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SCIENCE

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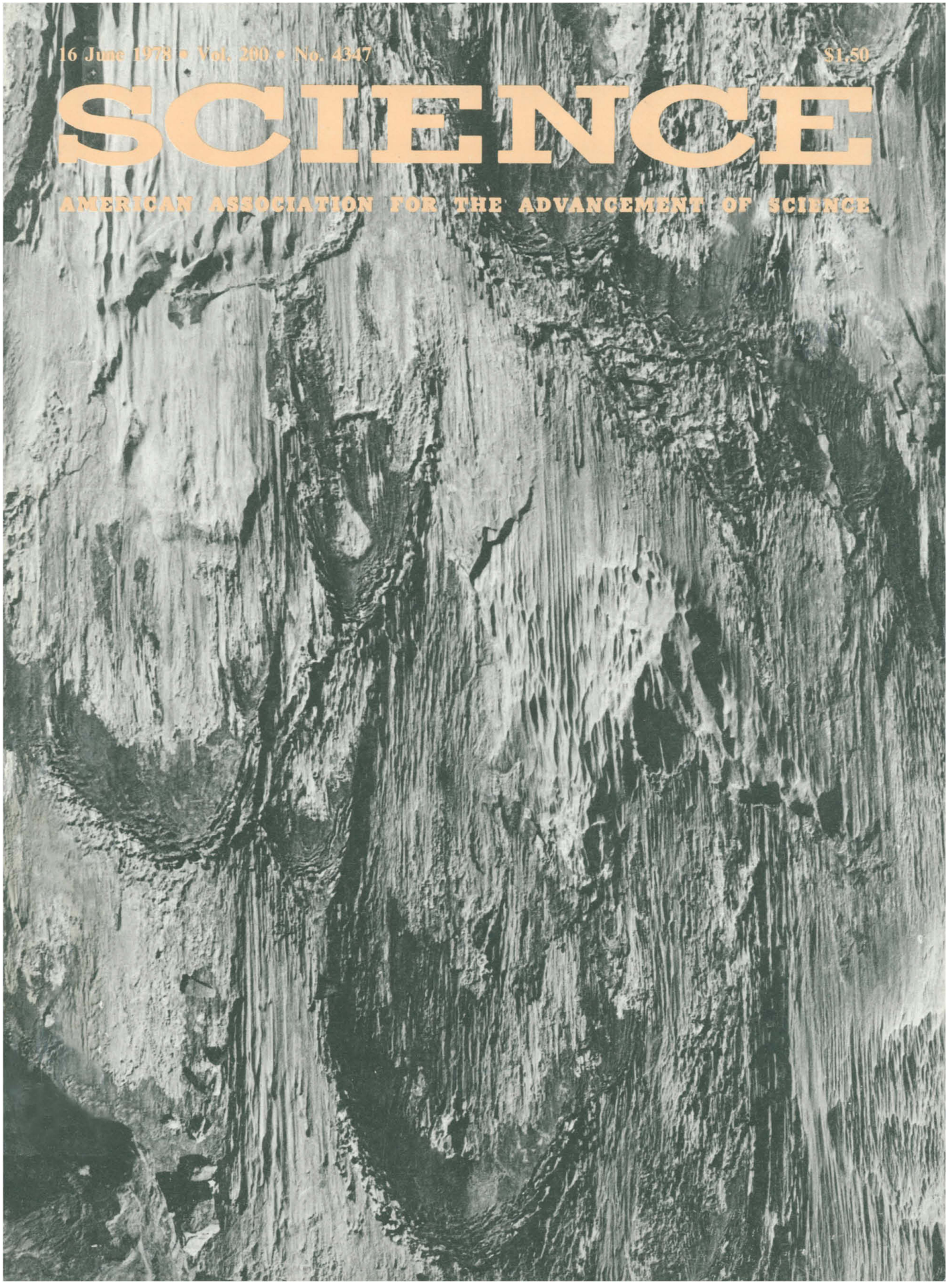

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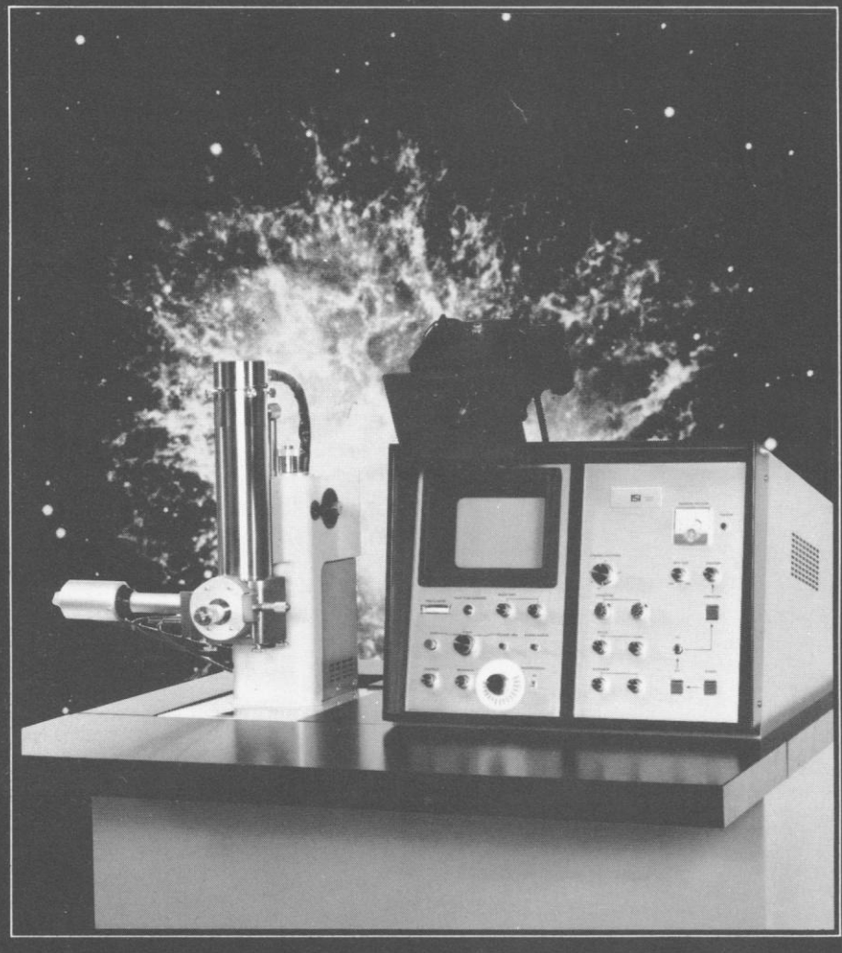

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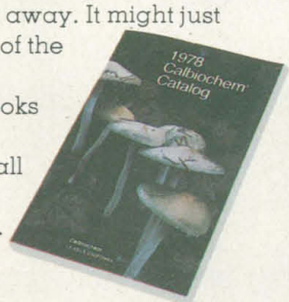

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16 June 1978

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SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

The lighter colored material is calcite that recently precipitated beneath the Blackfoot Glacier (Glacier National Park, Montana) when it overrode the dark colored Precambrian calcareous bedrock. See page 1267. [Photo about half scale; Bernard Hallet, Stanford University, Stanford, California]

The Nobe

The Nobel Prizes that gave birth to an idea

One part of every LKB instrument is over 30 years old: our experience in biochemical separation techniques.

30 years ago the Nobel Prize winners Prof. The Svedberg and Prof. Arne Tiselius instilled into the new company the need for high quality in scientific instruments. Their cooperation and encouragement developed into close contacts with scientists worldwide. As a result, LKB is today in the forefront of ideas in biochemistry, and can present to the scientist the right equipment and techniques at the right time.

Using LKB equipment guarantees nobody a Nobel Prize, but it does lay a sure and certain basis for careful experiments and accurate results.

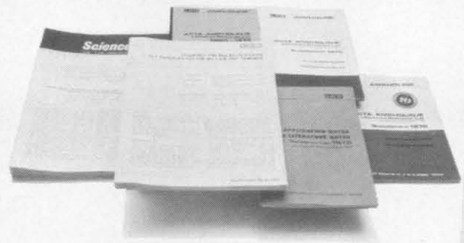
Complete and versatile equipment means access to a wide variety of methods

At LKB research and development of the instrument go hand in hand with research and development of the technique, so that the one is ideally suited to the other. Often, LKB instruments are developed with several techniques in mind. This allows the scientist to change methods easily without changing equipment, or to experiment within one method.

LKB supplies equipment necessary for growing and disintegration of microorganisms through to the final characterisation of a purified substance. Probably the most important techniques in biochemistry are those involving separation and analysis, and there we have our greatest experience.

LKB helps science advance, and serves the scientist

For science to advance, knowledge must be shared. At LKB knowledge comes from our experience and research and from our many worldwide contacts. We share our knowledge in several ways: in the quality of our instruments, as Workshops and Seminars, literature such as *Acta Ampholinae,* Application Notes and SCIENCE TOOLS.



Electrophoresis

This technique laid the basis of LKBs entry into biochemical separations, and prepared the way for further developments. In developing reliable equipment we were greatly helped and encouraged by Arne Tiselius, whose important work on electrophoresis was rewarded by a Nobel Prize in 1948.

LKB provides the basic equipment needed for an electrophoretic system, analytical or preparative, column or thin layer: equipment such as power supplies with constant power, voltage and current; Multiphor for thin layer electrophoresis and immunoelectrophoresis; and Uniphor® for column electrophoresis.

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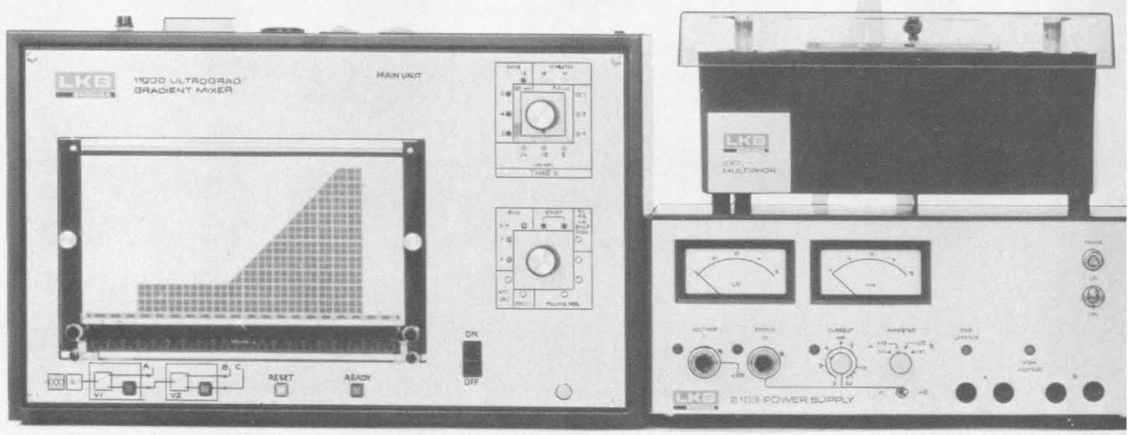


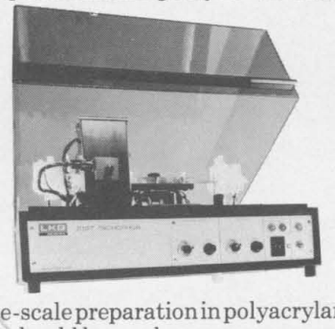
l Prize Kit

Electrofocusing

LKB has led the world in electrofocusing since we introduced it in 1966. Our breakthrough then was with Ampholine® carrier ampholytes and electrofocusing columns. The recent introduction of Multiphor, the ready-to-use Ampholine® PAG-plates, and the PEGG kit for preparative electrofocusing in granulated gel has extended even further the scope of this very efficient, high resolution, technique. Circle No. 171 on Readers' Service Card

Isotachophoresis

Kohlrausch's theory of 1897 was turned into simple practice when LKB introduced Tachophor in 1974. This latest and most advanced electrophoretic technique can be used for analysis or preparation on the microscale using Tachophor, a complete separation taking only 20–40 minutes.



For large-scale preparation in polyacrylamide gel, Uniphor should be used.

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Gel filtration

The lagging development of gel filtration media has been given a new impulse by the introduction of LKB Ultrogel®. This new medium, a copolymer of polyacrylamide and agarose, gives better resolution and high flow rates. Ultrogel is becoming the gel of choice, especially in the difficult area of serum protein fractionation.

All the equipment you need for gel filtration – columns, Uvicord® UV monitors, Perpex Pumps, UltroRac® and RediRac fraction collectors – is made by LKB. Circle No. 173 on Readers' Service Card

Ion exchange, affinity and adsorption chromatography

The "adapted gradient technique", using LKB Ultrograd® gradient mixer, gives much improved resolution over ordinary gradient elution. You dictate the shape of the gradient simply by cutting it out on chart paper. Ultrograd produces controlled and reproducible gradients, and to scale-up for preparative work you simply increase the flow rate. Circle No. 174 on Readers' Service Card

This summary of LKB equipment is necessarily short. Our new 58-page colour booklet "LKB Systems and Methods for Biochemical Research" illustrates all LKB equipment and describes in some detail the methods for which they are used. Our colour poster "Preparative Separation Principles in Biochemistry" is a worldwide attraction: like the booklet you can get a free copy by writing or phoning to us. Circle No. 175 on Readers' Service Card

LKB

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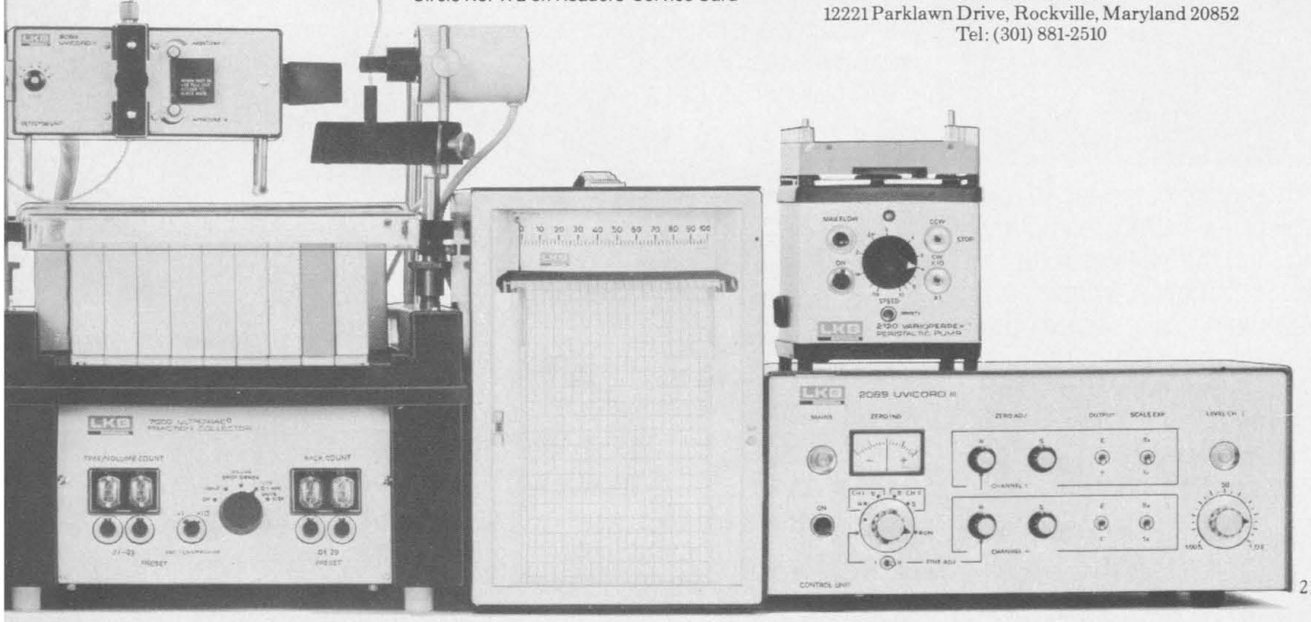
12221 Parklawn Drive, Rockville, Maryland 20852
Tel: (301) 881-2510



216

Optics aren't the only thing to look at in a research microscope.

Of course, they are the most important. And ours are among the finest in the field.

But there are other features you should examine.

We've always tried to make our research instruments easy to use and adapt to a wide variety of techniques and applications.

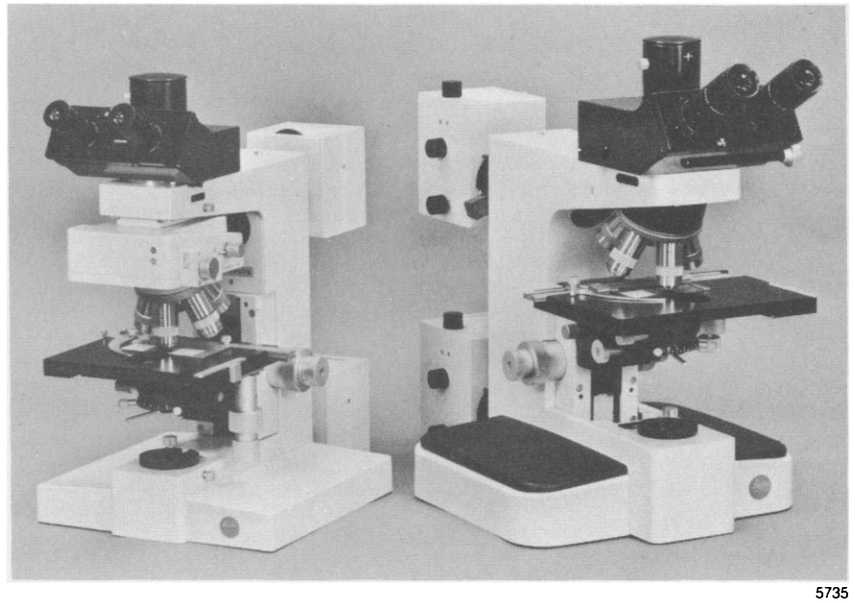
Many of these features aren't easy to see. Which is why we'd like to bring some of them to your attention.

Our fluotar objectives, for one example, offer some very distinct advantages.

They're color-coded to tell you at a glance which type you are using. And the sleeves rotate for rapid identification. That means no more craning your neck to identify the objective you're using.

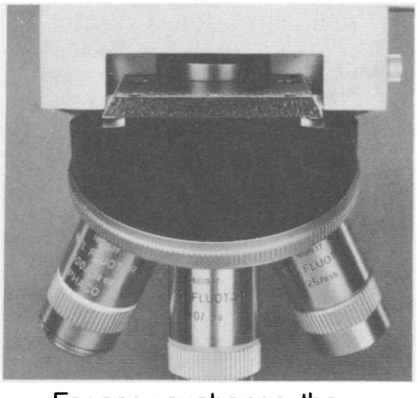
In addition, the knurled ring is placed low to make it easier to change objectives.

But don't overlook their truly superior optics. These are the result of combining the latest techniques in optical design with unique glasses developed in the Leitz Glass Research Laboratory.



5735

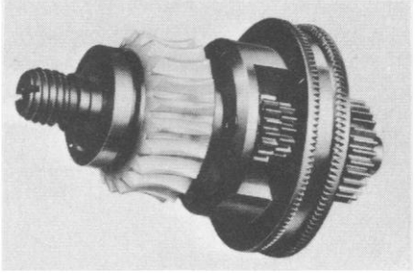
The objective carrier provides exceptional stability because of its unusually wide dovetail. This is very important for fluorescence work with the heavy incident light Ploem illuminator.



For easy exchange, the carrier slides out horizontally.

We don't expect you to look inside our microscope stand. B if you did, you'd find a complex system of planetary gears like the one shown below.

The gears move the object stage and are designed to produce razor sharp focusing.



There are other advantages to our research microscopes we hope that you will look into such as our complete range of easily interchangeable accessories and low life cycle cost.

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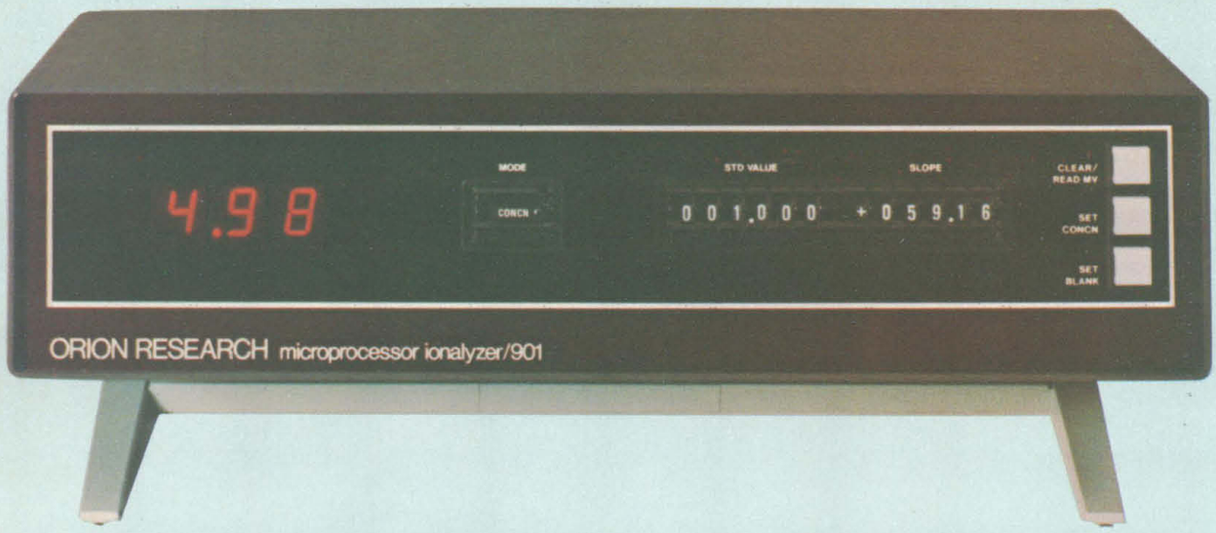


WORKS LIKE A COMPUTER.

a digital specific ion meter

ORION has developed the Model 901 to further simplify all analyses made using pH, specific ion, and gas-sensing electrodes. A series of operating modes covers the full range of analytical methods used for performing electrode analyses:

direct reading concentration	
incremental methods:	**known (standard) addition**
	known subtraction
	analate (sample) addition
	analate subtraction
absolute and relative millivolts:	**Gran's plots and titrations**
pH	

Results are calculated in real time with an accuracy that will satisfy the most demanding research applications – yet the 901 is simple enough to be used in all routine quality control applications.

Analytical parameters are entered on the digital switches on the control panel, with standardization and blank correction accomplished at the push of a button. Results are read directly from the LED display in the unit system of your choice. The 901 completely eliminates the use of calibration curves, tables, or calculations.

how the 901 works

The Model 901 has a high input impedance analog amplifier and analog-to-digital converter similar to that used in digital pH/mv meters. The output of the converter is fed to a microprocessor which is pre-programmed with equations for calculating pH's and concentrations. Parameters needed to solve the electrode equations are supplied to the microprocessor from the switches and pushbuttons on the front panel.

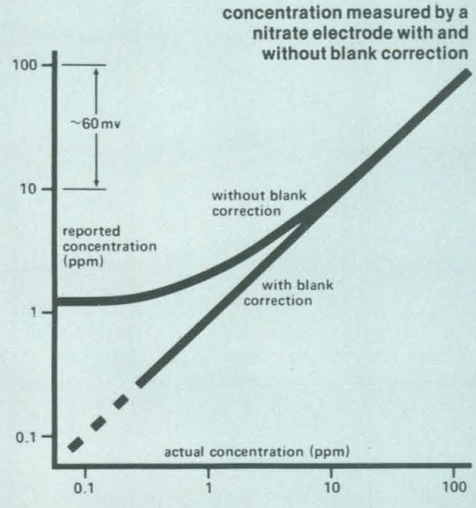
Twice each second the electrode's potential is digitalized and fed to the microprocessor, and the analytical result is calculated using the pre-programmed equations. A concentration result ranging between .000 and 999. is shown on the LED display in a three-digit floating decimal point format. Calculated pH results between 0.000 and 13.999 are displayed.

pushbutton blank correction

The 901 has a blank correction feature that is especially useful in overcoming two problems frequently encountered in making low-level measurements: slow time response of the electrode and deviation of the electrode response from theoretical.

In the first case a background level of the species measured is added to all samples and standards to bring the concentration up to the region of fast time response. The blank correction feature is used to automatically subtract this background level from the result.

In the second case the electrode potential in the blank solution is entered into the microprocessor's memory by pushbutton so that the results are automatically corrected over the region of nontheoretical response.



volume correction

When analyses are carried out by one of the incremental methods, the volume change that takes place when the standard is added to the sample (or vice versa) should be taken into consideration if a correct result is to be calculated. The various incremental modes include a volume correction factor that the microprocessor uses in calculating the result.

call us

Can we discuss applications for the 901 – or arrange a demonstration in your laboratory? Call us toll-free at 800-225-1480 (except Mass.) and ask for one of our Technical Service Representatives. In Canada call 800-363-9270.

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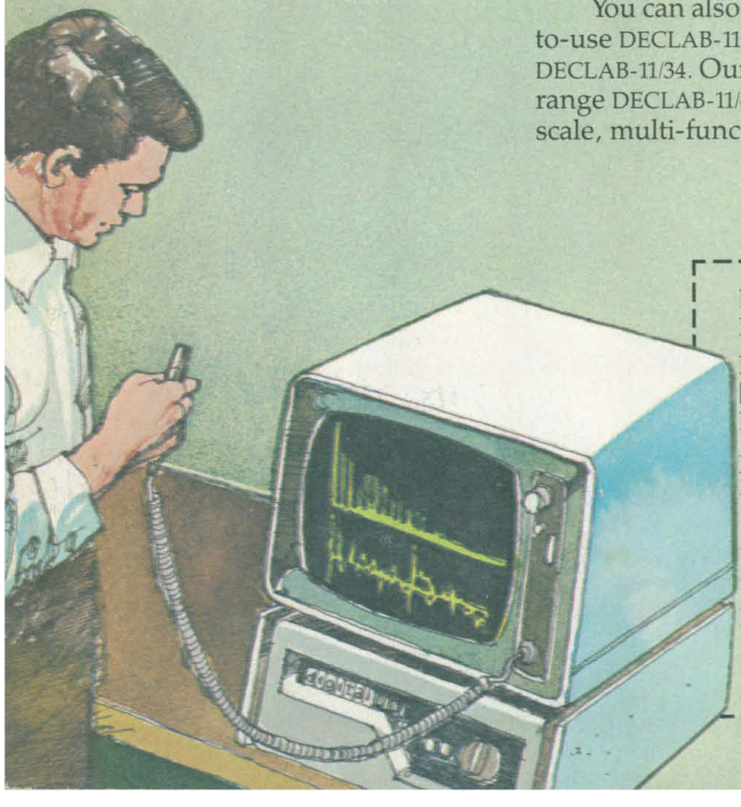

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Put less time in to get more results out with S&S pre-pleated filter papers.

A pre-pleated S&S filter paper gives you twice the exposed surface area of an ordinary filter folded by hand into quadrants. You not only save time on folding, your solid–liquid separations move faster, and a series of filtrations can be set up and run in measurably shorter time. Solids are more dispersed over the surface of the paper, and clogging is reduced or eliminated. Because of this, these filters are widely used to recycle reagents in chemistry autoanalyzers.

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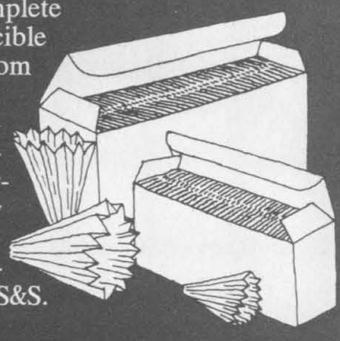

For complete information and specifications, contact your nearby laboratory supply dealer. Samples of pre-pleated filters are available upon request from S&S.

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Density gradient spin times can be reduced more than 80% by Sorvall® OTD ultracentrifuges with new vertical rotors.

High resolution and time savings result when the combined advantages of a Sorvall® OTD ultracentrifuge and a Sorvall® vertical rotor are used for density gradient separations.

These patented rotors* hold the tube in a fixed vertical position while tube contents are reoriented 90°. The sedimentation path length is thus reduced from the length to the width of the tube, resulting in shorter spin times. Three vertical rotors are available to suit a wide range of capacity requirements.

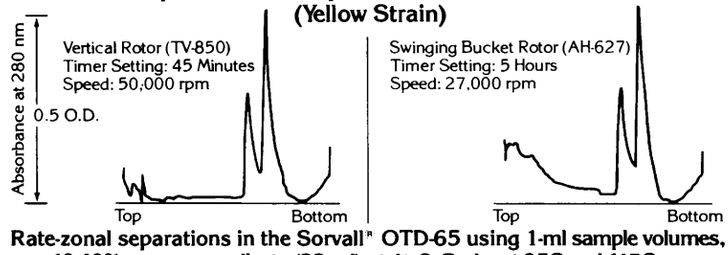
Typical results are shown in the rate zonal separation of cowpea mosaic virus particles using 1 ml samples. Use of a Sorvall® 8-place vertical rotor instead of a 6-place swinging bucket rotor of comparable tube volume reduced spin time more than 80% while maintaining resolution. These rotors are equally suitable for isopycnic density gradient separations.

Sorvall® OTD ultracentrifuges incorporate a unique low-friction oil turbine drive capable of providing soft starting and stopping, and smooth acceleration and deceleration. The Sorvall® Automatic Rate Controller and Reograd mode of deceleration take full advantage of this capability to avoid stirback and mixing of the gradient between 0 and 1,000 rpm.

The oil turbine drive also eliminates the maintenance and replacement of gears, belts and brushes. The many other features of OTD centrifuges include trouble-free self-contained cooling system; precise, wide-range temperature control; and automatic and manual vacuum pumping system.

For full information on Sorvall® OTD ultracentrifuges and vertical rotors, write to Du Pont Instruments, Biomedical Division, Room 36512, Wilmington, DE 19898. *U.S. Patents 3,998,383 and 4,015,775

Separation of Cowpea Mosaic Virus Particles (Yellow Strain)



Rate-zonal separations in the Sorvall® OTD-65 using 1-ml sample volumes, 10-40% sucrose gradients (33 ml) at 4° C. Peaks at 95S and 115S.

With Sorvall® Centrifuges the spin times are changing.

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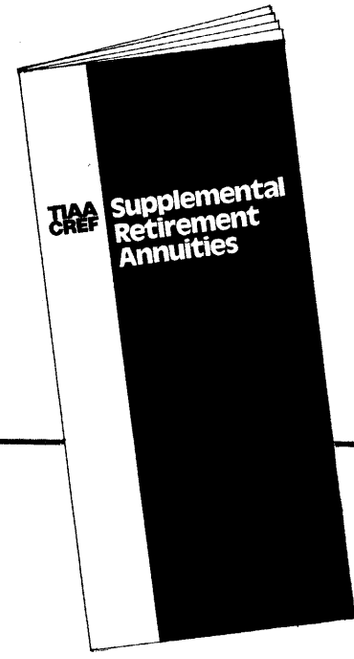
TIAA-CREF Supplemental Retirement Annuities



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Supplemental Retirement Annuities (SRA's) are new forms of TIAA and CREF contracts designed expressly for use by persons who want to set aside tax-deferred retirement funds over and above amounts being accumulated under their institution's basic retirement plan. They are available for employees of colleges, universities, private schools and certain other nonprofit educational organizations with tax-deferred annuity (salary-or-annuity option) programs. Through a properly drawn agreement with their institution, staff members may divert part of their compensation before taxes to the purchase of these new contracts.

And SRA's are cashable at any time. This means that if the money accumulated by salary reduction is needed before retirement, the SRA contracts can be surrendered for their cash value. Benefits, whether payable in cash or as income, are taxable as ordinary income when received.

For more information and answers to questions send for your copy of the booklet on Supplemental Retirement Annuities.

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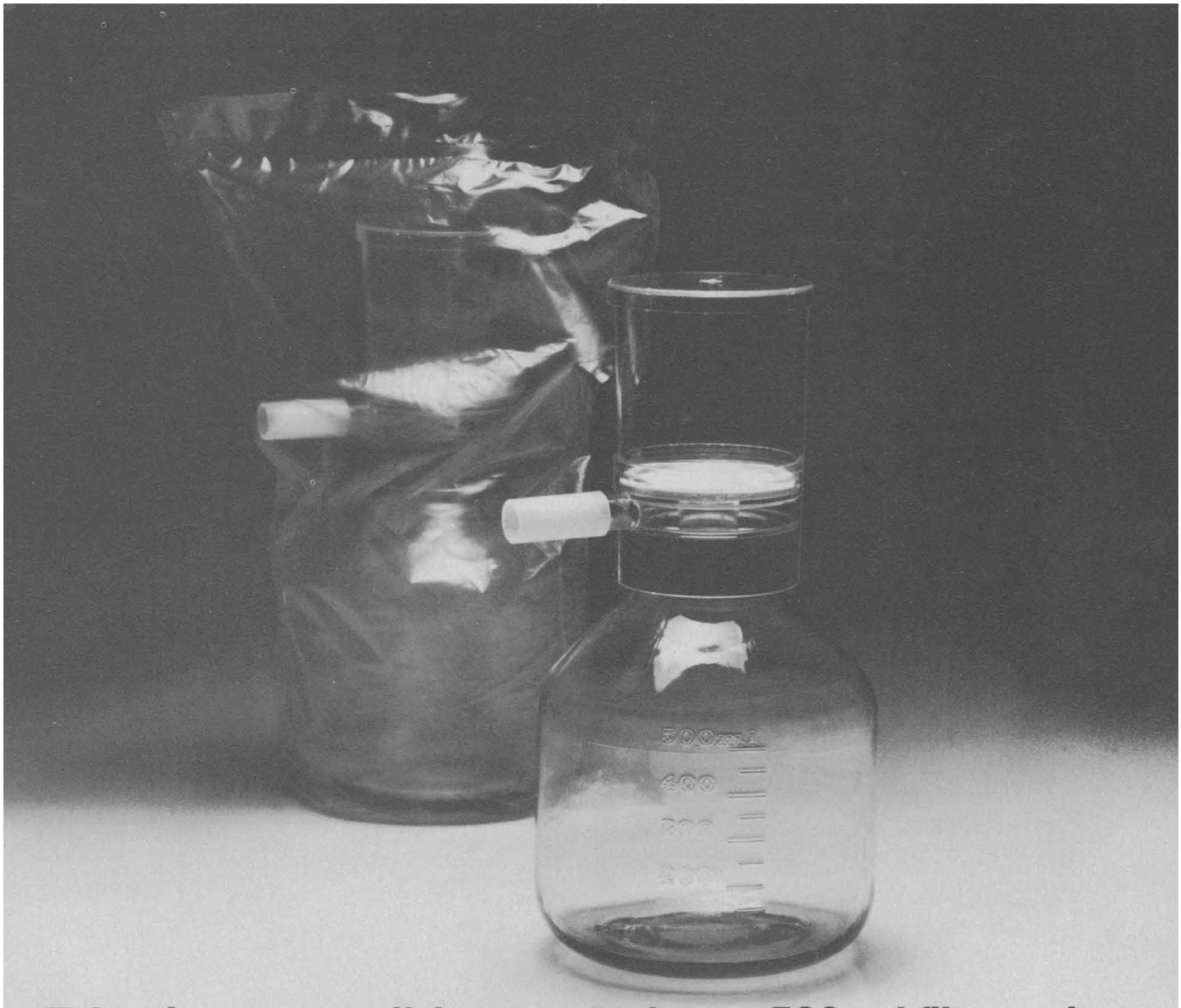


Take the wraps off the new Nalgene 500-ml filter unit.

And save time before, during, and after filtering.

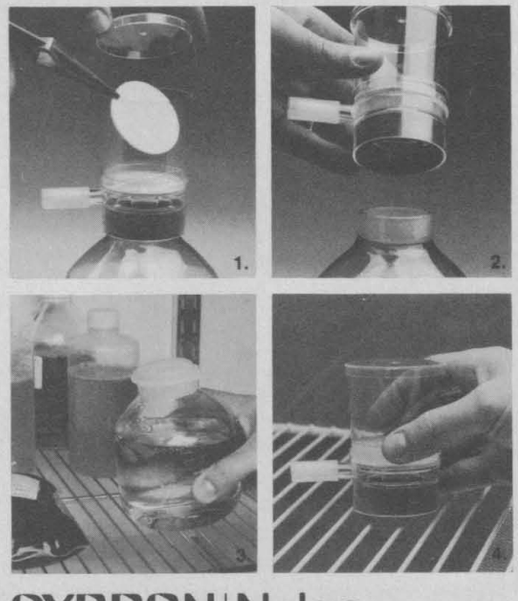
Before: There's no prep time needed. Like the widely-used Nalgene® 115-ml filter unit, the new Nalgene 500-ml filter unit is presterilized. Rigid quality control testing assures sterility of all filter unit elements. Like the 115-ml unit, the 500-ml filter unit is preassembled, so it's ready when you are. You don't waste time with costly autoclaving.

During: It offers increased throughput without compromising flow rate. A presterilized prefilter protects the membrane from clogging. Filter a full 500 ml with no stopping.

After: There's no clean-up. The Nalgene 500-ml filter unit is disposable, so you save time when your work is done. You can decant a full 500 ml from a sterile source, without transfer to a separate container. This is the first presterilized, disposable filter unit in the 500-ml size.

Now, choose either the standard Nalgene 115-ml filter unit (available with membranes in 0.20, 0.45 and 0.80 porosities) or the new 500-ml unit (in porosities of 0.20 and 0.45).

To order, call your lab supply dealer. For our current catalog, write: Nalge Company, Box 365, Rochester, New York 14602.



1. The new 500-ml filter unit comes complete with a prefilter for screening larger particles.
2. The filter cup and the receiver can be separated, and . . .
3. The receiver can be sealed with the presterilized polyethylene cap provided to store the filtrate. There's no need to transfer the sterile filtrate to a separate sterile container, so there's less chance of contamination.
4. With media added, the filter cup can be incubated to observe growth on the membrane.

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protected...

* in a light metal holder are the fine fitted plungers of these 800 Series Microliter Syringes (for 5 and 10 microlitres).

An extension which prevents the plunger from bending, and protects the samples from the warmth of the hand. But also an ingenious complement which gives the usual HAMILTON precision an even longer service life.

The barrel assembly and the holder are screwed together. It is, therefore, practical and economical when the barrel assembly needs to be replaced. The 800 Series types are, of course, also obtainable with removable needles.

For detailed technical information with prices please contact Hamilton Company, P. O. Box 10030, Reno, Nevada 89510, USA.

HAMILTON

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LETTERS

Tanker Safety

The article by Luther J. Carter discussing the *Amoco Cadiz* incident and ". . . the elusive goal of tanker safety" (News and Comment, 5 May, p. 514) unfortunately contains lopsided reporting on the February conference sponsored by the United Nations' maritime agency, the Intergovernmental Maritime Consultative Organization (IMCO). The author's statement that a sure way to prevent pollution which may arise from ballasting operations would be to require that tankers be equipped with segregated ballast tanks (SBT's) does not square with the facts.

It was emphasized both in papers prepared for delegates to the IMCO conference and in exchanges between delegations that the cost of retrofitting tankers with segregated ballast would be far out of proportion to the marginal environmental benefits which might be thereby derived.

The assertion that the crude oil washing (COW) system is neither as effective nor as self-enforcing from a pollution prevention standpoint as equipping vessels with segregated ballast is simply not true. Conference delegates recognized that proper operation of the SBT system would require heavy reliance on vessel personnel to prevent pollution. Routine washing of cargo tanks on ballast voyages after cargo has been discharged and periodic ballasting of cargo tanks during especially heavy weather would create a potential for marine pollution from vessels with segregated ballast. On the other hand, COW conducted in port under close supervision avoids this possibility of marine pollution.

An accurate account of the conference should also include recognition that, aside from the United States, the most ardent supporters of the SBT concept were the Greek, Norwegian, and Swedish delegations, whose interests were not so much environmental as economic. Requiring that tankers be retrofitted with segregated ballast would reduce worldwide tanker capacity by 10 to 25 percent, thus shrinking the immense tanker surplus which plagues the merchant fleets of these nations. However, retrofitting the tanker fleets of the world and placing into operation additional tonnage to carry the same volume of petroleum would also add billions of dollars to the energy bills of importing nations and, contrary to ongoing conservation efforts, would require the consumption of substantial additional amounts of vessel fuel. In the final analysis, IMCO delegates concluded that retrofitting tankers with SBT's simply could not be justified, either environmentally or economically.

With respect to the *Amoco Cadiz* spill, one must seriously question the author's assessment that the effects of the spill can be expected to persist for a decade or more in some places. This conclusion is not consistent with the fact that other areas affected by major oil pollution, such as resulted from the *Torrey Canyon* incident and offshore Santa Barbara drilling, fully recovered in a suprisingly short time. Scientific objectivity would be better served by making no dire predictions, but rather by letting the result of thorough investigations following such incidents speak for themselves.

T. S. WYMAN
Chevron Shipping Company,
555 Market Street,
San Francisco, California 94105

Carter's article on tanker safety is a poignant reminder of the magnitude of the task that confronts all of us in the tanker industry. Recently a former tanker captain with more than 40 years of experience in the tanker business with a major oil company wrote in a letter to me, "The tanker is an ugly, dirty beast, and the oil industry has a poor track record in trying to house-train this animal."

But it doesn't have to be this way. Oil tankers can be constructed and operated to be as environmentally and esthetically acceptable as the sailing ships that brought spices and teas into our harbors. We know how to do it. We need the legislative framework to establish the parameters within which the tanker industry can operate safely, economically, and practically pollution-free. No one company, no matter how big and rich, can afford to have its tankers operate at significantly higher costs than other tankers available for charter. Our industry wants, needs, requires, almost pleads for, firm government action to establish standards for tanker construction and operation that are considerably more effective than those presently in force. What we don't need is a watered-down, ineffective international agreement such as that proposed at the recent London conference on tanker safety and pollution prevention sponsored by IMCO. Our government should reject the results of this latest conference as inadequate and ineffective.

Changes are required in the way oil tankers are owned, operated, and built. Our government should legislate that foreign and U.S. tankers operating in U.S.–controlled waters or carrying oil for transhipment to the United States (i)

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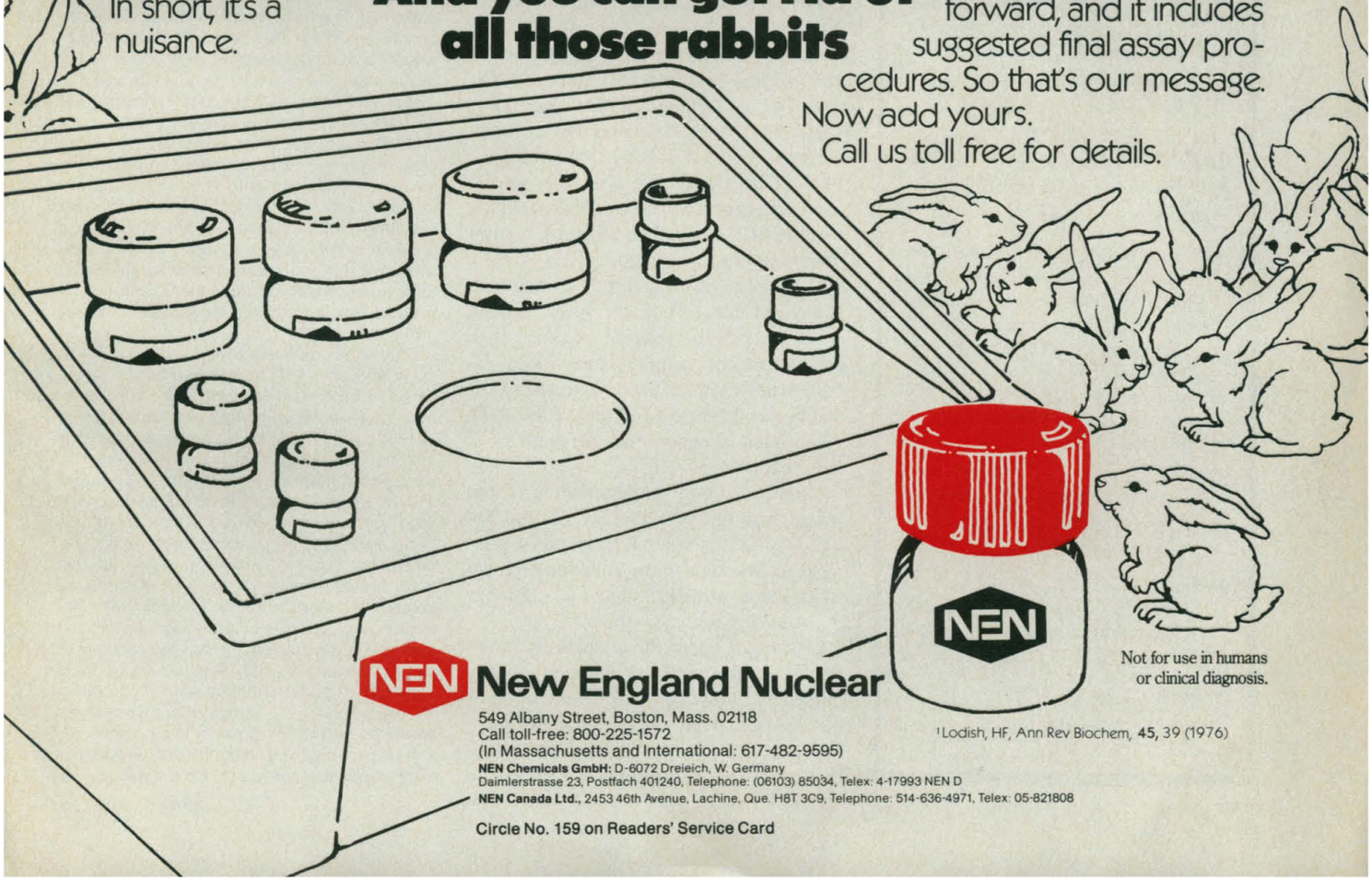

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[1] Lodish, HF, Ann Rev Biochem, **45**, 39 (1976)

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stop using water in the cargo tanks of tankers for washing and ballasting; (ii) require deck and engine officers and pilots of tankers to demonstrate their competency on simulators; (iii) provide charterers, insurers, and authorities with their accident and oil spill records; (iv) convert part of the cargo tanks on existing tankers into segregated ballast tanks; and (v) construct double hulls on future new tankers, with the space between the hulls sufficient for all segregated ballast requirements.

Unilateral action by the United States is required. Our actions will quickly become adopted by other maritime nations. These proposed changes would add less than 1 cent to the cost of gasoline. They would result in oil tankers becoming "beautiful."

ARTHUR MCKENZIE
Tanker Advisory Center, Inc.,
10 East End Avenue, New York 10021

Physicists Postpone Visit to Soviet Union

Under the aegis of the Joint Coordinating Committee on Research on Fundamental Properties of Matter (JCC-FPM) established under the Nixon-Brezhnev agreements and involving the U.S. Department of Energy and the U.S.S.R. State Committee on the Peaceful Uses of Atomic Energy, we had planned, as a formal U.S. delegation, to visit nuclear research institutes in Moscow, Dubna, Leningrad, Kiev, Kharkov, Tashkent, Alma Ata, and Novosibirsk during the period 24 May through 7 June 1978. This delegation was the formal counterpart of a Soviet one that visited a number of U.S. nuclear research institutions roughly a year ago.

Collaborative activities under the JCC-FPM have thus far been heavily concentrated in particle physics with productive cooperative utilization of facilities at Fermilab and Novosibirsk. It had been our hope—and that of the JCC-FPM—that through the personal contacts established during our visits, and through our better understanding of the research programs under way in the Soviet institutions visited, it would be possible to broaden these collaborative activities substantially to include a number of areas of nuclear science.

In view of recent developments in the Soviet Union and discussions among ourselves, however, we have found it necessary to postpone our visit. We have forwarded the following letter to the directors of the institutions that had been on our planned itinerary explaining this decision.

We believe our colleagues in the U.S. scientific community will be interested in our decision and the reasons for it.

As you have already learned through formal channels of the Joint Coordinating Committee on Research on Fundamental Properties of Matter (JCC-FPM), and the message from Dr. Kane to Professor Chuvilo dated May 22, 1978, we have decided to postpone our visit to your Institute.

We want to tell you why we have made this decision.

Our planned visits under JCC-FPM sponsorship have reflected our very strong belief in the importance of communication throughout the scientific—and particularly the physics—communities, and our belief that the activities already achieved under the JCC-FPM have made major contributions to scientific cooperation between our countries and to better understanding between our peoples. It has been—and is—our hope that such activities can be extended to new areas of science and to greater cooperation in those areas in which programs already exist.

We are sure that you will agree that one of the most important conditions for the advancement of any science—and again physics in particular—is freedom of communication among scientists. The exchange of ideas as well as the sharing of responsibilities is well known to be fruitful while compartmentalization is, in the end, sterile and unproductive.

It is for this reason that we are happy to have the opportunity to plan for our visits to Soviet institutions, such as your own, as a formal part of the JCC-FPM activity and as a counterpart of the productive visit paid to a number of U.S. nuclear research institutions by a Soviet nuclear science group during the past year. We have envisioned that cooperation between our two scientific communities would be mutually very valuable and we have been anxious to assist in its development.

It is, therefore, with the greatest regret that we have postponed the planned visits.

Cooperative ventures, however, as we are certain you will agree, can flourish only in an atmosphere of good will. It is a fact—an unfortunate fact, but nevertheless a fact—that the atmosphere of good will has eroded as a result of events in your country with the consequence that individual American physicists have progressively become more reluctant to become involved in joint programs involving our two countries.

It must be emphasized that American physicists have a very high regard for Soviet scientists and for Soviet science. It is a fact, however, that American physicists are reacting against a pattern of actions on the part of your government, which they view as repressive, exemplified most recently by the Orlov case. This reaction has now reached an intensity such that we, as individual members of the U.S. nuclear science community, have decided that it would not be possible, at this time, for us to achieve our goal of fostering greater communication and cooperation between our scientists and institutions and yours. It is our judgement that the concern of the American scientists who would be most valuable for participation in joint programs in nuclear science is so strong that little purpose would be served by our visit at this time.

In postponing our visit, it is of course our strong hope that, in future, circumstances will

change such that we can again take up and build upon the strong bonds of collaboration and understanding already forged in JCC-FPM activities. Critical to this change is the rebuilding of the necessary open and free atmosphere.

Let us assure you that it is with the deepest regret that we find it necessary to take this action. We had much looked forward to meeting you, to visiting your Institute, and to exploring areas of possible future collaboration. And we look forward to a future time when such activities can be resumed as an important part of the truly international fabric of our science.

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Brookhaven National Laboratory, Upton, Long Island, New York 11973

Solar Energy in 2000

I must comment on Luther J. Carter's article of 12 May (News and Comment, p. 627), in which he discusses the recent solar energy report by the Council on Environmental Quality (CEQ). I feel I was quoted in that article in a manner that did not reflect my intended meaning. Frankly, I think the CEQ estimate that 25 percent of America's energy will be provided by solar technology in the year 2000 is probably optimistic. Although it may seem curious, I use the nuclear industry as a rule of thumb. This amounts to comparing a complex industry (nuclear) with what in most cases is a much simpler one (solar). However there are factors that tend to cancel the nuclear industry's increased complexity, such as the strong contributions from the weapons and naval reactor programs and the unquestioning support of congresses and presidents during the 1950's and 1960's. Thus a well-supported, successful program was able to supply about 10 percent of the nation's electrical energy (2.5 percent of total energy) approximately 20 years after commercial demonstration, and 30 years after the beginning of the R & D program. Because solar energy is not limited to just the electricity market, I feel it can supply from 5 to 10 percent of the nation's energy by 2000.

This business-as-usual projection has many uncertainties associated with it. Probably the most significant is the extent to which solar energy is perceived as more than just another energy option, although one with relatively benign environmental and health impacts to balance its present economic limitations. A projection of 5 to 10 percent by 2000 is low to the extent that solar energy is increasingly perceived as a symbol of a new way of thinking about the future. This emerging mind-set or cultural paradigm would look to solar as an energy source with significance beyond narrow marketplace economics.

My other major point was that projecting that solar energy will provide 5 to 10 percent of the nation's total energy by 2000 does not mean that it is not an important part of the solution to our *current* energy problems. I find this attitude as unrealistic as a projection that the solar share of the market will be 25 percent by 2000.

RICHARD CAPUTO
Solar Energy Research Institute, Golden, Colorado 80401

Paraquat Pyrolysis Products

R. Jeffrey Smith, in two recent articles (News and Comment, 24 Feb., p. 861, and 28 Apr., p. 417), describes a health hazard arising from the presence of the herbicide paraquat (1,1′-dimethyl-4,4′-bipyridinium dichloride) on marijuana supplies obtained from Mexico. Smith states that pyrolysis of the paraquat results in the formation of "bypiridine," which is not considered to be cause for concern because it is present in smoke from tobacco cigarettes. Actually, the pyrolysis product of paraquat is 4,4′-bipyridine, a compound which has never been found in tobacco smoke. The only bipyridines which have been detected in tobacco smoke are the 2,2′ and 2,3′ isomers (*1*). 2,2′-Bipyridine decreases gastric secretory volumes and pepsin output in rats (*2*). I am not aware of any studies on the pharmacology or toxicity of 4,4′-bipyridine, but it seems highly unlikely that it is completely innocuous.

EDWARD LEETE
Natural Products Laboratory, School of Chemistry, University of Minnesota, Minneapolis 55455

References

1. I. Schmeltz and D. Hoffman, *Chem. Rev.* **77**, 295 (1977).
2. P. Bass, R. A. Purdon, M. A. Patterson, D. E. Butler, *J. Pharmacol. Exp. Ther.* **152**, 104 (1966).

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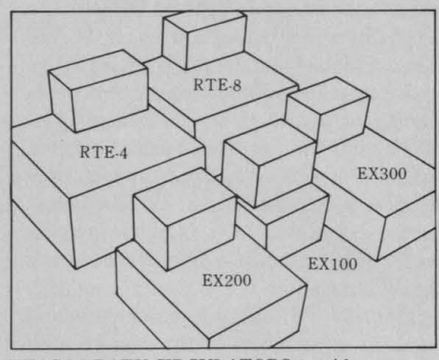

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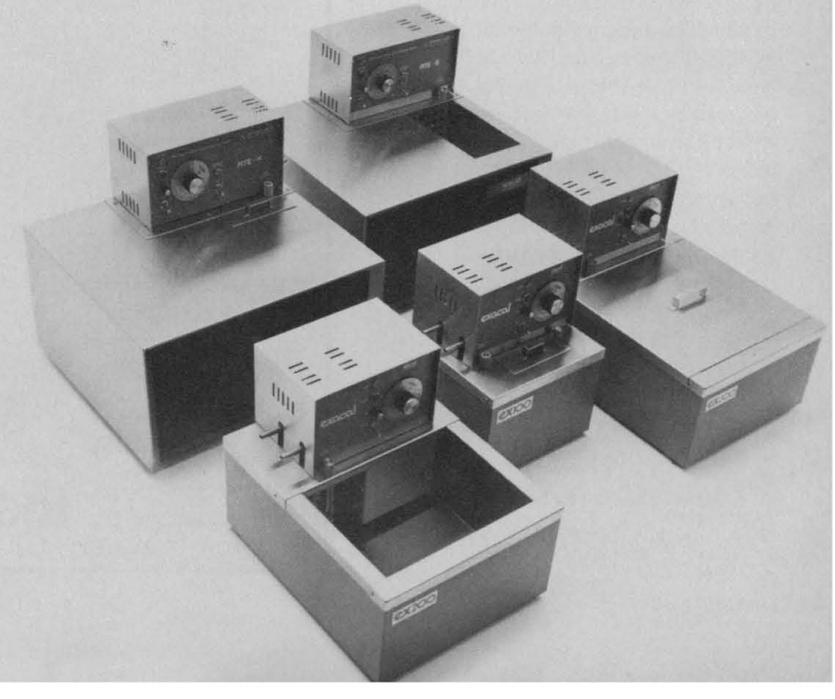

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16 June 1978, Volume 200, Number 4347 **SCIENCE**

Bad Science and Social Penalties

Bad science, especially in the environment and health area, may well impose socioeconomic penalties hardly envisioned. Health effects data, for example, are used as a basis and as a rationale (often emotional) for far-reaching decisions on the control of technology. All too often, published partial findings are taken uncritically at face value, misinterpreted, and misused; their qualifications are disregarded and their uncertainties forgotten. This can lead to technological fixes that do more harm than good.

I use the term bad science whenever hard conclusions from scientific investigation are not warranted by the data or the data are misapplied. The fault can lie with incompetent experimentation, analysis, or interpretation—the scientist's direct responsibility. Or the fault can lie with the misapplication of data. In the past, professional tradition has largely prevented or corrected bad science. Peer review and editorial discretion have promoted the scientific quality of published works; the responsibility and joy of scientists in confirming or denying published conclusions have led to the eventual obscurity of bad science.

But these professional procedures are being bypassed because of the needs of the times. The traditional outlet for scientific reporting is often short-circuited. Scientific work appears in unrefereed reports, news statements, hearing records, symposium transcripts, speeches, and independently published documents. Even editorial reviews are tending to become less critical to avoid any appearance of suppression of controversial findings. Also, much experimental work is becoming extremely difficult to confirm or refute—it may be large-scale, involve sophisticated techniques of experimentation and analysis, and be heavily computerized so that the original data are hard to obtain or the procedures difficult to check. In addition, political and regulatory pressures created by public concern often cannot await the inherently slow pace of scientific tradition.

Many practical problems caused by bad science currently arise from biomedical research, especially from epidemiologic studies. It is easy to understand, for example, why persons of keen analytic mind such as economists, physical scientists, and statisticians feel that if historical records exist on air pollution and in hospitals, it is easy to make correlations and determine the extent to which cleansing the air of the measured pollutants would improve health. But in reality, how difficult! The generally uncertain quality of the original data and the confounding factors are usually overlooked.

What can be done? Bad science, being more newsworthy, will tend to be publicized and seized on by some to support their convictions. Resolution of issues by the "science court" is untested, not having gained broad support, and the National Academy of Sciences is already overburdened. Perhaps the solution lies in greatly increased efforts of individual scientists—to vigorously take initiative and responsibility, to immediately expose bad science whenever it occurs, and thereby to reestablish credibility.

This plea to be more critical in the reporting and acceptance of science as a basis for important decisions is not meant to inhibit innovative work, withhold information from the public, or delay action needed in the public interest. Any reports that suggest a public health problem should be quickly examined to determine if immediate action is needed to prevent existing or imminent harm. (Fortunately, this determination can often be made on the basis of previous experiences.) Then such reports should be used to spur and guide any needed additional research.

The present spate of "doomsday" items, if taken at face value, could cumulatively produce either socioeconomic dislocations with little or no net health benefit, or public derision and counterreaction that would inhibit environmental improvement.—CYRIL COMAR, *Professor Emeritus, Cornell University, and Director, Environmental Assessment Department, Electric Power Research Institute, Palo Alto, California 94303*

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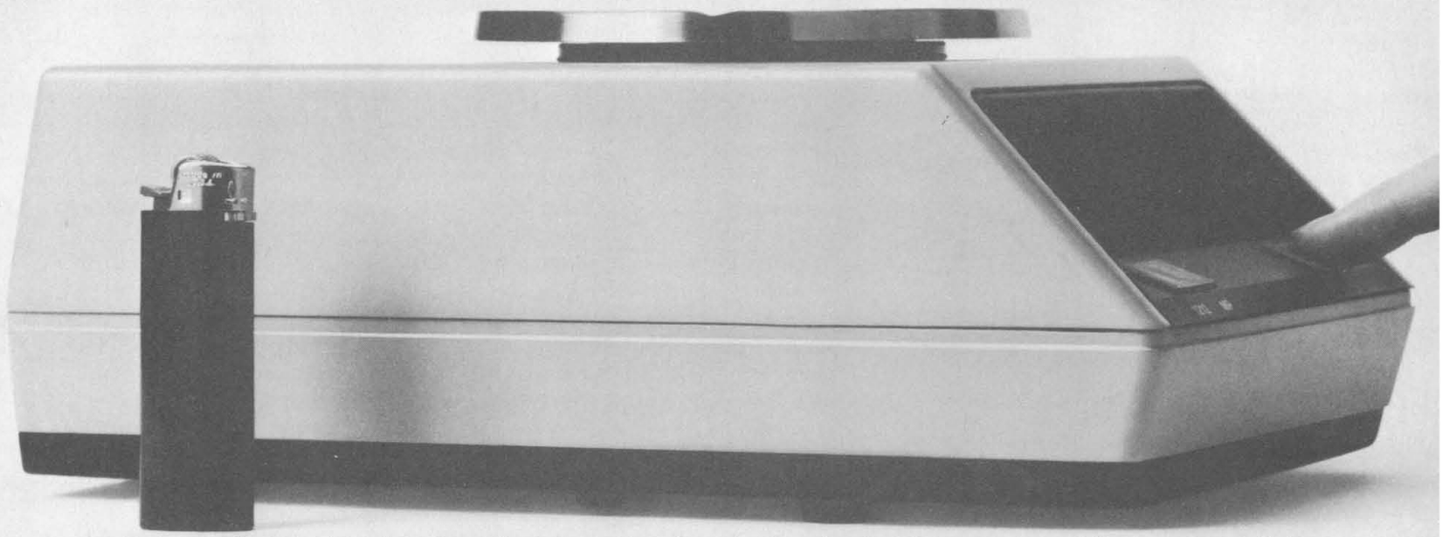

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Call for Contributed Papers

Poster Sessions Only. Deadline: 5 September 1978

Following our newly established tradition of the two recent Annual Meetings, AAAS will again have contributed paper sessions at its forthcoming Annual Meeting in Houston (3–8 January 1979). However, because the next Annual Meeting is some 6 weeks earlier in the year than the one just past, we will have less time to prepare for it and therefore we will be unable to schedule slide sessions. The Houston Meeting will have poster sessions only. All abstracts must be submitted according to the instructions given below, not later than 5 September 1978. Abstracts which fail to meet the requirements as indicated below will be returned. *All contributions must be submitted (and signed) by a AAAS member or fellow* (although this person need not be one of the authors). Contributors will be informed about where and when they will make their presentations in late October 1978. Contributed paper sessions will be of the poster session type only; in such sessions each contributor will have a bulletin board on which to place text and graphic material (of oversized nature) for an extended period of time so that he can discuss his work at length with all interested parties (see *Science*, 28 June 1974, page 1361).

Instructions for Contributors

Type abstracts, using a clean (new) ribbon, on ordinary white bond paper (8.5 by 11 inches; 21.5 by 28 cm) according to the format shown on the right (the example is reduced to about one-half of the linear dimension; your abstract will be printed *directly from your copy* at about two-thirds of its linear dimensions). Indicate at the top of the page the letter of the AAAS Section which comes closest to your subject matter (a full list will be found at the bottom of the contents page of any issue of *Science*), as well as two or three words which give the subspecialty involved.

It is very important to keep your abstract within the limits of a 5-inch (12.7-cm) square. If it is too wide, it will be returned; if it is too long, it may be arbitrarily cut. Note that your original will be our camera-ready copy, so type and letter as neatly as possible.

At the bottom of the page, left side, type the name and address of the person who should be contacted regarding the abstract (that is, the person we should notify of where and when the presentation should be made). On the right side, type the name and affiliation of the AAAS member or fellow who is submitting the abstract and have this person sign the abstract. *The privilege of submitting a contributed-paper abstract for the Annual Meeting is limited to AAAS members or fellows.*

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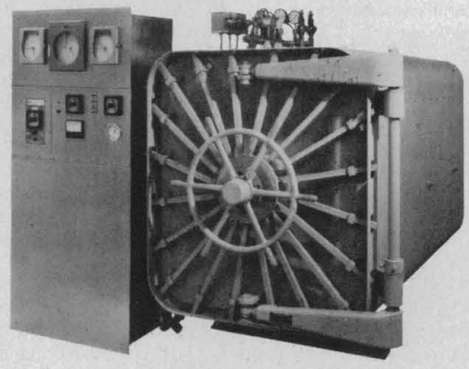

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- Monochromator; 190 to 740 nm
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- Computing integrator prints four lines per second
- Automatic or manual fraction detection
- 100 slit-size combinations

TRANSIDYNE GENERAL CORPORATION

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