SCIENCE 22 September 1967
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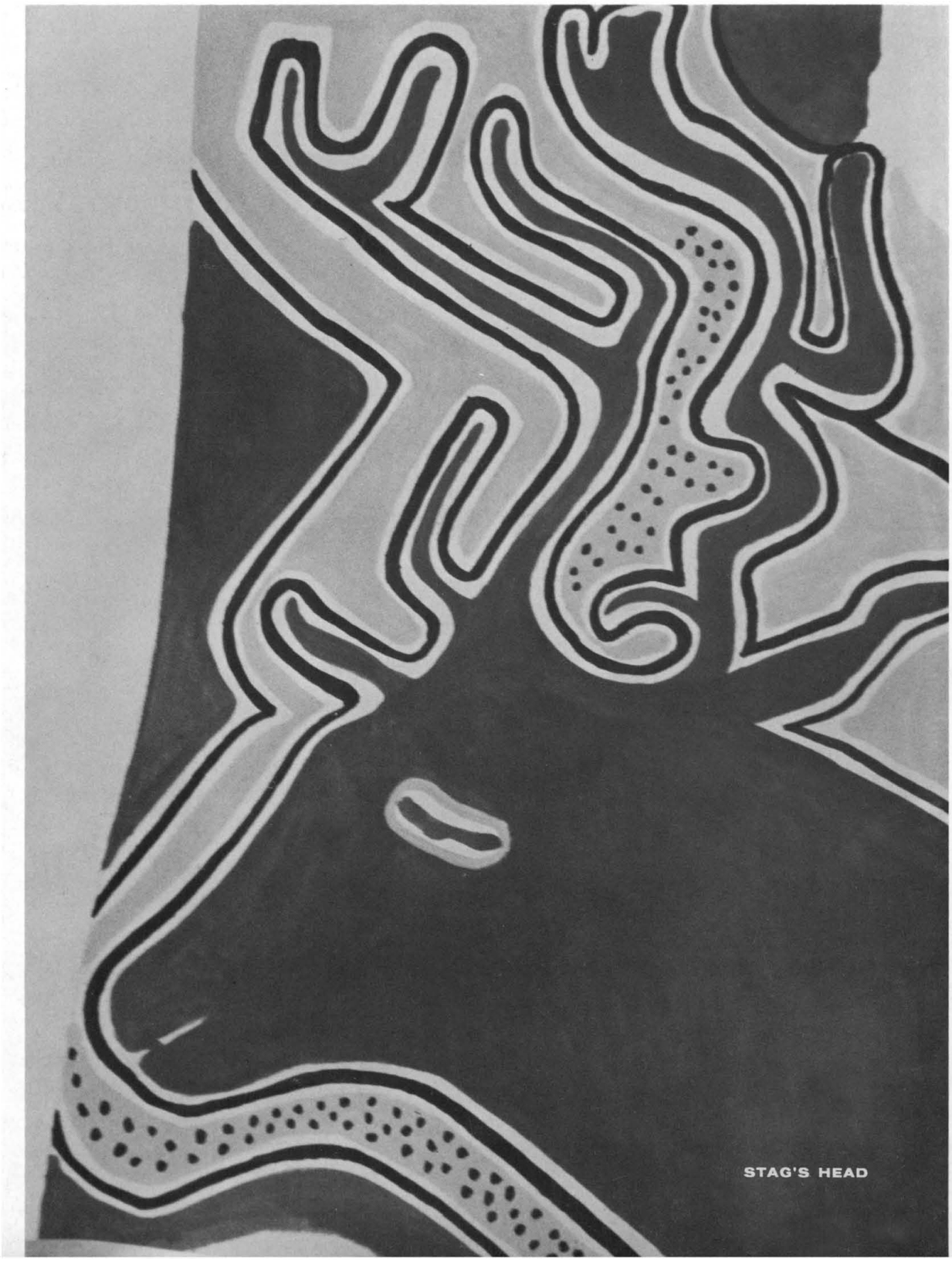
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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Manual: 217 pp., illustrated. $3.75. Published May, 1960.

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22 September 1967
Vol. 157, No. 3795

SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Wall painting of stag's head in red, black, and white found in shrine at Çatal Hüyük, Neolithic town in Anatolia. Çatal Hüyük, a community of considerable size in 7000 B.C., antedates the famous cities of Mesopotamia by 3000 years. See review of *Çatal Hüyük*, page 1416. [Mrs. M. A. Mellaart]

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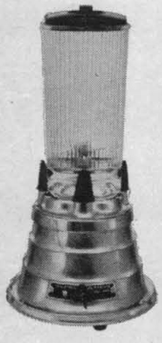

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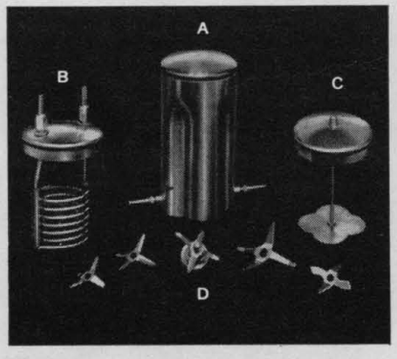

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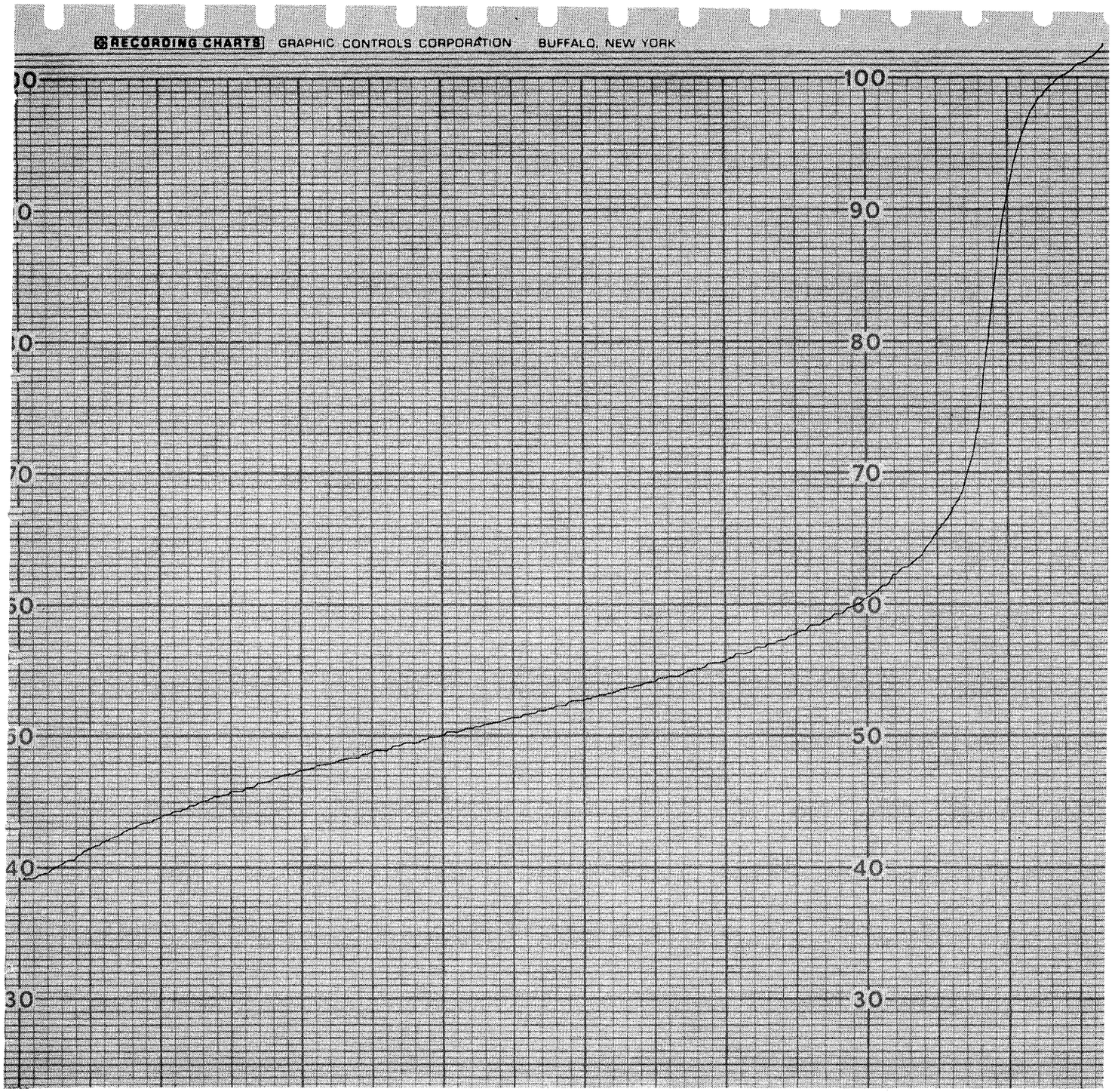

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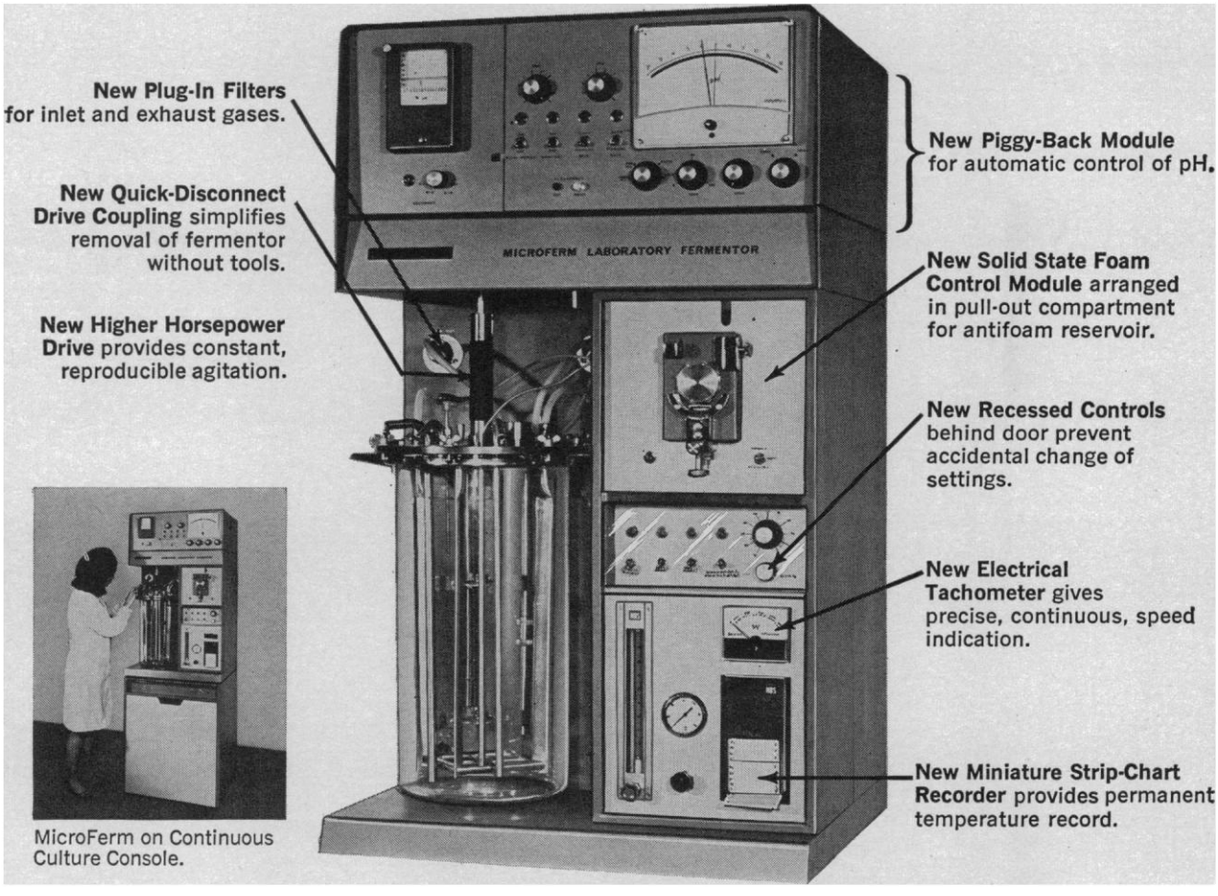

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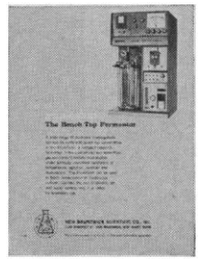

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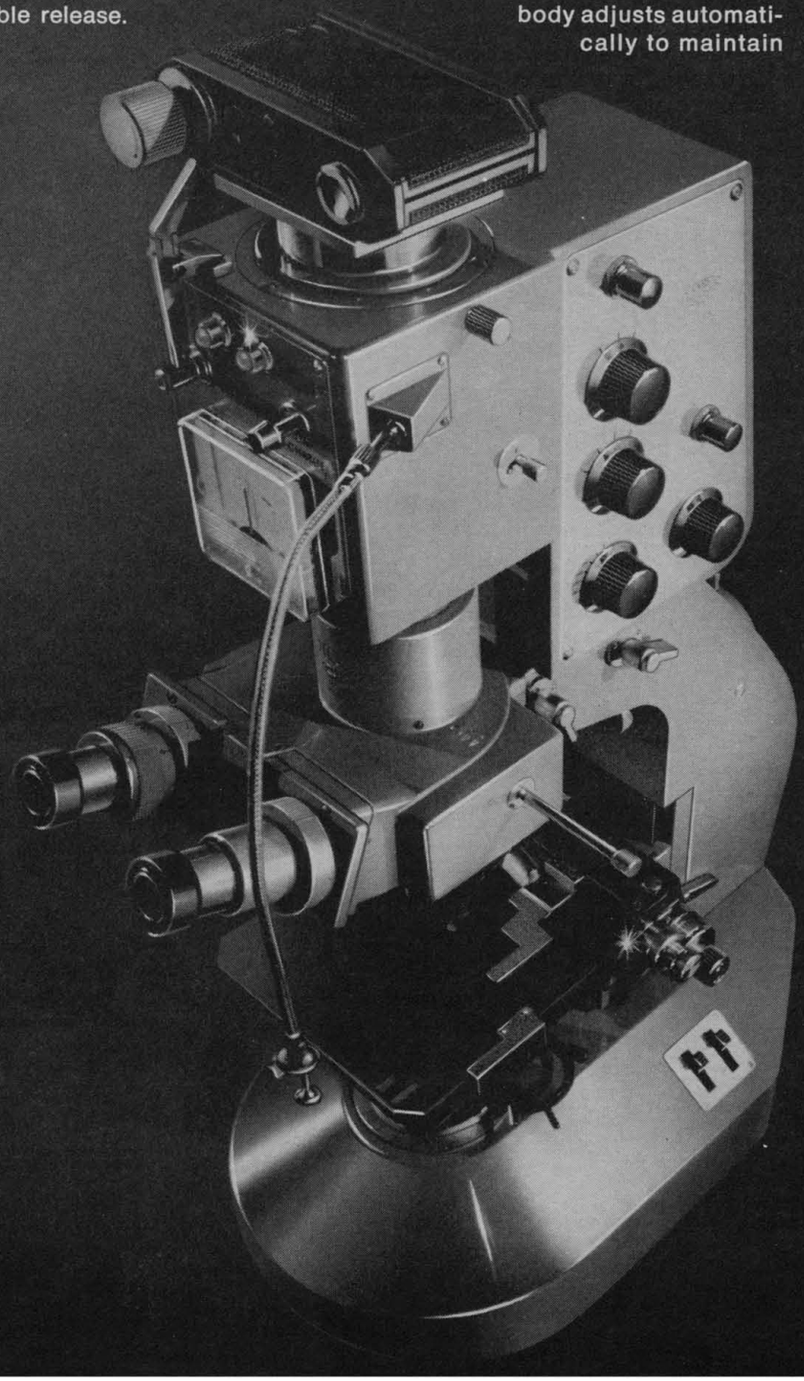

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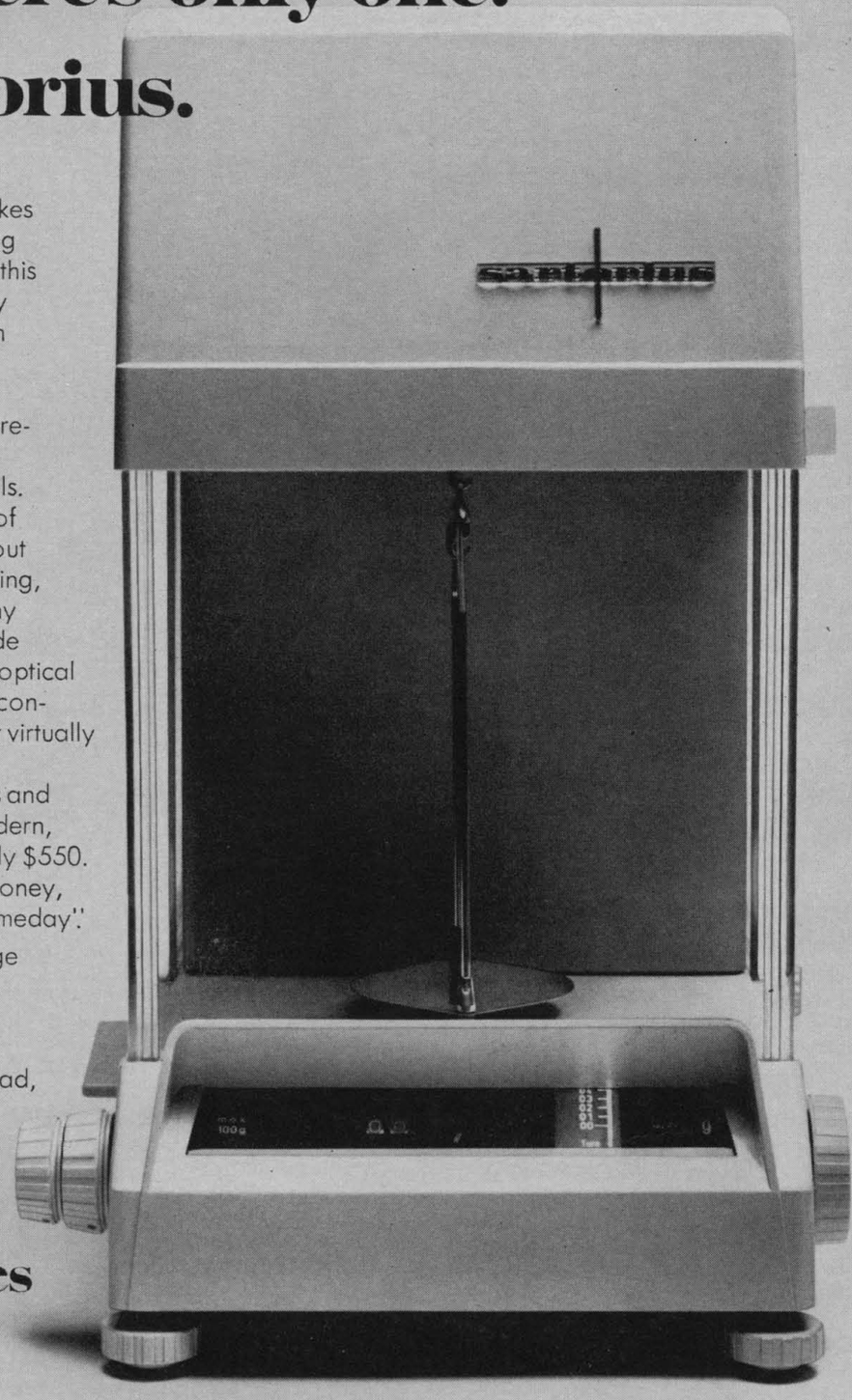

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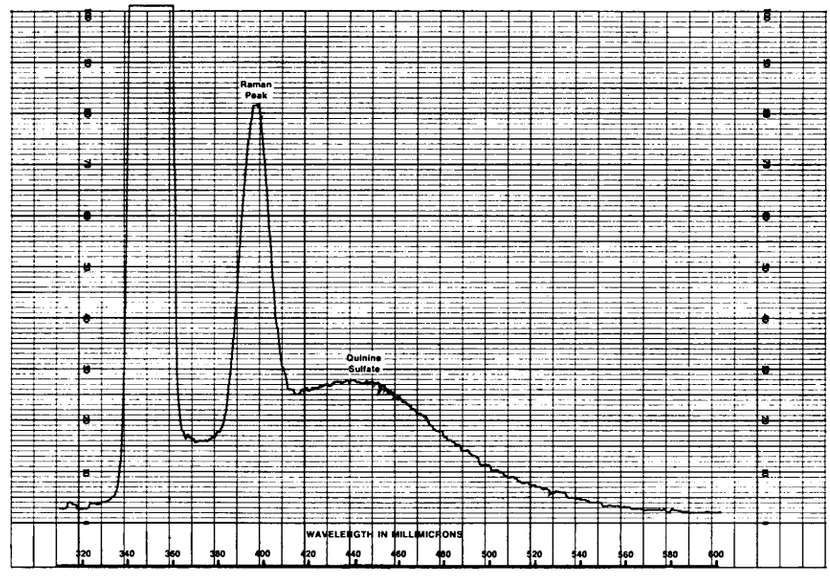

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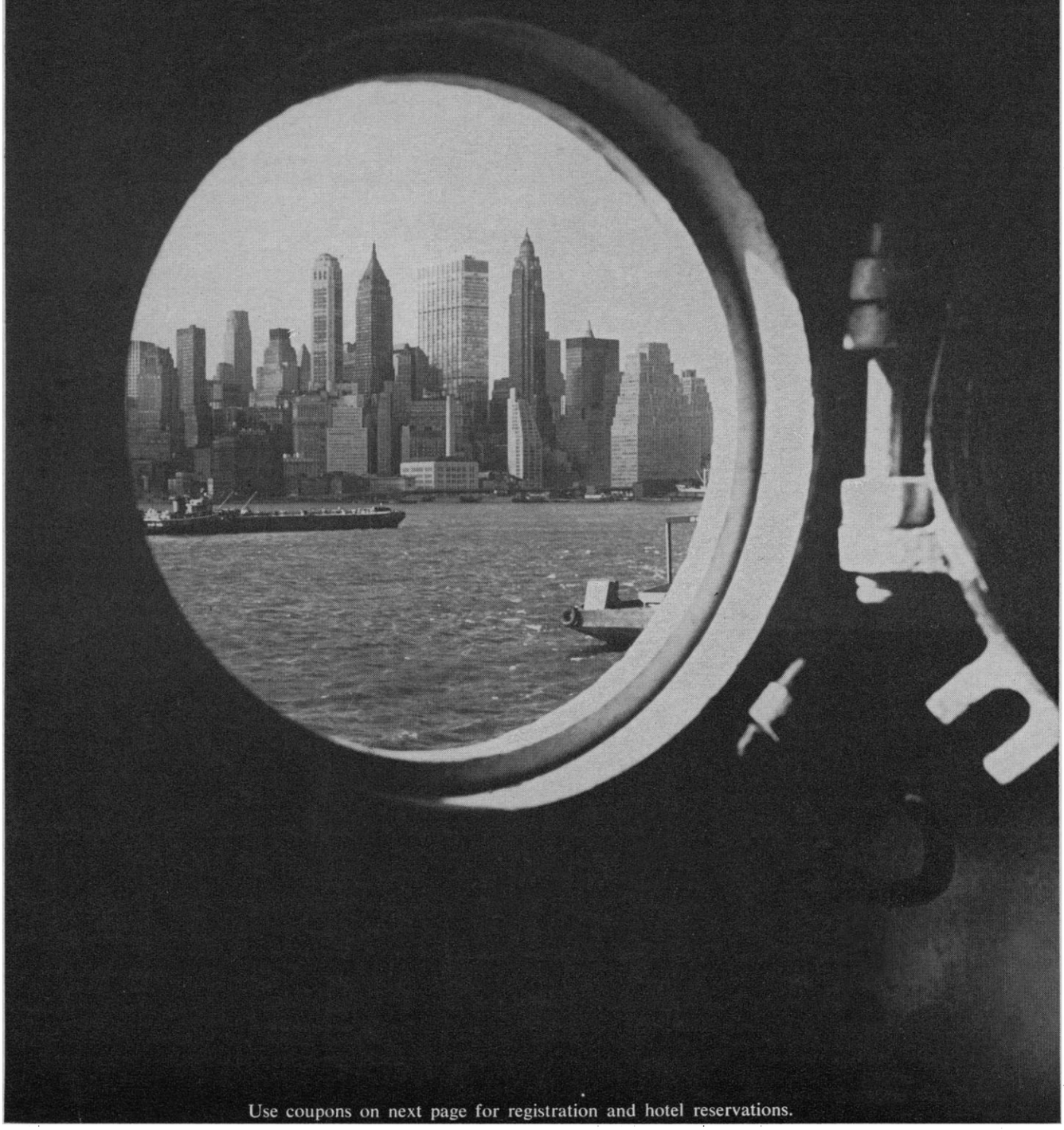

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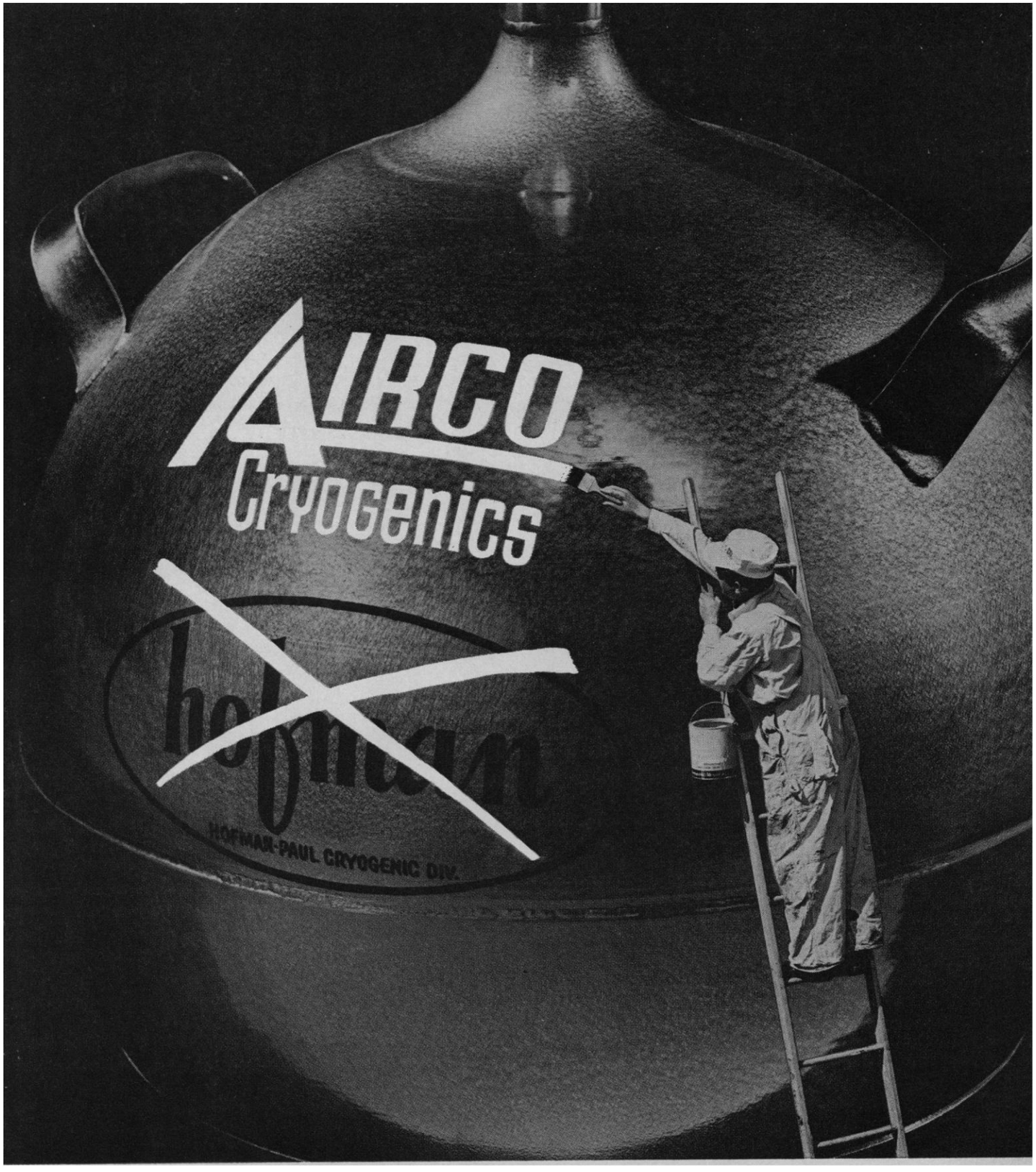

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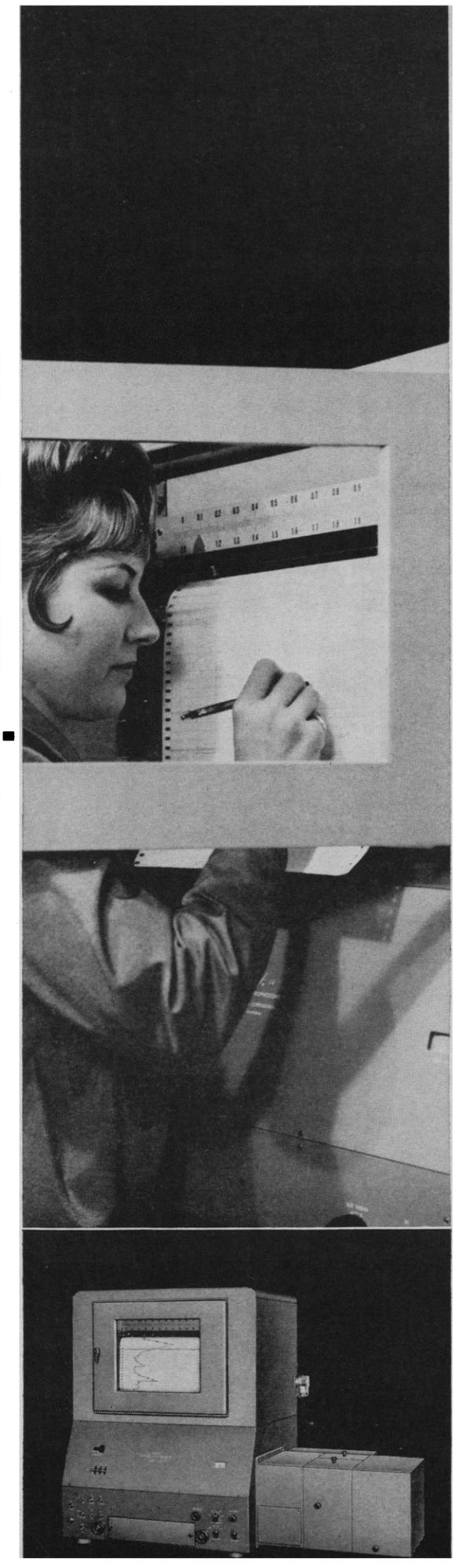

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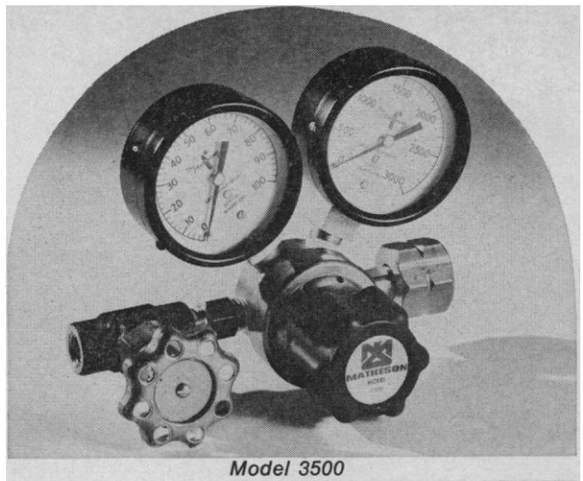

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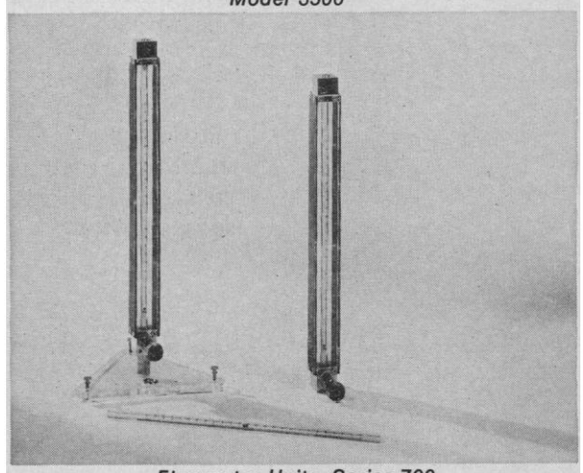

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- ☐ Flowmeter Units, Series 700
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- ☐ Matheson Gas & Equipment Catalog

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What makes the RCA EMU-4 the "new look" electron microscope?

...Four things: *stability, capacity, facility* and *flexibility.* Seldom are all four attributes so well combined as they are in the newest RCA electron microscope.

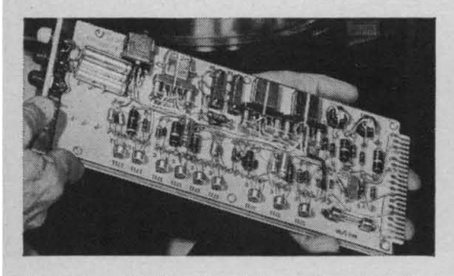
STABILITY in instrumentation permits maximum image resolution. In the EMU-4, operational stability stems from the uniformity of transistorized electronics in combination with extra-reliable "low impedance" lenses. (Objective-lens stability: to within 2.5 ppm; H-V stability: to within 5.0 ppm.)

CAPACITY is essential for microscope productivity. In the EMU-4, the combination of convenient specimen-handling facilities and large photo-plate capacity assures maximum micrograph productivity. (Specimen change in ten seconds or less; *30* or *36* 1½" x 2", *18* 3¼" x 4" or up to *200* ¼" x 2" exposures per chamber load.)

FACILITY in operational convenience. The EMU-4 is designed to complement the operator's physical needs: It relieves him (or her) of the mundane tasks of vacuum-system monitoring and control with self-sequencing, motor-driven vacuum valving; its "center-of-interest" console design minimizes physical fatigue by locating the various controls at the precise place of maximum operator comfort.

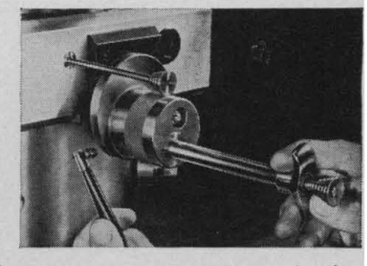
FLEXIBILITY for both quantitative and qualitative studies is assured in the EMU-4 by virtue of the *two* forms of magnification control it affords: Fixed-step control – 15 root-2 steps between 1400x and 200,000x—for quantitative studies and continuously-variable control for qualitative studies. Fixed-step and continuously-variable *focus* is also included in the EMU-4 for both forms of study. Fixed-focus steps are adjustable in 0.03, 0.06, 0.12, 0.25, 0.50 and 1.00 microns of focal length via pushbutton control while another set of six pushbuttons permits "summing" of these increments.

These are some of the reasons why the EMU-4 is a "new look" microscope. Further information is yours for the asking. RCA Scientific Instruments, Building 15-5, Camden, N.J. 08102. In Canada, RCA Victor Ltd., Montreal. Overseas, RCA International, Clark, N.J. 07066, U.S.A.

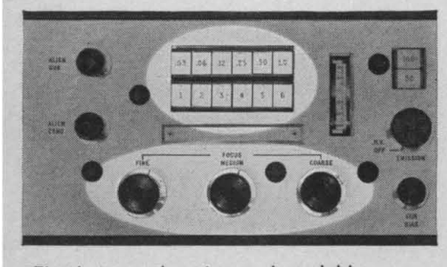


Maximum-stability transistorized electronics

Fully-flexible, high-capacity photographic facilities



A truly-universal specimen chamber with specimen airlock



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Leave it to Lauda Constant Temperature Circulators to get you into hot water.

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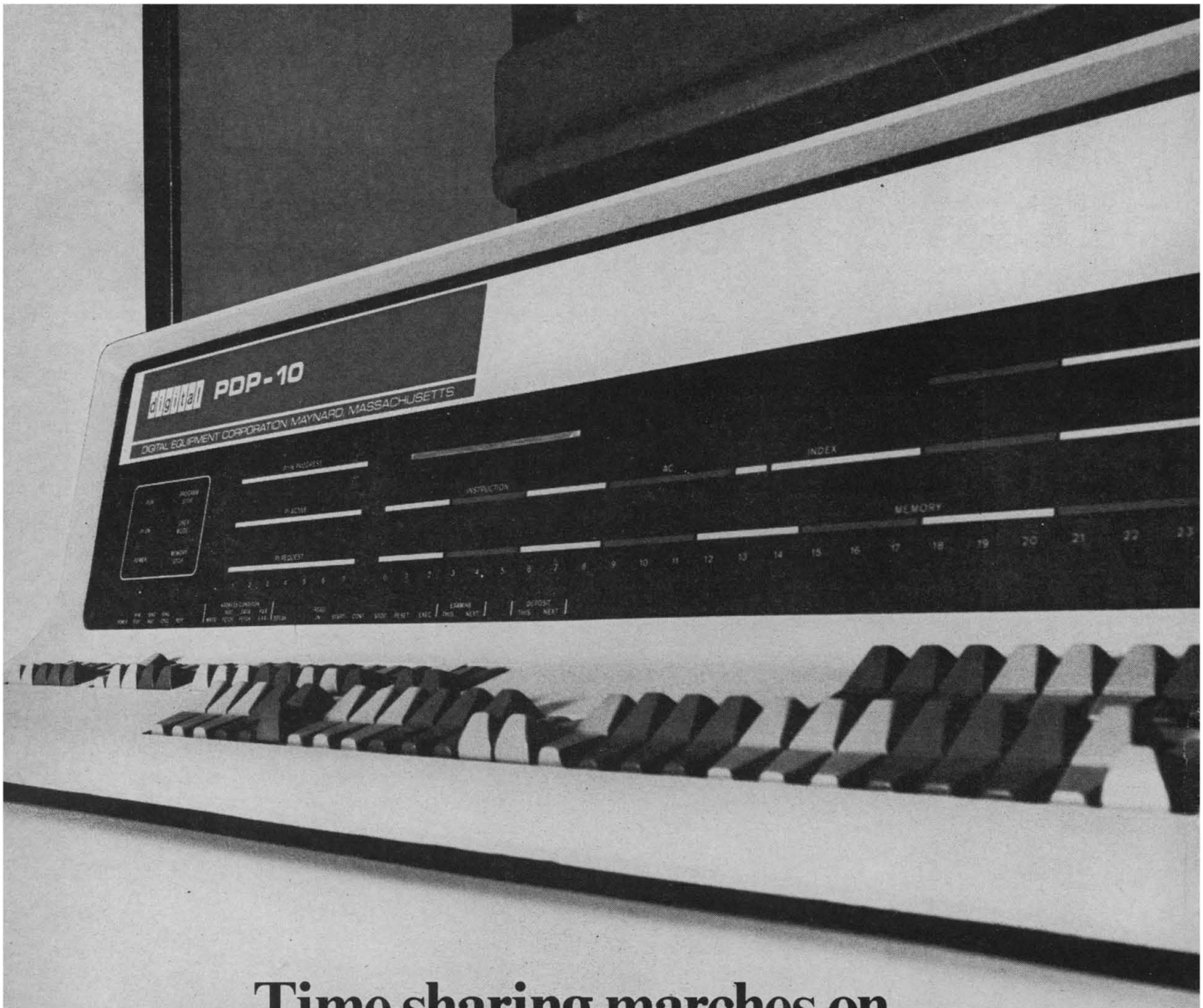

Time sharing marches on...

PDP-10 is **still** the leader.

DIGITAL started time-sharing some time ago. With the PDP-6. Hardware and software. PDP-10 is our second step.

The reason that's important is this: our first step is behind us. Two years' continuous work on the software. Nearly two dozen installations using it. Improving it. Refining it. That's all done.

When the PDP-10 hardware arrives in September (five versions, five software packages, upwards compatible, truly modular), it will be more than cabinets filled with electronics. It will be a working, problem-solving, 36-bit word, 1 μsec, expandable, scientifically oriented computing system with memory from 8 to 262 thousand words.

Two of those versions will offer time-sharing. Second generation time-sharing. Complete, general purpose, simultaneous multiusage, "time-slicing", "time-splicing" time-sharing.

Disc swapping. Batch processing. And in the hardware, 365 powerful instructions. 16 general purpose registers. 7 fully nested interrupt levels. 16 accumulators. 15 index registers. High speed multiplexer channels. 64 programmed operators. Modular mnemonics. Flexible I/O bus structure. Programmed priority-interrupt system. All 16 Boolean operations, each in four modes.

PDP-10 is big. Powerful. In the several million dollar class just a few years ago. But it's little, too. Little enough for a scientist to put the system on-line with his experiment as his personal research tool. Little enough for a physics department with time-sharing needs. And little in price, too. Nearest competitor wants 50% more. Write.

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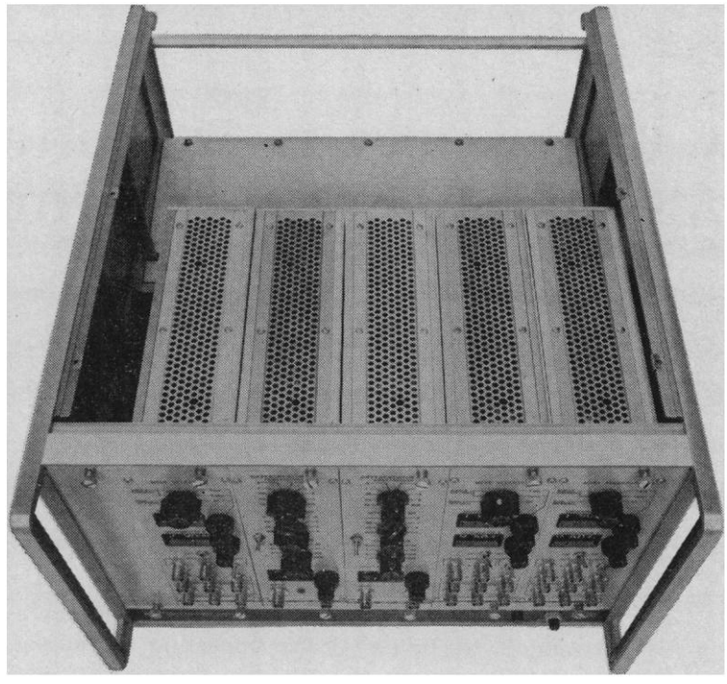


That's a safe bet.

Module protection and a ±6 V capability ideal for integrated circuits work are two unique features in the new Hewlett-Packard 5580 NIM Power Supply. The 5580 conforms to AEC voltage standards (TID—20893), has ±24 V, ±12 V *and* ±6 V outputs—furnishes 120 watts output power. Plus built-in overvoltage protection, blower-cooling for better reliability. This total performance is the result of the 5580's being built to HP's own exacting standards—it could make the difference between stable operation or drift and premature failure.

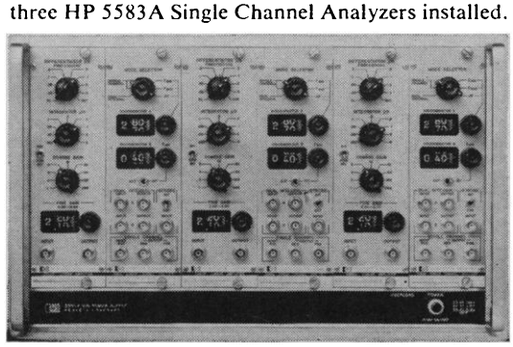
Modules powered by the 5580 are protected by a warning light to indicate when marginal operation might endanger the validity of your data. Specially designed current-limiting protection circuits act automatically to prevent costly damage from shorts and overloads in your modules. The mutual impedance between modules is very low, which prevents loading at one connector block from adversely affecting the dc voltages at other connector blocks.

For applications not requiring the full range of output voltages the 5580 can be ordered with only two or four supplies, can later be expanded to a 6-voltage supply simply by adding plug-in circuit boards.

The 5580B has space for 12 module widths. The 5580A has space for 11 module widths and is packaged to be compatible with the standard Hewlett-Packard modular enclosure system. Both models are identical electrically, both are rack mount or bench top convertible. Price: 5580B (12 module width), $825; 5580A, $775.

For more information on this and the other nuclear instrumentation offered by HP, call your Hewlett-Packard field engineer or write Jim Sheldon, Hewlett-Packard, Palo Alto, California 94304; Europe: 54 Route des Acacias, Geneva.

5580B with three HP 5582A Linear Amplifiers and three HP 5583A Single Channel Analyzers installed.



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22 SEPTEMBER 1967

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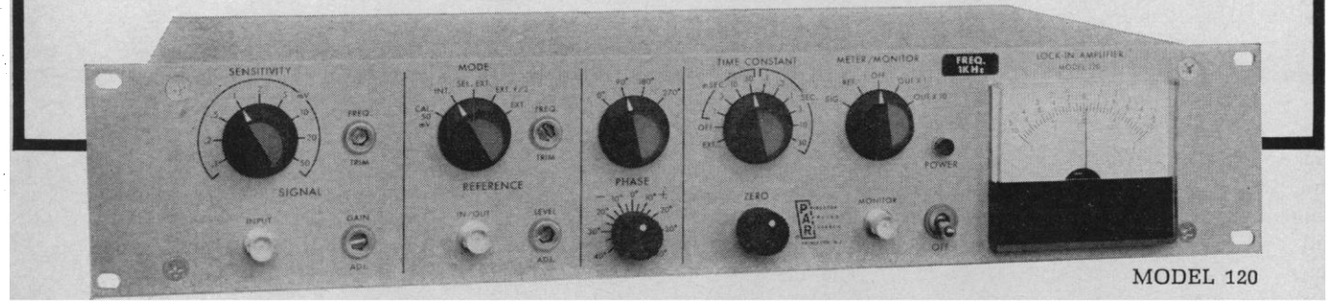
MODEL 121

New PAR Lock-In Amplifiers Recover Low-Level Signals from Noise



MODEL 120

Model 120 is a fixed frequency unit which allows the benefits of phase sensitive detection to be achieved at an economical price. Representative specifications are:

FREQUENCY RANGE: 5 Hz to 150 kHz. Frequency is determined by two plug-in circuit boards, each of which contains two or four (depending upon frequency) resistors and two capacitors. Plug-in frequency determining boards for any particular frequency in the above range can be ordered from PAR or the user can change frequency by changing the resistors and capacitors on the two plug-in circuit boards. A front panel vernier adjustment functions as a fine frequency control.

SIGNAL INPUT CHARACTERISTICS: Single-ended input of 10 Megohms shunted by 30 pF. Selectivity characteristic is that of a parallel resonant circuit with a Q of approximately 10.

SENSITIVITY: 100 μV to 50 mV rms full scale in a 1, 2, 5 sequence. Output X10 monitor position increases meter sensitivity by factor of 10 on any range.

FILTER TIME CONSTANT: 1 mS to 30 seconds in a 1, 3, 10 sequence and EXT position. 6 dB/octave roll-off rate.

OUTPUT: $\pm$ 10 volts full scale, single-ended with respect to ground.

PRICE: $850.00.

Export Prices approximately 5% higher, (except Canada).

Model 121 is continuously tunable throughout its entire operating frequency range. It provides the versatility required for use in many sophisticated research applications. Illustrative specifications are:

FREQUENCY RANGE: Continuously tunable from 1.5 Hz to 150 kHz in 5 ranges.

SIGNAL INPUT CHARACTERISTICS: Single-ended input of 10 Megohms, shunted by 20 pF. Adjustable Q from 5 to 25 over the entire frequency range.

SENSITIVITY: 10 μV to 500 mV in 1, 2, 5 sequence. Output X10 monitor position increases meter sensitivity by factor of ten on any range.

FILTER TIME CONSTANTS: 1 mS to 100 sec. in 1, 3, 10 sequence and EXT. position. 6 or 12 dB per octave roll-off.

OUTPUT: $\pm$ 10 volts full scale, single-ended with respect to ground.

VOLTMETER MODE: Internal demodulator reference signal derived from signal to be measured. Unit operates as average responding AC voltmeter with overall sensitivity unchanged.

PRICE: $1,600.00.

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For additional information write to Princeton Applied Research Corporation, Dept. G, P.O. Box 565, Princeton, New Jersey 08540. Telephone: (609) 924-6835.

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varied, complex, rich. It remains only to answer the objections posed by many skeptics.

Objection 1. Only natural phenomena breed sciences, but computers are artificial, hence are whatever they are made to be, hence obey no invariable laws, hence cannot be described and explained. *Answer.* 1. The objection is patently false, since computers and computer programs are being described and explained daily. 2. The objection would equally rule out of science large portions of organic chemistry (substitute "silicones" for "computers"), physics (substitute "superconductivity" for "computers"), and even zoology (substitute "hybrid corn" for "computers"). The objection would certainly rule out mathematics, but in any event its status as a natural science is idiosyncratic.

Objection 2. The term "computer" is not well defined, and its meaning will change with new developments, hence computer science does not have a well-defined subject matter. *Answer.* The phenomena of all sciences change over time; the process of understanding assures that this will be the case. Astronomy did not originally include the study of interstellar gases; physics did not include radioactivity; psychology did not include the study of animal behavior. Mathematics was once defined as the "science of quantity."

Objection 3. Computer science is the study of algorithms (or programs), not computers. *Answer.* 1. Showing deeper insight than they are sometimes credited with, the founders of the chief professional organization for computer science named it the Association for Computing Machinery. 2. In the definition, "computers" means "living computers"—the hardware, their programs or algorithms, and all that goes with them. Computer science is the study of the phenomena surrounding computers. "Computers plus algorithms," "living computers," or simply "computers" all come to the same thing—the same phenomena.

Objection 4. Computers, like thermometers, are instruments, not phenomena. Instruments lead away to their user sciences; the behaviors of instruments are subsumed as special topics in other sciences (not always the user sciences—electron microscopy belongs to physics, not biology). *Answer.* The computer is such a novel and complex instrument that its behavior is subsumed under no other science; its study does not lead away to user sciences, but to further study of computers. Hence, the computer is not just an instrument but a phenomenon as well, requiring description and explanation.

Objection 5. Computer science is a branch of electronics (or mathematics, psychology, and so forth). *Answer.* To study computers, one may need to study some or all of these. Phenomena define the focus of a science, not its boundaries. Many of the phenomena of computers are also phenomena of some other science. The existence of biochemistry denies neither the existence of biology nor of chemistry. But all of the phenomena of computers are not subsumed under any one existing science.

Objection 6. Computers belong to engineering, not science. *Answer.* They belong to both, like electricity (physics and electrical engineering) or plants (botany and agriculture). Time will tell what professional specialization is desirable between analysis and synthesis, and between the pure study of computers and their application.

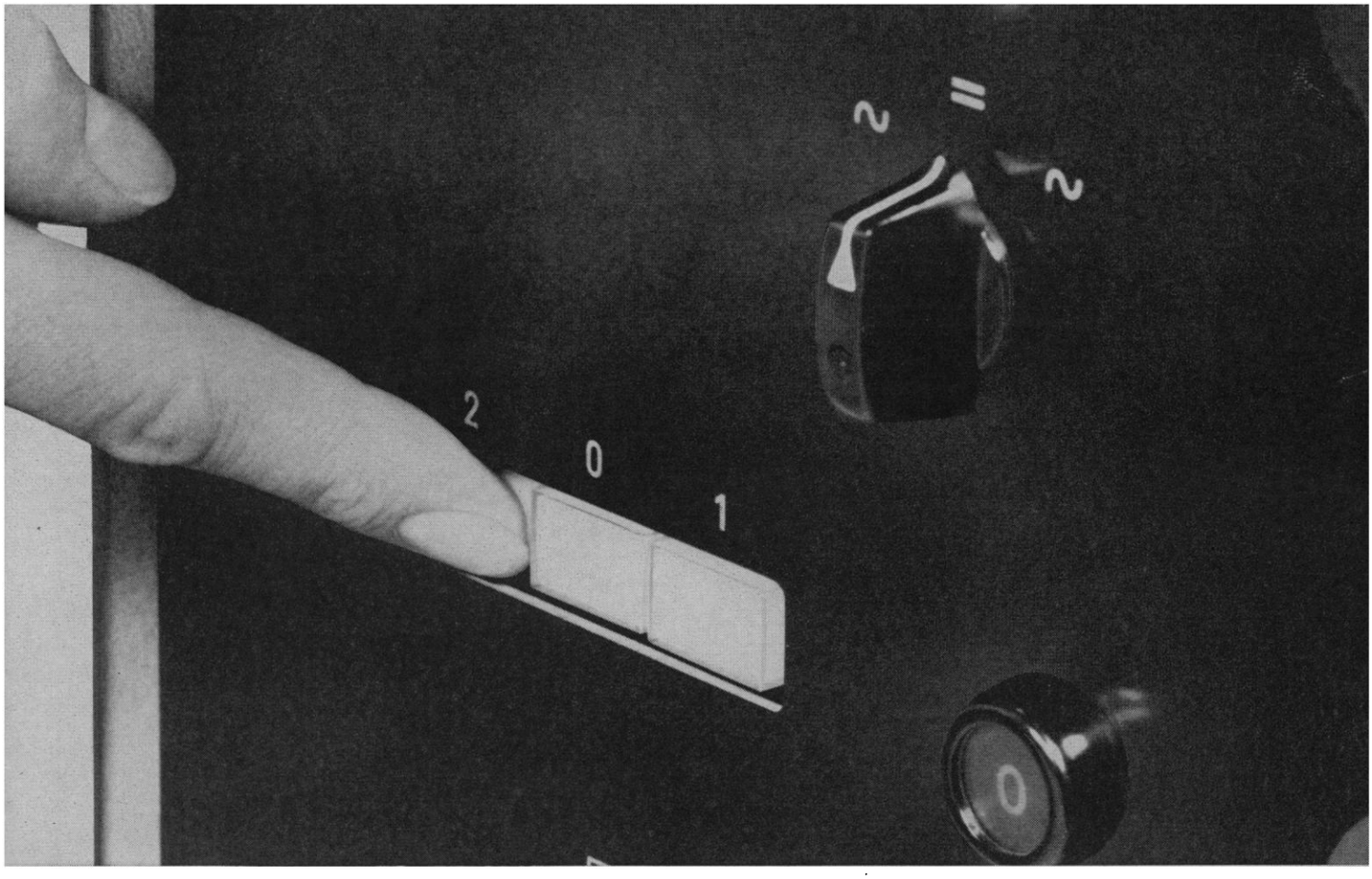
Computer scientists will often join hands with colleagues from other disciplines in common endeavor. Mostly, computer scientists will study living computers with the same passion that others have studied plants, stars, glaciers, dyestuffs, and magnetism; and with the same confidence that intelligent, persistent curiosity will yield interesting and perhaps useful knowledge.

ALLEN NEWELL
ALAN J. PERLIS
HERBERT A. SIMON

Graduate School of Industrial Administration, Carnegie Institute of Technology, Pittsburgh, Pennsylvania 15213

"The Big Trouble with Scientific Writing . . ."

When I see articles, as I frequently do these days, exhorting authors to greater simplicity and clarity (*1*), I think of the first little scientific note I wrote, when I was an idealistic graduate student. I wrote it as simply and directly as I could. It began, "The big trouble with diffusion cloud chambers is low radiation resistance," and it went on in the same vein. My co-workers thought it needed a little more work. Secretly I did not agree, so I decided to attempt to make it into a parody of



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scientific writing. I borrowed impressive but empty phrases from *The Review of Scientific Instruments.* Each sentence and each idea was made unnecessarily complicated, without being too obvious about it. The result began, "The principal difficulty encountered in the operation of an ordinary high-pressure hydrogen cloud chamber is inferior radiation resistance." I failed in my attempt, for now everyone thought it read fine, and it appeared in its complicated form in *The Review* (*2*).

My point is not that scientific writing cannot be parodied, but rather that scientific writing is the way it is because its readers actually prefer it that way. People's actions do not always correspond to their words. Everyone is against sin and bad writing, unless given a free choice.

ROBERT H. GOOD
Department of Physics, California State College, Hayward 94542

Reference

1. J. P. Woodruff, *Science* **156**, 743 (1967); Letters, *ibid.* **157**, 6 (1967).
2. R. H. Good, *Rev. Sci. Instr.* **28**, 472 (1957).

Role of Intuition

In much recent writing about science and scientific discovery a strong distinction is purported to exist between intuition and ostensive logical argument. Some authors attribute to intuition a special quality giving its results a status almost as though *ex cathedra.* In their view, intuition is such that scientific advance is made only on intuitive process while the exercise of intelligence and logic are pedestrian activities of which the result is merely a confirmation of that which was in the first instance accessible only to intuition.

Wilder's article, "The role of intuition" (5 May, p. 605), establishes a more reasonable perspective. His argument that "mathematical intuition, like intelligence, is a psychological quality which stems possibly from a hereditarily derived faculty, but which is, at any given time, principally an accumulation of attitudes derived from one's mathematical experience," supports a view that intuition is logical process unobserved.

In brief, intuition is an act of the mind, in nonverbal apprehension of significant relation. The quality of such acts is a function of the quality of

the mind in which they occur, and in this respect the quality of the mind is in part a function of the training it has had and of what is stored in it, for intuition involves a consultation of data and a use of the same logic that operates in any overt argument.

A claim to know something by intuition is only to assert that which is said to have been apprehended without being able to say how that is known; the claim secures for the assertion no exemption from trial. More advanced statements about knowing something intuitively may be (i) about the act and substance of apprehension itself; or (ii) a verbal formulation of what we understand our mind to have apprehended; or (iii) a logical argument in which we seek to represent the steps that must have been gone through by the mind in achieving apprehension; and, as Wilder shows, we may be in error in any or all of these. Yet, neither the frequent successes of intuition, nor the nature of our subsequent errors, makes of intuition anything other than an act of the mind that falls into those errors.

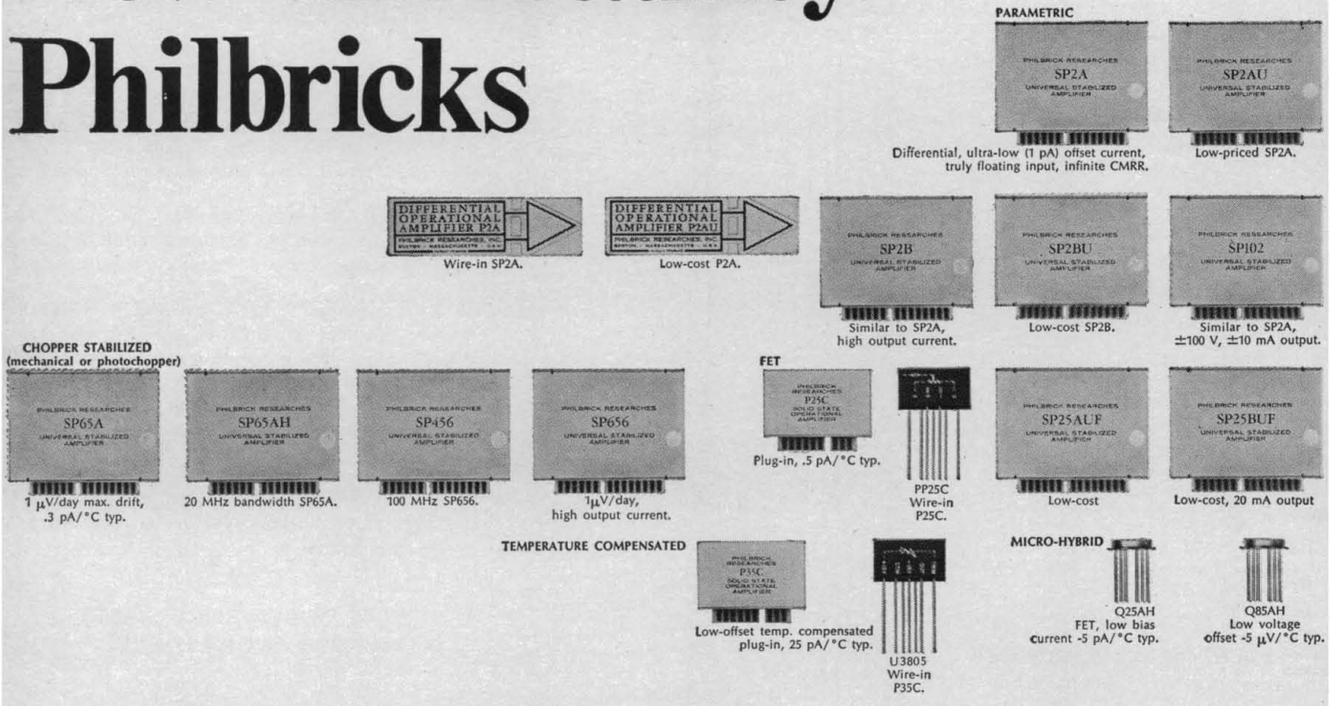
GEOFFREY L. KESTEVEN
Division of Fisheries and Oceanography, C.S.I.R.O., P.O. Box 21, Cronulla, New South Wales, 2230, Australia

Protests Unexpected Editorial Changes

Science editors introduced five changes into my recent letter ("Basic research and public support," 14 July 1967), all without my knowledge: they altered the title and my address (although trivially), added the word "so" (creating the tautology "sufficiently so"), reworded the last sentence and deleted its final phrase, "as effectively as it can be done," and *added*(!) the question whether biochemists can decide if biological systematists are competent, and vice versa (I asked whether either of these kinds of investigators can decide that the other field is wholly a waste of time, and therefore everyone in it by definition incompetent; the answers to the two questions are not the same). It saps one's confidence to realize he cannot control what he says in print, even in a brief letter to a magazine called *Science*.

RICHARD D. ALEXANDER
Museum of Zoology, University of Michigan, Ann Arbor 48104

Is amplifier noise your problem? Solve it with "low-uncertainty" Philbricks



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22 September 1967, Volume 157, Number 3795 **SCIENCE**

Whither AAAS Annual Meetings?

In the early years of its existence the AAAS met the need for face-to-face communication through its annual meetings. As professional societies grew in strength, in size, and in introspection, the AAAS offered them hospitality at its meeting and sponsored events that would not bend to specialization. Today, the physical limits on attendance, the mental boundaries on the information that can be transmitted usefully, and the subtle demands of interaction between speakers and audience call for an examination of these aims.

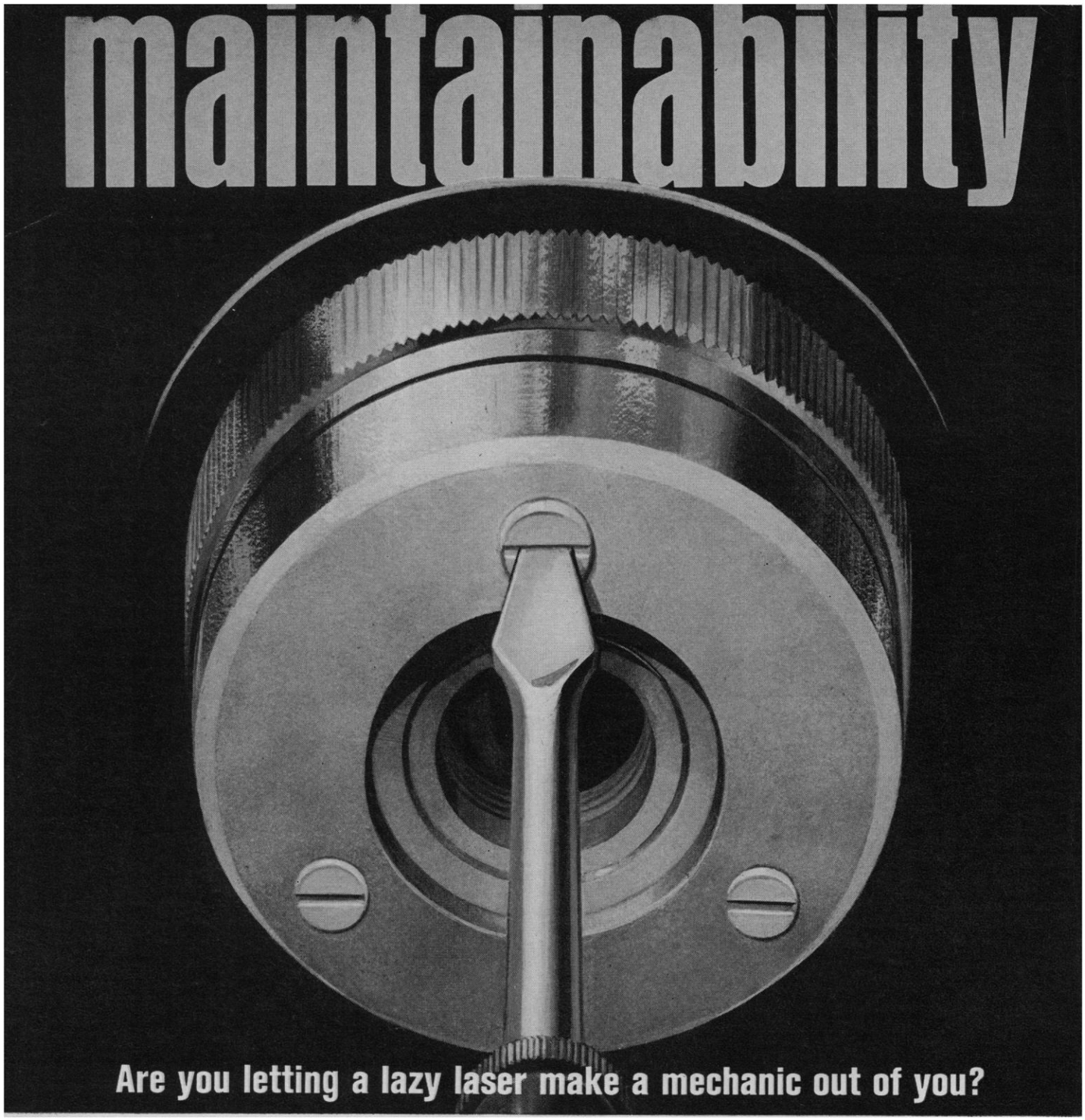
There is a growing awareness, expressed as early as 1951 by a special study group of the AAAS under the chairmanship of Warren Weaver, that heavy reliance on "standard" scientific papers and symposia can no longer serve. Functions that are best performed by groups and societies of experts should not be duplicated. Topics that are better resolved at small private meetings, by small groups of specialists, and at a particularly suitable time and place need not be discussed at AAAS meetings. Rather, the meetings should pay heed to those topics that benefit from illumination from many directions, before an audience of wide interests, by any method that insures the smooth flow of ideas. Emphasis should be on vigorous discussions of issues where resolution would be facilitated by exposure to public view. Individuals would report unusual discoveries and insights that will influence the direction of research and the future of our society. The most valuable function of the AAAS meetings would be to assist a questioning public to understand causes and weigh trends and prospects so that wise choices could be made, and made in time.

These are difficult demands. They require answers to many questions: How large should the meeting be? What should be the balance between the many claimants who want to be heard? What techniques of presentation and response? How varied the program? How specialized?

Caryl Haskins, the president of the Carnegie Institution of Washington, posed the problem in his most recent Report (1965/1966). "If the primary task of those engaged at the frontiers of scientific investigation is still, as it always has been, to enlarge and extend those frontiers, that task is also accompanied today by . . . a responsibility that, in effect, is twofold. First, for the scientist, is the challenge to communicate, to directly share, the experience which has been his—a relatively easy task vis-à-vis those who share his precise special interests. It becomes much more difficult when his audience, though scientific, has somewhat more distant concerns. Yet it is quite as important here. The other half of the task, however, is far broader and even more difficult. It is the challenge to communicate, by every effective means the imagination can command, the nature, the purpose, the rationale, and the intense social relevance of the scientific way. . . . For the link between the order of a society's understanding of the nature and significance of scientific investigation and the actual quality of the science going forward within it; the relation of the prescience of its own questioning to the quality of the answers that it receives; the shaping of effort by the specific nature of the demands made by society at any given moment, have never been so notable as they are now . . ."

This is a worthy challenge. For its resolution many ingrained habits must be modified and new paths be charted. Yet, failing to respond would have grave consequences.—WALTER G. BERL, *Editor, AAAS Annual Meeting*

maintainability



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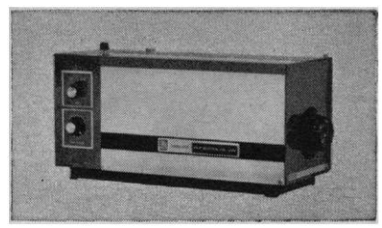

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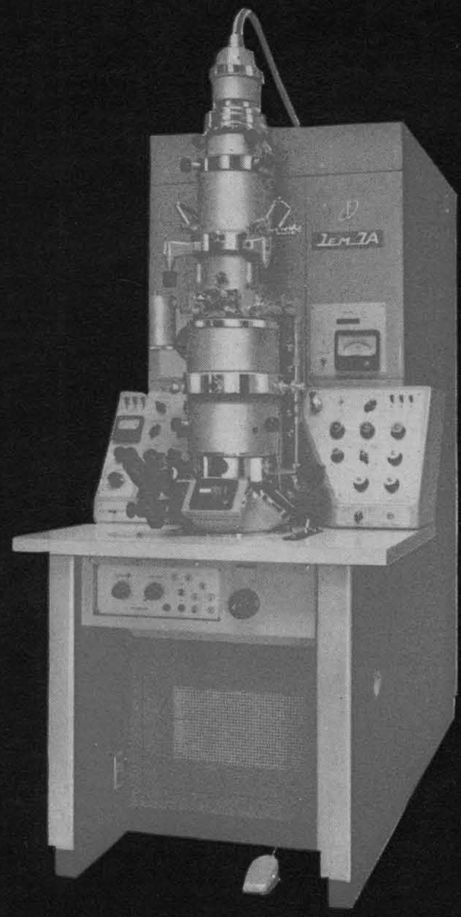

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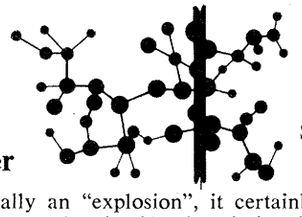
A close look into analytical efficiency... from polymers to pesticides

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.

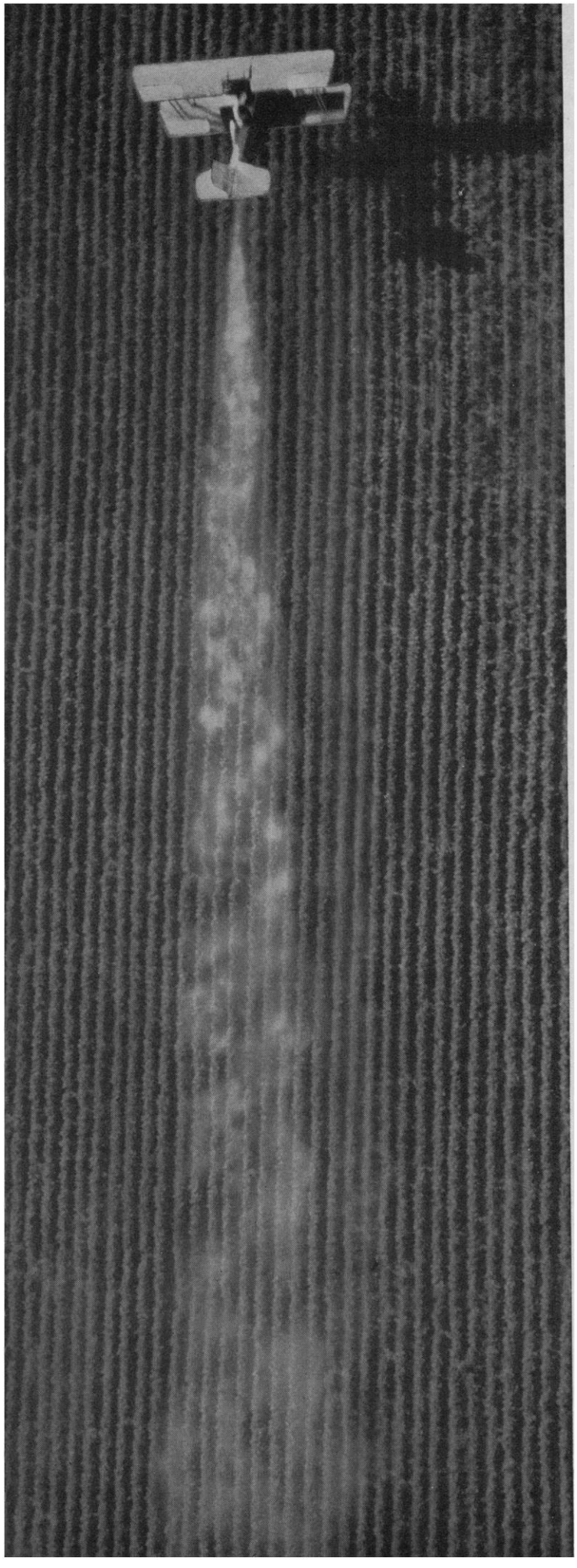
If the CHN Analyzer strays from the classical, H-P's Model DY-2801A Quartz Thermometer (hereinafter called the QT) departs radically. Platinum resistance thermometry has always been looked upon as the best (if not the most practical) means of making sensitive laboratory temperature measurements. This 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.

+026.530°C

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.

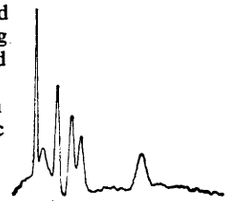


Garden Variety Pesticides

"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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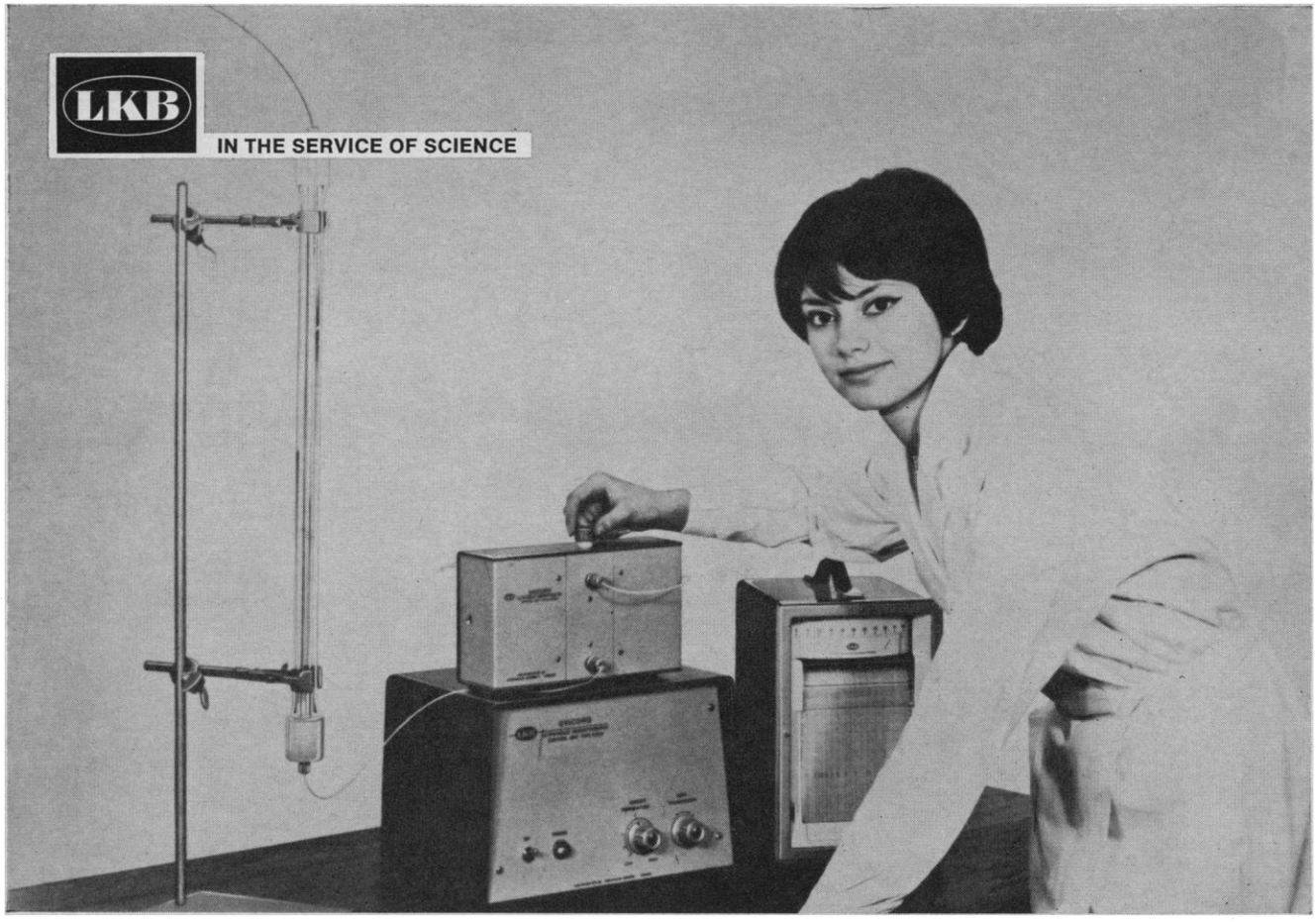
ANALYTICAL INSTRUMENTS



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AAAS ANNUAL MEETING

26–31 December 1967

New York City

Tentative Schedule of Sessions

AAAS INVITED LECTURES

☐ Moving Frontiers of Science Lecture I (26 Dec.).

Hormones, Genes, and Metamorphosis—Carroll M. Williams (Bussey Professor of Biology, Harvard University).

☐ Moving Frontiers of Science Lecture II (27 Dec.).

Some Studies of Human Stones—Dame Kathleen Lonsdale, F.R.S. (Professor of Crystallography, University College, London; President, British Association for the Advancement of Science).

☐ Moving Frontiers of Science Lecture III (28 Dec.).

Can the Poor Countries Benefit from the Scientific Revolution?—Roger Revelle (Director, Center for Population Studies, Harvard University). Followed by a panel discussion chaired by Athelstan Spilhaus.

☐ Distinguished Lecture (27 Dec.).

The Experimental City—Athelstan Spilhaus (University of Minnesota).

☐ George Sarton Memorial Lecture (28 Dec.).

The Metamorphosis and Survival of Outmoded Scientific Viewpoints—Cyril Stanley Smith (Institute Professor, M.I.T.).

☐ Address of the Retiring President (28 Dec.).

Major Steps in Vertebrate Evolution—Alfred Sherwood Romer (Alexander Agassiz Professor of Zoology Emeritus, Harvard University).

☐ General Lecture (29 Dec.).

Speculations on the Next Thirty-three Years—Herman Kahn (Director, Hudson Institute). Followed by a panel discussion chaired by Philip M. Hauser (University of Chicago).

☐ RESA Annual Address and Procter Prize (29 Dec.).

Environmental Pollution—Abel Wolman (Professor of Sanitary Engineering Emeritus, Johns Hopkins University). Followed by a panel discussion chaired by Chauncey Starr (University of California, Los Angeles).

☐ Sigma Xi-Phi Beta Kappa Lecture (29 Dec.).

Space and Time—John A. Wheeler (Professor of Physics, Princeton University).

☐ National Geographic Society Illustrated Lecture (30 Dec.).

Mapping Mount Kennedy—Bradford Washburn (Director, Museum of Science, Boston).

AAAS COMMITTEE SYMPOSIA

☐ Committee on Science in the Promotion of Human Welfare and Scientists' Institute for Public Information

- **Secrecy, Privacy, and Public Information**
  Part I. Science and Secrecy (28 Dec.).
  Part II. Privacy and Research Involving Human Subjects (28 Dec.).
  Part III. Public Information (29 Dec.).
- **The Norman Bauer Memorial Symposium on the Hazards of Iodine-131 Fallout in Utah (27 Dec.).**

☐ Committee on Arid Lands

- **Weather Modification (30 Dec.).**

GENERAL SYMPOSIA

☐ Michael Faraday—Natural Philosopher (26 Dec.).

☐ Crime, Science, and Technology

Part I. Crime and Systems Analyses (27 Dec.).
Part II. Crime and Technology (28 Dec.).
Part III. Science and the War on Crime (29 Dec.).

☐ Marine Science

Part I. Policies and Concepts (27 Dec.).
Part II. National Programs (27 Dec.).
Part III. Frontiers of Marine Science (28 Dec.).
Part IV. Food from the Sea (28 Dec.).

SYMPOSIA OF AAAS SECTIONS AND AFFILIATED SOCIETIES

Mathematics (A)

☐ Section Program

- Vice Presidential Address, "Symmetry, The Scientists' Friend," A. M. Gleason; and Invited Papers (30 Dec.).

- Computer-Aided Research (28 Dec.).

☐ **American Mathematical Society and Society for Applied Mathematics**

- Some Questions in Mathematical Biology (27 Dec.).

☐ **Association for Computing Machinery**

- Research Topics in Computer Science (27 Dec.).

Physics (B)

☐ **Section Program**

New Useful Developments Derived from Recent Pure Research in Physics; and Vice Presidential Address, "Basic Research in Nuclear Physics," W. W. Havens; (29 Dec.).

☐ **American Astronautical Society**

- Extra-Terrestrial Life (30 Dec.).

☐ **American Meteorological Society**

- Role of the Tropics in the General Circulation (29 Dec.).

Chemistry (C)

☐ **Section Program**

- Present State of the Art and Vice Presidential Address, "Are There Limits to Polymer Research?", H. F. Mark (27 Dec.).
- Chemistry and Urban Problems (Round-table discussion) (29 Dec.).
- Self-Assembly of Matter (29 Dec.).

☐ **American Association of Clinical Chemists**

- Contributed Papers on Clinical Chemistry (27 Dec.).
- Immunoglobulins (27 Dec.).

Astronomy (D)

☐ **Section Program**

- Lloyd V. Berkner Memorial Symposium on Evolution of the Earth's Atmosphere (27 Dec.).
- The Structure and Evolution of Our Universe (28 Dec.).
- Plasma Astrophysics (27 Dec.).

Geology and Geography (E)

☐ **Section Program**

- Earth Sciences in Secondary Schools and Vice Presidential Address (Joe Webb Peoples) (27 Dec.).

☐ **Association of American Geographers**

Report on Geography from NAS/NRC Committee (30 Dec.).

☐ **National Speleological Society**

- Contributed Papers: Cave Geology (29 Dec.); Cave Biology (29 Dec.).; Cave Geography and Exploration (30 Dec.).

Zoological Sciences (F)

☐ **Section Program**

- Vice Presidential Address (C. S. Pittendrigh) and Zoologists' Dinner (29 Dec.).

☐ **American Society of Naturalists**

- Presidential Address (28 Dec.).
- Sharing, As a Genecological Process (30 Dec.).

☐ **American Society of Zoologists**

- Past President's Symposium (27 Dec.).
- Animal Communication (28 Dec.).
- Contributed Papers on Invertebrate Zoology (27–30 Dec.).
- Contributed Papers on Developmental Biology (27–30 Dec.).
- Contributed Papers on Comparative Physiology (27–30 Dec.).
- Terrestrial Adaptations in Crustacea (27–29 Dec.).
- Contributed Papers on Miscellaneous Subjects (27, 29, and 30 Dec.).
- Refresher Course: Principles of Ecology (27 Dec.).
- Environmental Input and Endocrine Activity (27 Dec.).
- Functional Morphology of the Vertebrate Heart (28 Dec.).
- Contributed Papers on Comparative Endocrinology (28–30 Dec.).
- Contributed Papers on Chelonian Morphology (28 Dec.).
- Control Mechanisms in Morphogenesis (29 Dec.).
- Web-Building Spiders (29–30 Dec.).
- Contributed Papers on Vertebrate Morphology (29–30 Dec.).
- Interstitial Fauna (30 Dec.).

☐ **Animal Behavior Society**

- Contributed Papers (27–30 Dec.).
- Open Discussion (28-29 Dec.).
- Some Effects of Radiation on Behavior (29 Dec.).

☐ **Ecological Society of America**

- Contributed Papers (26–30 Dec.).
- Productivity and Mineral Cycling in Natural Ecosystems (27 Dec.).
- A Coastal Marine Ecosystem: Diversified Ecological Approaches (29 Dec.).
- Allelopathy (30 Dec.).

☐ **Herpetologists' League**

- Contributed Papers (28–29 Dec.).

☐ **Society of Systematic Zoologists**

- Contributed Papers (27 Dec.).
- Adaptive Radiation in Aquatic Animals (28 Dec.).
- Techniques for Comparative Studies of Protein Structure (29 Dec.).

Botanical Sciences (G)

☐ **Section Program**

- Morphogenesis '67 and Vice Presidential Address (W. C. Steere) (29 Dec.).
- Contributed Papers (27 Dec.).

Anthropology (H)

☐ Section Program

- Vice Presidential Address, "Anthropology—The Discipline Today," Alexander Spoehr (27 Dec.).
- Anthropologists in Relation to Other Fields (27 Dec.).
- Contributed Papers (27 Dec.).
- Obsidian Studies in Archeology (28 Dec.).
- Entrepreneurship in Primitive and Developing Countries—Part I. Africa: Market vs. Anti-Market Mentality (29 Dec.); Part II. Latin America: Urban and Rural Aspects of Entrepreneurship (29 Dec.); Part III. Asia: Local and Translocal Entrepreneurship (30 Dec.); Part IV. Entrepreneurship for What? (30 Dec.).

Psychology (I)

☐ Section Program

- Transfer, Interference, and Forgetting; and Vice Presidential Address, "Mechanisms of Interference in Forgetting," L. J. Postman (30 Dec.).
- Emotionally Disturbed Children in the Public Schools (29 Dec.).
- Attitude Change: Recent Developments in Experimental Research (29 Dec.).
- Quantitative Methodology in the Behavioral Sciences (30 Dec.).

☐ American Psychoanalytic Association

- Psychoanalytic Studies in Child Development: Biological and Social Deprivation in Early Childhood (27 Dec.).

☐ American Speech and Hearing Association

- Speech Pathology: Some Principles Underlying Therapeutic Practices (30 Dec.).

Social and Economic Sciences (K)

☐ Section Program

- Vice Presidential Address (David Truman) (29 Dec.).
- Science and Technology as Instruments of Policy (27 Dec.).
- Allocation of Resources for Science (28 Dec.).
- Workshop on Science and Public Policy (29 Dec.).
- Research in Birth Control and Changing Sex Behavior (30 Dec.).

☐ American Sociological Association

- Social Sciences as Public Policy (29–30 Dec.).

☐ American Society of Criminology

- Contributed Papers (28 Dec.).

☐ Metric Association

- Invited Papers (30 Dec.).

☐ National Institute of Social and Behavioral Sciences

- Contributed Papers (28 Dec.).

☐ Population Association of America

- Invited Papers (30 Dec.).

☐ Society for the Scientific Study of Religion

- Religion and Anti-Semitism (27 Dec.).

History and Philosophy of Science (L)

☐ Section Program

- Vice Presidential Address, "Recent Philosophy of Science in France," P. J. Caws (30 Dec.).
- The Logic of Scientific Discovery (26 Dec.).
- The Problem of Statistical Explanation (27 Dec.).
- Statistical Foundations of Quantum Mathematics (28 Dec.).
- Statistical Explanation in the Social Sciences (30 Dec.).

☐ Society for General Systems Research

- Role of General Systems Analysis in Education in the Seventies (26 Dec.).
- General Systems: Ecology, Systems, and Society (26-27 Dec.).
- Comparative Methodology of the Physical and Social Sciences (27 Dec.).
- Comparative Administration and Management Systems (29 Dec.).
- The Role and Training of a Generalist in Industry (29 Dec.).
- Systems Analysis in Metropolitan and Regional Planning (30 Dec.).

Engineering (M)

☐ Section Program

- Man and Transportation: Part I. Transportation Studies and Projects (27 Dec.); Part II. Traffic Flow and Congestion (27 Dec.); Part III. Future Modes of Ground Transportation (28 Dec.); Part IV. Future Modes of Air Transportation (28 Dec.); Part V. Ecology and Transportation (29 Dec.); Part VI. Urban Development and Transportation (30 Dec.); Part VII. Health and Transportation (30 Dec.); Part VIII. Automotive and Air Safety (30 Dec.).

Medical Sciences (N)

☐ Section Program

- Molecular Approaches to Learning and Memory (29 Dec.).
- Delivery of Personal Health Services (30 Dec.).
- Allocation of National Institutes of Health Resources (30 Dec.).

☐ American Association of Bioanalysts

- Invited Papers (26 Dec.).

☐ American Psychiatric Association

- Some Current Issues in Psychochemical Research Strategies in Man (28–29 Dec.).

Dentistry (Nd)

☐ **Section Program**

- Vice Presidential Address, "Global Oral Pathology," L. R. Cahn (28 Dec.).
- Adhesion in Biological Systems (28–29 Dec.).

Pharmaceutical Sciences (Np)

☐ **Section Program**

- Luncheon and Vice Presidential Address, "Pharmacy and the Developing Federal Programs," Curtis Waldon (29 Dec.).
- Contributed Papers on Hospital Pharmacy (29 Dec.).
- Contributed Papers on Pharmaceutical Sciences (30 Dec.).
- Distinguished Lecture (James L. Goddard) (30 Dec.).
- Absorption, Distribution, Metabolism, and Excretion of Therapeutic Agents (30 Dec.).

Agriculture (O)

☐ **Section Program**

- Education for the Crises in Food and Natural Resources (27–29 Dec.).

Industrial Science (P)

☐ **Section Program**

- Luncheon and Vice Presidential Address (Ellis A. Johnson) (28 Dec.).
- Systems Analyses of the City (28 Dec.).

Education (Q)

☐ **Section Program**

- Vice Presidential Address (Herbert A. Smith) (27 Dec.).
- International Science Education (26 Dec.).
- The Measuring of Group Achievement in Education (27 Dec.).
- Joint Session with AERA (28 Dec.).
- Report of Coordinated Science-Mathematics Conference (29 Dec.).

☐ **Alpha Epsilon Delta**

- Medical Education in the Next Decade (28 Dec.).

☐ **American Nature Study Society**

- Contributed Papers: Orientation to the New York City Environment (27 Dec.).
- Preserving and Utilizing Open Space (28 Dec.).
- Lenses on Nature (28 Dec.).
- Urban Environmental Resource Problems and Youth (29 Dec.).

☐ **American Physiological Society**

- Role of Physiology in Undergraduate College Curricula (30 Dec.).

☐ **Commission on Undergraduate Education in the Biological Sciences**

- Undergraduate Education in Biology (29 Dec.).

☐ **National Council of Teachers of Mathematics**

- Teaching of Mathematics Today and Tomorrow (29 Dec.).

☐ **National Science Teachers' Association**

- College Science (27 Dec.).
- Elementary Science (28 Dec.).
- Science and Liberal Education (29 Dec.).

☐ **Science Teaching Societies**

- Human Ecology and the Problem of Environmental Pollution (27 Dec.).
- The Problem of Education in the Urban Environment (29 Dec.).

☐ **Science Courses for Baccalaureate Education**

- Invited Papers (26 Dec.).

Information and Communication (T)

☐ **Section Program**

- Vice Presidential Address, "Confessions of a Communications Non-Conformist," Phyllis V. Parkins (29 Dec.).
- Communications and Self-Communing: Publication in Research Method (27 Dec.).
- The Role of Museums in Modern Communications (27 Dec.).
- The Genesis of Information Systems: Hindsight and Foresight (29 Dec.).

Statistics (U)

☐ **Section Program**

- Vice Presidential Address (G. E. P. Box) (29 Dec.).
- Statistical Questions in the Investigation of Urban Problems (29 Dec.).

☐ **Biometric Society**

- Estimating the Numbers in Insect Populations (27 Dec.).
- Testing Compatibility for Kidney Transplants (28 Dec.).

General Science (X)

☐ **Academy Conference**

- AAAS-Academy Relationships (27 Dec.).
- Youth Activities of the Academies (27 Dec.).
- Dinner and Presidential Address, "Academies by Other Names," V. E. Anderson (27 Dec.).
- American Junior Academy of Science Papers (28 Dec.).
- Junior Scientist' Papers (29 Dec.).

Sargent's portable pH meters are rugged enough—with transistorized circuitry in a shockproof, waterproof case—to withstand rough field use. Yet these portable pH meters—with an absolute accuracy of ±0.05 pH and reproducibility of ±0.01 pH—perform to standards normally found in only the highest-priced instruments.

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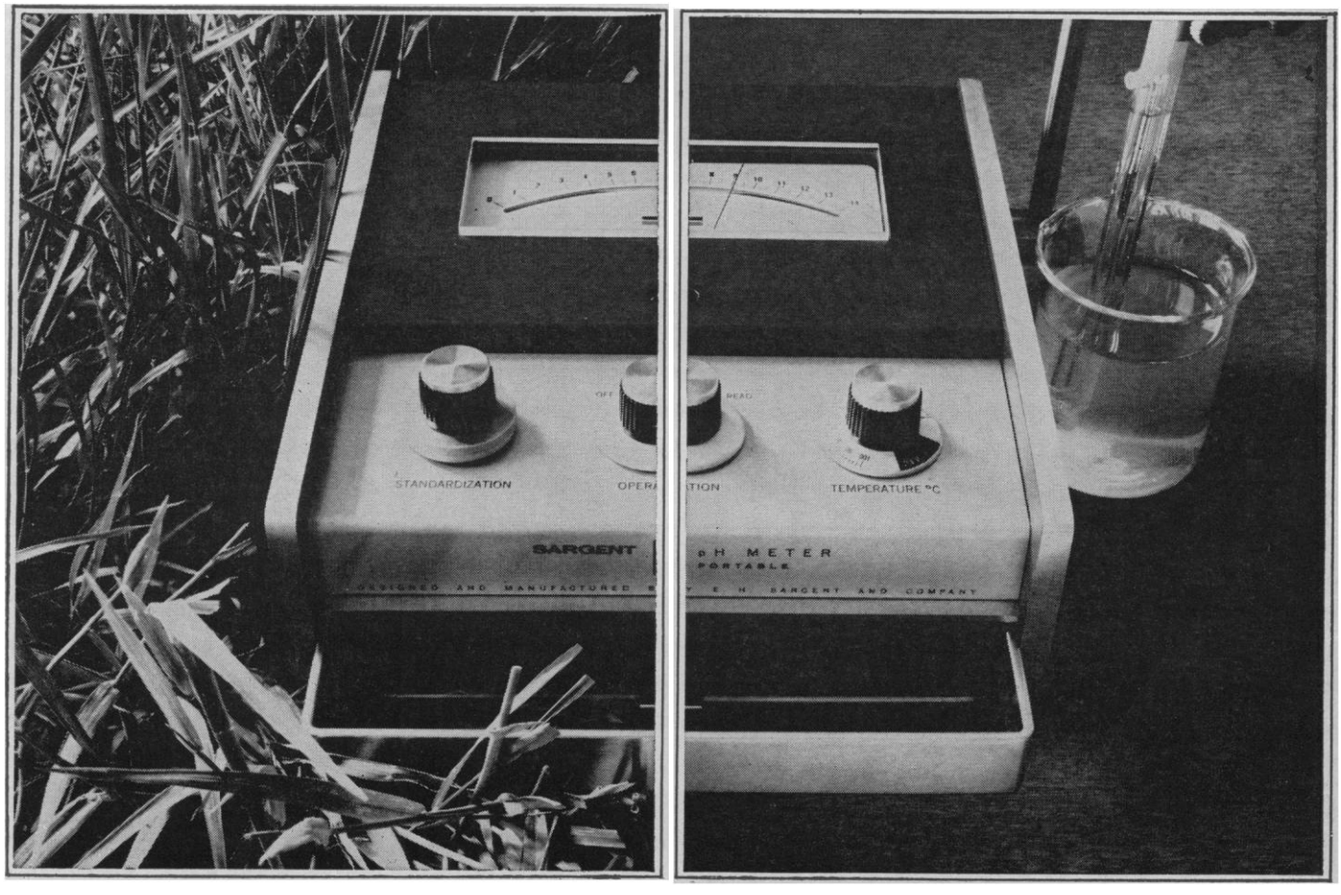

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communications as they relate to the patterns of associations and organization of cells into well defined structures. Dissociated skin cells of 8-day-old embryonic chicks, when placed in the chorioallantoic membrane, will form feathers. Older cells (12 to 14 days) will only form keratinized structures but no feathers. If skin cells are mixed with a heterologous population (liver, lung, kidney, or heart cells), the formation of feathers is completely suppressed, thus suggesting an incompatibility between different phenotypes. Moscona also studied interactions between cells of different genotypes, namely, skin cells of chicks and mice. When a mixture of skin cells (capable of forming hair follicles) from a 13-day-old mouse and embryos (capable of forming feathers) of 8-day-old chicks was placed in the chorioallantoic membrane, the following structures were produced: (i) feathers and hair follicles, (ii) sheets of cysts from either chick or mouse cells or chimeric mosaics with epidermal cells from both species, and (iii) feathers with mouse epidermal cells. On the other hand, chick epidermal cells never participated in hair follicle formation. When mouse epidermal cells (dermis removed by trypsinization) were mixed with total chick skin cells, their behavior was similar to that described previously. In addition, there were downgrowths of mouse epidermis attempting to form hair follicles which were associated with condensations of chick dermal cells, thus suggesting that induction was taking place with these genotypically different cells. When chick skin cells were mixed with epidermal or dermal mouse cells 13 days old, there was no interference with feather formation. However, if the mouse cells were older than 14 days, feather formation by the chick skin cells was suppressed. The author concluded that 14-day-old mouse skin cells have already established their phenotypic specificity so that they cannot participate in functions programmed in a different genotype.

The formation of interface materials during epithelial-mesenchymal interactions and their possible role in morphogenesis was discussed by Clifford Grobstein (University of California). When epithelia interact with mesenchyme through a Millipore filter, collagen fibers accumulate at the surface of the epithelium. Removal of the collagen fibers by collagenase seemed to interfere with epithelial morphogen-

esis. Autoradiographic data showed that the collagen was being synthesized by the mesenchyma. Further investigations on uptake of tritiated glucosamine showed that the epithelium was the site for synthesis of a mucopolysaccharide, susceptible to hyaluronidase digestion. The mucopolysaccharide probably participates in the process of fibrinogenesis at the surface of the epithelium. Thus, the data imply a two-way interaction between epithelia and mesenchyma in the formation of interface materials. Robert S. Hilfer (Temple University) described the interactions taking place between secretory and capsule cells in the thyroid of embryonic chicks. When 8-day-old epithelial thyroid cells are dissociated, spread in monolayer culture, and subsequently reaggregated, they fail to develop a canaliculate endoplasmic reticulum. Further, similarly treated older cells (18-day-old) lose their already organized endoplastic reticulum. However, if the reaggregation of spread thyroid epithelial cells (8 or 18 days old) are mixed with thyroid capsule cells, the epithelial cells develop into a normal thyroid pattern. This epithelial-mesenchymal interdependency seems to be specific since fibroblasts from the thyroid capsule cannot be substituted for fibroblasts from mesentery, heart, or perichondrium. This inductive effect of the thyroid mesenchyma also takes place through a Millipore filter.

Robert Auerbach (University of Wisconsin) discussed the interactions between the thymus gland, spleen, and bone marrow as they relate to lymphoid cell differentiation. Following sublethal irradiation of the spleen, its immunological reactivity can be restored by the thymus gland even if both tissues are separated by a Millipore filter. However, if a lethal dose of irradiation is given to the spleen, its immunological competence can only be restituted under both thymic and bone marrow inductive influences. It was also shown that when bone marrow is grown in vitro, lymphoid cells can only survive and proliferate if thymus tissue is added to the culture. This influence is also exerted through a Millipore filter. The same interdependency exists in the opposite direction; bone marrow influences lymphoid differentiation of the thymus gland. Moreover, the spleen may also exert a stimulatory effect on the lymphoid tissues of the thymus and bone marrow. The AKR mouse strain routinely develops lymphocytic leukemia at age 6 to 12 months. Prelim-

inary studies indicated that the thymus from the AKR mouse is more effective in stimulating lymphopoiesis in bone marrow than the thymus from nonleukemic lines (C_3H). Since mesenchymal influences are responsible for thymus lymphoid differentiation, Auerbach raises the question as to whether leukemogenic changes may have occurred through an inductive affect of altered mesenchymal cells.

Sister Muriel Lippman (Nazareth College) is primarily concerned with the effect of natural acidic glycosaminoglycans in cell division. In her earlier work, she showed that heparin reduces mitotic index and tumor growth in Ehrlich ascites carcinoma. Several acid mucopolysaccharides were tested for their ability to reduce growth of mouse L-cells in suspension cultures. All of them including hyaluronic acid, chondroitin sulfate, dermatan sulfate, heparitin sulfate, keratan sulfate and heparin acted as inhibitors of growth in varying degrees. Since most acid mucopolysaccharides in vivo are bound to a protein, a protein-polysaccharide complex (PP-L) obtained from bovine nasal cartilage was tested for its inhibitory effect on growth. The PP-L complex contains about 90 percent chondroitin-4-sulfate and about 10 percent of keratan sulfate. Both polysaccharides have marked inhibitory effects on growth. The results of this experiment were rather intriguing since the PP-L complex showed an initial marked stimulatory effect on growth rate, followed later by an inhibitory effect. Such results suggest that the protein fraction of the complex was already metabolized and let the free polysaccharide exert its inhibitory effect. Sister Lippman also showed that the polyanion polysaccharides are bound to the cell surface. In this regard, Ehrlich ascites cells treated with hyaluronic acid or heparin, and untreated controls, were injected into allogeneic or syngeneic hosts. While the untreated cells were promptly rejected, the treated ones developed into enormous tumors which metastasized and were transplantable. This suggests that the treated cells coated by the test material were not recognized as foreign by the host and consequently not rejected.

Ruppert E. Billingham (University of Pennsylvania) discussed the preservation of epithelial specificity through mesenchymal influences. A series of heterotypic recombination grafts from guinea pig skin (that is, epidermis from

Dissymmetries

LIGHT SCATTERING OF BIOPOLYMERS

Looking for a suitable topic for this column, we flipped through the subject index for the year 1966 (Vol. 5) of "Biochemistry," monthly journal published by the American Chemical Society. Under *Light scattering*, there were six papers mentioned, the authors, titles, and references of which were as follows:

(a) M. D. Stern (p. 2558), On the Estimation of Molecular Dimensions and Shape of Rigid, Asymmetric Macromolecules from Hydrodynamic Measurements.

(b) K. Banerjee and M. A. Lauffer (p. 1957), Polymerization—Depolymerization of Tobacco Mosaic Virus Protein. VI. Osmotic Pressure Studies of Early Stages of Polymerization.

(c) H. T. Miller and R. E. Feeney (p. 952), The Physical and Chemical Properties of an Immunological Cross-Reacting Protein from Avian Egg Whites.

(d) D. B. Millar and R. F. Steiner (p. 2289), The Effect of Environment on the Structure and Helix-Coil Transition of Soluble Ribonucleic Acid.

(e) P. S. Sarfare, G. Kegeles, and S. J. Kwon-Rhee (p. 1389), Relationship between Active Sites and Polymerization Sites in α-Chymotrypsin.

(f) E. Chiancone, M. S. Bruzzesi, and E. Antonini (p. 2823), Studies of Dextran and Dextran Derivatives. X. The Interaction of Dextran Sulfate with Lysozyme.

The first paper listed above deals with some theoretical aspects of the evaluation of the lengths of different models for the rigid asymmetric macromolecules. A comparison has been made with the lengths derived from the radius of gyration as measured by light scattering. Such a comparison offers a possibility of distinguishing between different models. Data for paramyosin, light meromyosin, tropomyosin B, and tobacco mosaic virus were discussed.

Paper (b) presents mostly the osmotic pressure results of the polymerization of the protein moiety of the tobacco mosaic virus. Some light scattering measurements by means of the transmittance technique were also made and compared with the osmotic pressure data.

The other four papers describe, among other information, the results of light scattering investigations, in all of which Brice-Phoenix light scattering photometers were used. In addition to the usual molecular weight determination, the interactions of biopolymers and small ions and molecules, as well as the interaction of biopolymers with other biopolymers were explored by means of light scattering. Miller and Feeney (c) of the Department of Food Science and Technology, University of Davis, California, found for the molecular weight of an immunologically cross-reacting macroglobulin in chicken egg white a value of approximately 8×10^6, in agreement with the value obtained from sedimentation-diffusion.

The influence of magnesium ion, neutral salt, and ribonucleotide concentration on the molecular weight of soluble ribonucleic acid (s-RNA) was studied in paper (d) by Millar and Steiner at the Naval Medical Research Institute, Bethesda, Md. s-RNA exhibits a polyelectrolyte behavior as evidenced by the effect of the ionic strength of the medium on the apparent molecular weight. A molecular weight (at infinite dilution) of about 23,000 to 25,000 is indicated. Magnesium ions cause an increase of the apparent molecular weight: s-RNA exists largely in associated form in 0.02 M Mg^{++} at concentrations greater than 2 mg./ml. and at 25°C.

Sarfare et al. (e) at Clark University, Worcester, Mass., investigated whether polymerization of α-chymotrypsin takes place via the active sites of the enzyme monomer units. To this effect, the dependence of the weight-average molecular weight was studied as a function of enzyme concentration in the presence of various amounts of β-phenylpropionate, a competitive inhibitor. The results have been compared with the predicted molecular weights computed for several models involving the existence of various distinct polymeric species. It was confirmed that the active sites were accessible regardless of the polymerization of the enzyme.

Finally, the interaction between two biopolymers were studied in paper (f) at the University of Rome. Since lysozyme carries a net positive charge at neutral pH and dextran sulfate is negatively charged, a strong interaction between the two was expected on electrostatic grounds. Depending on the conditions, both soluble and insoluble (precipitated) macromolecular complexes were formed. The tendency to precipitate increases at low ionic strength, pH and temperature. A quantitative evaluation of the results obtained for soluble complexes has been attempted on the basis of models involving a reversible association-dissociation equilibrium and different stoichiometric ratios.

If you would like reprints of the previous articles in this series as well as complete information on the instrumentation described in the above study, write **Phoenix Precision Instrument Co.**, 3803 N. 5th Street, Phila., Penna. 19140.

the ear combined with dermis from the sole) were transplanted to an appropriate host. Histologic examination of these combined grafts strongly suggested that epidermal specificity was determined by the underlying dermis. On the other hand, epithelia from mucosae (tongue or esophagus) retained its original characteristics when recombined with ear or sole dermis. However, when mucosal epithelium was recombined with trunk dermis, it acquired the characteristics of trunk epidermis. In order to study cytodifferentiation and morphogenetic potentials of epidermal cells in a nondermal mesenchymal environment, suspensions of epidermal cells were inoculated in muscle, spleen, and beneath the renal capsule. Histologic examination of these cellular implants revealed not only formation of epidermal cysts, but more complex structures. Sebaceous glands and hair follicles with papillae, surrounded by a connective tissue with a structure resembling that seen in the dermis, were noted.

The behavior of adult epidermal cells in vitro and in vivo, as it relates to organization, differentiation, and mitotic activity was reported by Eugene J. Van Scott (National Institutes of Health). Adult epidermal cells cultured in a suitable medium and placed in contact with a glass or plastic surface develop, after 2 to 3 weeks, an outgrowth of several layers with a distinct gradient of cell maturation. Mitotic activity was seen only in the first two lower layers of basal cells. The next three to four layers consisted of basal cells, whereas the uppermost layers, in contact with the nutrient medium, consisted of mature epidermal cells undergoing keratinization. Thus, adult epidermal cells in vitro can organize and differentiate (tonofibrils present) in the absence of connective tissue. However, in these experiments, keratohyaline granules and a stratum corneum did not develop. This study suggests that the connective tissue may play a role in promoting the full manifestation of epidermal cell behavior. The control of mitotic activity of the germinative cells in the hair follicles is determined by the surface area of the dermal papilla, since only those cells in contact with it divide. Keratinization or cell death takes place when a follicular cell is separated from the stroma by a distance of 100 microns. Further studies on the interdependency of the follicular epidermis and its corresponding papilla were re-

ported by Roy F. Oliver (University of Birmingham, England). He showed that implants of follicular epidermis from vibrissae, where the tubular arrangement was preserved, would regenerate a papilla and whisker while similar implants of flat follicular epidermis failed to do so. Thus, the spacial arrangement of follicular epidermal cells seemed to be a prerequisite for morphogenesis to take place. Transplantation of vibrissa dermal papillae to the upper half of vibrissae follicles induced whisker growth. However, induction of follicle or hair formation did not take place when epidermis from the ear (which contains hair follicles) or from afollicular scrotal sac epidermis were implanted into ear skin in proximity with vibrissa dermal papillae. Both types of epidermis did, however, become organized locally into "matrices" around the papillae. This lack of inductive effect may be due to several factors. The stimulating effect of the papillae was not intense enough; some epithelia are more refractory to dermal influences than others; and the effect of local dermal influence(s) at the site of implantation overrides the inductive properties of the vibrissa dermal papillae.

Clyde J. Dawe (National Institutes of Health) reported that the induction, in vitro, of tumors in salivary gland rudiments by polyoma virus, requires the presence of both epithelium and mesenchyma. If trypsin-isolated epithelial and mesenchymal components are exposed separately to the polyoma virus, neither component causes the development of tumors. The appearance of tumors in the salivary gland rudiments was accompanied by some morphogenetic changes of the epithelium. These experiments also revealed that tissue from polyoma-virus induced tumors is capable of supporting growth and normal adenomere formation of isolated salivary gland epithelium. It is not known whether this morphogenetic effect is due to the neoplastic or to the stromal components of the tumor.

Johannes Holtfreter (University of Rochester) and C. B. McLoughlyn (University College, London) were unable to attend the meeting but their contributions will be included in the publication of the full-length papers. The Williams and Wilkins Company will publish the proceedings.

RAUL FLEISCHMAJER
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Calendar of Events—October

National Meetings

1–4. **Neurosurgical** Soc. of America, New York, N.Y. (C. H. Davis, Jr., Bowman Gray School of Medicine, Winston-Salem, N.C. 27103)

1–4. Society of **Petroleum Engineers**, Houston, Tex. (J. B. Alford, 6200 N. Central Expressway, Dallas, Tex. 75206)

2–4. **Stochastic Optimization and Control** Procedures, mtg., Madison, Wis. (H. F. Karreman, Mathematics Research Center, Univ. of Wisconsin, Madison)

2–5. American **Petroleum** Inst., Div. of Refining, fall mtg., Dallas, Tex. (API, 1271 Avenue of the Americas, New York 10020)

2–5. American Soc. of **Photogrammetry**/Cong. on **Surveying and Mapping**, conv., St. Louis, Mo. (C. E. Palmer, 105 N. Virginia Ave., Falls Church, Va. 22046)

2–5. **Research Equipment and Instrument** Symp., 17th annual, Bethesda, Md. (J. B. Davis, Chief, SMB, NIH, Bldg. 12A, Room 4003, Bethesda 20014)

2–6. American College of **Surgeons**, Chicago, Ill. (J. P. North, 55 Erie St., Chicago 60611)

2–6. **Animal Care** Panel, 18th annual, Washington, D.C. (J. J. Garvey, Box 1028, Joliet, Ill. 60434)

2–6. National **Aeronautic and Space** Engineering and Manufacturing mtg., Los Angeles, Calif. (W. I. Marble, SAE, 485 Lexington Ave., New York 10017)

4–6. **Nuclear Metallurgy** Conf., Phoenix, Ariz. (K. E. Horton, Fuels and Materials Branch, Div. of Reactor Development and Technology, U.S. Atomic Energy Commission, Washington, D.C. 20545)

5–7. American **Ceramic** Soc., Bedford, Pa. (ACS, 4055 N. High St., Columbus, Ohio 43214)

8–13. **Electrochemical** Soc., fall mtg., Chicago, Ill. (E. G. Enck, 30 E. 42 St., New York 10017)

8–13. **Water Pollution Control** Federation, 40th annual conf., New York, N.Y. (R. E. Fuhrman, 3900 Wisconsin Ave., NW, Washington, D.C. 20016)

9–11. **Single-Cell Protein** Conf., Cambridge, Mass. (c/o Room 16-325 Massachusetts Inst. of Technology, Cambridge 02139)

9–11. Society of **Aerospace Material and Process Engineers**, 12th natl. symp., Orange County, Calif. (R. O. Burton, 12742 Elizabeth Way, Tustin, Calif.)

9–12. Association of Official **Analytical Chemists**, annual mtg., Washington, D.C. (L. G. Ensminger, Box 540, Benjamin Franklin Station, Washington 20044)

10–11. **Industrial Hygiene** Foundation, 32nd annual mtg., Pittsburgh, Pa. (R. T. de Treville, 4400 Fifth Ave., Pittsburgh 15213)

11–13. **Optical** Soc. of America, annual mtg., Detroit, Mich. (M. E. Warga, 1155 16th St., NW, Washington, D.C. 20036)

15–18. American **Oil Chemists** Soc., Chicago, Ill. (D. E. Weber, 35 E. Wacker Dr., Chicago 60601)

15–19. American Assoc. of **Medical Record Librarians**, annual mtg., Los Angeles, Calif. (M. Waterstraat, 211 E. Chicago Ave., Chicago, Ill. 60611)

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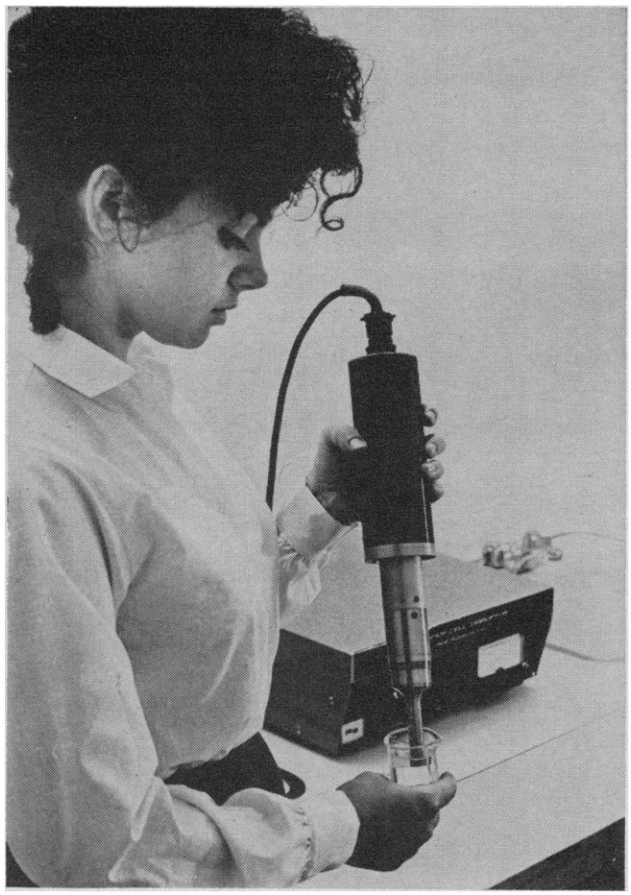

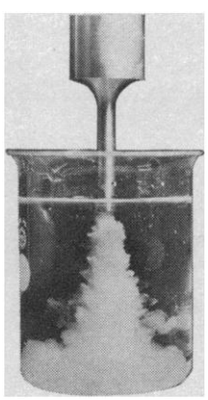

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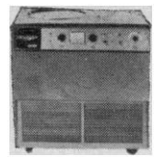

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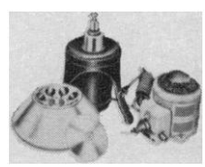

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16–17. **Systems Science and Cybernetics**, conf., Boston, Mass. (M. D. Rubin, Mitre Corp., Bedford, Mass.)

16–18. **Aerospace and Electronic** Systems, conv., Washington, D.C. (M. N. Abramovich, Washington Technical Consultants, 422 Washington Bldg., Washington 20005)

16–19. **Molecular Dynamics and Structure of Solids**, Gaithersburg, Md. (R. S. Carter, Inst. for Materials Research, National Bureau of Standards, Washington, D.C. 20234)

16–20. **Metallurgical** Soc., fall mtg., Cleveland, Ohio. (J. V. Richard, 345 E. 47 St., New York 10017)

16–20. American Soc. of **Civil Engineers**, annual mtg., and Water Resources, engineering conf., New York, N.Y. (W. H. Wisely, ASCE, 345 E. 47 St., New York 10017)

16–20. American Soc. for **Metals**, Cleveland, Ohio. (Meetings Manager, Metals Park, Ohio)

16–20. Society for **Non-Destructive Testing**, Cleveland, Ohio. (SN-DT, 914 Chicago Ave., Evanston, Ill. 60202)

18–20. **Exploding Wire Phenomenon**, 4th conf., Boston, Mass. (W. G. Chase, Air Force Cambridge Research Labs., L. G. Hanscom Field, Bedford, Mass. 01730)

18–22. American Soc. of **Clinical Hypnosis**, 10th annual scientific mtg., New York, N.Y. (F. D. Nowlin, 800 Washington Ave., SE, Minneapolis, Minn. 55414)

19–20. National **Fluid Power** Assoc., Chicago, Ill. (W. R. Smith, 3300 S. Federal St., Chicago 60616)

19–20. **Severe Local Storms**, conf., St. Louis, Mo. (K. C. Spengler, 45 Beacon St., Boston, Mass. 02108)

19–22. American Assoc. of **Textile Chemists and Colorists**, New Orleans, La. (G. P. Paine, AATCC, Box 12215, Research Triangle Park, N.C. 27709)

20–23. American **Heart** Assoc., 40th annual mtg., San Francisco, Calif. (AHA, 44 E. 23 St., New York 10010)

21–23. American Soc. of **Cytology**, Denver, Colo. (W. R. Lang, 1025 Walnut St., Philadelphia, Pa. 19107)

21–26. American Acad. of **Pediatrics**, annual mtg., Washington, D.C. (R. G. Frazier, 1801 Hinman Ave., Evanston, Ill. 60204)

22–26. American **Documentation** Inst., New York, N.Y. (J. E. Bryan, 2000 P St., NW, Washington, D.C. 20036)

22–26. American Soc. of **Sanitary Engineering**, annual mtg., Boston, Mass. (S. Schwartz, 228 Standard Bldg., Cleveland, Ohio 44113)

23–24. American College of **Preventive Medicine**, annual mtg., Miami, Fla. (J. J. Wright, Box 1263, Chapel Hill, N.C. 27514)

23–25. National **Electronics** Conf., Chicago, Ill. (R. J. Napolitan, 228 N. LaSalle St., Chicago 60601)

23–25. Society of **Rheology**, 38th annual mtg., Washington, D.C. (J. C. Miller, Plastics Div., Union Carbide, Bound Brook, N.J.)

23–26. American **Vacuum** Soc., 14th natl. mtg., Kansas City, Mo. (P. J. Bryant, Midwest Research Inst., 425 Volker Bldg., Kansas City, Mo. 64110)

23–27. American Inst. of **Aeronautics and Astronautics**, 4th annual mtg., Anaheim, Calif. (Meetings Manager, AIAA, 1290 Sixth Ave., New York 10019)

23–27. American **Public Health** Assoc., 95th annual mtg., Miami Beach, Fla. (B. F. Mattison, 1790 Broadway, New York 10019)

25–27. **Antimicrobial Agents and Chemotherapy**, 7th interscience conf., Chicago, Ill. (R. W. Sarber, 115 Huron View Blvd., Ann Arbor, Mich.)

25–27. **Graphics Arts**, 4th conf., Rochester, N.Y. (K. G. Chesley, TAPPI, 360 Lexington Ave., New York 10017)

25–27. Gulf Coast Assoc. of **Geological** Socs./American Assoc. of **Petroleum Geologists**, San Antonio, Tex. (A. M Borland, Sun Oil Co., Box 3308, Lafayette, La.)

25–28. American Acad. of **Periodontology**, 53rd annual mtg., Washington, D.C. (R. G. Keses, 211 E. Chicago Ave., Chicago, Ill. 60611)

25–28. Congress of **Neurological Surgeons**, 17th annual mtg., San Francisco, Calif. (J. M. Thompson, 1955 Blossom Way S, St. Petersburg, Fla. 33712)

26–27. **Planetology and Space Mission Planning**, New York, N.Y. (R. D. Enzmann, 29 Adams St., Lexington, Mass.)

26–28. Unconventional **Photographic Systems**, symp., Washington, D.C. (H. J. Hall, 10 Maguire Rd., Lexington, Mass.)

27–28. American Soc. of **Ophthalmologic and Otorhinolaryngologic Allergy**, annual mtg., Chicago, Ill. (L. El. Morrision, 603 Hume Mansur Bldg., Indianapolis, Ind.)

26–29. **Photographic Interaction between Radiation and Matter**, colloquium, Washington, D.C. (Society of Photographic Scientists and Engineers, 1330 Massachusetts Ave., NW, Washington 20005)

28–2. American **Fracture** Assoc., annual mtg., Chicago, Ill. (H. W. Wellmerling, 610 Griesheim Bldg., Bloomington, Ill. 61701)

29–1. Association for **Research in Ophthalmology**, annual mtg., Chicago, Ill. (Secretary-Treasurer, Univ. of Florida, College of Medicine, Gainesville 32603)

29–4. American College of **Gastroenterology**, 32nd annual conv., Los Angeles, Calif. (D. Weiss, 33 W. 60 St., New York 10023)

30–2. American **Dental** Assoc., 108th annual mtg., Washington, D.C. (H. Hillenbrand, 211 E. Chicago Ave., Chicago, Ill. 60611)

30–2. **Nuclear Science**, 14th symp., Los Angeles, Calif. (R. E. Emberson, 345 E. 47 St., New York 10017)

31–2. **Numercial Prediction**, conf. Monterey, Calif. (K. C. Spengler, 45 Beacon St., Boston, Mass. 02108)

31–3. Society for **Experimental Stress Analysis**, annual mtg., Chicago, Ill. (B. E. Rossi, 21 Bridge Sq. Westport, Conn. 06880)

International and Foreign Meetings

1–4. Gondwana **Stratigraphy and Paleontology**, 1st intern. symp., Mar del Plata, Argentina. (Secretario, L Simposio Internacional Sobre Estratifrafia y Paleontologia del Gondwana, Casilla de Correo 5483, Buenos Aires, Argentina)

1–6. World Federation for **Mental**

Health, 20th annual mtg., Los Angeles, Calif. (Administrative Headquarters, 1, rue Gevray, Geneva, Switzerland)

1–14. Field Symp. on the **Granites** of Northeastern Brazil and Their Comparison with Those of West Africa, Recife, Brazil. (J. Lombard, 12, rue de Bourgogne, Paris 7, France)

2–5. **Standardization of Pharmaceutical Preparations**, 3rd intern. cong., Halle an der Saale, Germany. (Sekretariat, Pharmazeutische Gesellschaft in der D.D.R., Weinbergweg., X-402 Halle an der Saale)

2–6. **Disease Epidemiology**, Forecasting and Losses, conf., Rome, Italy. (International Agency Liaison Branch, Office of the Director General, Food and Agricultural Organization, Via Delle Terme di Caracalla, Rome)

2–6. Scientific Society for **Air and Space Travel**/German Soc. for **Rocket Technology** and Space Travel, annual mtg., Karlsruhe, Germany. (Wissenschaftliche Gesellschaft fur Luft- und Raumfahrt, Martinstr. 40-42, 5 Cologne, Germany)

3–5. International Conf. on **Hydraulic Research**, Brno, Czechoslovakia. (Vysoke Uceni Technicke, Fakulta Stavebni Vedeco Vyzkumny Ustav, Vodniho Stavitelstvi A Hospodarstvi, Rekreacni 1, Brno 35)

3–6. **Psychiatric Problems during Puberty**, symp., Rostock, Germany. (O. Kucera, Nam. Sv. Ceca 13, Prague 10-Vrsovice, Czechoslovakia)

3–7. **Tuberculosis**, 19th intern. conf., Amsterdam, Netherlands. (J. Meijer, Postbus 146, The Hague, Netherlands)

4–6. **Ultrasonics** Symp., Vancouver, B.C., Canada. (B. A. Auld, W. W. Hansen, Labs. of Physics, Stanford Univ., Stanford, Calif. 94305)

4–9. International Academy of **Legal Medicine and of Social Medicine**, 7th cong., Budapest, Hungary. (M. Helpern, 520 First Ave., New York 10016)

5–7. **Protection of Seacoasts against Pollution**, symp., Hamburg, Germany. (L. R. Alldredge, ESSA/IER, Inst. for Earth Sciences, Boulder, Colo. 80302)

8–13. International Congr. of **Plastic Surgery**, Rome, Italy. (G. Francesconi, Via Lamaramora 10, Milan, Italy)

9–11. **Industrial Research** Inst., fall mtg., Quebec, Canada. (G. W. McBride, 100 Park Ave., New York 10017)

11–13. **Hot Atom Chemistry**, intern. mtg., Kyoto, Japan. (N. Saito, Dept. of Chemistry, Univ. of Tokyo, Bunkyo-Ku, Tokyo, Japan)

12–13. **Forest Biology**, conf., Montreal, Canada. (K. G. Chesley, TAPPI, 360 Lexington Ave., New York 10017)

12–13. **Selenium and Tellurium**, intern. symp., Montreal, Canada. (Selenium Tellurium Development Assoc., 11 Broadway, New York 10004)

12–15. **Communications**, 15th intern. congr., Genoa, Italy. (Secretary, Instituto Internazionale Delle Comunicazioni, Viale Brigate Partifiane, 18, Genoa)

13–14. **Neuroendocrinology**, intern. symp., Paris, France. (H. P. Klotz, Hopital Beaujon, 100, Boulevard du General-Leclerc, 92-Clichy, France)

15–19. Society of American **Foresters**, 67th annual mtg., Ottawa, Canada. (Y. W. Rainer, 1010 16th St., NW, Washington, D.C. 20036)

16–18. Canadian **Chemical Engineering**,

conf., Niagara Falls, Ont., Canada. (T. H. G. Michael, 151 Slater St., Ottawa 4, Ont., Canada)

16–18. International **Scientific Radio** Union/Inst. of **Electrical Engineers**, fall mtg., Ann Arbor, Mich. (J. Hannaum, USNC-URSI, 2101 Constitution Ave., NW, Washington, D.C. 20418)

16–19. **Continental Drift** Emphasizing the History of the South Atlantic Area, Montevideo, Uruguay. (J. Garrido, Latin American Science Cooperation Office, UNESCO, P.O. Box 859, Montevideo)

17–20. Action Mechanism and Metabolism of **Psychoactive Drugs** Derived from Phenothiazine and Structurally Related Compounds, 2nd intern. symp., Paris, France. (B. Weber, Laboratoire d'Eutonologie, Hopital Boucicaut, 78, rue de la Convention, Paris 15)

18–20. **Electron Devices**, intern. mtg., Washington, D.C. (Group on Electron Devices, Inst. of Electrical and Electronics Engineers, 345 E. 47 St., New York 10017)

22–27. **Mining and Groundwater Geophysics**, conf., Niagara Falls, Ont., Canada. (L. W. Morley, Geological Survey of Canada, 601 Booth St., Ottawa, Ont., Canada)

22–29. **Stable Isotopes**, 5th symp., Leipzig, Germany. (J. Muhlenpfordt, Inst. fur Stabile Isotope, Deutsche Akademie der Wissenschaften zu Berlin, Permoserstr. 15, 705 Leipzig)

24–25. **High Polymers**, conf., Leipzig, Germany. (Kammer der Technik, Clara-Zetkinstr. 115/117, Leipzig)

25–27. **Potency Control of Vaccines**, symp., London, England. (J. P. R. Toothill, c/o Glaxo Research Ltd., Greenford, Middlesex, England)

25–28. International Union of the **Medical Press**, 8th congr., Prague, Czechoslovakia. (M. Zdenek, Capajevovo Nam. 9, Prague)

26–28. American Acad. of **Implant Dentures**, 16th annual mtg., Washington, D.C. (R. L. Bodine, School of Dentistry, University of Puerto Rico, San Juan 00905)

29–2. Society of **Exploration Geophysicists**, 37th annual intern. mtg., Oklahoma City, Okla. (H. Breck, Box 1067, Tulsa, Okla. 74101)

30–31. Therapy of **Portal Hypertension**, intern. symp., Bad Ragaz, Switzerland. (N. Markoff, c/o Medizinische Klink, Kantonspital, Chur, Switzerland)

30–2. Physics and Related Safety Problems of **Fast Reactors**, Karlsruhe, Germany. (International Atomic Energy Agency, Karnter Ring 11, Vienna 1, Austria)

30–4. Social Effects of **Alcoholism**, intern. conf., Cardiff, United Kingdom. (A. Tongue, Case Postale 140, 1001-Lausanne, Switzerland)

31–4. Latin American Congr. on **Allergology**, 2nd, Quito, Ecuador. (P. Naranjo, Casilla 2339, Quito)

November

1–3. International Federation for **Information Processing**, Mexico, D.F. (J. G. MacKarness, c/o British Computer Soc., Finsbury Court, Finsbury Pavement, London, E.C.1, England)

4–12. **Industrial Chemistry**, 37th intern. congr., Madrid, Spain. (Organizing Committee, Jose Antonio 15, Madrid)

BOOKS RECEIVED

(Continued from page 1428)

Crop Responses to Water at Different Stages of Growth. P. J. Salter and J. E. Goode. Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England, 1967. 256 pp. Illus. $6.80.

The Depth of Cold. A. R. Meetham. Barnes and Noble, New York, 1967. 173 pp. Illus. $4.75.

Design of Active-Site-Directed Irreversible Enzyme Inhibitors. B. R. Baker, Wiley, New York, 1967. 341 pp. Illus. $13.50.

Design of Digital Computers: An Introduction. Hans W. Gschwind. Springer-Verlag, New York, 1967. 538 pp. Illus. $19.80.

Diabetes mellitus: Theorie-Klinik-Therapie. G. Mohnike, Ed. Verlag Volk und Gesundheit, Berlin, 1967. 437 pp. Illus. MDN 34.90. Thirty-five papers.

Dialogues on Mathematics. Alfréd Rényi. Holden-Day, San Francisco, 1967. 106 pp. Illus. Paper, $2.50; cloth, $4.95.

A Dictionary of Geography. W. G. Moore. Praeger, New York, 1967. 254 pp. Illus. $5.50.

A Dictionary of Geology. John Challinor. Univ. of Wales Press, Cardiff; Oxford Univ. Press, New York, ed. 3, 1967. 314 pp. Illus. $6.75.

Discovering Rocks and Minerals: A Nature and Science Guide to Their Collection and Identification. Roy A. Gallant and Christopher J. Schuberth. Published for the American Museum of Natural History. Natural History Press, Garden City, N.Y., 1967. 127 pp. Illus. $3.95.

Earth Photographs from Gemini III, IV, and V. Natl. Aeronautics and Space Administration, Washington, D.C., 1967 (order from Superintendent of Documents, Washington, D.C.). 276 pp. Illus. $7.

Education and Social Crisis. Perspectives on teaching disadvantaged youth. Everett T. Keach, Jr., Robert Fulton, and William E. Gardner, Eds. Wiley, New York, 1967. 427 pp. Illus. Paper, $4.95; cloth, $7.95. Forty-nine papers.

Electrochemistry of Semiconductors. Viktor A. Myamlin and Yurii V. Pleskov. Translated from the Russian edition (Moscow, 1965). Plenum Press, New York, 1967. 454 pp. Illus. $19.50.

Electronic Absorption Spectra and Geometry of Organic Molecules. An application of molecular orbital theory. Hiroshi Suzuki. Academic Press, New York, 1967. 582 pp. Illus. $24.

Electronic Counting Circuits. J. B. Dance. Iliffe, London, 1967. 390 pp. Illus. $16.75.

Electronics for Biologists. Franklin F. Offner. McGraw-Hill, New York, 1967. 197 pp. Illus. $6.95.

Elementary Particle Physics. Stephen Gasiorowicz. Wiley, New York, 1966. 635 pp. Illus. $14.95.

Elementary Theory of Metals. B. Donovan. Pergamon, New York, 1967. 273 pp. Illus. $13.50. International Encyclopedia of Physical Chemistry and Chemical Physics.

The Elements of Physics: A New Approach. F. A. Kaempffer. Blaisdell (Ginn), Waltham, Mass., 1967. 303 pp. Illus. $8.50.

Eleventh Symposium (International) on Combustion (Berkeley, Calif.), August 1966. Organized by the Combustion Institute. Combustion Institute, Pittsburgh, Pa., 1967. 1224 pp. Illus. $42. There are 117 papers.

The Empty Ark. Philip Kingsland Crowe. Scribner, New York, 1967. 319 pp. Illus. $7.50. An account of three journeys in search of vanishing wildlife undertaken on behalf of the World Wildlife Fund.

Encyclopaedic Dictionary of Physics. Suppl. vol. 2. J. Thewlis, Ed. Pergamon, New York, 1967. 463 pp. Illus. $25.

Encyclopedia of Chemical Technology. vol. 12, *Iron to Manganese.* Herman F. Mark, John J. McKetta, Jr., and Donald F. Othmer, Eds. Interscience (Wiley), New York, ed. 2, 1967. 919 pp. Illus. $50.

Encyclopedia of Polymer Science and Technology. vol. 6, *Enzymes to Finishing.* Herman F. Mark, Norman G. Gaylord, and Norbert M. Bikales, Eds. Interscience (Wiley), New York, 1967. 832 pp. Illus. $50.

L'Endocrinologie des Vers et des Mollusques. Maurice Durchon. Masson, Paris, 1967. 249 pp. Illus. Paper, 60 F.

Engineering: An Introduction to a Creative Profession. George C. Beakley and H. W. Leach. Macmillan, New York, 1967. 560 pp. Illus. $9.95.

Engineering Manual. Robert H. Perry, Ed. McGraw-Hill, New York, ed. 2, 1967. Unpaged. Illus. $11.75.

Entropy and Low Temperature Physics. J. S. Dugdale. Hillary House, New York, 1967. 206 pp. Illus. $6.

Environmental Perception and Behavior. A symposium (Columbus, Ohio), April 1965. David Lowenthal, Ed. Department of Geography, Univ. of Chicago, Chicago, 1967. 94 pp. Illus. Paper, $4. Five papers.

Epidemic Disease in Mexico City, 1761–1813: An Administrative, Social, and Medical Study. Donald B. Cooper. Published for the Institute of Latin American Studies. Univ. of Texas Press, Austin, 1967. 250 pp. $6.

Essays in Biosynthesis and Microbial Development. John D. Bu'Lock. Wiley, New York, 1967. 83 pp. Illus. $5.95. E. R. Squibb Lectures on Chemistry of Microbial Products.

Ethnographic Atlas. George Peter Murdock. Univ. of Pittsburgh Press, Pittsburgh, 1967. 134 pp. $4.95.

Evolution and Human Behavior. Alexander Alland, Jr. Published for the American Museum of Natural History. Natural History Press, Garden City, N.Y., 1967. 259 pp. Illus. Paper, $1.45; cloth, $5.95.

Evolution of the Forebrain: Phylogenesis and Ontogenesis of the Forebrain. A symposium (Frankfurt and Sprendlingen, Germany), August 1965. R. Hassler and H. Stephan, Eds. Thieme, Stuttgart, 1966; Plenum, New York, 1967. 472 pp. Illus. $28.

The Evolution of the Microscope. S. Bradbury. Pergamon, New York, 1967. 367 pp. Illus. $12.50.

Experiments in Second-Language Learning. Edward Crothers and Patrick Suppes. Academic Press, New York, 1967. 384 pp. Illus. $13.50.

Fertilization: Comparative Morphology, Biochemistry, and Immunology. vol. 1.

Charles B. Metz and Alberto Monroy, Eds. Academic Press, New York, 1967. 503 pp. Illus. $19. Nine papers.

Fiber Optics: Principles and Applications. N. S. Kapany. Academic Press, New York, 1967. 447 pp. Illus. $17.50.

536 Puzzles and Curious Problems. Henry Ernest Dudeney. Scribner, New York, 1967. 442 pp. Illus. $7.95.

Fortschritte der Zoologie. vol. 18, pt. 2. Hans Bauer and Gerhard Czihak, Eds. Fischer, Stuttgart, 1967. 336 pp. Illus. Paper. Four papers.

Friction and Lubrication. F. P. Bowden and D. Tabor. Methuen, London; Barnes and Noble, New York, 1967. 178 pp. Illus. $3.75. Methuen's Monographs on Physical Subjects.

The Genetic Analysis of Behaviour. P. A. Parsons. Methuen, London; Barnes and Noble, New York, 1967. 184 pp. Illus. $4.50.

The Geography of Frontiers and Boundaries. J. R. V. Prescott. Aldine, Chicago, 1967. 190 pp. Illus. Paper, $2.45. Reprint, 1965 edition.

Geography of Religions. David E. Sopher. Prentice-Hall, Englewood Cliffs, N.J., 1967. 128 pp. Illus. Paper, $1.95; cloth, $4.50. Foundations of Cultural Geography Series.

The Geography of Soil. Brian T. Bunting. Aldine, Chicago, 1967. 213 pp. Illus. Paper, $2.45. Reprint, 1965 edition.

The Geology of Carbonatites. E. W. Heinrich. Rand McNally, Chicago, 1967. 621 pp. Illus. $10.

Guide to Fluorescence Literature. Richard A. Passwater. Plenum Press, New York, 1967. 375 pp. $19.50.

A Guide to the Laser. David Fishlock, Ed. Elsevier, New York, 1967. 174 pp. Illus. $8.50. Eleven papers.

Edmond Halley. Angus Armitage. Nelson, London, 1966. 232 pp. Illus. 42s.

Hamilton's Principle and Physical Systems. B. R. Gossick. Academic Press, New York, 1967. 261 pp. Illus. $8.50.

Handbook of Telemetry and Remote Control. Elliot L. Gruenberg, Ed. McGraw-Hill, New York, 1967. Unpaged. Illus. $35.

Histologie und Zytologie des Menschen: Einführung für Ärzte und Studenten. H. Leonhardt. Thieme, Stuttgart, 1967. 415 pp. Illus. DM. 10.80.

An International Bibliography: Water Resources Development, 1950–1965. Compiled by H. Wellisch. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1967. 139 pp. Paper, $8.50.

International Review of Cytology. vol. 21. G. H. Bourne and J. F. Danielli, Eds. Academic Press, New York, 1967. 400 pp. Illus. $18. Seven papers.

Introduction to Creative Design. D. Henry Edel, Jr., Ed. Prentice-Hall, Englewood Cliffs, N.J., 1967. 251 pp. Illus. Paper, $3.95; cloth, $6.95.

Introduction to Dynamic Systems. James B. Reswick and Charles K. Taft. Prentice-Hall, Englewood Cliffs, N.J., 1967. 304 pp. Illus. $8.95. Prentice-Hall Series in Engineering of the Physical Sciences.

Introduction to Experimental Ecology. T. Lewis and L. R. Taylor. Academic Press, New York, 1967. 413 pp. Illus. $6.50.

Introduction to Linear Algebra. Peter J. Kahn. Harper and Row, New York, 1967. 464 pp. Illus. $11.95. Harper's Series in Modern Mathematics.

Introduction to the Quantum Theory of Scattering. Leonard S. Rodberg and R. M. Thaler. Academic Press, New York, 1967. 412 pp. Illus. $11.50.

Invertebrate Nervous Systems: Their Significance for Mammalian Neurophysiology. A conference (Pasadena, Calif.), January 1966. C. A. G. Wiersma, Ed. Univ. of Chicago Press, Chicago, 1967. 380 pp. Illus. $10. Twenty-seven papers.

Laboratory Manual of General Ecology. George W. Cox. Brown, Dubuque, Iowa, 1967. 175 pp. Illus. Paper, $3.75.

Landmarks of the Western Heritage. vol. 2, *1715 to the Present*. C. Warren Hollister, Ed. Wiley, New York, 1967. 528 pp. Illus. Paper, $4.95; cloth, $7.95.

The Larousse Encyclopedia of Animal Life. Foreword by Robert Cushman Murphy. McGraw-Hill, New York, 1967. 640 pp. Illus. $22.50 until 31 December; thereafter $25.

List Processing. J. M. Foster. Elsevier, New York, 1967. 60 pp. Illus. $4.50.

Low Noise Electronics. W. P. Jolly. Elsevier, New York, 1967. 159 pp. Illus. $5. Introductory Science Texts.

MAA Studies in Mathematics. vol. 4, *Studies in Global Geometry and Analysis*. S. S. Chern, Ed. Published by the Mathematical Association of America. Prentice-Hall, Englewood Cliffs, N.J., 1967. 205 pp. Illus. $4.

Management Systems. Peter P. Schoderbek. Wiley, New York, 1967. 495 pp. Illus. $10.95. Wiley Series in Management and Administration.

Mathematics and Computing: with FORTRAN Programming. William S. Dorn and Herbert J. Greenberg. Wiley, New York, 1967. 613 pp. Illus. $8.95.

The Meaning of Crystallinity in Polymers. American Chemical Society Symposium (Phoenix, Ariz.), January 1966. Fraser P. Price, Ed. Interscience (Wiley), New York, 1967. 155 pp. Illus. Paper, $6.50. *Journal of Polymer Science*, No. 18, pt. C, Polymer Symposia.

Mechanisms for Engineering Design. S. B. Tuttle. Wiley, New York, 1967. 188 pp. Illus. $9.95.

Mechanisms of Inorganic Reactions: A Study of Metal Complexes in Solution. Fred Basolo and Ralph G. Pearson. Wiley, New York, ed. 2, 1967. 715 pp. Illus. $17.95.

Methods of Contour Integration. M. L. Rasulov. Translated by Scripta Technica. North-Holland, Amsterdam; Interscience (Wiley), New York, 1967. 453 pp. Illus. $19. North-Holland Series in Applied Mathematics and Mechanics, vol. 3.

Molecular Basis of Some Aspects of Mental Activity. vols. 1 and 2. Proceedings of a NATO Advanced Study Institute (Drammen, Norway), August 1965. Otto Walaas, Ed. Academic Press, New York, 1966. vol. 1, 492 pp., $19.50; vol. 2, 533 pp., $21.50. Illus. Fifty-eight papers.

Morphogenesis of the Vertebrates. Theodore W. Torrey. Wiley, New York, ed. 2, 1967. 460 pp. Illus. $10.95.

The Next Ninety Years. Proceedings of a conference (Pasadena, Calif.) March 1967. California Inst. of Technology, Pas-