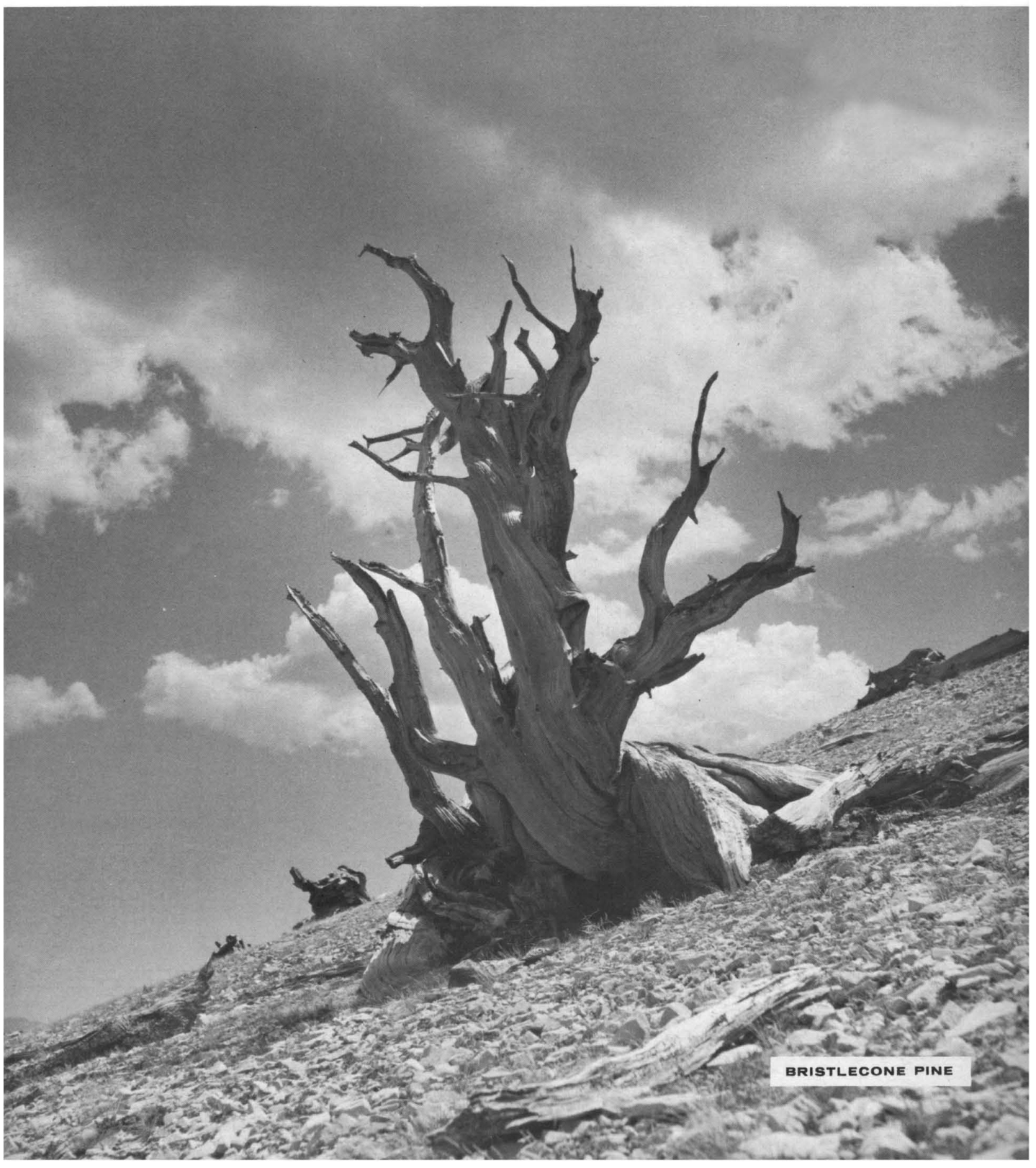
SCIENCE

23 February 1968

Vol. 159, No. 3817

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



BRISTLECONE PINE

compact, well-regulated, constant voltage bench power supply

now add $25 and get constant voltage/ constant current

with no compromise in reliability and performance

Because of new fabrication techniques, Hewlett-Packard has been able to design this new series of low cost DC power supplies without sacrificing component quality, circuit reliability, or performance. In addition to making ideal power sources for circuit development, component evaluation, and testing, BENCH Series supplies are convenient substitutes for batteries in many physical, chemical, and biomedical laboratory applications.

Voltage is adjustable (as well as current in the Constant Voltage/ Constant Current models) to zero; the front panel meter can be switched to monitor either voltage or current. All models in the BENCH Series are designed to insure short-circuit-proof operation, and permit series and parallel connection of two or more supplies when greater voltage or current is desired. Design safeguards prevent overshoot of output voltage when AC power is suddenly applied or removed.

All units have a constant voltage load regulation of 0.01% + 1 mV, and line regulation of 0.01% plus 4 mV. Maximum ripple voltage is 200 μV RMS or 1 mV P-P (DC to 20 MHz). In addition, the constant current models have a constant current regulation for both load and line of 500 μA. Maximum ripple current is 150 μA RMS or 500 μA P-P (DC to 20 MHz).

The molded, impact-resistant case has an interlocking feature for vertical stacking, which cuts down the bench space required for multiple supplies. The size of all units is 3¼" high, 5¼" wide, and 7" deep. Up to three units can be mounted side by side in a 19" rack using a special Rack Mounting Kit.

For more information, call your local hp field engineer, or write Hewlett-Packard Company, 100 Locust Avenue, Berkeley Heights, New Jersey 07922. Europe: 54 Route des Acacias, Geneva.

CONSTANT VOLTAGE/CURRENT LIMITING

6213A	6215A	6217A
0-10V 0-1A	0-25V 0-400 mA	0-50V 0-200 mA

CONSTANT VOLTAGE/CONSTANT CURRENT

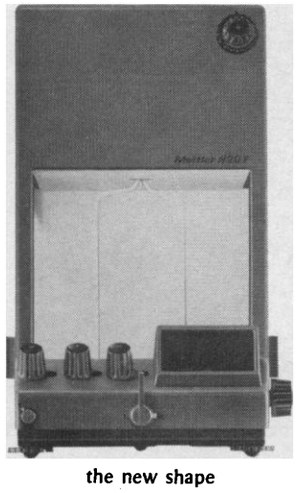
6214A	6216A	6218A
0-10V 0-1A	0-25V 0-400 mA	0-50V 0-200 mA

HEWLETT hp PACKARD

POWER SUPPLIES

Mettler unleashes its new breed of balances on the weighing world

The six balances of the new Mettler H series are setting the weighing world on its arrestment mechanism. Five of them – three macro analyticals and two semi-micro analyticals – have full-range taring, digital data presentation and a filling guide. Of these, one also has preweighing and two have digital printout of weighing results. The sixth is an electronic balance designed to work jack-in-plug with a computer.



the new shape

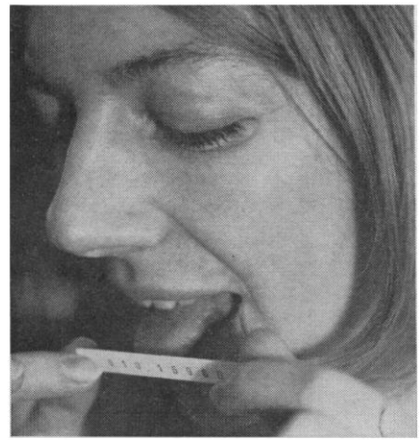
DOWN WITH ARITHMETIC

Unrestricted taring through their full capacity is a prime feature of the new analyticals. The weight of your container can be tared off in seconds, letting you begin weighing-in with the readout at zero. If you are adding several components, you can dial back to zero for each one. With all weighings beginning at zero, you just can't make a mistake. Unless you are unnecessarily obdurate.

FIRST GUTENBERG, THEN METTLER

Two of the new balances, the H10P macro and the H20P semi-micro, have the Mettler printout system. Weighing results are printed out, at the push of a button, in all-digital form. They are printed on the adhesive-backed paper tape you see on telegrams. (Mettler's Marketing Director wanted to call this feature "Tell-a-gram" but we hooted him down.)

You can affix weighing data directly to sample containers, laboratory notebooks or other records. You can't misread, transpose, or forget your weighing results.

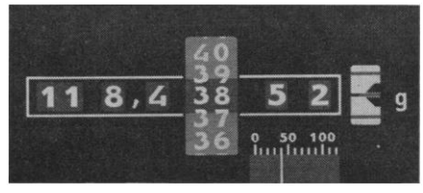


m-m-mmmm

The one thing we haven't done is to lick the tape for you – you must find a way to do it yourself. If you are too fastidious to lick it, just call a friend.

LINE UP, YOU DIGITS!

All the new analyticals have their weighing results presented in aligned, all-numerical form. This speeds reading the data and avoids errors from misreading tricky verniers and micrometers.



to 0.01 mg.

The digital readout panel and controls are conveniently grouped for easy operation and reading.

PREWEIGH OUR WAY

One instrument, the Mettler H10TW, offers improved preweighing for direct indication of rough weight. When preweighing, part of the optical scale is blocked out to avoid any risk of mistaking the preliminary value for the final result.

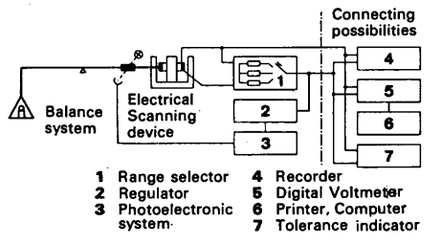
Further, the Mettler preweighing system operates over the full 160-gram range of the balance, eliminating the need for an additional dialing step if the unknown is more than 100 grams.

GUIDE TO GRACIOUS FILLING

Well over half of the hours spent before a balance are used for weighing-in. The filling guide on each of our new analyticals lets you do the job without the usual repeated interruptions. No overshooting the target weight or waiting for the optical scale to stop whizzing past . . . you proceed in orderly fashion, continuously adding your material right up to all but the final few milligrams. Our analyticals, the only ones ever to have a filling guide, can cut those hours spent at weighing-in by at least 50%.

BALANCE WITH ELECTRICAL OUTPUT

Last and most unusual of the new Mettler breed is the H20E electronic balance. It provides an analog signal for use with such instrumentation as recorders and analog-to-digital converters. It can be used to record weight changes, to code weight values into punch cards or paper tape, to print weight values by accounting machines, and to sort and control objects or processes within given weight tolerances.



Mettler H20E, figuratively

How you use it depends upon your needs – and you know them better than we do. We don't know the answers to all your problems. Just holding our position as the world's leading balance maker takes a lot out of us.

BALANCE AFICIONADOS TAKE NOTE

The redoubtable Kolthoff and Elving TREATISE ON ANALYTICAL CHEMISTRY, Volume 7 (Interscience 1967) contains a chapter that serious students, analytical chemists and research chemists might well note. Written by Lloyd B. Macurdy, Mettler's well-known staff metrologist, it is a definitive approach to the measurement of mass. History, definitions, instrumentation, units of mass, uncertainties of weighing and the elimination thereof . . . they're all there.

DO IT NOW . . .

Write for complete product literature on the new H balances. We are Mettler Instrument Corporation, 20 Nassau Street, Princeton, New Jersey 08540.

Mettler®

23 February 1968
Vol. 159, No. 3817

SCIENCE

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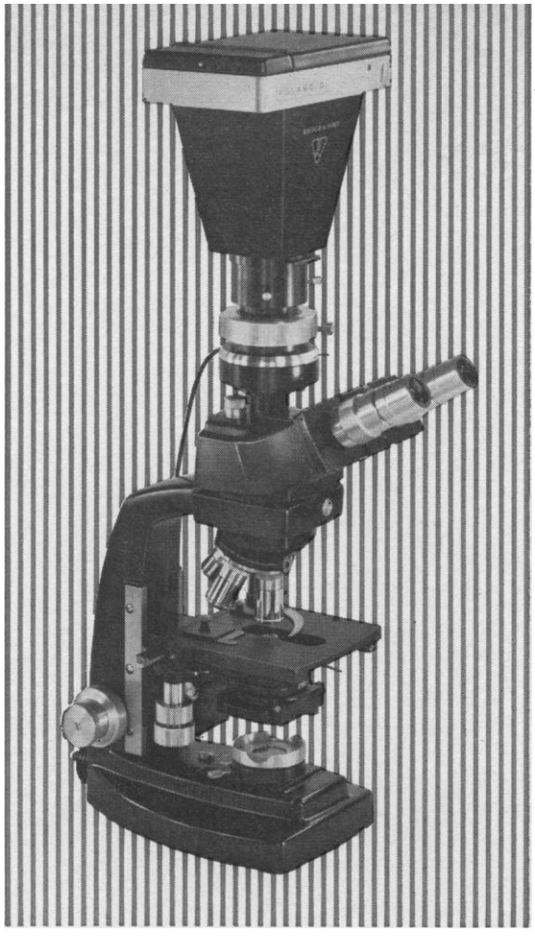
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Wood of bristlecone pine (*Pinus aristata*) withstands erosion by the elements for millennia after death. Tree-ring records of such remanents, added to the chronology derived from living trees almost 5000 years old, have made possible a continuous 7100-year tree-ring chronology. See page 839. [C. W. Ferguson, Laboratory of Tree-Ring Research, University of Arizona, Tucson]



21-jewel precision movement

Borrowing these famous words of the watchmaker, we introduce you to an inside view of the exclusive Dynazoom/Flat Field Optical System by Bausch & Lomb. Conceived by an award-winning team of microscope designers. Executed by master craftsmen in optical/mechanical precision. Nothing else in the world can match this advance in microvision. You glide through continuously variable magnifications to the one just right for what you want to see or photograph. You are always in visual contact with the specimen . . . and you see it flat from edge to edge. Such microscope performance cannot be matched for anywhere near the Dynazoom® price. But —let your own eyes decide. We can arrange for you to try a Dynazoom in your own laboratory. **Meanwhile we will send you the deluxe Laboratory Microscope brochure, 31-185, and an indexed reproduction of the 21-jewel rendering. You'll want to display it in your office or use it in your classroom. Just write Bausch & Lomb, 77402 Bausch Street, Rochester, New York 14602.**

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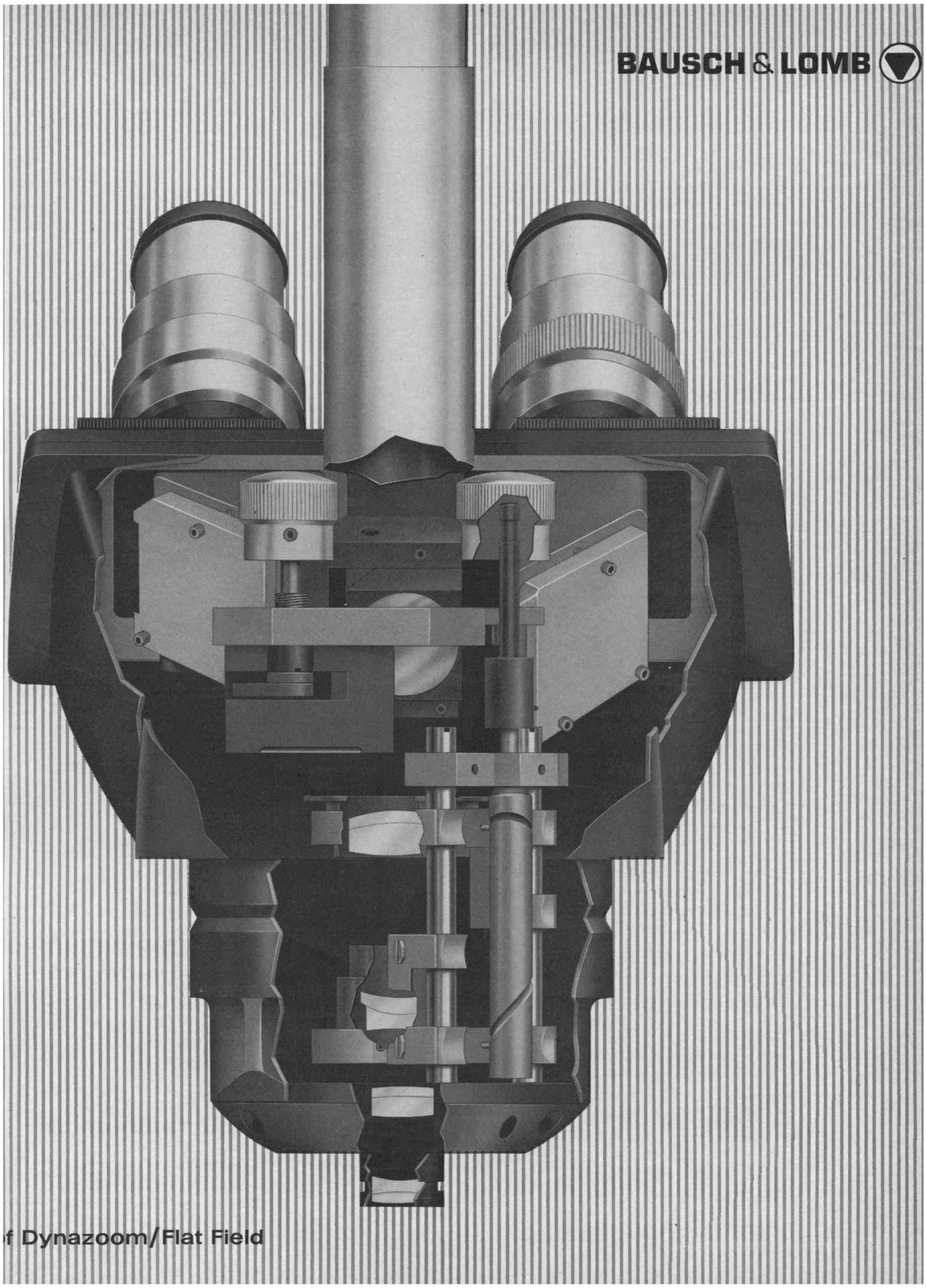
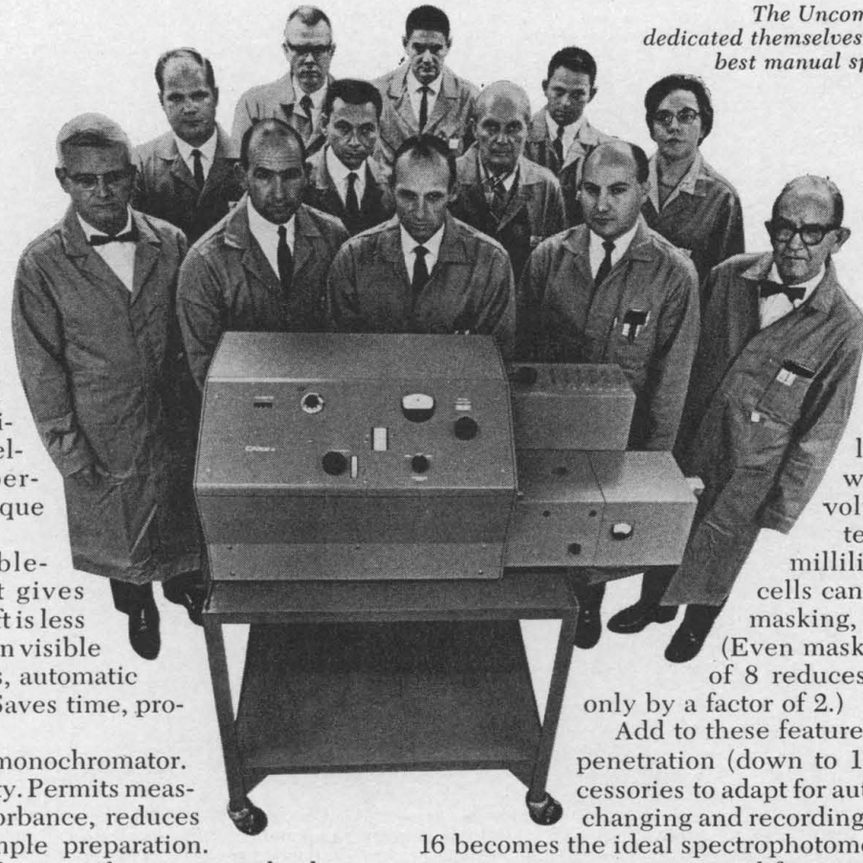


f Dynazoom/Flat Field

The excellence of our manual spectrophotometer is automatic



The Uncompromisers—They dedicated themselves to producing the best manual spectrophotometer. And did it.

And like our recording spectrophotometers, the CARY 16 manual instrument automatically achieves its excellence and reliable performance through unique design features.

First, take the double-beam photometer. It gives high zero stability (drift is less than 0.00016 abs/hour in visible range) and continuous, automatic blank compensation. Saves time, produces reliable data.

Next, the double monochromator. This insures light purity. Permits measurements at high absorbance, reduces errors, minimizes sample preparation. The CARY 16's the only manual instrument that has a double-beam, double monochromator system.

Then the photometric accuracy. It's the highest of any spectrophotometer made, manual or recording. 0.00024 absorbance near zero, 0.001 near 1 absorbance.

Finally, the exceptional beam geometry is particularly important where sample volumes are limited. Normally, 1 milliliter semi-micro cells can be used. With masking, micro cells. (Even masking by a factor of 8 reduces the S/N ratio only by a factor of 2.)

Add to these features the deep UV penetration (down to 1700Å) plus accessories to adapt for automatic sample changing and recording, and the CARY 16 becomes the ideal spectrophotometer for kinetic measurements or exacting life science studies, as well as for general analytical work.

A price list and catalog are yours for the asking. Write Cary Instruments, a Varian Subsidiary, 2724 South Peck Road. Monrovia, California 91016. Ask for Data File E706-28.

CARY® 16

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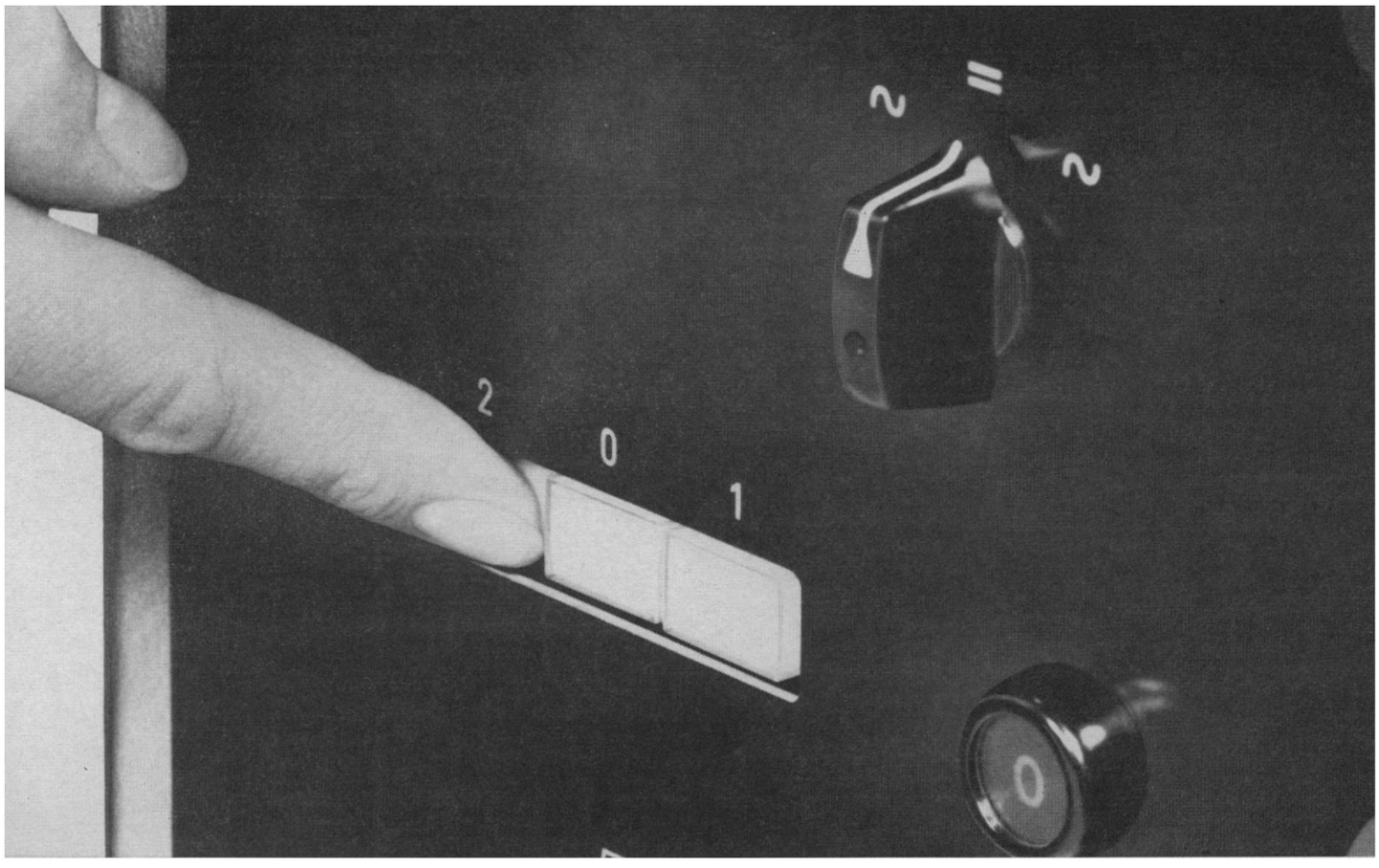

We took your tip to speed up electron microscopy.

The most important tip on the Zeiss Electron Microscope EM 9A is your fingertip. With it, you can activate time-saving automation never before possible.

Your fingertip gives you complete control of the error-free, automatic vacuum system which saves time during start-up and shutdown.

A flip of your fingertip is all it takes to activate a completely automated photomicrographic system that sets correct exposure, takes the picture, numbers micrographs sequentially and neatly stacks up to 75 negatives without reloading.

You save still more time in several other ways. Alignment is exceptionally fast and stable with the EM 9A's new adjustable single condenser that gives 15 to 20 times more brightness than was possible before.

Specimen airlock is not only fast, but foolproof, too. Specimen exchange can be made within 10 seconds.

Which all adds up to more time to concentrate on microscopy . . . rather than on the microscope.

The EM 9A's resolving power: 10-12Å. Operating range: 900x-40,000x. Astigmatism compensation: new, easy-operating electrostatic stigmator. Focusing: easy, because the unique fine-focusing device with digital read-out combines advantages of both step and continuous focusing. Binocular: 10x with exceptionally high light transmittance; special high-eyepoint eyepieces for people who wear glasses.

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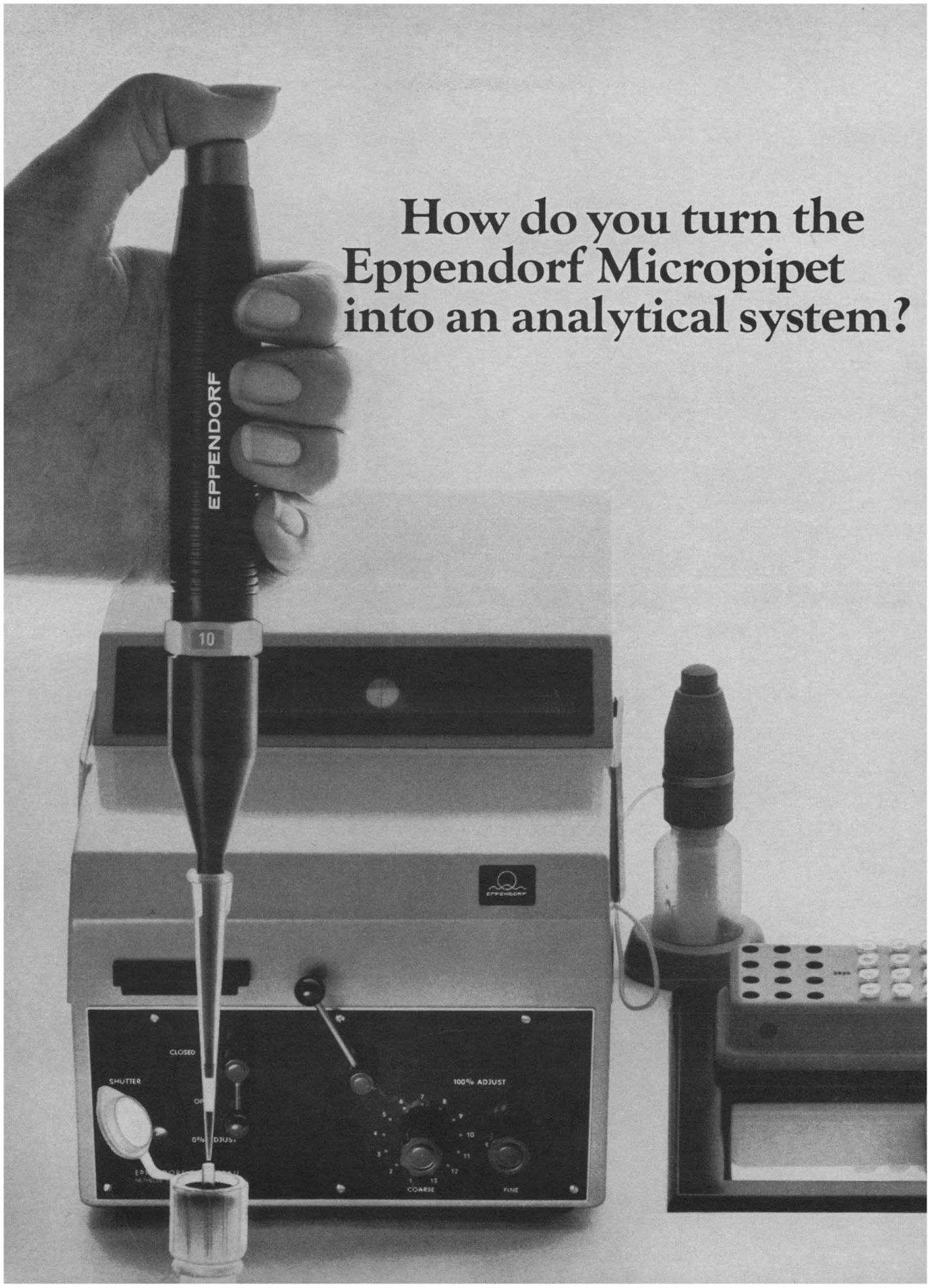
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Perhaps you're already familiar with the amazing new Eppendorf Micropipet. Perhaps you've already discovered for yourself the revolutionary ease and speed it brings to pipetting, thanks to its disposable plastic tips, automatic push-button sample blowout, and its unbelievable accuracy and precision.

Now an entire micro-analytical system based on this pipet is available. It encompasses over 30 different manual photometric methods for clinical and biochemical analysis for use where fully automated methods are impossible or impractical.

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Care to know more about our system? Just write: Eppendorf Division, Brinkmann Instruments, Cantiague Road, Westbury, New York 11590.

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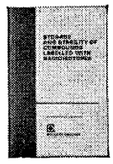
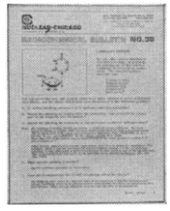
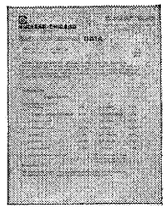




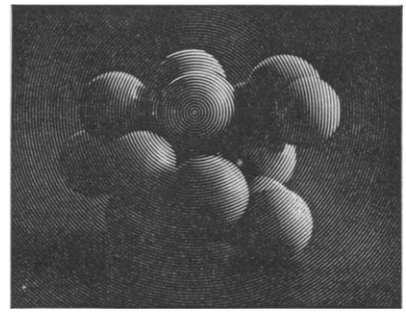


Since we're always looking for new ways to inform, enlighten, *help* you, there's always something hot off the press. Such as our new **Radiochemical Users Guide.** It's written to clarify such subjects as the storage of a radiochemical, the opening of its ampoule, as well as transferring it to another container.

And if there's anything else you'd like to have in the way of printed materials—bibliographies, abstracts, or you-name-it—we can help. Just call or write us.

That's a good idea anyway. Because when you call or write us, we'll put you on our mailing list. You'll start receiving all the publications we've talked about.

RADIOCHEMICAL REVIEWS



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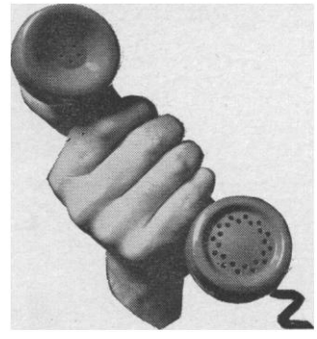
THE CALL THAT COUNTS

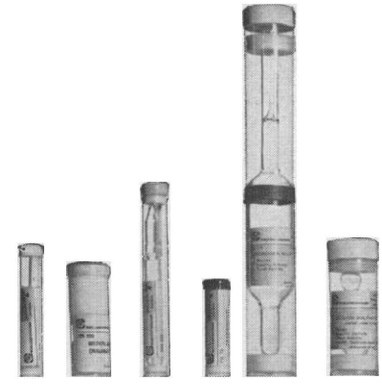


Up there beneath our name is a phone number. We printed it big so you'd take special notice of it. It's a pretty special phone number.

For one thing, dialing (312) 296-1055 puts you on a *direct* line with one of our radiochemical specialists. And a direct line is the shortest cut to the best answers to your questions. Whatever they may be. Our man is there to give you facts, figures, assistance. In short, to consult. And, of course, to take your order for radiochemicals. Your order will be processed by this same man. Putting things in his hands is the surest way we know to guarantee prompt delivery of any compound you order from us.

So remember: when you call on our direct radiochemical telephone line, you talk to a man who specializes in radiochemical theory and application. And in being easy to talk to.

HIGH SPECIFIC ACTIVITY C14 COMPOUNDS



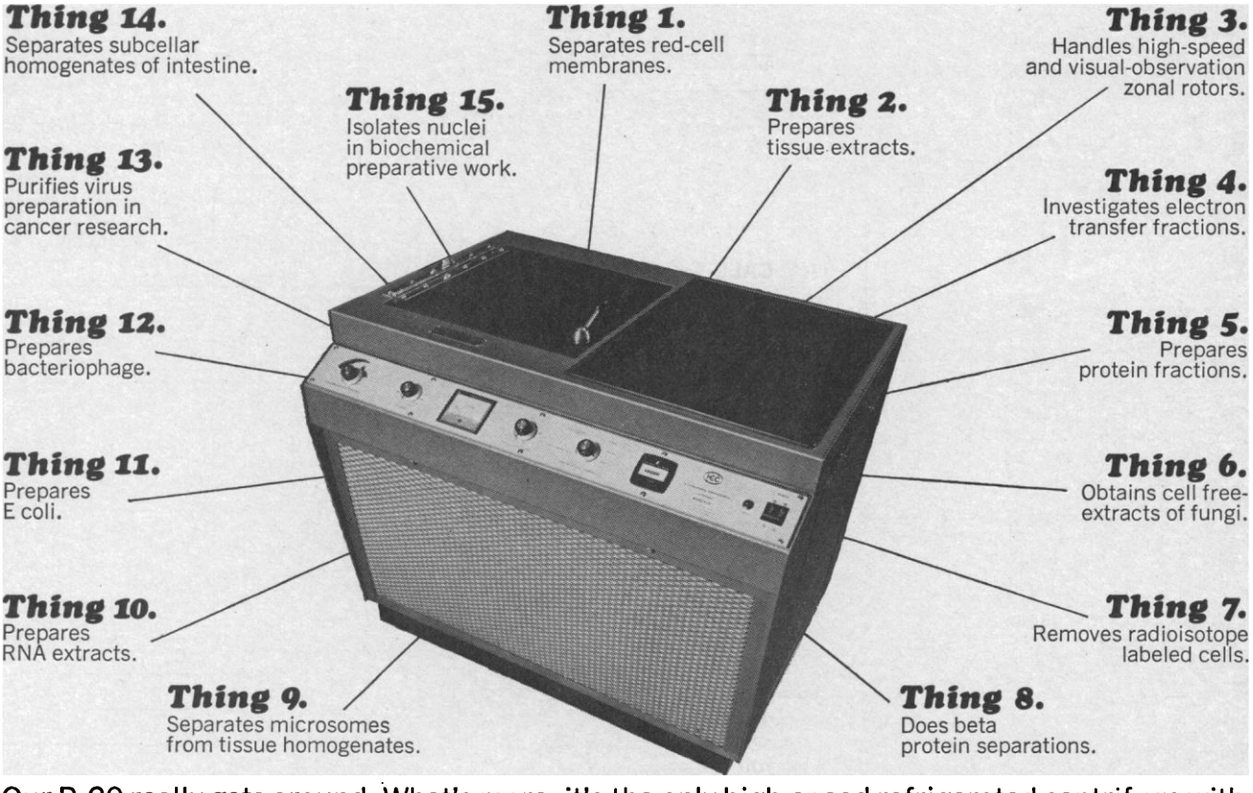
We are now supplying carbon-14-labelled compounds at over 90% isotopic abundance—at no extra cost. The theoretical maximum specific activity for C14 is 62 mc/mA. Many of our compounds now approach this value.

Our currently available high specific activity amino acids are listed below. We have determined by direct measurement (not calculation) that the activities shown are higher than those offered by any other manufacturer. A further important exclusive: all these amino acids are crystallized at the final stage of purification.

For prices on these compounds and ordering data, request our **Radiochemical Bulletin No. 33.** It also contains similar information on other high specific activity compounds of biological interest—steroids, sugars, nucleics.

AMINO ACIDS	Current Specific Activity mc/mM
L-Alanine-C14(U)	162
L-Arginine-C14(U) monohydrochloride	324
L-Aspartic-C14(U) acid	217
L-Crystine-C14(U) hydrochloride	324
L-Glutamic-C14(U) acid	276
Glycine	108
L-Histidine-(2-*ring*-C14)	57.8
L-Leucine-C14(U)	305
L-*iso*Leucine-C14(U)	290
L-Lysine-C14(U) monohydrochloride	324
L-Methionine-(*methyl*-C14)	56.8
L-Phenylalanine-C14(U)	495
L-Proline-C14(U)	270
L-Serine-C14(U)	160
L-Threonine-C14(U)	208
DL-Tryptophan-(*methylene*-C14)	52
L-Tryptophan-(*methylene*-C14)	52
L-Tyrosine-C14(U)	475
L-Valine-C14(U)	270

Among other things, it handles zonal rotors.



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Price: $4.00. *AAAS Member's Cash Price:* $3.50.

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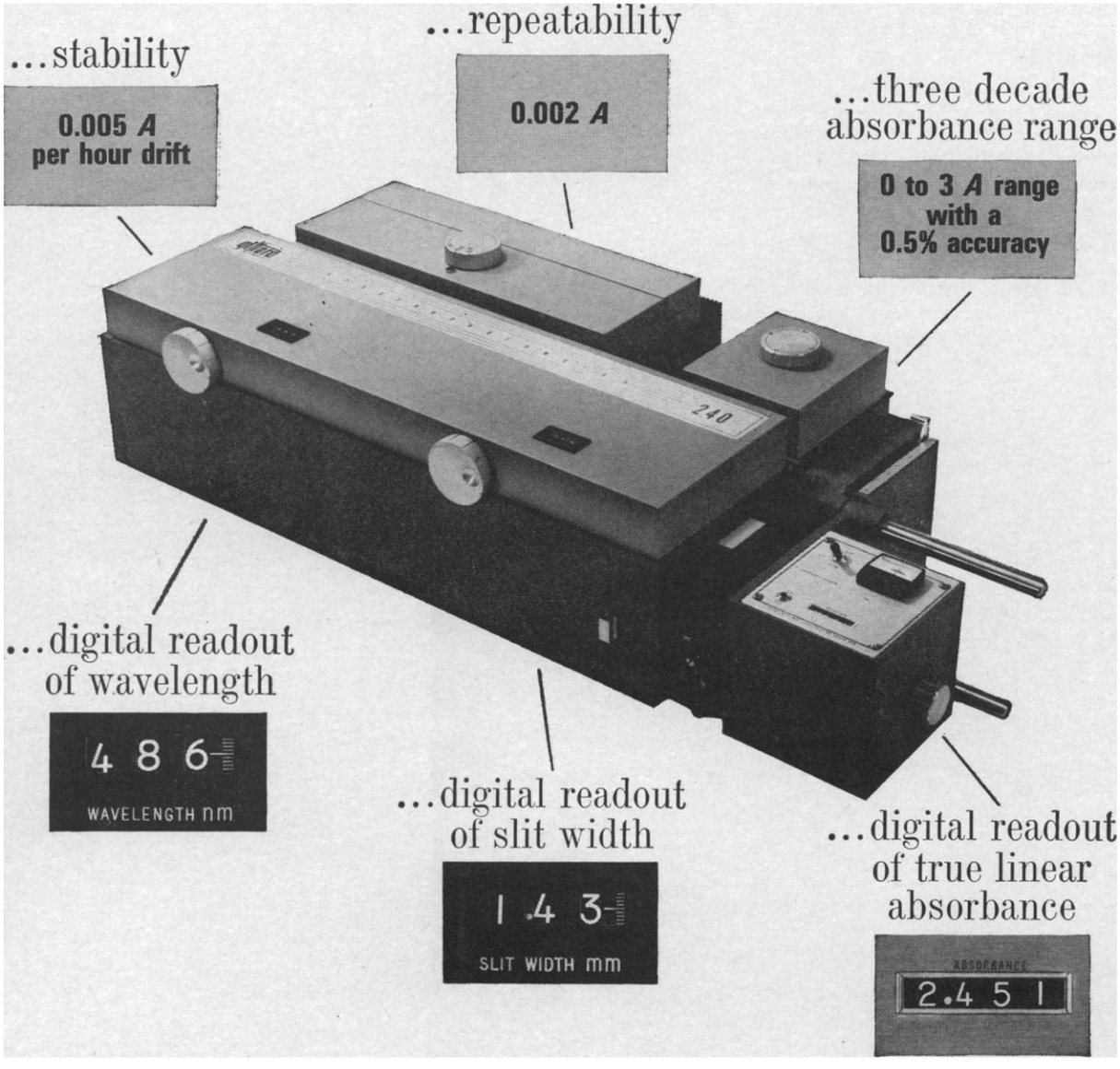

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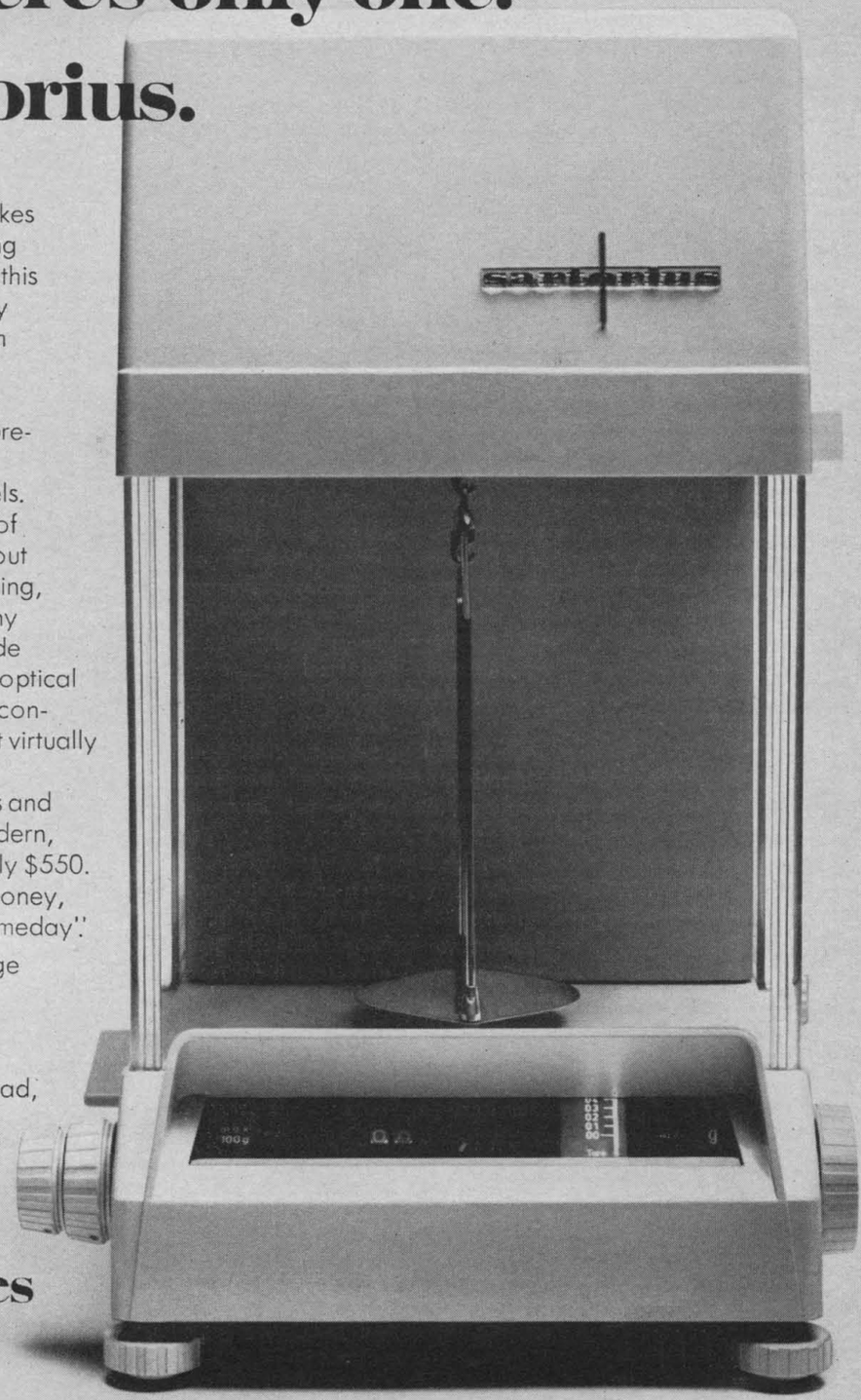

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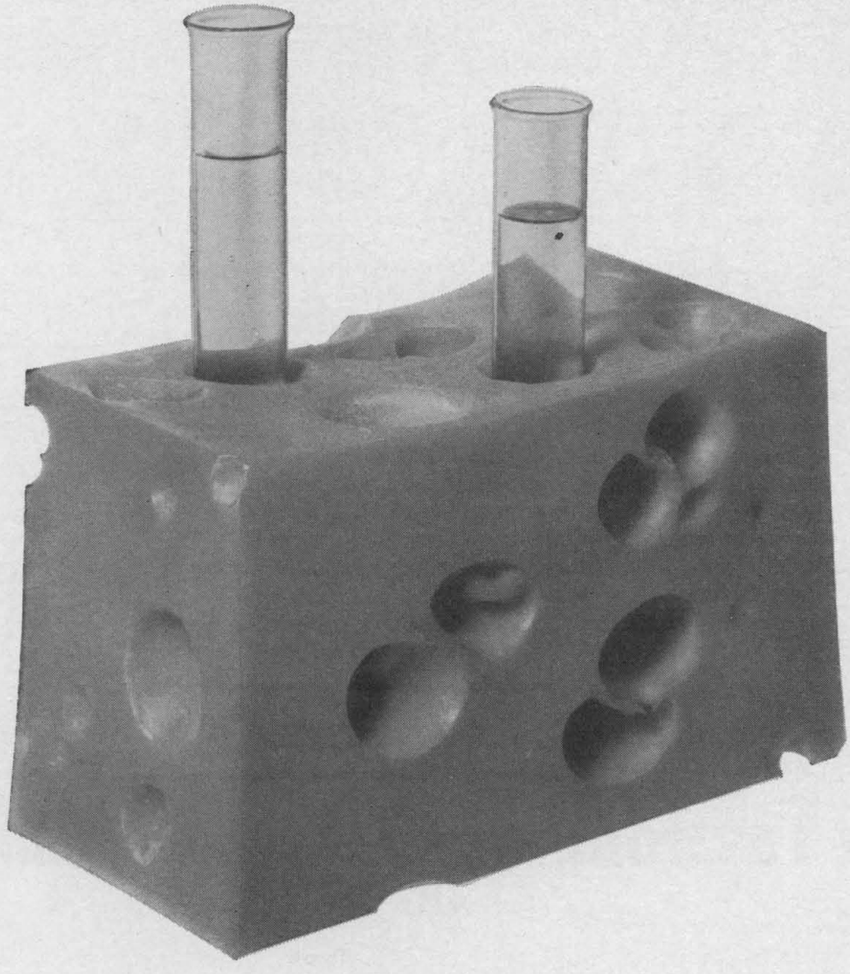

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This uniquely designed four-sided test-tube rack holds all standard size test tubes from 6 to 25 mm. All you do is turn it to the side that accommodates the test tubes you're using.

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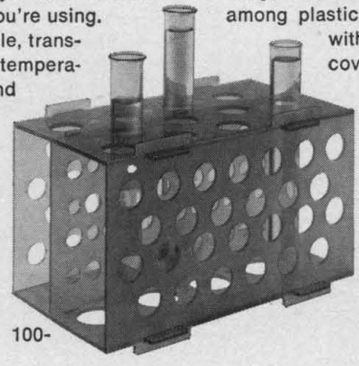

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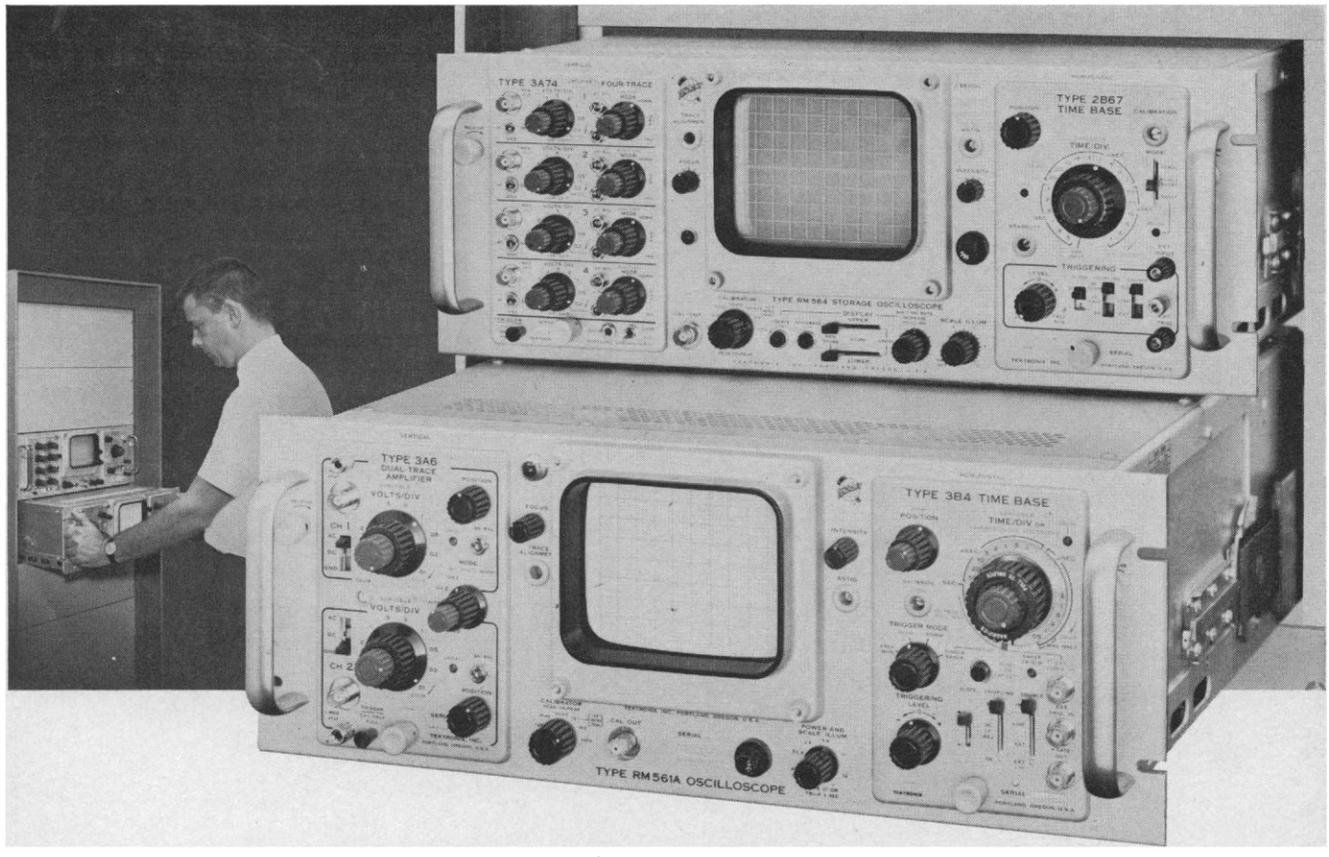
The Econo-Multi-Rack
The test-tube rack you can use four ways

LW-2



plug in a Tektronix rack-mount oscilloscope

- Conventional or storage
- Multi-trace, differential, sampling and spectrum analyzer plug-ins
- 7 inches of rack height

The Type RM561A 7-inch high rack-mount oscilloscope provides conventional oscilloscope performance with measurement capabilities extending from DC through 1 GHz with appropriate plug-in units. It has an 8 by 10-cm CRT with a bright P31 phosphor and an illuminated, internal graticule.

The measurement system illustrated consists of the Type RM561A with the Type 3B4 Time-Base Plug-in and the Type 3A6 Dual-Trace Amplifier. The Type 3B4 provides versatile triggering and calibrated sweep speeds from 5 s/div to 50 ns/div. A direct-reading magnifier provides up to X50 magnification about the center of the CRT. The Type 3A6 Dual-Trace Amplifier has DC-to-10 MHz bandwidth and 35-ns risetime over its 10 mV/div to 10 V/div deflection range.

Type RM561A Oscilloscope	$ 580
Type RM561A MOD 171A (Includes slide-out tracks)	$ 630
Type 3B4 Time Base	$ 425
Type 3A6 Dual Trace Amplifier	$ 525

The Type RM564 split-screen storage oscilloscope is virtually two instruments in one. It offers all the advantages of a storage oscilloscope plus those of a conventional plug-in oscilloscope. The contrast ratio and brightness of stored displays are constant and independent of viewing time, writing and sweep speeds, and signal repetition rates.

The entire screen or either half can be used for storage and/or conventional displays. In the stored mode, either half of the screen can be erased independently of the other half. A rear panel connector permits remote erasure of either or both halves of the display.

The plug-ins shown in the Type RM564 are the Type 2B67 Time-Base Unit that has calibrated sweep speeds from 5 s/div to 1 μs/div extending to 200 ns/div with the X5 magnifier, and the Type 3A74 Four-Channel Amplifier that provides DC-to-2 MHz bandwidth over its 20 mV/div to 10 V/div calibrated deflection range.

Type RM564 Storage Oscilloscope	$1025
Type RM564 MOD 171A (Includes slide-out tracks)	$1075
Type 2B67 Time-Base	$ 225
Type 3A74 Four-Channel Amplifier	$ 625

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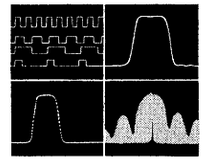
For a demonstration, contact your nearby Tektronix Field Engineer or write: Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005.

TEKTRONIX

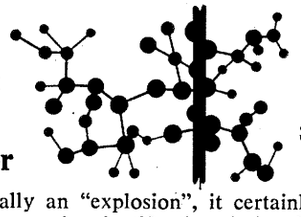
Conventional or storage oscilloscopes



...with multi-trace, differential, sampling and spectrum analyzer plug-ins

A close look into analytical efficiency... from polymers to pesticides

In Pursuit of the Polymer



So widespread is the pursuit of the polymer molecule by so many scientists in so many laboratories that Sunday Supplement writers will soon be calling it the polymer explosion. Even if it isn't really an "explosion", it certainly is an expensive pursuit because so much scientific time is involved . . . hence a growing demand for instruments to replace the tedious and time-consuming classical methods heretofore used by the polymer chemist.

For some, it may seem curious that these demands come from analytical and micro-chemical sources as well as from the polymer chemist . . . but polymer chemistry is a complex field that involves all these chemical disciplines. It will be more curious to others that Hewlett-Packard, a company generally known for its achievements in electronics, is also deeply involved with things chemical, including polymer research.

Molecular weight determination, a chief factor in polymer characterization, provides examples. Hewlett-Packard offers no fewer than four types of molecular weight instruments now considered by many as standard laboratory apparatus because of their proven efficiency: the Model 302 Vapor Pressure Osmometer for determining number average molecular weight in the range of 100 to 20,000; the Series 500 Membrane Osmometer for the same type of measurement up to 1 million; the Model 701 Light Scattering Photometer for determining weight average molecular weight from 500 to 5,000,000; and the Model 5901B Auto-Viscometer for determining viscosity average molecular weight.

When reminded that polymer characterization is a case of establishing molecular weight by *all* rather than just *one* of these methods, and that molecular weight determination via classical routes is expensive, complex, and time-consuming, the efficiency of one or all of these Hewlett-Packard instruments is considerably more beneficial than might otherwise be apparent. For a full description of these instruments, write for Data Sheets 3020, 5000, and 7010.

Granted that molecular weight counts heavily in polymer chemistry, there are several polymers (and many more co-polymers) whose characterization would be incomplete without CHN analysis (determination of carbon, hydrogen, nitrogen proportions). Unfortunately classical CHN analysis tends to defy efficiency, requiring lengthy procedure, costly equipment, and an environment-controlled balance room, all resulting in a somewhat classic laboratory fee.

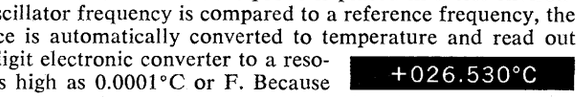
To the extent that H-P's Model 185 CHN Analyzer streamlines traditional CHN analysis it is a boon to all concerned. For the bench chemist, no more than this need be said of the 185's capability: one sample, one weighing, ten minutes per determination, with reliability well within the traditional 0.3% allowable error. For the managing chemist, a more direct comparison might be in order: CHN analysis is valued on the order of $15.00 per hour, with the classical approach requiring about one hour per determination. The 185 makes determinations at the rate of six per hour. Or a value of $90.00. Or an improvement over the classical of $75.00 per hour. The calculation of how long it would take the Model 185 to pay for itself will be left to others. The instrument costs $6,000.00. It's fully described in Bulletin 1850.

Frequency in Degrees C.

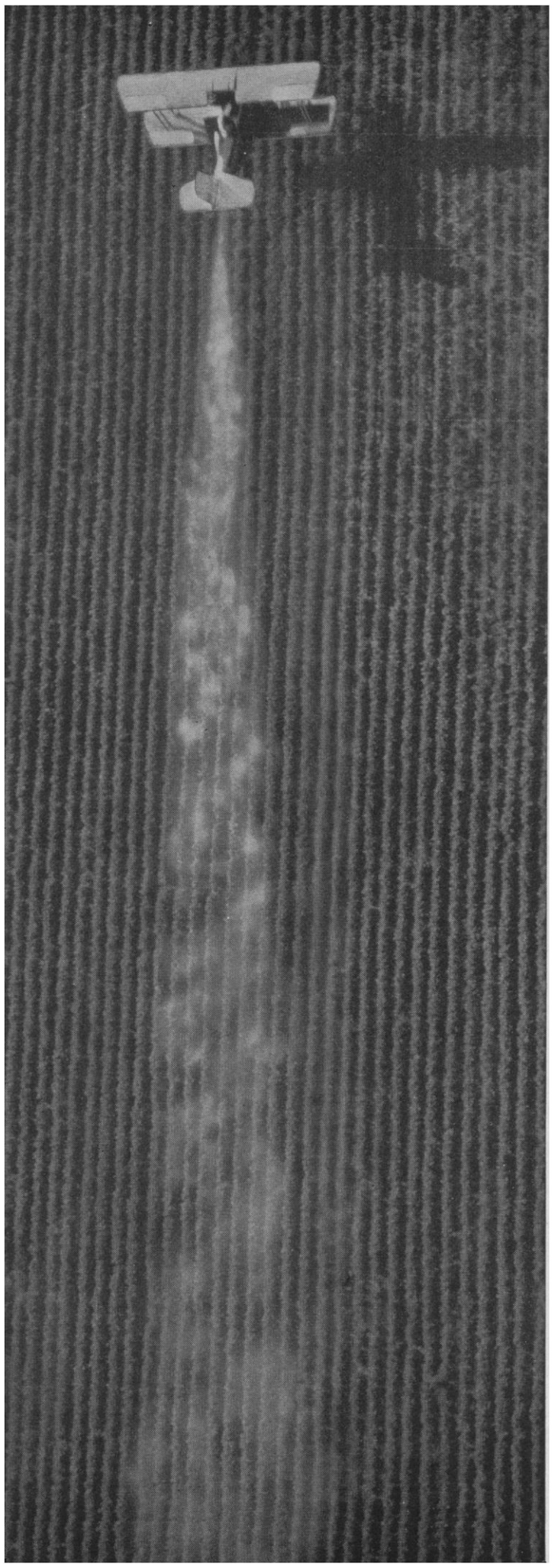
If the CHN Analyzer strays from the classical, H-P's Model DY-2801A Quartz Thermometer (hereinafter called the QT) departs radically. Platinum resistance thermometry has always been looked upon as the best (if not the most practical) means of making sensitive laboratory temperature measurements. This view will likely soon change in the direction of quartz thermometry, which in the QT has been developed to such a fine state that there's a breakthrough in the offing—both a technological and a practical one.

The new technology lies in the precise angle of cut of a quartz crystal wafer, which gives the QT a linearity of ±0.05% vs ±0.55% (−40 to +250°C) for platinum resistance devices. The new practicality can be traced to H-P's electronics design capability, which has given the QT direct digital readout in degrees—no bridge balancing, no conversion tables. Together they make for a very gifted instrument: the QT is ten times more linear and conservatively that many times more convenient to use than anything else available.

The QT operates on the basis of the variation of the resonant frequency of its quartz crystal due to temperature change. The crystal wafer is mounted in a small probe and connected by cable to its oscillator circuit. When the probe is placed in a test environment, oscillator frequency is compared to a reference frequency, the difference is automatically converted to temperature and read out on a 6-digit electronic converter to a resolution as high as 0.0001°C or F. Because the QT can be equipped with one or two probes, it can measure the temperature of either probe or the difference between the two. It can also double as a highly accurate 300 kHz electronic counter.



In application, the Quartz Thermometer can be depended upon to improve determinations in just about every popular area of temperature analysis. This is apparent in the field of differential thermal analysis—qualitative characterization and quantitative identification of a material by measuring the temperature difference between its sample and an inert reference—where the superiority of the QT can again be laid to its superior linearity. Discussions on how to use the QT in calorimetry and molecular weight determinations can be found in Application Notes 78-2, 78-3.

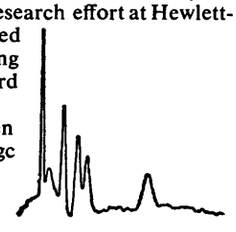


Garden Variety Pesticides

"For the first time in the history of the world, every human being is now subjected to contact with dangerous chemicals, from the moment of conception until death. In the less than two decades of their use, synthetic pesticides have been so thoroughly distributed throughout the animate and inanimate world that they occur virtually everywhere." RACHEL CARSON—*Silent Spring*

The determination of precisely how much contact human beings do have with synthetic pesticides is currently a very active scientific pursuit, and a bit more difficult than Miss Carson's statement might reveal. In fact, never before in the field of chemical analysis has it been necessary to detect such minute amounts of such unstable compounds, whose presence is so greatly clouded by the natural samples in which they exist.

While the men engaged in pesticide detection are many and far flung, instrumentation for this sensitive work falls almost solely on the gas chromatograph. On this basis much research effort at Hewlett-Packard's F & M Scientific Division is directed at pesticide analysis with the aim of perfecting both instrumentation and technique. In regard to the former, it is interesting to note that although pesticide detection is still most often recorded in the nanogram range, an F & M gc —more than two years ago—separated a laboratory pesticide sample at the picogram level ($1x10^{-12}$, or .000,000,000,001 gram).



Most of this chemical detective work is being performed on the F & M Model 402 High-Efficiency Gas Chromatograph—an instrument perfected especially for this and other biochemical research. H-P's pesticide analysts prefer to use this instrument equipped with an electron capture type of detector. The latter employs a radioactive tritium source to produce electrons whose capture by the pesticide molecules is a direct measure of their presence. Recently, H-P chemist-designers have perfected a new electron capture detector that employs a radioactive Ni^{63} source that is more stable at higher temperatures, thereby holding out a promise of more searching pesticide detection than the older tritium type can accomplish.

Sometimes the inherent difficulty of pesticide analysis is resolved by improvements in technique rather than hardware. A case in point is an H-P developed procedure that aids in the identification of elusive eluted pesticide peaks by running the same sample through two dissimilar gc columns. When the suspected pesticide has the correct retention time in both columns, identification becomes more positive; conversely its presence is ruled out if it doesn't have the correct retention time in either column.

This work was first recorded in H-P laboratories using samples of a domestic and an imported marmalade. The first column indicated that the domestic sample was free of pesticides but that the imported one showed the presence of Endrin. Those partial to imported jams should feel free to eat them anyway since the presence of Endrin was ruled out on the second column.

H-P chemists have developed similar techniques for the analysis of pesticide residues in many foodstuffs, and sample extraction techniques for the analysis of bovine and human milk.

If you care to pursue this subject in depth, ask for Applications Lab Report 1003. Write Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94304.

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ANALYTICAL INSTRUMENTS

Ligand Exchange Chromatography: a better way of amino acid analysis from Perkin-Elmer.

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The KLA-3B will automatically perform two complete accelerated analyses of either a protein hydrolyzate or physiological fluid sample, including column regeneration, without operator attention. Two hydrolyzate samples will be analyzed by this technique in four hours, and two physiological fluid samples in 15 hours.

For detailed technical information on the Hitachi Perkin-Elmer KLA-3B featuring Ligand Exchange Chromatography, write to: Instrument Division, Perkin-Elmer Corporation, 723 Main Avenue, Norwalk, Conn. 06852.

*Patent applied for.

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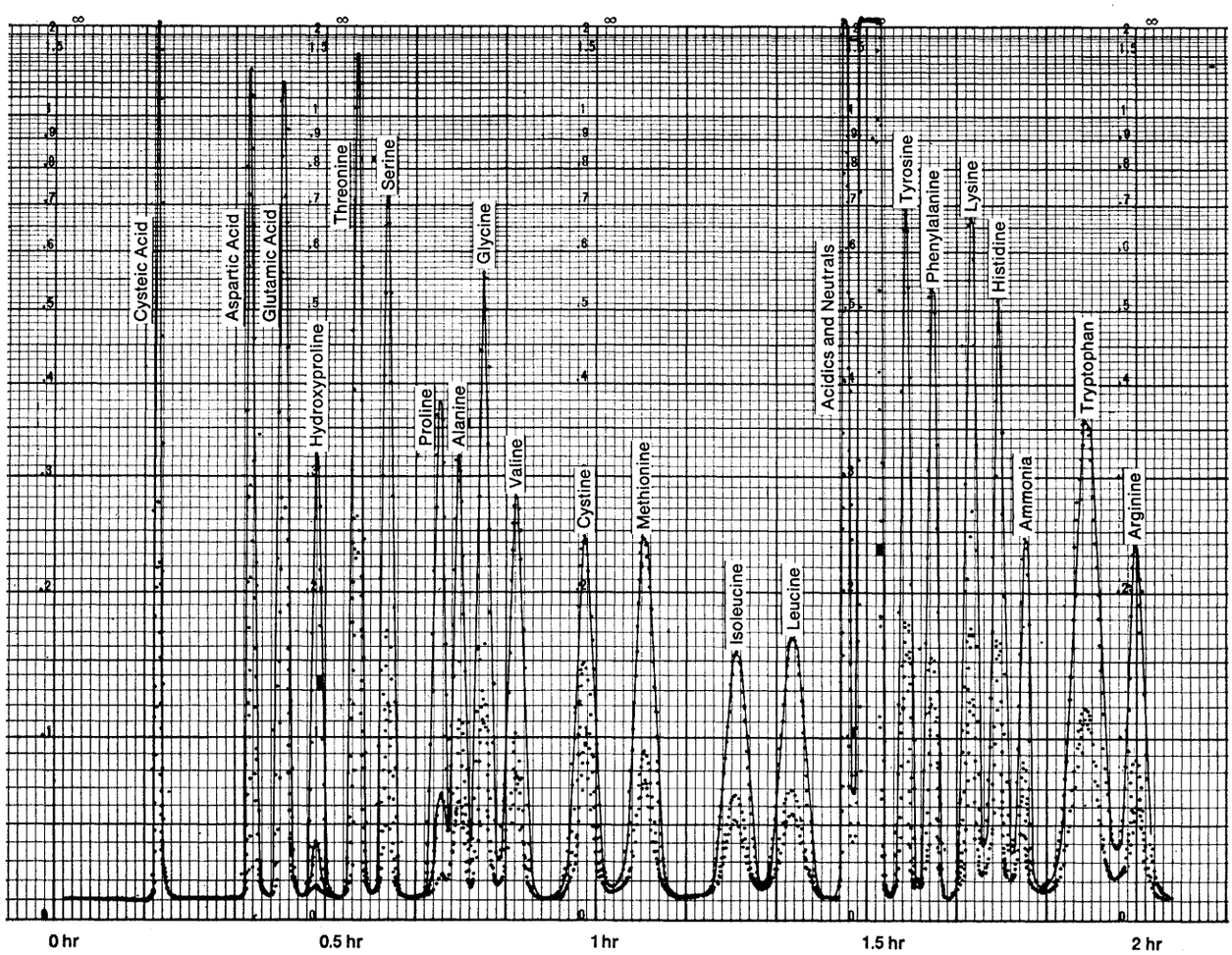


population growth. At most it provides individuals with easier means of determining their family size. The committee skirts this challenge by inferring that the goal, too, must be acceptable. It thus conceives of population policy as simply a service function, providing means that people approve to give them what they want. This idyllic notion bears no relation to the problem of population growth about which the committee is presumably exercised. That problem implies a conflict between behavior and its consequences, and it is that conflict that population policy must resolve.

For clear thinking about population policy, the question of effectiveness must be separated from that of acceptability. Analysis of the effectiveness of policies (actual and potential) is the scientific part of the task. Its contribution, independent of acceptability, is precisely that it allows minds to break out of the tyranny of what is and think effectively of what can be. Even if it were true (as is not the case) that no people wants zero population growth, it would still be important, for population policy, that the goal be discussed and debated, and that the measures necessary to reach it be fully analyzed.

Given the difficulty of determining acceptance in advance, and the tendency to assume that absence is proof of disapproval, a preoccupation with acceptability encourages proposals that are *behind* public opinion. (No one predicted the popularity of sterilization in Puerto Rico or mass abortion in Japan.) It causes the range and power of potential policies to be underestimated, because they are dismissed rather than analyzed. It thus precludes the possibilty of moving an effective measure from the unacceptable to the acceptable column. Reforms do not suddenly jump from being tabooed to being welcomed. They have to be advocated, exposed to view, debated, tried out, improved. Early advocates of contraception did not wait until contraception was "within the framework of existing values"; they had more courage than that, and more sense. "Existing values" are not the means for solving the problem; they are the problem itself. Since they give the motivation for sizable families, policies that "operate within" them will necessarily prove ineffective.

The conservative tenor of the committee's letter, like that of its two pamphlets, suggests again that the emphasis on family planning in current population policies provides an escape

from consideration of the painful social and economic changes necessary to achieve fertility control. The common but mystical notion that family planning "provides its own dynamic" does nothing to lessen this impression.

KINGSLEY DAVIS
Department of Demography,
University of California, Berkeley 94720

How Many Smokes per Flight?

I concur with Abelson's editorial (22 Dec., p. 1527), in which he expressed concern over the effects of smoking on air pollution and the infringement of the rights of nonsmokers. As a frequent airline passenger, I have experienced the initial stages of acute asphyxia resulting from too many people smoking in a poorly ventilated aircraft. I wonder whether the automatic devices to provide oxygen used in airplanes are sensitive to these environmental conditions as well as problems of altitude.

It may be necessary to provide special smoking sections, or smoking flights similar to the railroads' use of smoking cars. Certainly if individuals are unable to regulate their own activities, it may one day be necessary for the industry or government to regulate the number of smokes per flight.

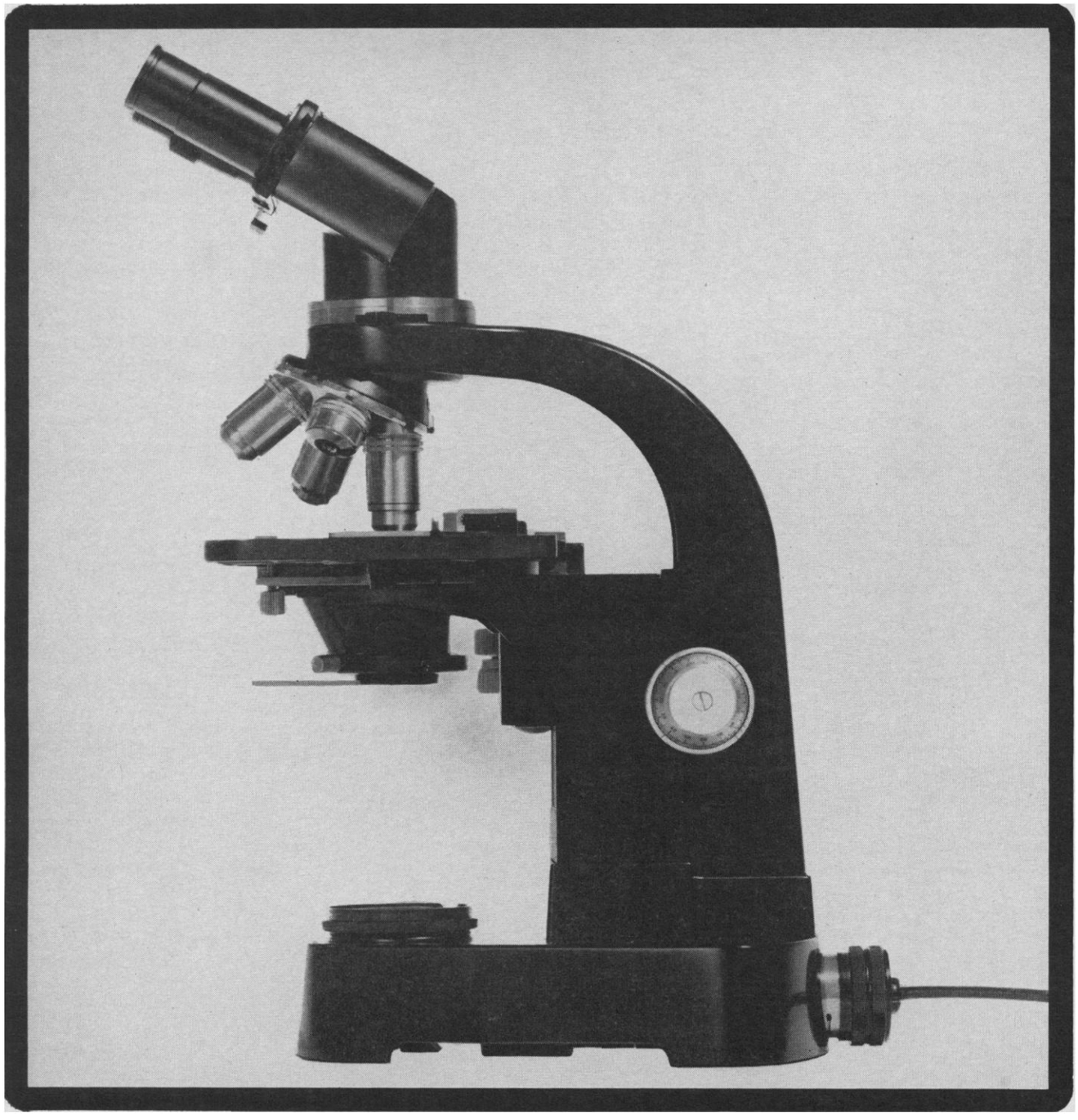
JACK WERBOFF
Jackson Laboratory,
Bar Harbor, Maine 04609

. . . The situation that most irks me, I think, is the airplane at meal time. Pressurized aircraft cabin ventilating systems are good. No matter how good they are, however, I have yet to experience one that can stay ahead of the smokers. When I am finishing a good airline meal and enjoying it, I frequently have to hold my breath for the last several bites because some nervous smoker close by has lighted a cigarette before finishing his or her meal, and spews smoke out into the restricted confines of the cabin. Ugh! . . .

HENRY F. DOBYNS
Department of Anthropology,
University of Kentucky, Lexington

. . . Would someone explain to me the validity of *my* government using *my* tax money to support tobacco farmers whose product is detrimental to *my* health?

MARVIN R. TURNIPSEED
Zoology Department, University of Georgia, Athens 30601



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23 February 1968, Volume 159, Number 3817

SCIENCE

The Use of Human Subjects

The conflict between the individual's right of privacy and the requirements of research involving human subjects was the theme of an address* at the recent AAAS meeting by Oscar M. Ruebhausen, a member of the New York Bar who has devoted special attention to the relations between science and law. He advised scientists to get busy and establish standards to govern the use of human subjects, and promised that if their standards are adequate they "will rank high in relevance for a court of law." But he also warned that if they "are not thought to measure up to the values of the community . . . it is probable that the judges will, themselves, seek to devise the necessary standards to give effect to the community's values."

A range of rights must be considered. The individual's right to control the use of his own property and to preserve his own physical integrity have long been recognized. More recently, the courts have been coming to recognize a right of privacy of personality. There is also a range of research activities—in medicine, biology, psychology, sociology, and perhaps also anthropology—that may be thought to invade privacy unless there be proper consent, for the right of privacy is really the right of an individual to decide how he will share his privacy or what intrusions or exposures he will permit.

The several disciplines differ somewhat in their research requirements, but it would be dangerous for them to work alone in establishing standards. The reason is partly that no firm boundary separates man's biological and psychological natures and partly that standards adopted by one discipline are likely to be applied by the law to other disciplines.

Medicine has accumulated much wisdom in the use of private and confidential data concerning patients. If scientists are to develop satisfactory standards, they will take account of medical experience. If scientists fail to develop satisfactory standards, the judges will probably take too much account of it. If the judges find the scientists' standards unsatisfactory, they are likely to turn to medicine for their model, and that model is incomplete.

A recent study† of the attitudes of physicians toward their patients reconfirms the fact that the physician considers his overriding responsibility to be the individual patients with whom he is working at the time. This is exactly what we wish of physicians. But when we are concerned with public health or the advancement of knowledge we want to be assured that experimental methods and controls are adequate.

The relation of doctor to patient need not be challenged by biomedical or behavioral research, but the distinction between this relationship and the relationship of researcher to subject must not be confused. It will be difficult to maintain this distinction clearly, to satisfy research needs, and to assure society that the rights of privacy are fully protected. But if by default, because the job is difficult, the judges are left to decide matters on the basis of their traditions and the experience of medical practice, progress in science and its applications to human welfare will be retarded.—DAEL WOLFLE

* Oscar M. Ruebhausen, "Experiments with human subjects," *The Record* of the Association of the Bar of the City of New York, vol. 23, No. 2 (Feb. 1968). † Amasa B. Ford *et al.*, *The Doctor's Perspective* (Case Western Reserve University Press, Cleveland, Ohio, 1967).

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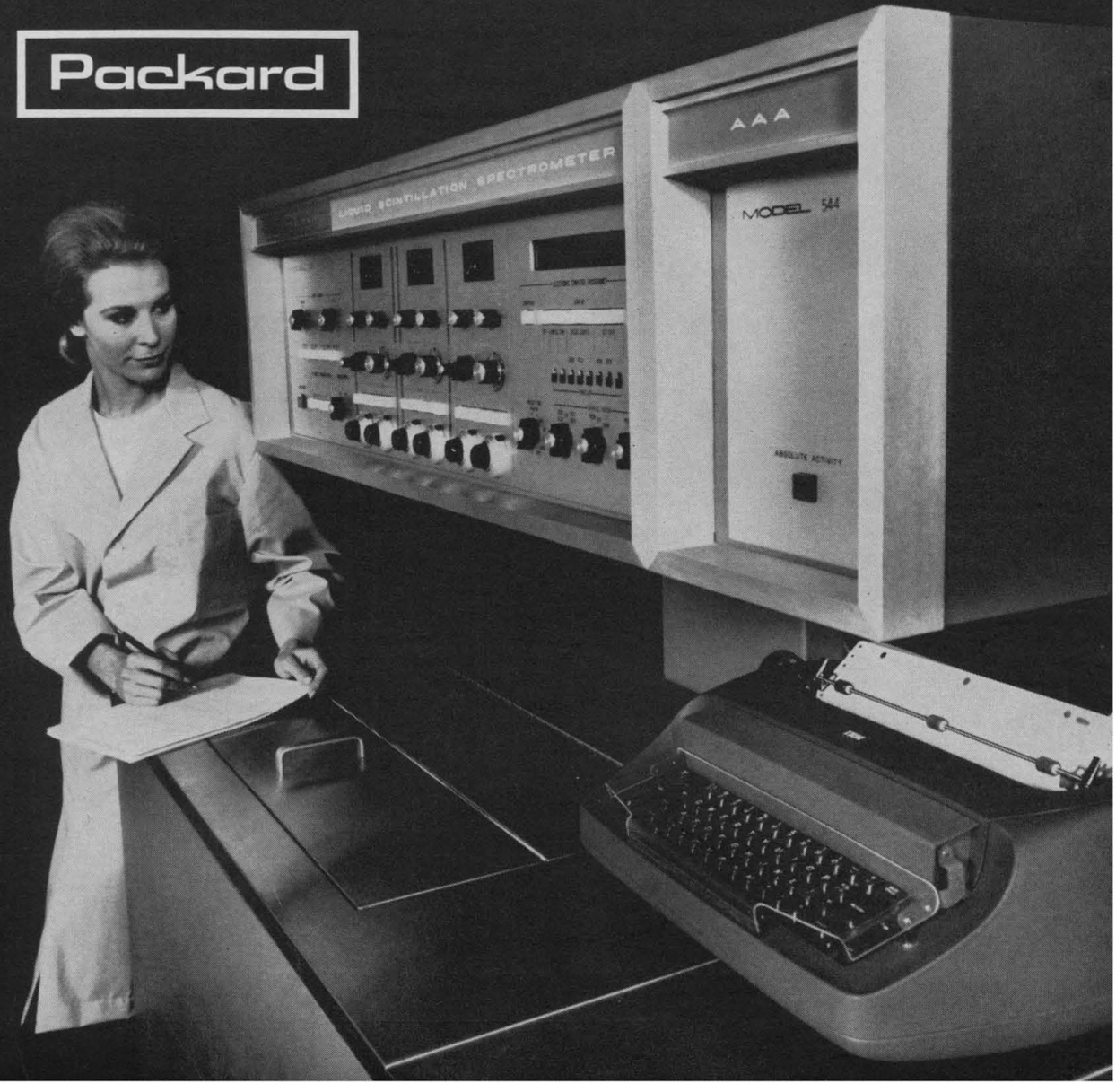

emitted beta particles is predominant. This localized effect is of value as a source of internal radiation in studies of mutagenesis, carcinogenesis, chromosome aberrations, and cell kinetics. As a source of radiation, C^{14} is unsuitable because of its long half-life and the low specific activities currently available. In tracer studies these very factors, however, give C^{14} some advantages over H^3. The transmutation of P^{32} leading to single- and double-strand breaks in DNA may be useful in studying the organization and repair of DNA and chromosomes. The influence of localized effects in proteins may be studied with S^{35} transmutation, and the role of protein inactivation in lethality and mutagenesis assessed. Finally, it was agreed that consideration should be given to possible biological applications of transmutation by neutron activation and the Auger effect.

With respect to protection recommendations, the members concluded that presently there is no justification to modify the recommendations on body burdens on the basis of the contributions of effects resulting from transmutation.

The panel proceedings, including papers, discussions, and workshop summaries, will be published by the International Atomic Energy Agency.

MURRAY SCHULMAN
Unit of Radiation Biology, Division of Life Sciences, International Atomic Energy Agency, Vienna I, Austria

JAMES E. CLEAVER
Laboratory of Radiobiology, University of California Medical Center, San Francisco

Calendar of Events

National Meetings

March

4–6. Society of **Toxicology**, Washington, D.C. (C. S. Weil, Mellon Inst., 4400 Fifth Ave., Pittsburgh, Pa. 15213)

4–6. **Technology for Manned Planetary Missions**, New Orleans, La. (Meetings Manager, 1290 Sixth Ave., New York)

4–7. **Neutron Cross Section and Technology** Conf., Washington, D.C. (D. T. Goldman, Natl. Bureau of Standards, Washington, D.C. 20234)

4–8. **Analytical Chemistry and Applied Spectroscopy**, Cleveland, Pa. (R. T. Oliver, Alcoa Research Labs., New Kensington, Pa.)

4–8. **Diagnosis and Treatment of Cardiovascular and Pulmonary Diseases**, Miami Beach, Fla. (H. L. Kruse, Executive

Assistant, American College of Chest Physicians, 112 East Chestnut St., Chicago, Ill.)

5–7. **Aviation-Electronics and Its Supporting Sciences**, Fort Monmouth, N.J. (Commanding General, U.S. Army Electronics Command, Attention AMSEL-RD-LN, Fort Monmouth 07703)

6–8. Fundamental **Cancer Research**, 22nd annual symp., Houston, Tex. (F. Goff, Special Projects, M. D. Anderson Hospital and Tumor Inst., Univ. of Texas, Houston 77025)

7–8. The **Doctor and His Hospital**, Inst. of Medicine of Chicago workshop, Chicago, Ill. (R. M. Potter, Secretary, Inst. of Medicine of Chicago, 332 S. Michigan Avenue, Chicago 60604)

7–8. Society of **Vacuum Coaters**, 11th annual, Miami Beach, Fla. (The Society, P.O. Box 3095, Cleveland, Ohio)

7–9. **Cerebellum in Health and Disease**, Dallas, Tex. (S. P. Cole, Coordinator, Univ. of Texas Southwestern Medical School at Dallas, 5323 Harry Hines Blvd., Dallas 75235)

7–9. Southern Soc. of **Anesthesiologists**, Dallas, Tex. (R. G. Zepernick, Mercy Hospital, New Orleans, La. 70119)

8–10. Colorado **Medical** Soc., Denver. (D. G. Derry, Colorado Medical Soc., 1809 E. 18 Ave., Denver 80218)

8–10. National **Wildlife** Federation, 32nd annual, Houston, Tex. (The Federation, 1412 16th St., NW, Washington, D.C. 20036)

9–10. American Psychiatric Assoc. Colloquium on Postgraduate **Teaching of Psychiatry**, New Orleans, La. (M. L. Enelow, 3439 Prytania St., New Orleans 70115)

10–12. American Soc. for **Abrasive Methods**, Philadelphia, Pa. (R. J. Mayer, ASAM, 330 S. Wells St., Chicago, Ill. 60606)

10–14. **Gas Turbine** Conf., Washington, D.C. (A. B. Conlin, Jr., Meetings Manager, 345 E. 47 St., New York 10017)

10–15. American Soc. of **Photogrammetry**/American Congr. on Surveying and Mapping, annual mtg., Washington, D.C. (W. B. Overstreet, 1819 Franwall Avenue, Silver Spring, Md. 20902)

11–12. **Phonocardiography**, American College of Cardiology, Chicago, Ill. (W. D. Nelligan, 9650 Rockville Pike, Washington, D.C. 20014)

11–13. American College of **Surgeons**, sectional mtg. for **Doctors** and **Nurses**, Williamsburg, Va. (Communications Department, 55 E. Erie St., Chicago, Ill. 60611)

11–13. New Tools for **Planning and Research Programming**, Commercial Chemical Development Assoc., Inc. annual mtg., New York, N.Y. (R. L. Chilenskas, Manager of Commercial Development, M & T Chemicals Inc., New York, N.Y.)

11–13. **Wildlife** Management Inst., 33rd natural resources conf., Houston, Tex. (Wildlife Management Inst., 709 Wire Building, Washington, D.C. 20005)

11–14. **Canaveral Council of Technical Societies**, 5th space congr., Cocoa Beach, Fla. (E. P. Wynne, General Electric Co., Apollo Support Dept., P.O. Box 7011, Cape Canaveral, Fla. 32920)

11–14. Western **Metal and Tool** Conf. and Exposition, Los Angeles, Calif. (J. A. Fellows, Director of Technical Programming, Metals Park, Ohio)

11–15. Basic Inst. for **Medical Record Personnel**, Memphis, Tenn. (Miss M. C. Beard, RRL, Director, Institute Dept., 840 North Lake Shore Drive, Chicago, Ill. 60611)

12–14. **Fire Weather** Conf., Salt Lake City, Utah. (K. C. Spengler, 45 Beacon St., Boston, Mass. 02108)

13–15. **Instrumentation for the Iron and Steel Industry**, 18th natl. conf., Pittsburgh, Pa. (T. Schuerger, U.S. Steel Corp., Research Lab., Monroeville, Pa. 15146)

13–16. **Optical** Soc. of America, spring mtg., Washington, D.C. (M. W. Warga, Executive Secretary, 1155 16th St., NW, Washington, D.C. 20036)

14–15. Forum on **Geology of Industrial Minerals**, 4th annual, Austin, Tex. (W. L. Fisher, Bureau of Economic Geology, Univ. of Texas, Austin 78712)

14–15. **Neurohumoral Control of the Circulatory System**, 7th natl. symp., Philadelphia, Pa. (F. R. Johnson, Heart Assoc. of Southeastern Pennsylvania, 318 S. 19 St., Philadelphia 19103)

14–16. Arizona Acad. of **General Practice**, Tucson. (P. R. Boykin, Executive Secretary, P.O. Box 441, Scottsdale, Ariz. 85252)

14–16. **Biomathematics and Computer Science** in the Life Sciences, 6th annual, Houston, Tex. (Office of the Dean, Univ. of Texas Graduate School of Biomedical Sciences at Houston, Division of Continuing Education, P.O. Box 20367, Houston 77025)

14–20. Marquette Univ. **Medical Alumni** Assoc., clinical conf., Palm Springs, Calif. (R. H. Herzog, Executive Secretary, The Association, 561 N. 15 St., Milwaukee, Wis. 53233)

15–16. State **Mental Health** Representatives, 14th annual, Chicago, Ill. (W. Wolman, Dept. of Mental Health, 535 N. Dearborn St., Chicago 60610)

18–20. **Lubrication and Lubricant Rheology**, symp., Ann Arbor, Mich. (W. O. Winer, Dept. of Mechanical Engineering, 225 West Engineering Bldg., Univ. of Michigan, Ann Arbor 48104)

18–20. American Acad. of **Pediatrics**, spring session, Atlanta, Ga. (G. E. Hughes, Secretary for Meetings, 1801 Hinman Ave., Evanston, Ill. 60204)

18–20. **Psychedelic Drugs**, Hahnemann Medical College and Hospital meeting, Philadelphia, Pa. (B. L. Segal, Program Chairman, Hahnemann Medical College and Hospital, 230 N. Broad St., Philadelphia 19102)

18–20. **Systems Analysis and Social Change** Forum, Washington, D.C. (L. E. Root, American Inst. of Aeronautics and Astronautics, 1290 Sixth Ave., New York 10019)

18–21. American **Physical** Soc., Berkeley, Calif. (W. Whaling, California Institute of Technology, Pasadena 91109)

18–21. American **Radium** Soc., annual mtg., Miami Beach, Fla. (J. L. Pool, Executive Secretary, Memorial Hospital, 444 E. 68 St., New York, N.Y.)

18–22. National Assoc. of **Corrosion Engineers**, 24th annual conf. and show, Cleveland, Ohio. (T. J. Hull, 980 M & M Building, Houston, Tex. 77002)

19–20. **Equipment Manuals** Symp., Washington, D.C. (National Security Industrial Assoc., 1030 15th St., NW, Washington, D.C. 20005)

19–20. **Ocean Sciences and Engineering of the Atlantic Shelf**, natl. symp., Philadelphia, Pa. (T. Evans, Conference Management Organization, Inc., Sheraton Park Hotel, 2660 Connecticut Ave., NW, Washington, D.C. 20008)

19–21. American **Railway Engineering** Assoc., Chicago, Ill. (E. W. Hodgins, Executive Secretary, 59 E. Van Buren St., Chicago 60605)

20. **Suicidology**, 1st natl. conf., Chicago, Ill. (E. S. Shneidman, Center for Studies of Suicide Prevention, National Inst. of Mental Health, 5454 Wisconsin Ave., Chevy Chase, Md. 20203)

20–22. American **Petroleum** Inst., southwestern district meeting, Tyler, Tex. (American Petroleum Inst., 1271 Avenue of the Americas, New York 10020)

20–22. Institute of **Management Sciences**, Atlanta, Ga. (E. T. Alsaker, Lockheed-Georgia Co., Dept. 88-la, Zone 283, Marietta, Ga. 30060)

20–22. Progress in **Operable Heart Disease**, American College of Cardiology, New York, N.Y. (W. D. Nelligan, Executive Director, 9650 Rockville Pike, Washington, D.C. 20014)

20–23. American **Orthopsychiatric** Assoc., 45th annual, Chicago, Ill. (The Association, 1790 Broadway, New York 10019)

21–22. **Modulation Transfer Function**, Boston, Mass. (Society of Photo-Optical Instrumentation Engineers, P.O. Box 288, Redondo Beach, Calif. 90277)

21–23. Symp. on **Microwave Power**, 3rd symp., Boston, Mass. (C. Olsen, % Eimac, Division of Varian Assoc., 301 Industrial Way, San Carlos, Calif. 94070)

21–24. **Radiographic Diagnosis of Head and Neck**, Miami Beach, Fla. (L. R. Kelley, Dept. of Radiology, Jackson Memorial Hospital, Miami, Fla.)

22–23. Montana **Medical Assoc.**, Helena. (L. R. Hegland, The Association, P.O. Box 1692, Billings, Mont. 59103)

22–23. **Socio-Economics of Health Care**, 2nd natl. congr., Chicago, Ill. (H. W. Doan, Dept. of Health Care Services, American Medical Assoc., 535 N. Dearborn St., Chicago 60610)

22–27. California **Medical** Assoc., San Francisco. (R. L. Thomas, 693 Sutter St., San Francisco 94102)

23. New Jersey **Post Graduate Anesthesia** Seminar, 9th annual, Cherry Hill. (P. A. Tucci, 22 The Fairway, Upper Montclair, N.J. 07043)

23–24. Missouri Soc. of **Anesthesiologists**, Kansas City. (G. W. N. Eggers, Jr., Univ. of Missouri Medical Center, Columbia 65201)

23–25. Postdoctorate Seminar in **Professional Development**, Philadelphia, Pa. (L. Hymes, Pennsylvania College of Podiatry, Pine at Eighth, Philadelphia 19107)

24–27. American Assoc. of **Dental Schools**, 45th annual session, San Francisco, Calif. (D. E. Mattson, 211 E. Chicago Ave., Chicago, Ill. 60611)

24–29. American College of **Allergists**, 24th annual congr., Denver, Colo. (E. Bauers, 2160 Rand Tower, Minneapolis, Minn. 55402)

24–30. American Soc. of **Clinical Pathologists**, New Orleans, La. (L. H. Hoyt, Methodist Hospital, Indianapolis, Ind.)

25–26. **Geochemistry of Subsurface Brines**, symp., Lawrence, Kans. (E. E.

Angino, State Geological Survey, Univ. of Kansas, Lawrence 66044)

25–27. **Electrocardiographic Interpretation of Arrhythmias**: A Physiological Approach, American College of Cardiology, Indianapolis, Ind. (W. D. Nelligan, Executive Director, 9650 Rockville Pike, Washington, D.C. 20014)

25–27. **Operations Research** Symp., 2nd, Pittsburgh, Pa. (H. O. Teeple, TAPPI, 360 Lexington Ave., New York 10017)

25–27. **Simulation and Support** Conf., AIAA 2nd flight test, Los Angeles, Calif. (Meetings Manager, American Inst. of Aeronautics and Astronautics, 1290 Sixth Ave., New York 10019)

25–28. National **Plant Engineering and Maintenance** Show and Conf., Philadelphia, Pa. (K. E. Knowles, 245 Park Ave., New York 10017)

25–28. **Organic Solid State Chemistry** Symp., Upton, N.Y. (G. Adler, Brookhaven National Lab., Upton, L.I., N.Y. 11973)

25–28. Southeastern **Surgical** Congr., Washington, D.C. (A. H. Letton, 340 Boulevard NE, Atlanta, Ga. 30312)

27. **Oral Cancer** Symp., 6th, Poughkeepsie, N.Y. (M. A. Engelman, One East Academy St., Wappingers Falls, N.Y. 12590)

27. Association for the Advancement of **Psychoanalysis**, New York, N.Y. (E. Schattner, Secretary, 147 E. 50 St., New York 10022)

27–28. **Railroad** Conf., Chicago, Ill. (Institute of Electrical and Electronics Engineers, Inc., 345 E. 47 St., New York 10017)

27–29. **Linear Free Energy Relationships**, 2nd conf., Irvine, Calif. (J. E. Leffler, Dept. of Chemistry, Florida State Univ., Tallahassee 32306)

28–29. American Assoc. of **Petroleum Geologists**, Pacific Section, Bakersfield, Calif. (E. W. Ellsworth, Convention Manager, 1444 South Boulder, Box 979, Tulsa, Okla. 74101)

28–30. **Etiology, Diagnosis, and Treatment of Thromboembolism**, American College of Chest Physicians, Philadelphia, Pa. (H. L. Kruse, 112 E. Chestnut St., Chicago, Ill.)

28–30. American **Fertility** Soc., San Francisco, Calif. (H. H. Thomas, 944 S. 18 St., Birmingham, Ala. 35205)

28–31. Missouri State **Medical** Assoc., Kansas City. (R. McIntyre, The Association, 515 E. High St., Jefferson City, Mo. 65101)

29. **Symbiosis**, symp., Fullerton, Calif. (L. A. Stevens, Div. of Life Sciences, Fullerton Junior College, 321 Chapman Avenue, Fullterton 92634)

29–2. National **Science Teachers** Assoc., natl. conv., Washington, D.C. (R. H. Carleton, NSTA, 1201 16th St., NW, Washington, D.C. 20036)

29–30. **Rural Health**, 21st natl., Seattle, Wash. (B. L. Bible, 535 N. Dearborn St., Chicago, Ill. 60610)

29–31. American **Nuclear** Soc., student conf., Tucson, Ariz. (K. D. Kearns, Dept. of Nuclear Engineering, Univ. of Arizona, Tucson 45215)

29–31. **Clinical Pharmacology of Cardiovascular Drugs**, American College of Cardiology, Nutley, N.J. (W. D. Nelligan, Executive Director, 9650 Rockville Pike, Washington, D.C. 20014)

29–31. American **Psychosomatic** Soc., Inc., Boston, Mass. (H. Weiner, Secretary-Treasurer, 265 Nassau Road, Roosevelt, N.Y. 11575)

29–31. American Soc. of **Group Psychotherapy and Psychodrama,** New York, N.Y. (H. B. Weiner, 1323 Avenue N, Brooklyn, N.Y. 11230)

29–31. American Soc. of **Internal** Medicine, Boston, Mass. (E. E. Daleske, 3410 Geary Blvd., San Francisco, Calif. 94118)

29–31. Arizona **Chest Disease** Symp., Tucson. (L. D. Hudson, P.O. Box 6067, Tucson 85716)

30–3. American Soc. of **Abdominal Surgeons,** Chicago, Ill. (B. F. Alfano, 675 Main St., Melrose, Mass. 02176)

30–3. Technical Assoc. of **Pulp and Paper** Industry, 5th water conf., Portland, Ore. (The Association, 360 Lexington Ave., New York 10017)

31–3. American **Mosquito Control** Assoc., New Orleans, La. (G. Carmichael, New Orleans Mosquito Control, 6601 Lakeshore Dr., New Orleans 70126)

31–3. **Erosion as Related to Air and Water Pollution,** Las Vegas, Nev. (R. B. Reams, Desert Research Inst., Univ. of Nevada, Reno 89507)

31–4. American Assoc. of **Cereal Chemists,** 53rd annual, and American **Oil Chemists** Soc., 58th annual, joint mtg., Washington, D.C. (R. J. Tarleton, 1955 University Ave., St. Paul, Minn. 55104)

31–4. **Materials Engineering** and **Sciences,** conf. and exposition, Philadelphia, Pa. (C. S. Grove, Jr., 5110 Brockway Lane, Fayetteville, N.Y. 13066)

31–5. American **Chemical** Soc., 155th spring natl. mtg., San Francisco, Calif. (A. T. Winstead, 1155 16th St., NW, Washington, D.C. 20036)

31–7. North American **Clinical Dermatologic** Soc., New Orleans, La. (E. F. Finnerty, The Society, 510 Commonwealth Ave., Boston, Mass. 02115)

International and Foreign Meetings

March

1–7. International Acad. of **Pathology,** 57th annual, Chicago, Ill. (F. K. Mostofi, Armed Forces Institute of Pathology, Washington, D.C. 20305)

2–16. International Soc. of **Sugar Cane Technologists,** 13th congr., Taipei, China. (H. S. Wu, Taiwan Sugar Corp., P.O. Box 35, Taipei)

3–6. **Electrical Industry** Show, 9th intern., New York, N.Y. (R. Pomerance, Intern. Electrical Shows, Inc., 331 Madison Ave., New York 10017)

4–6. Agricultural Sciences and the **World Food Supply** Symp., Wageningen, Netherlands. (International Agricultural Centre, P.O. Box 88, Wageningen)

5–7. European Symp. on the Application of **Automatic Computation in Chemical Engineering,** Munich, Germany. (Dechema, Postfach 7746, 6 Frankfurt am Main 7, Germany)

5–7. **Materials for Engineering** Conf. and Exhibition, Melton Mowbray, Great Britain. (Production Engineering Research Assoc. of Great Britain, G. E. Clark, Exhibition Organiser, Melton Mowbray, Leics)