. F. Singer, R. Revelle, et al. 10/69—Sessions I ☐ II ☐ III ☐ IV ☐

Biology and Sociology of Violence: L. L. Havens, A. Kling, et al. 24/69—Sessions I ☐ II ☐

Technology Assessment and Human Possibilities: A. Spilhaus, C. Starr, E. Mesthene, et al. 25/69—Sessions I ☐ II ☐ III ☐

Science and the Future of Man: J. Platt, V. F. Weisskopf, G. Wald, et al. 35/69—Sessions I ☐ II ☐ III ☐

Power Generation and Environmental Change: Reconciling Man's Desire for Power With the Needs of His Environment: A. M. Squires, D. Berkowitz, et al. 41/69—Sessions I ☐ II ☐

Brain and Language: R. S. Cohen, S. Toulmin, N. Chomsky, et al. 44/69—One Session ☐

Are We Winning the War Against Urban Fires?: H. Newell, H. C. Urey, P. H. Abelson, et al. 58/70—One Session ☐

Automobile Pollution: J. D. Caplan, W. P. Lear, et al. 59/70—One Session ☐

Advances in Human Genetics and Their Impact on Society: D. S. Borgaonkar, S. A. Shah, et al. 61/70—Sessions I ☐ II ☐

Lake Restoration: R. A. Ragotzkie, W. T. Edmondson, et al. 67/70—Sessions I ☐ II ☐

Industrial Approaches to Urban Problems: J. D. Lewis, H. B. Finger, et al. 69/70—Sessions I ☐ II ☐

Is Population Growth Responsible for the Environmental Crisis in the United States?: M. W. Corr, G. Wald, B. Commoner, et al. 73/70—One Session ☐

Reducing the Environmental Impact of a Growing Population: S. F. Singer, J. E. Dunwoody, et al. 74/70—Sessions I ☐ II ☐ III ☐ IV ☐

Population Control in Social and Economic Perspectives: W. H. Goodenough, J. J. Spengler, et al. 96/71—One Session ☐

The Energy Crisis: Some Implications and Alternatives: D. E. Abrahamson, J. Fay, B. Commoner, et al. 101/71—Sessions I ☐ II ☐ III ☐ IV ☐

Environmental Sciences and International Development: D. Bajracharya, M. T. Farvar, et al. 110/71—Sessions VII ☐ VIII ☐

Heavy Metals as an Environmetal Hazard to Fish, Bird, and Man: G. J. Lauer, W. Fulkerson, et al. 111/71—Sessions I ☐ II ☐

A Search for the Recognizable Goals and Constraints of the Steady State Earth: P. L. Blackshear, Jr., A. Kantrowitz, G. Buglierello, et al. 112/71—Sessions I ☐ II ☐

Technology and Growth in a Resource Limited World: R. U. Ayres, H. Kahn, J. H. Hollomon, et al. 113/71—Sessions I ☐ II ☐

Can We Develop an Index for the Quality of Life?: S. F. Singer, M. R. Gainsbrugh, M. L. Olson, et al. 117/71—Sessions I ☐ II ☐

Communications Technology and Its Effect on People: W. S. Baer, E. S. Mason, et al. 119/71—One Session ☐

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Here are Some New (and old) Problem Solvers from Varian, the Multi-Product, Quality Instrument Company.

Varian instruments are helping life scientists shed light on a variety of problems in their research — instruments with the well-known brand names Cary®, Aerograph®, Anaspect, MAT, Techtron, and Varian®.

From UV-Vis through GC and LC to NMR, EPR or AA — you have a wide selection from which to choose the tools best suited to your needs. And a Varian expert will help you pick the best possible combination of instruments plus back-up assistance so you can focus on life science problems, not hardware problems.

Here are some of the kinds of problems in which Varian instruments can help the life science lab. There are others. Ask us about them.

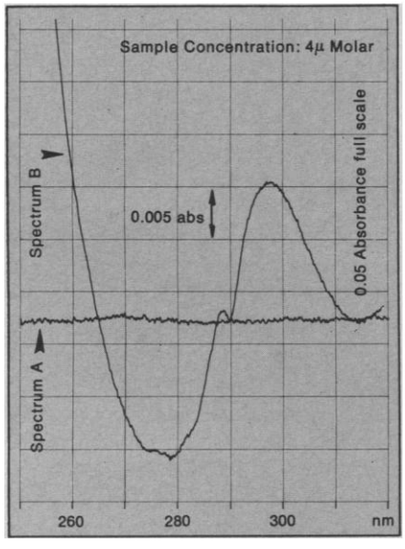
Protein difference spectroscopy needs the Cary 118's accuracy

With difference spectroscopy the life scientist has a valuable probe for investigating the structure of protein macromolecules. It is a very sensitive method for detecting small, discrete changes in a sample which could not be observed with standard absorption procedures, where strong overlapping bands obscure many weaker peaks. To measure these small absorbance changes, the scientist must have a good spectrophotometer.

Because of its unmatched photometric accuracy, the Cary 118 Spectrophotometer is the ideal instrument for difference measurements (at 0.1 abs the accuracy is 0.00035 abs). Such performance is necessary, since even

very small errors can sometimes lead to incorrect interpretation of the spectrum.

In practical terms the 118's exceptional performance frees the scientist from concern about the quality of the data. He knows that any peaks recorded on the spectrum result from sample absorption, and not from an instrument artifact.

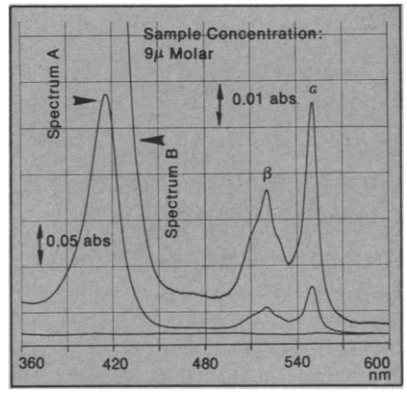


These spectra of oxidized cytochrome C, recorded on the Cary 118, illustrate one effect of pH on this protein. Spectrum A was recorded with identical sample and reference solutions (both pH 7). For Spectrum B the sample was increased to pH 11, while the reference was unchanged. Perturbation of the tyrosine residues becomes readily apparent.

To obtain further information about the Cary 118's capabilities for difference spectroscopy, kinetics, determining concentration in small-volume samples, quantitative analyses, or even recording derivative spectra, circle Reader Service No. 29.

With the Cary 17 changing absorbance ranges makes a mountain out of a mole hill

Often when recording a UV-Vis spectrum, a particular wavelength region of interest may produce only a small hump on the spectrum, because

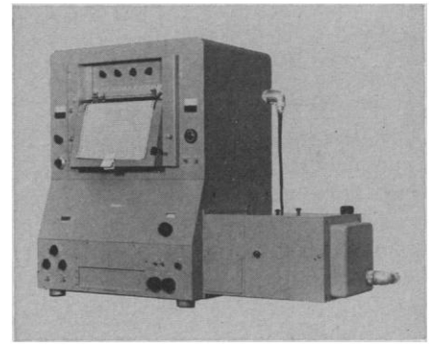


To demonstrate the advantages of changing absorbance ranges, these spectra of cytochrome C reduced with ascorbic acid were recorded on the Cary 17. Spectrum A (0-0.5 abs range) fully resolves the Soret band at 415 nm, but shows little detail on the peaks at the longer wavelengths. The expanded presentation in Spectrum B (0-0.1 abs range) gives better detail of the α and β bands at 550 and 520 nm.

the sample's absorption is not very great in that area. In such a situation, changing the absorbance range expands the chart scale and makes it possible to see more spectral detail.

With the Cary 17 Spectrophotometer, switching absorbance ranges is convenient and rapid. The instrument is equipped with a universal absorbance/%T slidewire so that any of eight absorbance ranges or a 0-100 %T range may be selected. This feature, along with the coupled wavelength scan and chart drive, makes it easy to back up the chart and rescan a particular area using expanded scale to increase the sensitivity of the recording. A small, smooth hump becomes a detailed peak.

A second advantage of the range change capability is that absorbance bands with widely divergent molar absorptivities can be recorded on the same chart, a more convenient presentation for most purposes. Too, it requires less sample preparation because no sample dilution is necessary to bring absorbance values on scale.



Circle Reader Service No. 15 for more information on the Cary 17.

The Techtron 635 Spectrophotometer simplifies kinetics

Enzyme kinetics involve a lot of sample handling problems. They're a major concern in this type of measurement. With the Varian Techtron 635K Spectrophotometer we've solved many of them.

To do this we designed the instrument on a modular concept so the scientist can select the system best suited to his work, and purchase it at a moderate cost.

For analyzing numerous samples, for instance, an Auto-5 cell programmer with dual sample/reference turrets can be included in the system. Also, there are thermostattable cell holders, a temperature readout module, wavelength programmer, and other accessories, all designed to make kinetics studies easier.

Another step we've taken to simplify kinetics is to incorporate push-button controls on the instrument. You just punch a button to set operating parameters.

To obtain more information, circle Reader Service No. 16.

varian instruments

Spin labeling biological membranes: What For and What With

First, the What For.

Here's a list of literature references, all of which deal with the use of nitroxide spin labels and EPR (ESR) to study biological membranes:

Biosynthetically spin labeled mitochondria subjected to EPR analysis contained at least two incorporated spin labels with different degrees of constraint.
A. Kieth, A. Waggoner, and O. Griffith, Proc. Nat'l Acad. Sci., **61**, *819 (1968).*

Incorporation of spin-labeled compounds into membranes by using a protein carrier or, for experiments with micelles or liposomes, by agitation or sonication of the aqueous suspension should prove to be more valuable in the future as a probe of the membranes of living cells.
A. Waggoner, T. Kingzett, S. Rottschaefer, and O. Griffith, Chem. Phys Lipids, **3**, *245 (1969).*
M. Barratt, D. Green, and D. Chapman, Chem. Phys. Lipids, **3**, *140 (1969).*

The orientation properties of spin labels were used to show that the phospholipid regions of both nerve and erythocyte membranes strongly resemble lipid bilayers with phospholipids being more tightly packed in erythrocytes than in nerve fibers.
W. Hubbell and H. McConnell, Proc. Nat'l Acad. Sci., **63**, *16 (1969).*

The spin label attached to cytochrome *C* in submitochondrial membranes underwent reversible changes in mobility when the metabolic state of the submitochondrial particles was altered.
C. Lee, H. Drott, B. Johansson, T. Yonetani, and B. Chance in Probes of Structure and Function of Macromolecules and Membranes, *B. Chance, C.-P. Lee, and T. Yonetani, Eds., Academic, New York (1971).*

They're all available in your local technical library.

Now, the What With.

Varian EPR systems, of course. The EM-500, E-4, E-Line—the finest EPR systems available anywhere. For literature, write on your letterhead indicating the systems of interest.

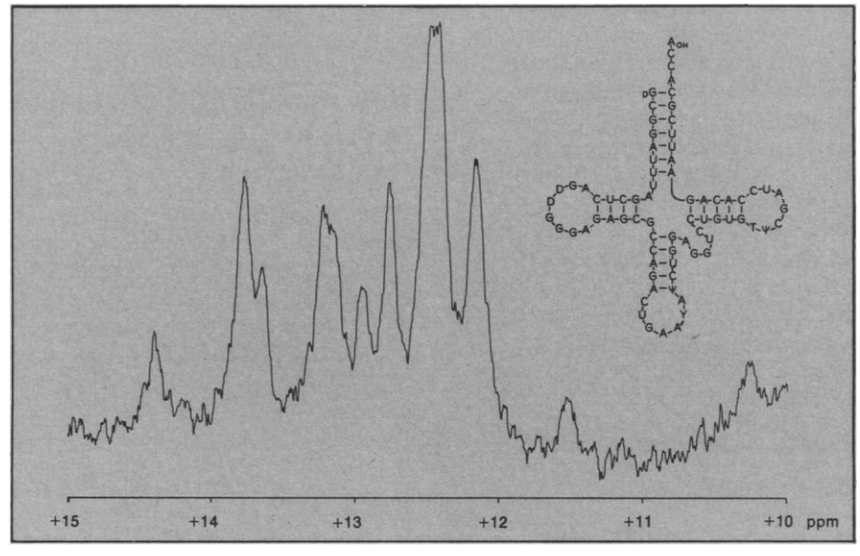
For E-Line information only, circle Reader Service No. 17.

The high field NMR analysis of living cell components

Transfer RNA plays a vital role in protein synthesis in the living cell, selecting a specific amino acid and attaching it to the growing protein amino acid sequence at the point specified by the genetic code of the cellular DNA. Now, high field NMR, by helping to provide detailed knowledge about t-RNA's conformation in aqueous solution, offers a promise of better understanding the exact way in which t-RNA accomplishes its function.

Recent work[1] involving a Varian superconducting NMR system has shown that high field proton NMR studies in H_2O allow observation of the number and type of hydrogen bonds involved in Watson-Crick base pairing in yeast phenylalanine t-RNA.

In this 300-MHz spectrum, obtained using the most powerful NMR spectrometer available, Varian's HR-300, the region between +15 and +10 ppm from DSS[2] shows a number of peaks whose integrated intensity can be interpreted in terms of the *number* of base pairs, and whose shift values reflect the *type* of bases paired. These data have now been used to confirm the clover-leaf model for the secondary structure of t-RNA and may even throw additional light on the tertiary structure believed to be responsible for the specificity of action of these vitally important molecules.



The renowned and well-established HR-220 series of Superconducting NMR Spectrometers has been upgraded to the HR-300, the instrument that provided this data. Now an improved version of the HR-300 is available, Varian's SC-300.

For more detailed information, circle Reader Service No. 18.

REFERENCES:

1. Y. P. Wong, D. R. Kearns, B. R. Reid and R. G. Shulman, *M. Mol. Biol.*, in press.
   D. R. Lightfoot, K. L. Wong, D. R. Kearns, B. R. Reid, R. G. Shulman and L. Cary, *Ann. N.Y. Acad. Sci.*, in press.
2. 2,2-dimethyl-2-silapentane-5-sulfonate.

Doing difficult GC analyses? Ease your task with our Model 2100

This outstanding gas chromatograph can really help you operate easily and efficiently with the most difficult samples. Samples like you encounter in drug, toxicology, pesticides, steroids, lipids, pharmaceuticals, and other metal-sensitive compounds. Here's why.

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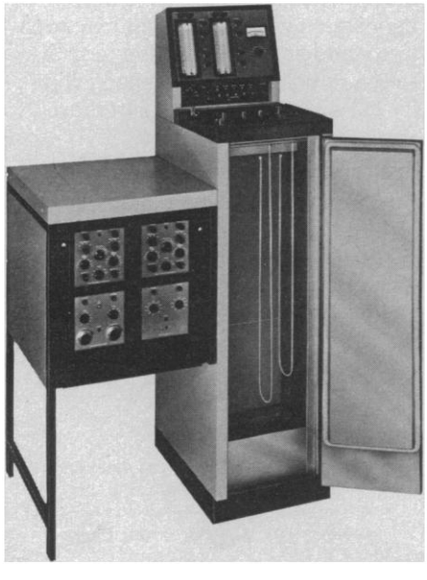
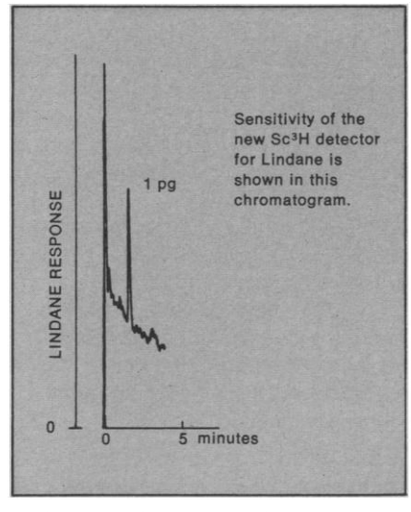
Our unique methodology books also help to make your GC life easier. Each one is a procedural "cook book" for a particular type of analysis: Pharmaceuticals and Drugs; Lipids; Fatty Acids; Digital Integrator Methodology; Carbohydrates; Derivatives; Trace Gas Analysis; Steroids. You can have any or all of the titles shown, as well as literature on the 2100, with our compliments. Just drop us a note on your letterhead.

For Model 2100 literature only, just circle Reader Service No. 19.



New rare earth ^{3}H detector improves GC sensitivity for pesticides

Varian's new EC detector both provides and exceeds the best performance characteristics of present ^{3}H and ^{63}Ni detectors. And perhaps best of all, they can be removed, cleaned,

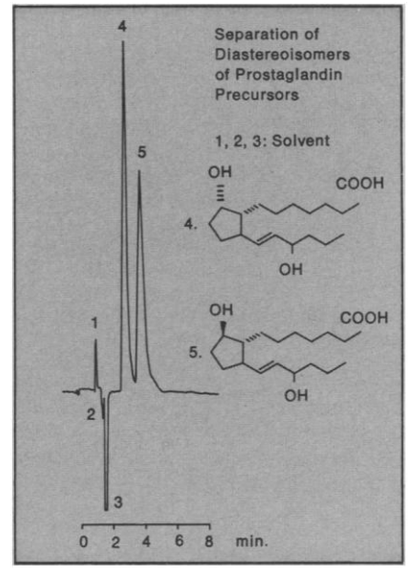


and returned to the GC in less than 30 minutes! Since they can be heated to 325°C, contamination is minimized. Sensitivity for Lindane is better than 0.2 picograms of Lindane when eluted in 5 minutes or less, and dynamic range exceeds 1000:1. The unit fits the standard universal detector base on most Varian Aerograph gas chromatographs.

For details circle Reader Service No. 20.

Steroids separation, one of many performed easily and precisely with Aerograph Liquid Chromatographs

Whether your separations involve steroids or other biochemicals, you'll have no concerns about being equipment-limited with Varian Aerograph liquid chromatograph systems; they provide capability to perform any LC separation with precision and speed. Our UV and RI detectors are second to none in sensitivity; our pumps deliver flowrates that are easily set, precisely regulated, and reproducible to ±0.1%; columns and related hardware offer state-of-the-art efficiency and capacity. All these let you perform rapid separations, even with diastereomers of heat labile biochemicals.



Conditions: Varian MicroPak® SI-10 column, 50 cm x 2.1 mm i.d.; mobile phase, heptane (70), THF (30), acetic acid (1); sample 0.5 mg; flowrate 126 ml/hr; pressure 950 psi; RI detector; attenuation 16. Chromatogram courtesy Dr. R.P. Lanzilotta, Syntex Research.

If you have questions about an LC system to meet your specific needs, we'd like to help. Outline your requirements to us and our experts will offer recommendations promptly.

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Good back-up is that invisible specification that's necessary to bring out the best from your analytical tools. Here are the extras you get with every Varian product.

Applications

Chemists in our Field Applications Laboratories can help you select the right instrument and the most feasible method of solving your analytical problems.

U.S. Field Application Laboratories are located in Houston, Texas; Springfield, New Jersey; Park Ridge, Illinois; and Los Altos, California — as well as in key locations in Europe, the Far East, and other parts of the world.

Also, applications chemists in our Palo Alto headquarters are working constantly to improve and develop analytical methodology in areas of wide scientific interest.

Local Instrument Division sales offices have available a supply of printed technical information from the laboratories: applications notes, methodology books, reprints — all aimed toward increasing the utility of your Varian instrument.

R and D

Behind closed doors scientists and engineers are working on developments leading to the new generations of instruments and accessories. In fact, in just the past year, Varian has introduced a number of new instruments and accessories, and Varian Instrument Division scientists and engineers have been awarded over three dozen new patents. The Instrument Division has a commitment to continual R and D in the area of analytical instrumentation.

Workshops, Seminars, Scientific Meetings, Customer Training Courses

Varian has a long history of sponsoring and participating in scientific gatherings throughout the world. Regular programs of GC, LC, NMR, EPR, AA, and Raman workshops have reached thousands of scientists in recent years — and are continuing to do so. Here's a recent schedule of activities with, where appropriate, contacts for more information for those interested in attending.

Calendar of Events

For more information, contact your local Varian Instrument Division sales office unless otherwise indicated.

UV-Vis Life Science Seminars

Special life science training seminars entitled "How to Get the Best Answers from *Your* Spectroprotometer" will be held during the month of May in Boston, New York City, Washington DC, Atlanta, Houston, Chicago, Seattle, San Francisco, Los Angeles. Watch for announcements of specific dates.

Circle Reader Service No. 22 for more information.

Gas Chromatography Courses

April 16-18, 1973: Houston, Texas

May 16-18, 1973: Springfield, N.J.

Liquid Chromatography Courses

February 14-16, 1973: Chicago, Illinois

April 9-11, 1973: San Francisco, Calif.

May 9-11, 1973: Houston, Texas

Mass Spectrometer Meetings

May 15-16, 1973: Varian MAT Instrument Owners Meeting, Springfield, New Jersey

May 18-19, 1973: Varian MAT Instrument Owners Meeting, Palo Alto, California

May 20-25, 1973: American Society for Mass Spectrometry Meeting, San Francisco, California

NMR Workshops

April 4-6, 1973: One-day T-60A Workshops, Springfield, New Jersey

Exhibits/Scientific Meetings

Varian instruments on exhibit

February 20-23, 1973: Forensic Science Meeting, Las Vegas, Nevada.

March 5-8, 1973: Pittsburgh Conference, Cleveland, Ohio, USA

March 6-10, 1973: Medex 73, Basel, Switzerland

March 11-20, 1973: Leipzig Spring Fair, Leipzig, Germany

March 27-30, 1973: Labex International 73, London, England

April 4-15, 1973: Electro Mash 73, Moscow, USSR

April 11-18, 1973: Mesucora/Exp. de Physique, Paris, France

April 16-20, 1973: FASEB, Atlantic City, New Jersey, USA

May 7-12, 1973: Interlabor, Zagreb, Yugoslavia

May 18-24, 1973: TV-Symposium, Montreux, Switzerland

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The best service is no service at all. Since there's no such thing as a perfect instrument, we do the next best thing: design instruments for the most reliability at a given price tag, then back that up with trained Service Engineers in 15 locations in the U.S. plus many additional locations throughout the rest of the world.

Your orders for spare parts and supplies are shipped on either a normal or emergency basis, depending on need. And we're improving our turnaround time continually.

On those occasions when you have instrument difficulty, you can call your local Varian Service Engineer and perhaps even get the help you want over the telephone — all part of the responsive service that we're making even better.

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the Nicolet 1020A is a time averaging system for magnetic resonance spectrometers that gives you results like these:

The Nicolet 1020A is an easy-to-use time averaging system combining unique data processing capabilities with extremely useful display and readout routines.

Using a normalized signal averaging method, the 1020A presents a true average on its built-in 5″ CRT display. The complete spectrum (or any expanded portion of it) is continuously displayed throughout the averaging process.

Thumbwheel switches select sweep times from 60 milliseconds to 1,999 seconds for a 2048-word sweep with 4-digit accuracy. The 1020A can provide sweep current to the spectrometer and can compensate for spectrometer field drift when using the Field Stabilization mode. The calibrated sweep widths are front panel selected and can be matched to any spectrometer.

The analog-to-digital converter (ADC) resolution is 12 bits (one part in 4096) for sweep times over 1 second and 9 bits (one part in 512) for sweep times less than 1 second.

Total memory capacity is 2048 words, 24 bits long. The upper 12 bits store the final average while the lower 12 may be used to store the integral. Averaged spectra may be stored in halves of memory and added to or subtracted from one another.

Digital integration is built-in and does not destroy the original spectrum thus allowing simultaneous display of spectrum and integral. Baseline correction can be accomplished during display of the integral to assure optimal results.

Another unique display feature is the ability to expand the displayed spectrum in both the X and Y axes by factors of 2 up to a total expansion of 64 times. (Typical expansion examples are shown to the right). In addition to this analog display a simultaneous numerical display shows the amplitude and address values of any data point selected by a moveable electronic cursor.

Write or call collect for complete details or to arrange a demonstration in your laboratory.

NICOLET INSTRUMENT CORPORATION

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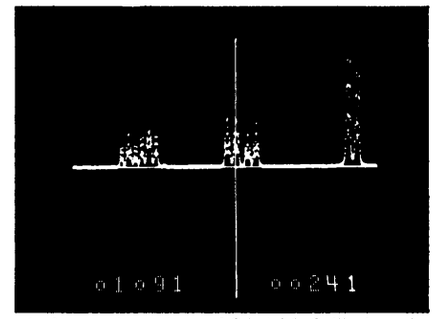
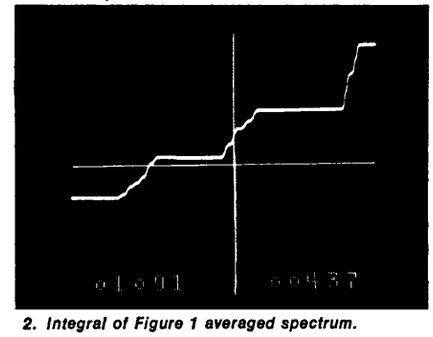
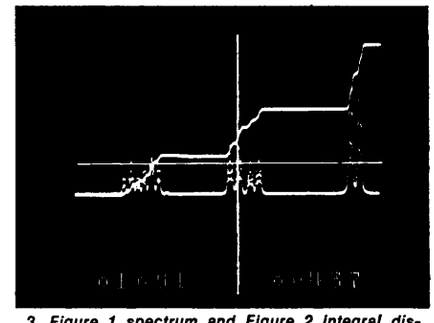


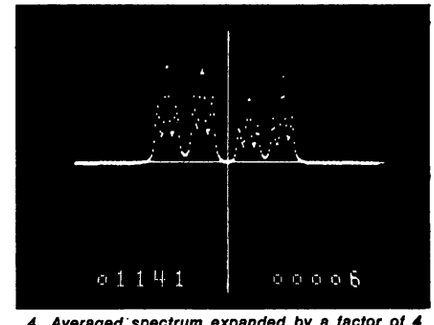
1. Averaged spectrum of 2-butyl-1, 2-dihydropyridene with spectrum expanded on amplitude scale by a factor of 2.



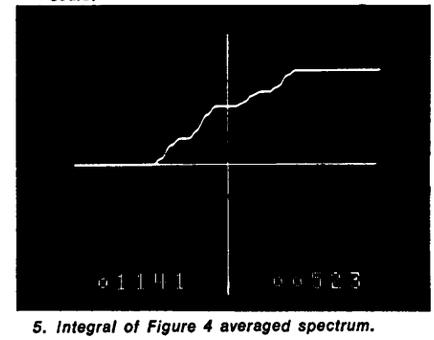
2. Integral of Figure 1 averaged spectrum.



3. Figure 1 spectrum and Figure 2 integral displayed simultaneously.



4. Averaged spectrum expanded by a factor of 4 on both the amplitude scale and the frequency scale.



5. Integral of Figure 4 averaged spectrum.

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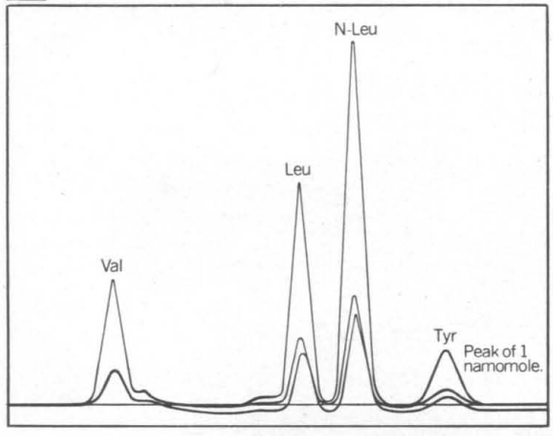

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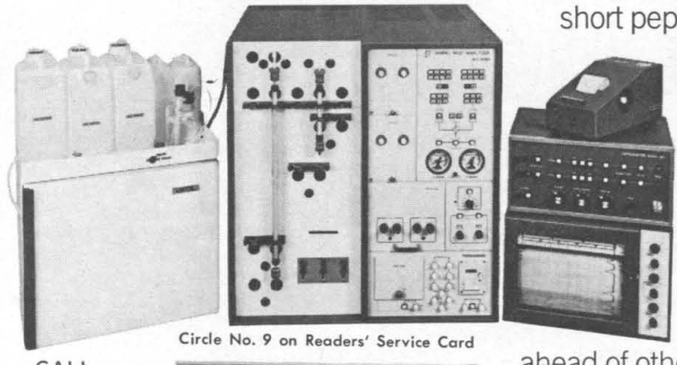

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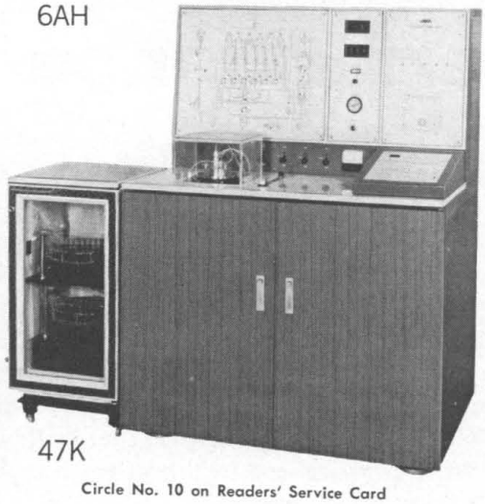

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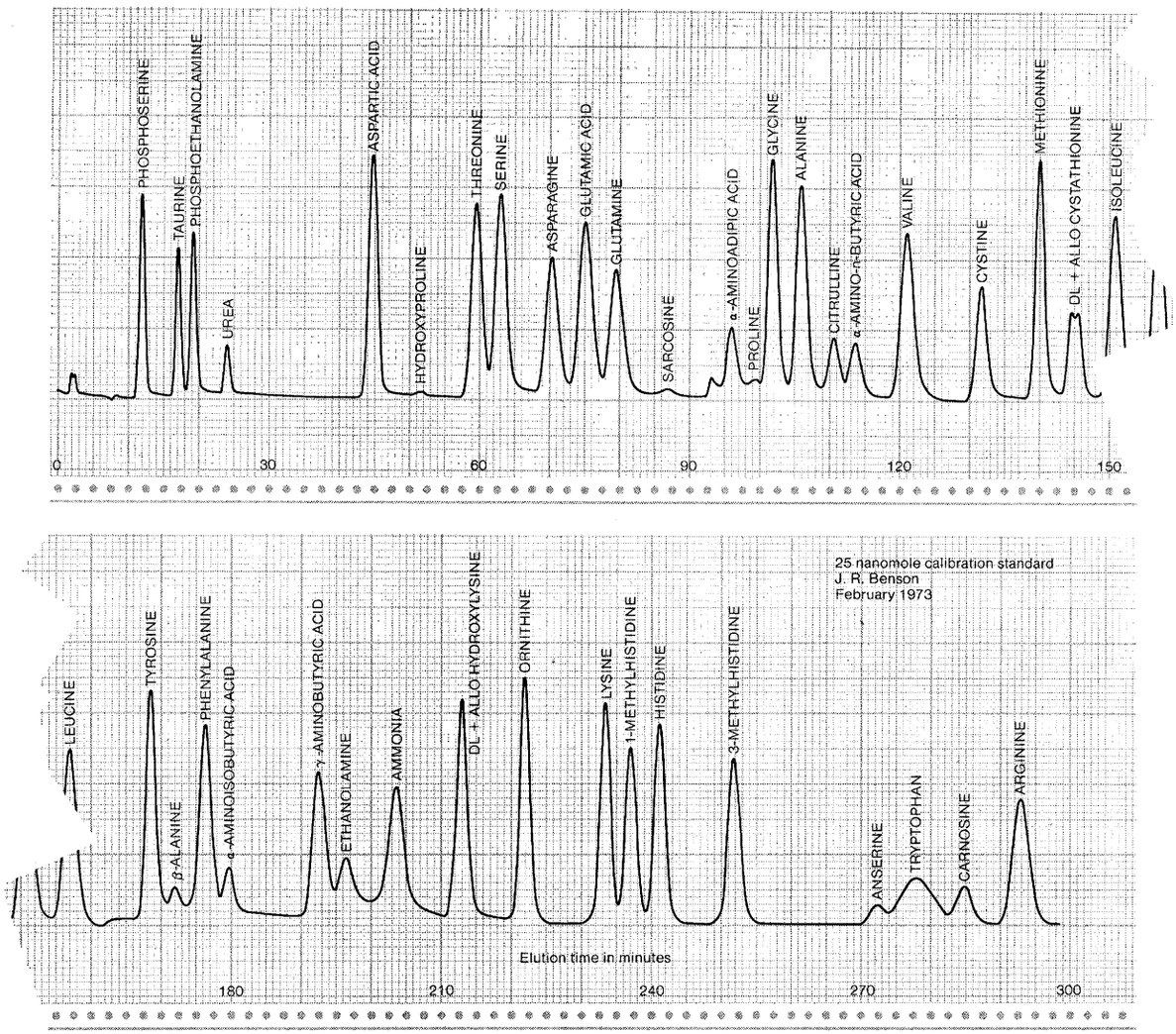

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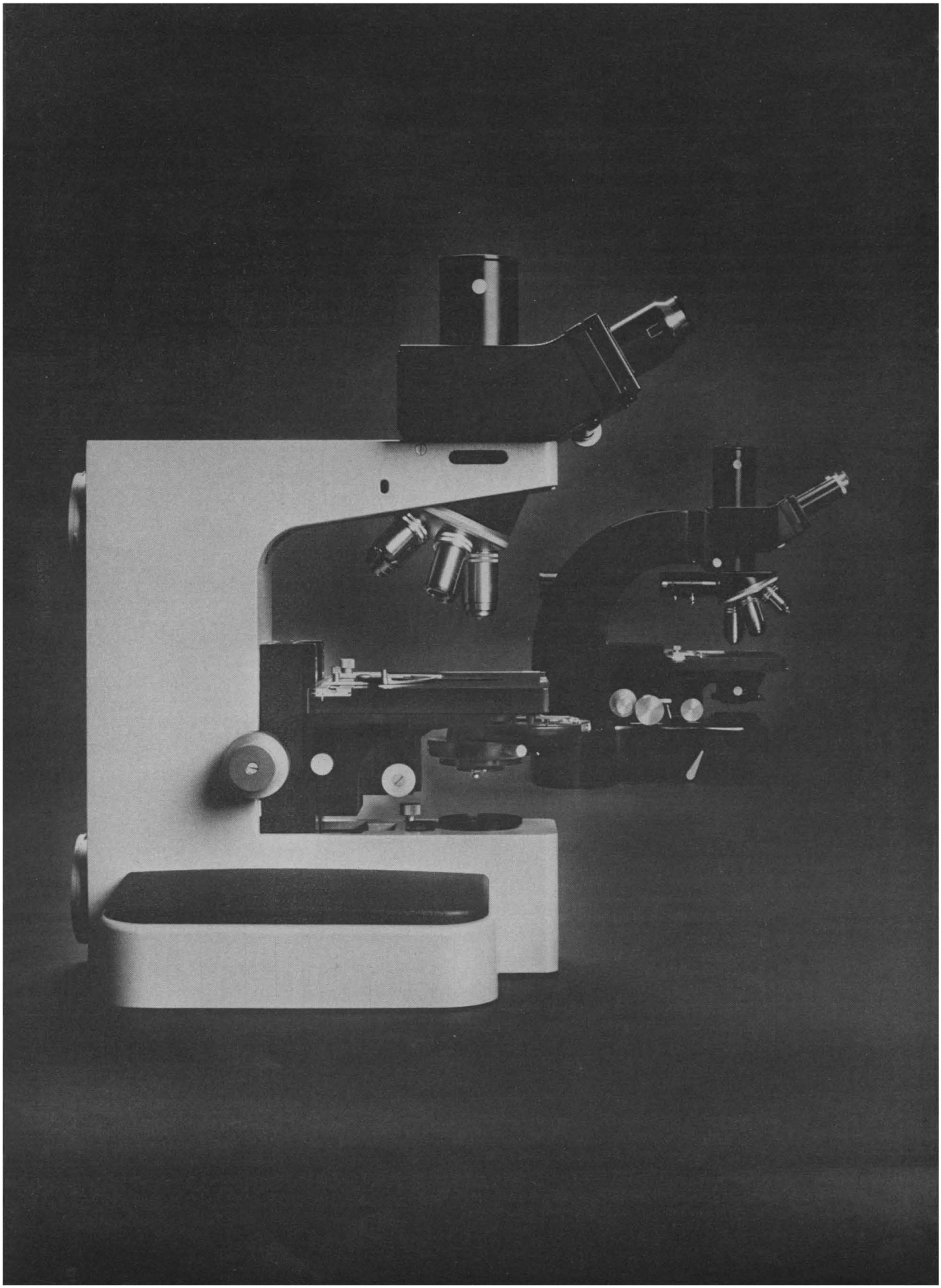

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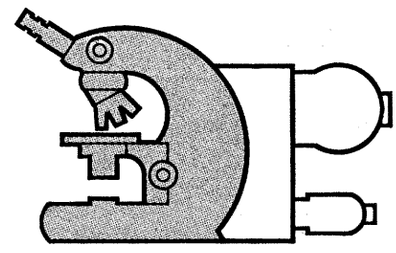

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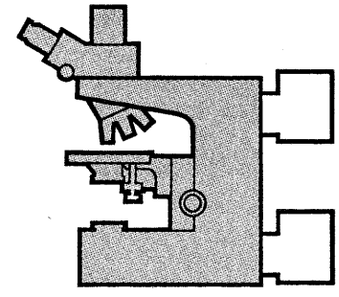

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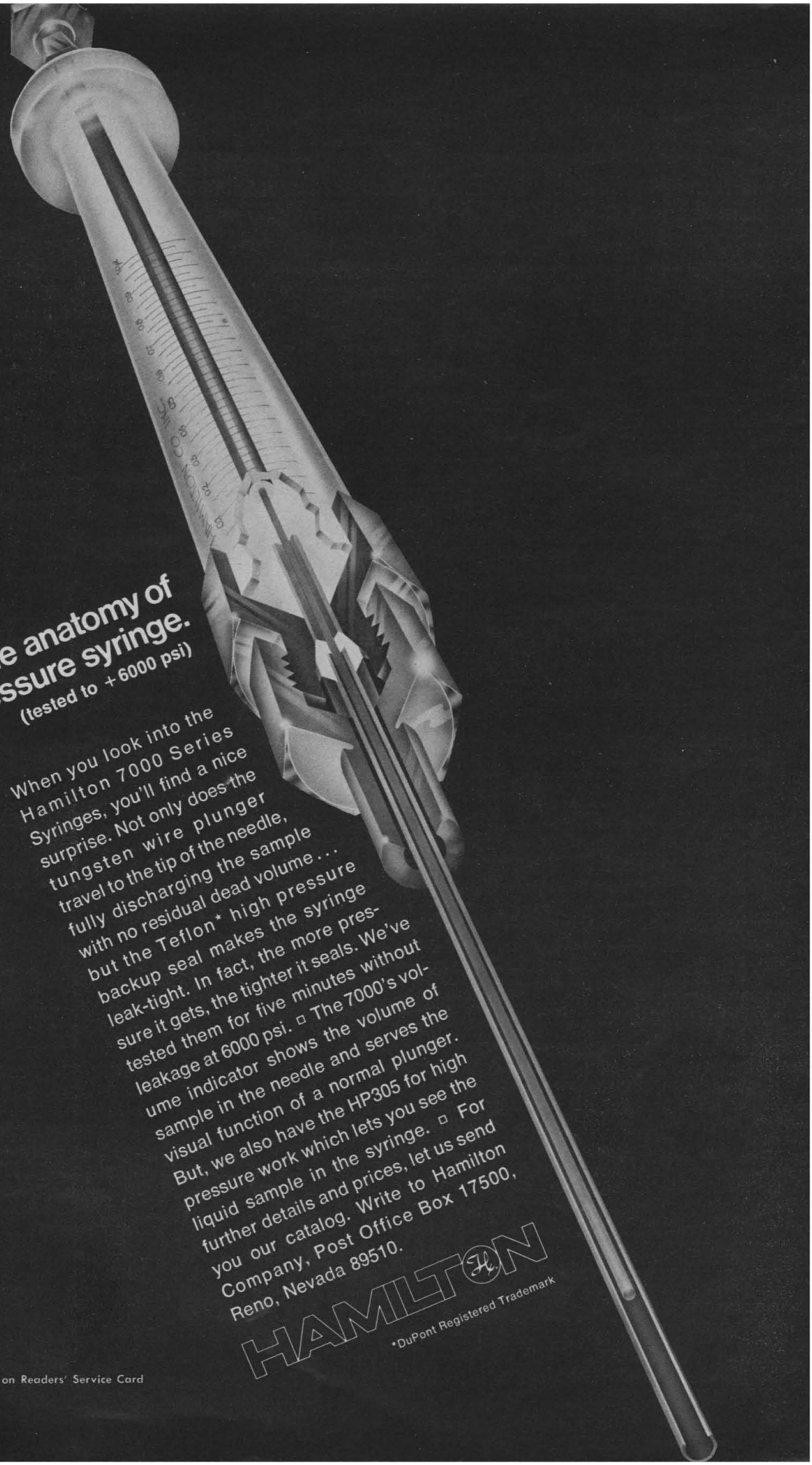

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was interesting and, in view of considerable folklore perpetuating (or perpetrating) contrary views, reassuring. It would seem difficult, under the system as he describes it, for an individual or small group to influence, for nonscientific reasons, a study section's vote on any particular application.

This does not, however, deal with the issue of very general scientific biases which the group as a whole may share. Wade's comment that NIH and NSF staffs apparently feel that "they have to go to good places to get good people" (both as members of study sections and as successful applicants for grants) clearly implies a consensus on what constitutes good scientific work. While it is possible to specify general criteria for "good" science, it is also true that, beyond a certain point, decisions must rest upon subtle qualitative judgments about the direction of the field as a whole—the importance of certain questions as well as the formulation of a particular problem. It is in this complex and difficult area that the value and danger of the present review system may lie. A group of intellectually like-minded scientists may be able, through grants awarded on the basis of what they regard as "scientific merit," to support work conducted within a particular intellectual fromework, until the paradigm either proves fruitful to most workers in the field or it does not. In any event, such a system is valuable in that the approach currently in fashion will get a fair trial; funds will not be distributed in such a way that no cohesive intellectual framework is thoroughly tested. The danger, however, is that the "peers" in the study sections may, for various reasons, become isolated and insulated from a recognition that the approach they support may have more promising alternatives. This is particularly true in the social sciences, and lies behind the criticism that the present reviewing system is too inbred. If women and other minority-group scientists were in a position to determine, by allocation of funds, the direction of research in certain fields (psychology, nonmolecular biology, and sociology come immediately to mind), the fields would be different. Not necessarily better, perhaps, but different.

A middle-of-the-road solution to the various problems presented by the peer review system would be to limit, absolutely, appointments to study sections to one 4-year term. The study sections should—at least in the social sciences—be representative of workers in the field in terms of sex, race, and perhaps region of the country. A consideration of these "nonscientific" factors in forming study sections is not new; I am suggesting that they be considered differently—to include, rather than to exclude. Suggestions for changing criteria for this or that (be it membership on a study section or tenure in a university) are frequently labeled as "lowering the standards"; do we really have the best possible system so that any change is automatically for the worse?

MARY BROWN PARLEE
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Mental Health Care

The Nader study on mental health centers (News and Comment, 4 Aug. 1972, p. 413) contains many excellent and telling criticisms, but it is weakened by serious omissions. Nowhere do the authors recognize the existence of presently incurable schizophrenia patients who occupy the majority of beds in mental hospitals. There is no treatment for these patients, rich or poor, Caucasian or otherwise; their care is chiefly a custodial problem, because they cannot look after themselves. The quality of that custodial care is a measure of what the community is willing to spend. Wealthy families can afford better hotels, but whether the American society will in the future be willing to spend enough to improve the housing for less affluent schizophrenics is an open question. Historically, it has not been willing to do so. If society does desire to spend more money on the schizophrenic, the question also arises of whether it should be spent for better hotels or for more research on treatment.

The Nader report does not consider

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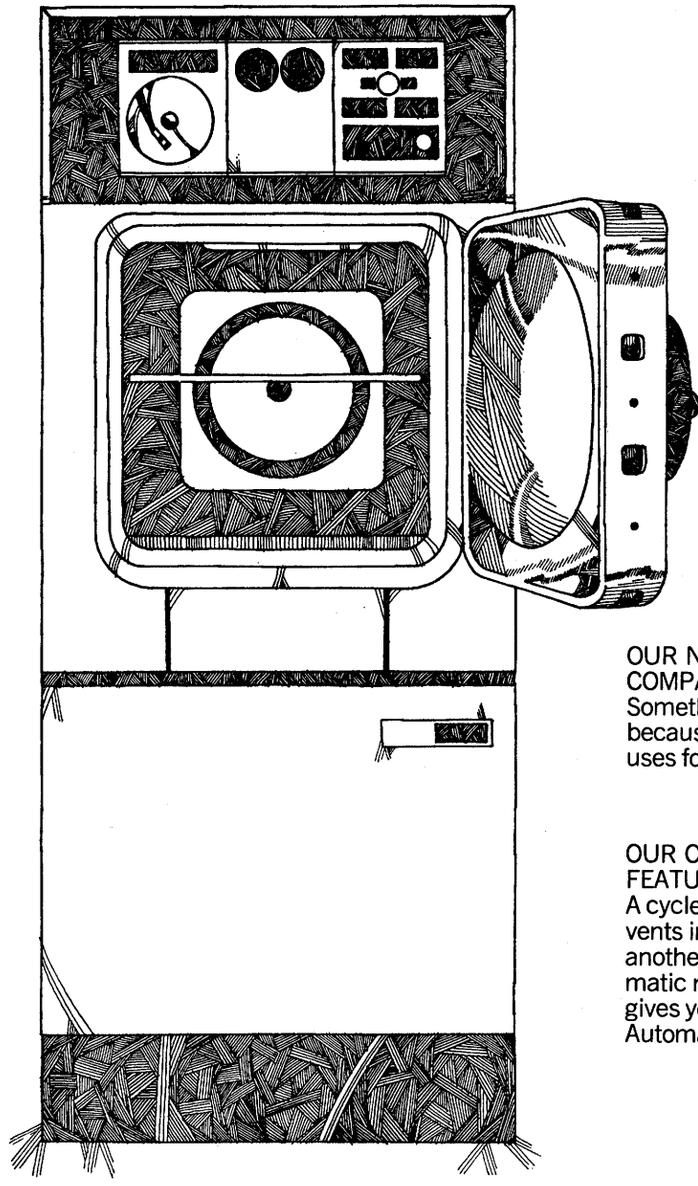

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the existence of another group which occupies a large number of hospital beds—those afflicted with organic dementia. There is no way of treating these patients at present that will permit them to leave the hospital for any significant length of time; once again it is a question of custodial care. The problems created by incurable illnesses are among the greatest facing psychiatrists, or, indeed, any medical specialists, today.

Further, the Nader study criticizes individual research, as opposed to more programmatic approaches. The most successful treatment in the history of psychiatry stemmed essentially from individual research. I refer to the discovery of penicillin, which prevented huge numbers of people from developing tertiary syphilis, previously the most predominant affliction of mental hospital patients.

JOHN HANLEY
Department of Psychiatry and *Brain Research Institute, University of California, Los Angeles 90024*

Politics of Psychiatry

The readers of *Science*, in whatever country, should be aware of the use of psychiatric procedures for the suppression of political dissent. The phenomenon is international and not rare. The most prominent recent example is the moderately publicized information about the alleged misuse of mental hospitals in the Soviet Union. Case histories are documented of forced "detention without recourse" of seemingly "normal," nonviolent, but politically dissident, persons by some Russian psychiatrists, apparently acting in the service of the Soviet secret police. Perhaps there are Russian psychiatrists who believe that anything short of complete public and private acceptance of the political regime in power at any given time represents sufficient departure from sanity to warrant protracted institutional incarceration. Persons have been forcibly hospitalized in the Soviet Union "whose only symptoms have been the avowal of opinions disapproved by their society" (*1*). Moreover, in the Soviet Union, as reported to the Board of Trustees of the American Psychiatric Association (*2*), there is no provision for judicial review of civil commitments to mental prison-hospitals.

Several outstanding psychiatric associations, such as the Canadian Psy-

chiatric Association (*3*), the World Federation for Mental Health (*1*), the American Psychoanalytic Association (*4*), and the American Psychiatric Association (*2*) have issued position papers and resolutions condemning the use of psychiatric incarceration as a political weapon.

An article by I. F. Stone (*5*) presents a comprehensive study of much of this material. Stone suggests that the World Psychiatric Association, meeting in Mexico City in December 1971, refused to consider a resolution condemning the use of psychiatric imprisonment as a means of suppressing political dissent because of a threatened boycott of the congress by the Russian delegation. The Canadian resolution (*3*) points out that the Soviet Union is a member of the United Nations and signatory to both the Section on Human Rights and the World Health Organization. Yet the Russians have been either unresponsive or hostile to the resolutions and statements of foreign psychiatric associations, stating through their Ministry of Health that the protests are nothing but subtle machinations in the cold war (*5*).

Collective individual action, in the form of a deluge of letters and telegrams to the Soviet Ministry of Health, from both inside and outside the Soviet Union, effected the release of the scientist and academician Zhores Medvedev from a mental hospital and the dismal prospect of indefinite imprisonment (*6*). An informed academic and scientific community, within which individual and concerted action can be taken, might exert a commanding influence against the prostitution of psychiatry as a means of suppressing political dissent.

PETER L. WATSON
LAWRENCE HARTMANN
JEREMY P. NAHUM, CAROL NADELSON
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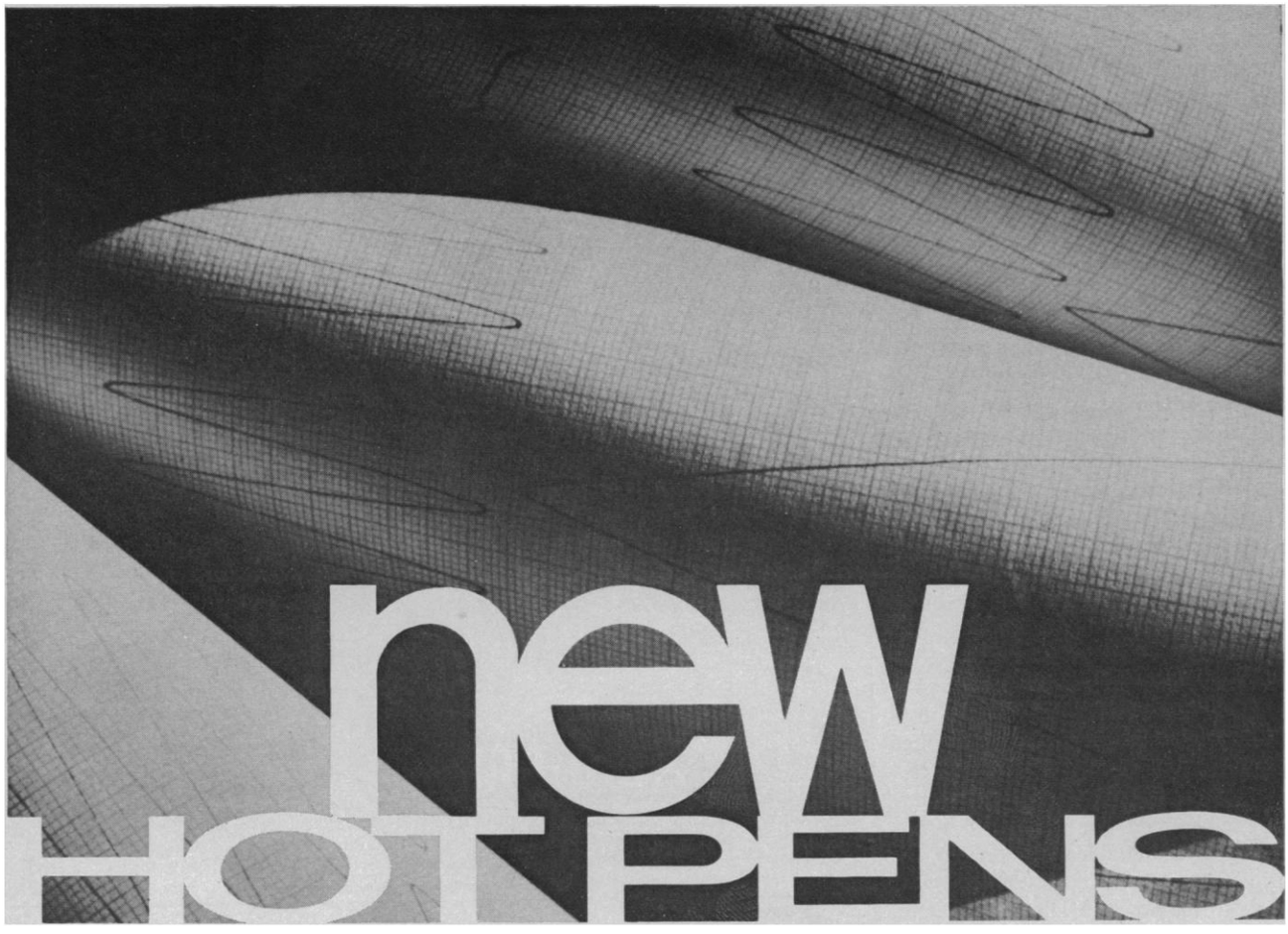
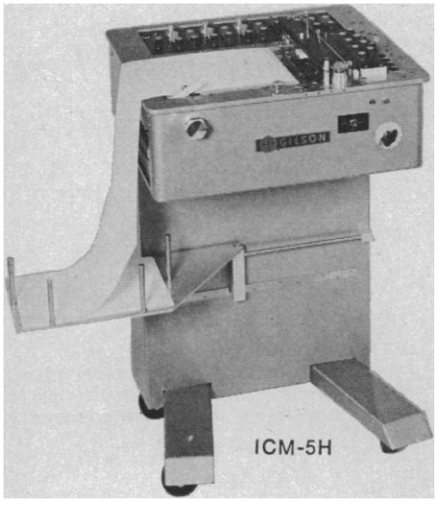
Harvard Medical School,
Boston, Massachusetts 02115

References and Notes

1. Resolution of the World Federation for Mental Health, Hong Kong, 25 November 1971.
2. Resolution endorsed by the Board of Trustees of the American Psychiatric Association, May 1972, for consideration by the World Psychiatric Association Executive Committee at its meeting in November 1972.
3. Endorsement by the Board of Directors of the Canadian Psychiatric Association of a resolution from the Executive Body of the British Columbia Medical Association's Section of Psychiatry, Vancouver, 19 January 1971.
4. Resolution of the American Psychoanalytic Association, Meeting of Members, New York, 18 December 1971.
5. I. F. Stone, *N.Y. Rev. Books* **18**, No. 2, (1972), p. 7.
6. R. A. Medvedev and Z. A. Medvedev, *A Question of Madness* (Knopf, New York, 1971).





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23 March 1973, Volume 179, Number 4079 **SCIENCE**

A Strategy for Science Education in the 1970's

The majority of recent committees on science education* have spelled out two basic themes: (i) the need to broaden university curricula to make science students more aware of the scientist's role in society, more responsive to society's needs, and more informed of the diverse options within a science career and (ii) the need to raise the scientific literacy of the public. These themes are related; action on the second will depend largely on accomplishing the first.

Today's public is more interested in solving social ills than in science and technology. At the same time, the increasing complexity and intrusiveness of science-based technology have increased the public's expectations of accountability and have sharpened its criticisms. Scientists now find it difficult to separate themselves from the institutional and political dimensions of their work. Those who sit on committees advocating curriculum reform have basically agreed on the desirability of broadening the curricula to produce scientists able and willing to work toward the goals of educating both themselves and the public about science and its role in society.

While agreeing that these goals are "critical," "imperative," or "essential," scientists are generally unaware of how to achieve them. What is required is a scientist who not only attains expertise in a field, but also has the capacity to view it in a social context. The traditional techniques of science education do not produce such a person, and there is little hope that adjustments within the existing courses by teachers heretofore uninterested in the problem will succeed.

An alternative approach is the development of a year-long, social-science-of-science program designed specifically for science undergraduates. This course would aim to orient students in the workaday world of science, acquaint them with the background and rationale of its organization, support, and rituals, and trace out the relation of basic research to technological development in specific instances that reveal the political and social dimensions of such developments. The state of being informed and aware of this broader perspective is the precondition for addressing the two needs stated at the beginning; the second half of the course would be devoted to these ends.

Aspects of this approach are well developed in several existing courses and programs across the country. Established courses in the history of science and the philosophy of science cover some of the area in depth, but they seldom address problems today's students will face. The sociological aspects of science are dealt with in a few sociology-of-science courses, but these emphasize the sociological concerns of science as a profession and generally do not attract science students. The development of a social-science-of-science course would provide a unified exploration of the social, political, and economic dimensions of science and the technologies it generates. Such a course cannot be solely within the purview of either the natural scientists or the social scientists.

Blue-ribbon science committees are asking for changes that can come only from a new and reciprocal working relationship with social scientists. A social-science-for-scientists program can effect a marked change in science education without a radical restructuring of the university. The only radical element will be the extent to which scientists will have to change their attitudes toward the role social science can play in helping them achieve their self-imposed goals.—DOROTHY ZINBERG, *Department of Sociology, Harvard University, Cambridge, Massachusetts 02138*

*For example: AAAS Committee on Science Education; Federation of American Scientists, Ad Hoc Committee Report on Science, Technology, and Education; and American Chemical Society, International Conference on Education in Chemistry.

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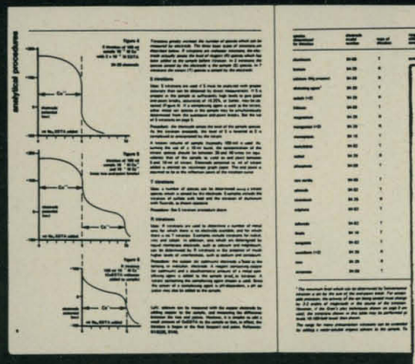
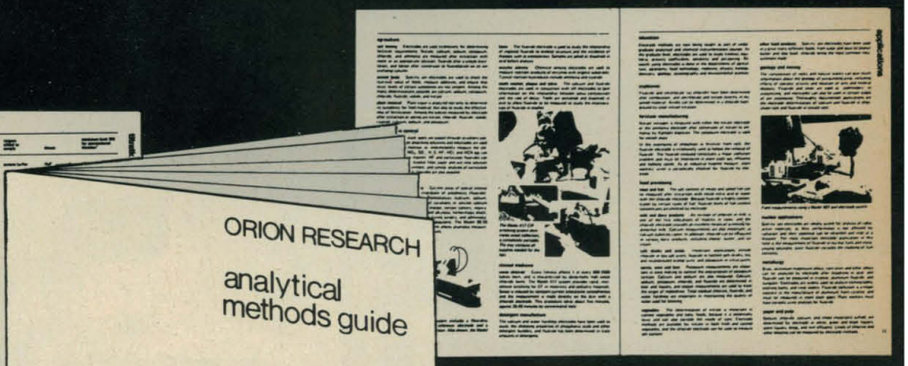
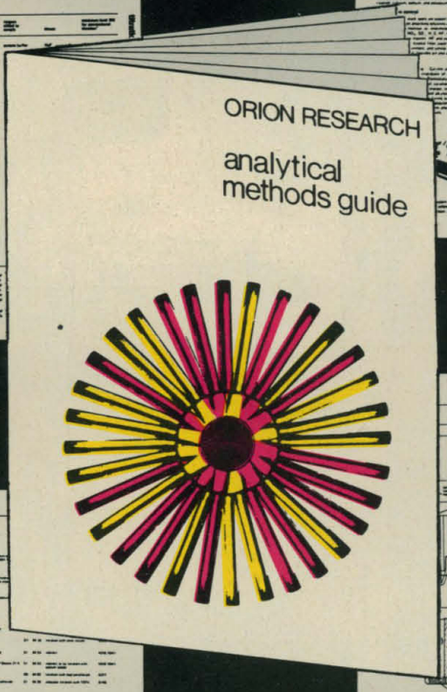




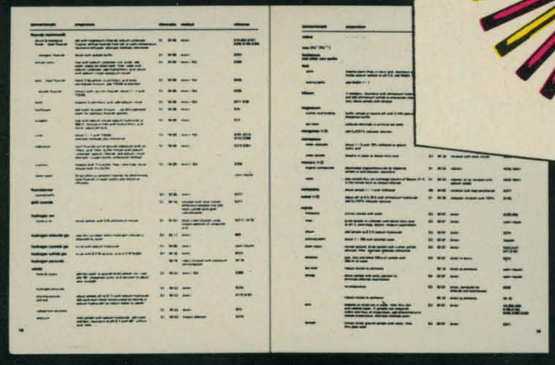


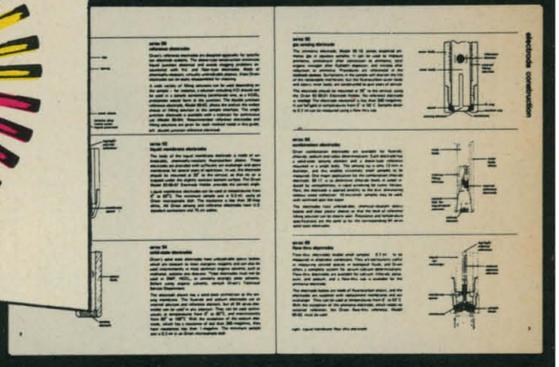
applications

where and how electrodes are used — by industry and field.

methods

outlines of sample preparation and analytical method listed by species and sample. Literature references.





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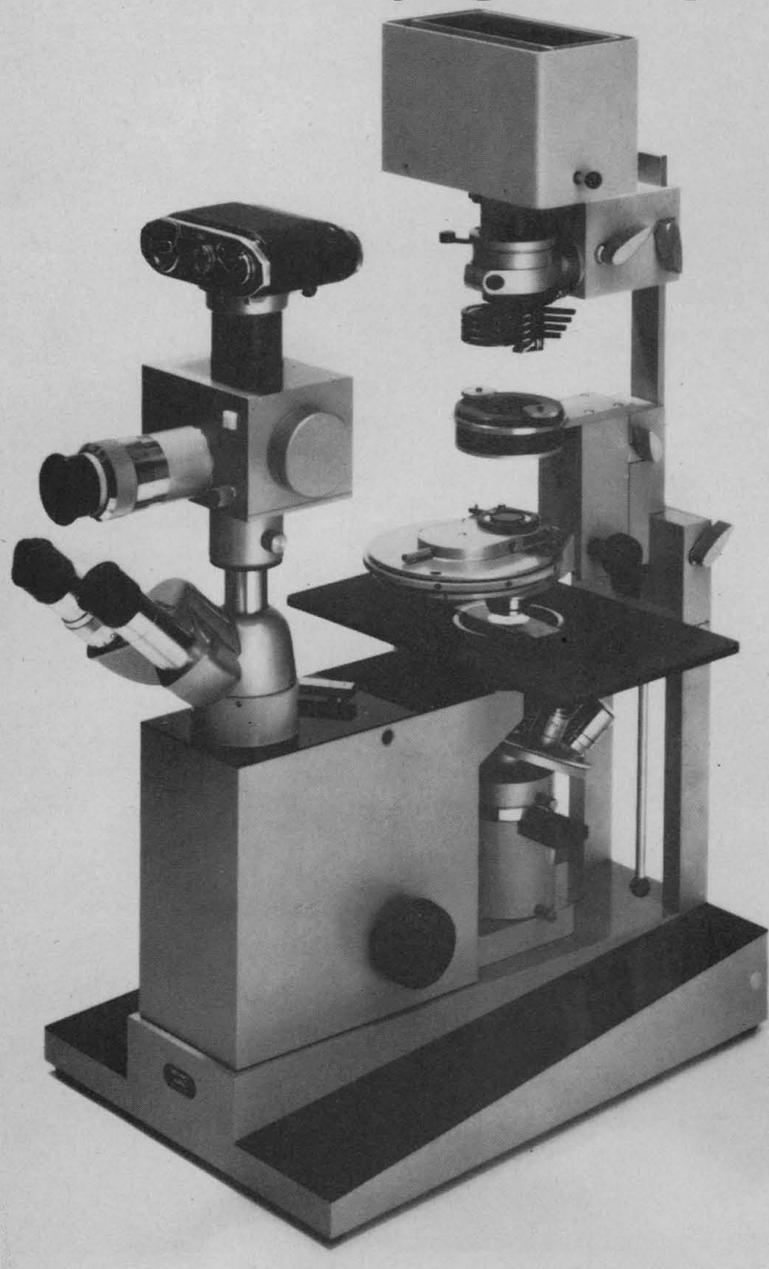

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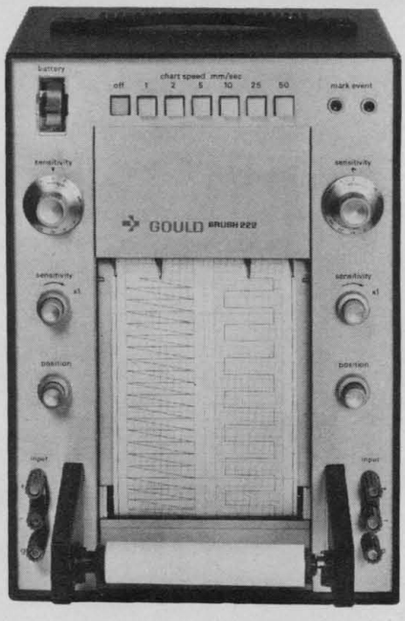

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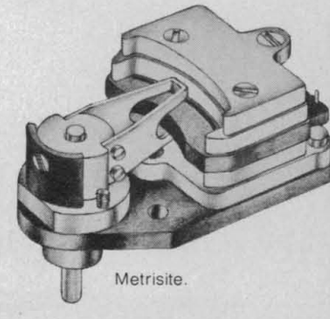
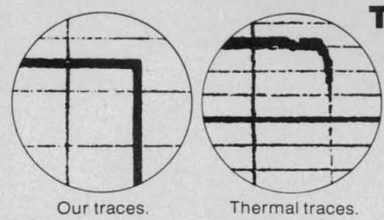

Metrisite.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CENTRAL THEMES

The Sea and Its Resources	June 25, 26, 27 and 28	☐
Ecology and Deterioration of the Environment	June 27, 28 and 29	☐
Deserts and Arid Lands	June 25, 26 and 27	☐
Nutrition and New Food Technology	June 20, 21, 22 and 23	☐
Earthquakes and Earthquake Engineering	June 20, 21 and 22	☐
Science, Development, and Human Values	July 2 and 3	☐
Problems of Population	June 26, 27 and 28	☐
Opportunities in Education	June 25, 26, 27, 28, 29 and 30	☐
Non-Nuclear Energy for Development	June 20, 21, 22 and 23	☐
Earth Sciences for Development	July 2 and 3	☐

TECHNICAL SYMPOSIA

Transfer of Technology and National Economic Development	June 20, 21, 22 and 23	☐
Aerial Inventory of National Resources	June 21, 22 and 23	☐
Tropical Ecosystems	June 29 and 30	☐
The Impact of Range Science in the Americas	June 30	☐
Volcanism in Mexico and Central America	June 21, 22 and 23	☐
Geodynamics	June 20, 21, 22 and 23	☐
Archaeo-Astronomy in Pre-Columbian America	June 20 and 21	☐
Land Connections between North and South America	July 3 and 4	☐
Hurricanes	June 22 and 23	☐
Symmetry	June 20 and 21	☐
Psychodysleptic Drugs, Addiction, and Pharmaceutical Education	June 28 and 29	☐
Research in Natural Products	June 25 and 26	☐
Mathematical Questions in Biology	June 30	☐
Educational Planning	Between June 29 and 30	☐
Environmental Health in the Americas	July 3 and 4	☐
Health Services	July 2 and 3	☐
Health and Illness, Birth and Death: The Cultural Context for Bio-medical Intervention	June 29 and 30	☐
Neurohumoral Coding of Brain Function	June 26 and 27	☐
Aerobiology of Diseases, Pests, and Allergens in the Western Hemisphere	July 2 and 3	☐
Effects of Malnutrition on Human Development	June 25 and 26	☐
Development of Arid Lands	July 3 and 4	☐
Anthropology Applied to Health Programs	June 29 and 30	☐
Family Planning	June 29 and 30	☐
Violence and Behavior	July 3 and 4	☐
Aquaculture in the Americas	July 2	☐
Wildlife and Its Environments in the Americas	June 25	☐
Interstellar Dust	July 4	☐
Sociolinguistics and Language Planning	June 27 and 28	☐
Information Requirements in Technology Transfer	June 25	☐
Settlements of Tomorrow	July 2 and 3	☐

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Products and Materials

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Computer-Coupled Fermentation

A computer-coupled fermentation system permits the simultaneous monitoring and control of some 40 variables. An experiment or industrial process may be modeled and altered in progress as the results of changes in any combination of parameters are instantly available in graphic or digital display (Fig. 1). The system, available from New Brunswick Scientific Co., Inc., is applicable to microbiological research and to industrial processes that depend upon the metabolism of microorganisms. The data analysis system allows adjustment of such physical and chemical variables as temperature, substrate or by-product concentration, *p*H, agitation, and others to optimize the desired process. The great single advantage of the system is to reduce the time required to determine the effect of changes in experimental conditions on the outcome of experiments with metabolic processes. Although he is able to rely upon programmed optimization, the researcher may choose to alter the experimental conditions manually as he monitors the digital display or printed results. The computer is the PDP/11/20 system from Digital Equipment Corp.; it is interfaced with a highly instrumented fermentor from Fermentation Design, Inc., a subsidiary of New Brunswick Scientific. Circle No. 120 on Readers' Service Card.

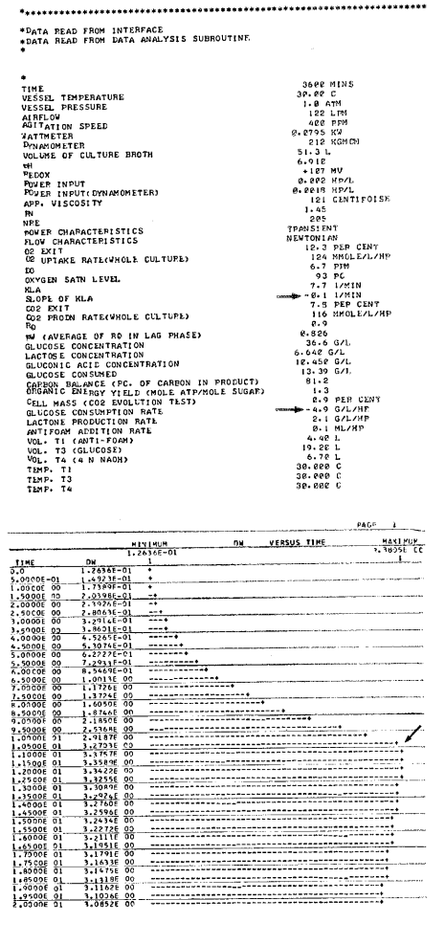

Fig 1. (Top) Data from a fermentation process which ordinarily takes several hours to obtain is readily available at any time during the experiment. Thus, the researcher can control variables as the process occurs. Arrows indicate conditions that suggest that increased agitation or aeration would improve the process. (Bottom) Real-time analysis of cellular dry weight in a fermentation process. Dry weight is indicated numerically and plotted. Arrow indicates point at which growth terminated. These figures illustrate some of the capabilities of the computer-coupled fermentation system available from New Brunswick Scientific Co.

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The Ektalite microfiche reader weighs less than 5 pounds and fits easily on a tabletop. It accepts 4 by 6 inch microfiches, each capable of storing from 60 to 98 pages of easily indexed material such as journal contents, research reports, or experimental results. The Ektalite screen concentrates the light of a low-wattage lamp and provides visual clarity even in daylight. The Ektalite microfiche reader is available from Eastman Kodak Co. Circle No. 121 on Readers' Service Card.

Immersion Circulator

A new immersion circulator is available from Brinkmann Instruments, Inc. The unit is equipped with a pump and a reading thermometer. It includes temperature control capability from 0° to 100°C, a 1000-watt heater, and a pumping capacity of 10 liters per minute at zero head. All immersible components are stainless steel. The accuracy of the temperature control is ± 0.5°C. The unit operates on standard current and the motor capacity is 20 watts. Although the pump shaft is 5 inches long, the minimum depth required is but 2 inches. Circle No. 122 on Readers' Service Card.

Literature

Instrumentation Chemicals for Analytical Work. Chemicals in seven classifications are listed for various types of spectroscopy and other analytic techniques. EM Laboratories, Inc. Circle No. 124 on Readers' Service Card.

Electronic Instruments and Systems for Measurement / Analysis / Computation (1973). This is a complete hardcover catalog of electronic products and features descriptions of processes, techniques, and applications in addition to product specifications. Hewlett-Packard. Circle No. 125 on Readers' Service Card.

Photoelastic Stress Analysis Techniques and Products. Bulletin SFC-200 includes a good illustrated referenced introduction to photoelastic phenomena as well as applications to specific problems of stress analysis. Photolastic, Inc. Circle No. 126 on Readers' Service Card.

the effect of mechanical stirring on aerosol formation in chambers, the inhibition of aerosol formation that occurs with certain hydrocarbon mixtures, and the effect of primary aerosols on the formation of secondary aerosols.

The final session of the workshop was concerned with the role of atmospheric measurements in modeling. Eschenroeder discussed the type of field measurements required for model verification. He recommended that vertical profiles of temperature and pollutant concentrations be obtained and that more numerous hydrocarbon measurements be taken. He also suggested that atmospheric removal processes for NO_x should be identified and the influence of concentration inhomogeneities upon atmospheric reaction rates should be determined.

W. A. Perkins (Metronics Associates, Inc.) discussed the measurement program planned for the Los Angeles Basin during the 1973 smog season. The objective of this program is to provide a data base suitable for developing and testing photochemical models. In this study a block of air will be followed by ground and air mobile units as it traverses an area. Aerometric measurements will be made of the pollutants in this air mass. By following an air parcel, rather than sampling from ground stations, one can observe directly changes in the nature of the pollutants as they undergo reaction.

R. C. Sklarew (EPA) ended the session with a discussion of some of the difficulties that the Meteorology Laboratory must solve before the full potential of photochemical models can be realized. One of the problems of current concern is the incorporation of chemistry into the models. Chemical reactions can be handled with relative ease by utilization of the trajectory approach. However, errors in following the chemistry can result if the grid approach is used. Another difficulty that must be resolved is that the effects of local point sources are presently handled by smearing the emissions over a wide area, giving poor resolution to the models. The efforts presently being made to resolve these difficulties were discussed.

The proceedings of this workshop, including presentations and discussions, are available upon request.

MARCIA C. DODGE
Environmental Protection Agency, Research Triangle Park, North Carolina

BOOKS RECEIVED

(Continued from page 1229)

Halsted (Wiley), New York, 1973. xii, 224 pp., illus. $13.50.

Health Hazards of the Human Environment. World Health Organization, Geneva, 1972 (U.S. distributor, American Public Health Association, Washington, D.C.). 388 pp. Paper, $11.

A Historical Introduction to the Philosophy of Science. John Losee. Oxford University Press, New York, 1972. 218 pp., illus. Paper, $3.50.

Human Nutrition. Its Physiological, Medical and Social Aspects. A Series of Eighty-Two Essays. Jean Mayer. Thomas, Springfield, Ill., 1972. xvi, 272 pp. $12.95.

Immune Complexes and the Pathogenesis of Various Diseases. Papers by Margherita Branca and others. MSS Information Corp., New York, 1973. 240 pp., illus. $15.

Introduction to Marine Environments. Robert Zottoli. Mosby, Saint Louis, 1973. xii, 125 pp., illus. Paper, $4.95.

An Introduction to Respiratory Physiology. Frederick F. Kao. Excerpta Medica, Amsterdam, and Elsevier, New York, 1972. xii, 332 pp., illus. $20.

The Isoquinoline Alkaloids. Chemistry and Pharmacology. Maurice Shamma. Academic Press, New York, and Verlag Chemie, Weinheim, Germany, 1972. xviii, 596 pp., illus. $35. Organic Chemistry, vol. 25.

Katamnesen bei kastrierten Sittlichkeitsdelinquenten aus forensisch-psychiatrischer Sicht. F. Cornu. Karger, Basel, 1973 (U.S. distributor, Phiebig, White Plains, N.Y.). viii, 132 pp., illus. Paper, $15.40.

Laboratory Embryology of the Chick. Lloyd E. Downs. Brown, Dubuque, Iowa, ed. 2, 1972. x, 96 pp., illus. Spiral bound, $2.95.

Laboratory Methods in Infrared Spectroscopy. R. G. J. Miller and B. C. Stace, Eds. Heyden, New York, ed. 2, 1972. xxii, 376 pp., illus. $18.

Life Between Tidemarks on Rocky Shores. T. A. Stephenson and Anne Stephenson. Freeman, San Francisco, 1972. xiv, 426 pp., illus. Cloth, $15; paper, $6.95.

A Life of One's Own. Three Gifted Women and the Men They Married. Joan Dash. Harper and Row, New York, 1973. xx, 388 pp., illus. $10.

Linnaeus. Heinz Georke. Translated from the German edition (Stuttgart, 1966) by Denver Lindley. Scribner, New York, 1973. xii, 178 pp., illus. $9.95.

Lipide während der Schwangerschaft und Niederkunft. Franz Jaisle. Karger, Basel, 1972 (U.S. distributor, Phiebig, White Plains, N.Y.). vi, 184 pp., illus. $16.80. Fortschritte der Geburtshilfe und Gynäkologie, vol. 48.

The Living Oceans. Alec Laurie. Doubleday, Garden City, N.Y., 1973. 188 pp., illus. $6.95. Nature and Science Library.

Machine Intelligence 7. Bernard Meltzer and Donald Michie, Eds. Halsted (Wiley), New York, 1972. xiv, 486 pp., illus. $30.

Macromolecular Microsymposia VIII and IX. A symposium, Prague, Aug. 1971.

B. Sedláček, Ed. Butterworths, London, 1972 (U.S. distributor, Crane Russak, New York). vi, 280 pp., illus. $24.60. Also published as *Pure and Applied Chemistry*, Vol. 31, Nos. 1–2 (1972).

Management and Technology. Vol. 1, An Anglo-American Exchange of Views. A meeting, London, 1972. Alan Mencher and Cyril C. Gee, Eds. Inforlink, London, 1972 (U.S. distributor, Pergamon, New York). Variously paged, illus. Paper, $12.50. Science Policy Foundation Special Publications Series.

Many-Body Problems. G. E. Brown. North-Holland, Amsterdam; Elsevier, New York, 1972. viii, 232 pp., illus. Paper, $13.75.

The Meaning of Race. Phillip V. Tobias. South African Institute of Race Relations, Johannesburg, ed. 2, 1972. iv, 42 pp. Paper, $0.60.

Metabolic Inhibitors. A Comprehensive Treatise. Vol. 3. R. M. Hochster, Morris Kates, and J. H. Quastel, Eds. Academic Press, New York, 1972. xx, 506 pp., illus. $26.

Natural Environments. Studies in Theoretical and Applied Analysis. A workshop. John V. Krutilla, Ed. Published for Resources for the Future by Johns Hopkins University Press, Baltimore, 1973. x, 352 pp., illus. $16.50.

New Perspectives on Ape and Human Evolution. Adriaan Kortlandt. Stichting voor Psychobiologie, Amsterdam, 1972. 100 pp. + map. Paper, $5.

Newer Methods of Nutritional Biochemistry. With Applications and Interpretations. Vol. 5. Anthony A. Albanese, Ed. Academic Press, New York, 1972. xviii, 252 pp., illus. $16.50.

Nuclear Structure Theory. J. M. Irvine. Pergamon, New York, 1973. xiv, 478 pp., illus. $27. International Series of Monographs in Natural Philosophy, vol. 49.

Nutrition in Old Age. A symposium, Saltsjöbaden, Sweden, Aug. 1971. Lars A. Carlson, Ed. Published for the Swedish Nutrition Foundation by Almqvist and Wiksell, Stockholm, 1972. 180 pp., illus. 50 Sw. kr. Symposia of the Swedish Nutrition Foundation, 10.

On the Measurement of Human Fertility. Selected Writings of Louis Henry. Translated and edited by Mindel C. Sheps and Evelyne Lapierre-Adamcyk. Elsevier, New York, 1972. xxii, 228 pp., illus. $15. Population Council Book.

Optical Waveguides. N. S. Kapany and J. J. Burke. Academic Press, New York, 1972. xii, 328 pp., illus. $18.50. Quantum Electronics—Principles and Applications.

Optimal Control of Differential and Functional Equations. J. Warga. Academic Press, New York, 1972. xiv, 532 pp. $27.50.

Organotin Compounds. Vol. 3. Albert K. Sawyer, Ed. Dekker, New York, 1972. xiv pp. + pp. 623–1078, illus. $32.50; by subscription, $25.

Oxidation and Reduction of Organic Compounds. Kenneth L. Rinehart, Jr. Prentice-Hall, Englewood Cliffs, N.J., 1973. xii, 148 pp., illus. Cloth, $9.65; paper, $5.95.

Pacem in Maribus. A conference, Valleta, Malta, June 1970. Elisabeth Mann Borgese, Ed. Dodd Mead, New York, 1972. xxxiv, 382 pp. $10.

The Penguin Dictionary of Geology. D. G. A. Whitten and J. R. V. Brooks. Penguin Books, Baltimore, Md., 1973. 496 pp., illus. + appendix. Paper, $3.45. Penguin Reference Books.

Pharmacology of the Endocrine System and Related Drugs. Progesterone, Progestational Drugs and Antifertility Agents. Vol. 2. M. Tausk, Ed. Pergamon, New York, 1972. xviii, 538 pp., illus. $36. International Encyclopedia of Pharmacology and Therapeutics, section 48.

Photomicrography. Douglas Lawson. Academic Press, New York, 1972. xiv, 496 pp., illus. $21.50.

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