

SCIENCE

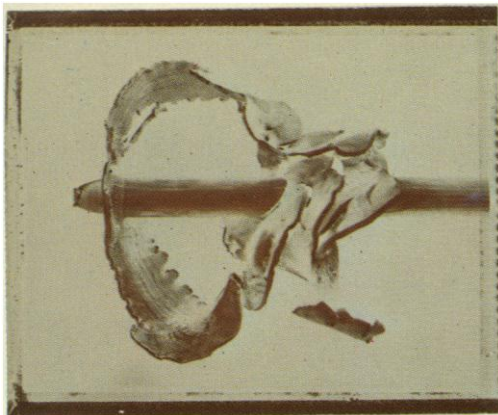
24 September 1971

Vol. 173, No. 4003

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



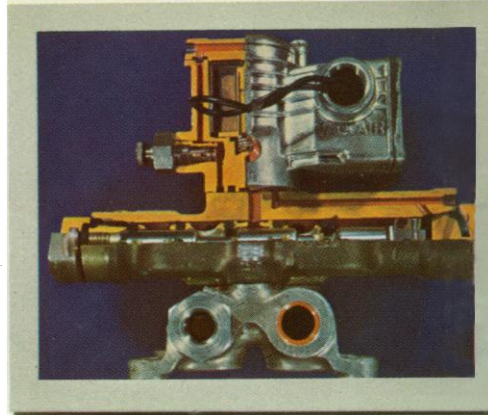
Index Issue



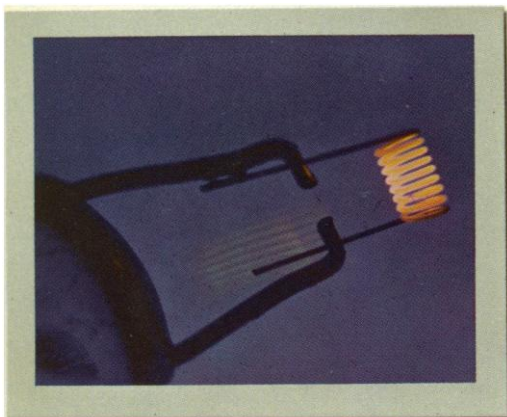
Tensile fracture of copper wire (negative).



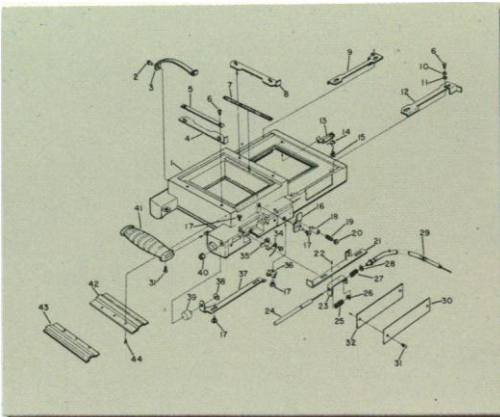
Photomicrograph of p-Nitrophenol crystals.



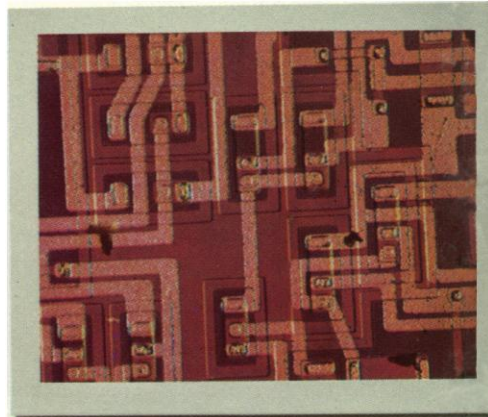
Record of prototype design.



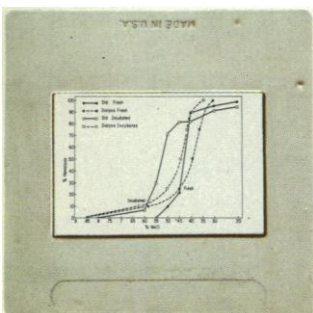
Macro photograph (10X) of glowing lamp filament.



Reduction copy of engineering drawing.



Photomicrograph of integrated circuit.



35mm slide from chart.

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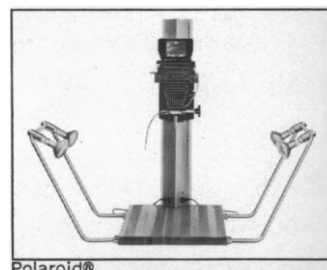
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24 September 1971

Vol. 173, No. 4003

SCIENCE

LETTERS	An Unexpected Nuclear Spin-Off: <i>D. E. Abrahamson</i> ; Pet Cats and Pollutants: <i>W. P. Priester</i> ; Complementarity: <i>W. R. Dickinson</i> ; <i>H. Elias</i> ; <i>P. R. Gould</i> ; <i>W. M. Elsasser</i> ; <i>T. R. Blackburn</i> ; Artichokes: <i>W. M. Woods</i> ; Reciprocity: <i>R. G. Glaser</i>	1191
EDITORIAL	Open Admissions: The Real Issue: <i>A. W. Astin</i>	1197
ARTICLES	Dental Caries: Prospects for Prevention: <i>H. W. Scherp</i>	1199
	Perception of Changes in Certain Exteroceptive Stimuli: <i>J. M. Notterman</i> , <i>R. D. L. Filion</i> , <i>F. J. Mandriota</i>	1206
	The Scientific Advisory System: Some Observations: <i>M. L. Perl</i>	1211
NEWS AND COMMENT	Administration Talent Search: Alternatives to the Buddy System	1216
	ACS: Disgruntled Chemists Seek New Activism from an Old Society	1218
	Race for Human Cancer Virus: Odds against Houston Team Lengthen	1220
RESEARCH TOPICS	Partons: New Fundamental Particles in the Nucleons	1223
BOOK REVIEWS	<i>Physics of Hot Plasmas</i> , reviewed by <i>D. Montgomery</i> ; other reviews by <i>C. L. Maier</i> , <i>N. O. Kaplan</i> , <i>L. Leyton</i> ; Books Received	1225
REPORTS	Interstitial Silica and pH in Marine Sediments: Some Effects of Sampling Procedures: <i>K. A. Fanning</i> and <i>M. E. Q. Pilson</i>	1228
	Infrared Rainbow: <i>R. G. Greenler</i>	1231

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Explosion Effects and Earthquakes in the Amchitka Island Region: <i>F. R. Engdahl</i>	1232
Ages of Crystalline Rocks from Fra Mauro: <i>L. Husain, J. F. Sutter, O. A. Schaeffer</i>	1235
Xenon as a Nucleophile in Gas-Phase Displacement Reactions: Formation of the Methyl Xenonium Ion: <i>D. Holtz and J. L. Beauchamp</i>	1237
Antiprismatic Coordination about Xenon: The Structure of Nitrosonium Octafluoroxenate(VI): <i>S. W. Peterson et al.</i>	1238
Temporal Synergism of Corticosterone and Prolactin Controlling Gonadal Growth in Sparrows: <i>A. H. Meier, D. D. Martin, R. MacGregor, III</i>	1240
Thyroxine: Conversion to Triiodothyronine by Isolated Perfused Rat Heart: <i>J. L. Rabinowitz, E. S. Hercker</i>	1242
Nonencapsidated Infectious DNA of Adeno-Satellite Virus in Cells Coinfected with Herpesvirus: <i>D. W. Boucher, J. L. Melnick, H. D. Mayor</i>	1243
Linkage of Genes Controlling the Rate of Synthesis and Structure of Aminolevulinate Dehydratase: <i>D. L. Coleman</i>	1245
Metachronal Limb Movements by <i>Artemia salina</i> : Synchrony of Male and Female during Coupling: <i>C. M. Lent</i>	1247
Auditory Evoked Potentials during Speech Perception: <i>C. C. Wood, W. R. Goff, R. S. Day</i>	1248
Technical Comments: Polywater: <i>L. C. Allen; J. Donohue</i>	1252

ASSOCIATION AFFAIRS	Man-Machine Interactions and Their Implications for Society: <i>C. Sandler</i> ; Can We Develop an Index for Quality of Life?: <i>S. F. Singer</i> ; Engineering—For the Survival of Man: <i>T. T. Reboul</i>	1253
----------------------------	---	------

MEETINGS	Brain, Genetics, and Behavior: <i>G. S. Omenn and A. G. Motulsky</i>	1255
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COVER

Infrared rainbow. Photograph was taken with infrared sensitive film and filters which exclude all visible light. See page 1231. [R. G. Greenler, University of Wisconsin, Milwaukee]

The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

Some things are changing for the better..



Whatever your job, here's a calculator that speaks your language. You can customize its keyboard, memory size, display, programs and peripherals to suit your number-crunching tasks.

Many people know us as an instrument manufacturer: we make more than 2,000 products for measurement, test and analysis. Others know us as a computer company: more than 10,000 own our programmable calculators and computers. We prefer to think that our business is to serve measurement, analysis and computation needs . . . in science, industry, medicine and education. This is the rationale behind every new instrument, computer or system that we tell you about in these ads. This month:

For picky people with particular problems: A design-your-own calculator

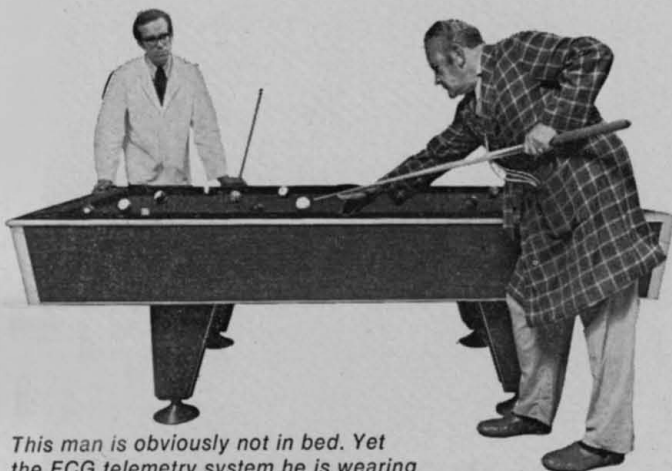
A user in virtually any discipline now can customize a powerful new programmable calculator to his specific computational needs.

An agronomist, for example, may want to examine the characteristics of a large plant population and determine the mean, standard deviation and standard error of their distribution. With the Model 10, he simply enters the raw data and hits a

single key for the complete statistical analysis. A chromatographer can obtain per cent concentration and relative retention time of each component on his chromatogram . . . at a single keystroke. A physicist completes a sequence of acceleration, velocity, force and work . . . and a clinical pathologist computes a full blood gas analysis . . . at a single keystroke. Et cetera.

This is possible because the new Model 10 calculator has interchangeable function blocks which can define its keyboard to meet varying needs. One standard plug-in block emphasizes powerful statistical computations, another gives higher mathematics capability, and the third is completely user-definable. This block provides single keystroke solutions to multiple-step calculations commonly encountered by the user. Once programmed each key performs its customized function whenever he strikes it.

For more on tailoring the \$2,975 Model 10 to your particular profession (full alphanumeric printing capability, expandable memory, a wide line of peripherals, etc.) write for our brochure.



This man is obviously not in bed. Yet the ECG telemetry system he is wearing enables nurses at a central monitoring station to keep close watch on his heart action.

Freedom with protection for the post-coronary patient

Once the coronary patient is released from the intensive care unit, his recovery can often be aided by freedom to move about and mild exercise . . . provided his ECG can be continuously monitored.

With the new HP ECG Telemetry System, the post-coronary patient can be ambulatory. Wherever he goes, his heart action is transmitted to a receiver at the nursing station where it can be continuously observed. The transmitter is small enough to be carried comfortably in a bathrobe pocket, has a strong enough signal to reach the nursing station from 200 feet even through several masonry walls, and is rugged enough to operate reliably even if dropped.



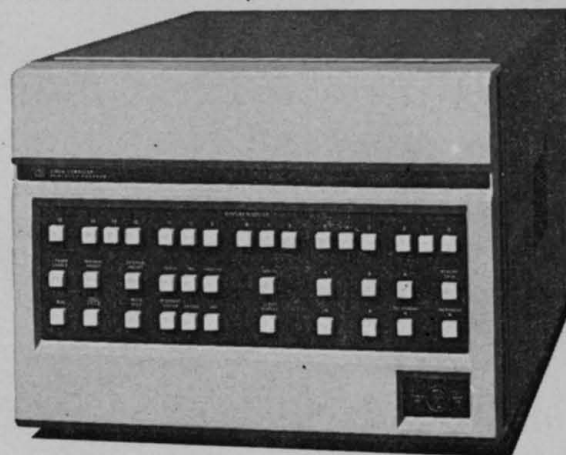
At the nursing station, the patient's ECG signal is monitored by a receiver that operates automatically, never requires tuning and accepts only valid signals, minimizing artifacts from patient motion.

An automatic warning light alerts the nurse of such inoperative conditions as: patient out of range, dislodged electrode, low battery power. It is completely compatible with HP patient monitoring systems. Because it doesn't require new wiring, the ECG Telemetry System is easily introduced into existing facilities. Price is \$1,800 for each patient unit. Write for our new illustrated brochure.

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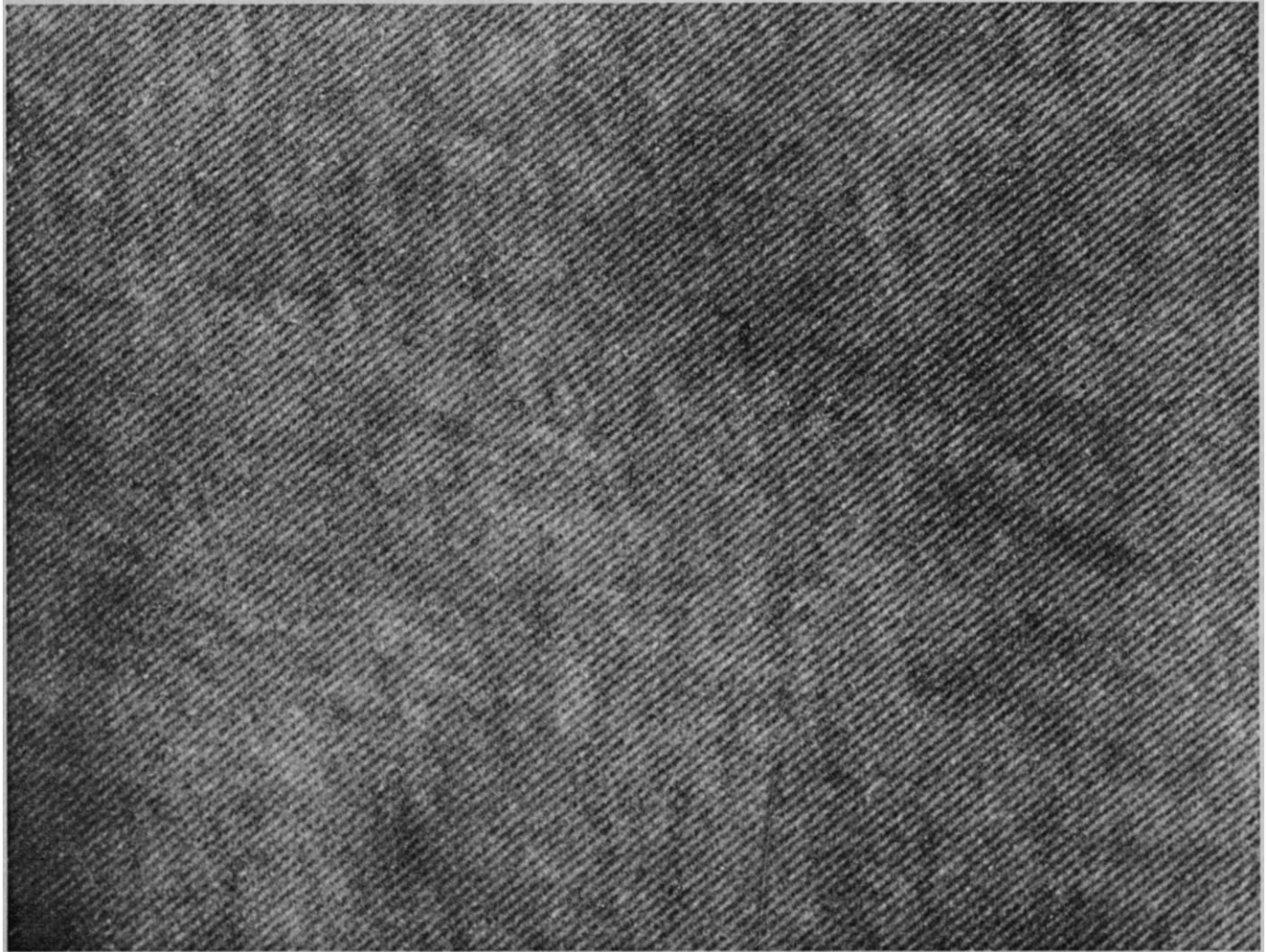


Image of (200) lattice planes in gold. Lattice spacing 2.04Å. Courtesy, Mr. Frederick Sheldon, Application Laboratory Pye Unicam Ltd Cambridge (U.K.)

The reach of the EM 300 into the farthest angstrom range—2.04Å, as shown—demonstrates an unusual, but expected fineness of visualization. As you may know, most electron microscopists in search of instrumental excellence have selected the Philips EM 300. Don Rodgers, Product Manager, Electron Optics will tell you why. He'll show you why, too. Call him at 914-664-4500 for a demonstration.

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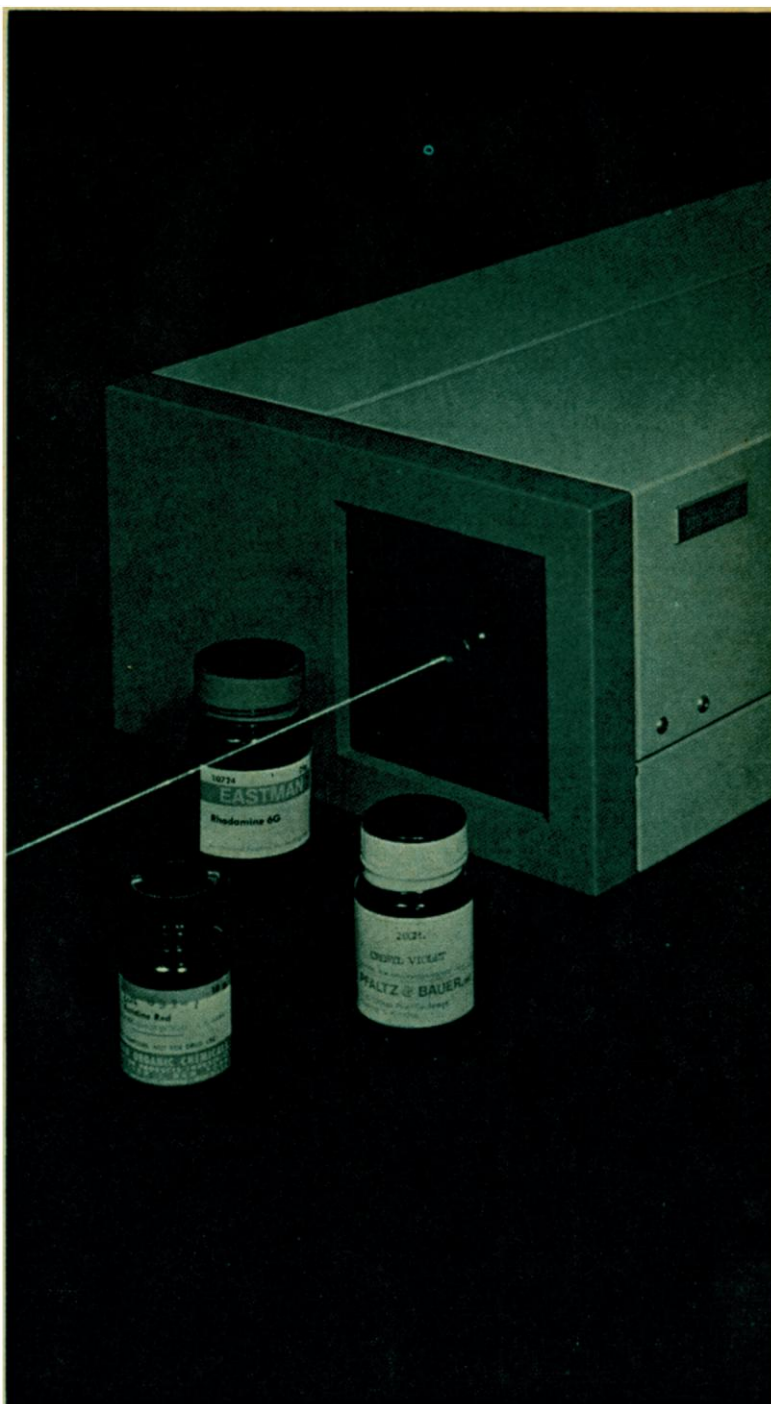


TABLE 1: Model 1000 Specifications

WAVELENGTH μ	PEAK POWER TEM ₀₀ (kW)	NOMINAL PULSE LENGTH Half Amplitude (ns)	AVERAGE POWER TEM ₀₀ (mW)
0.473	2.0	300	30
0.526	2.0	125	70
0.531	2.5	110	100
0.532	3.0	200	400
0.537	2.0	125	80
0.556	1.5	300	100
0.558	2.0	250	150
0.562	2.0	300	150
0.659	2.5	110	150
0.667	2.5	110	150
0.679	2.5	125	100

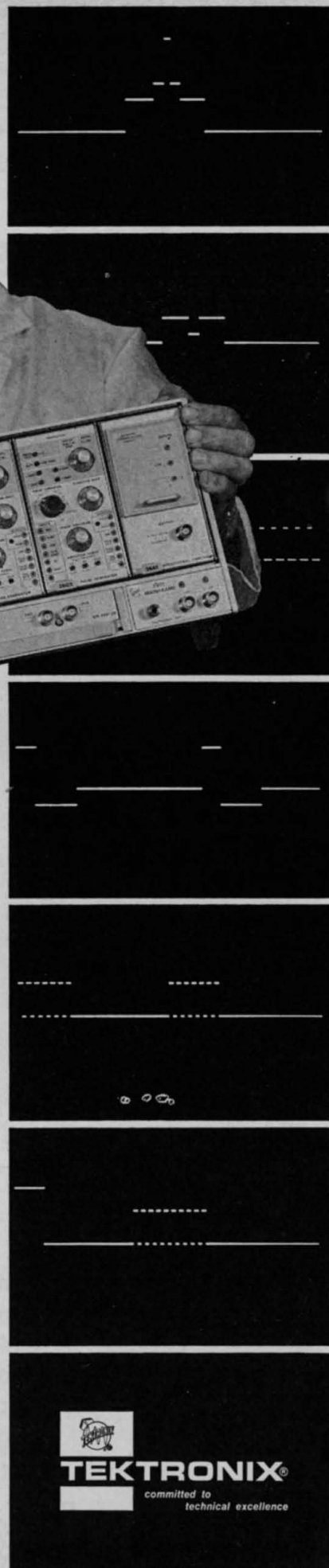
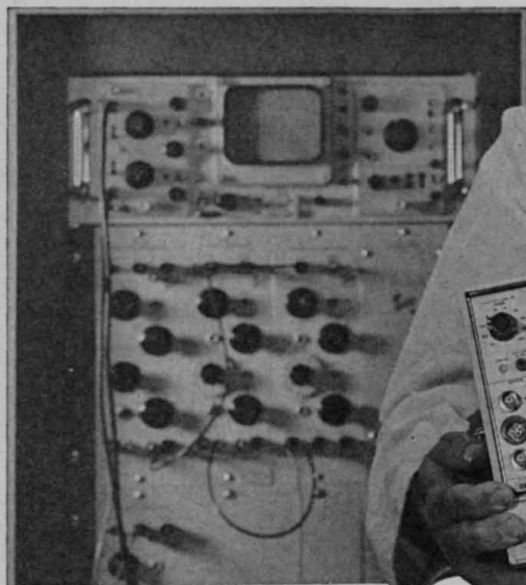
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● 26G2 Ramp Generator	\$300	● 2620 Stimulus Isolator	\$450

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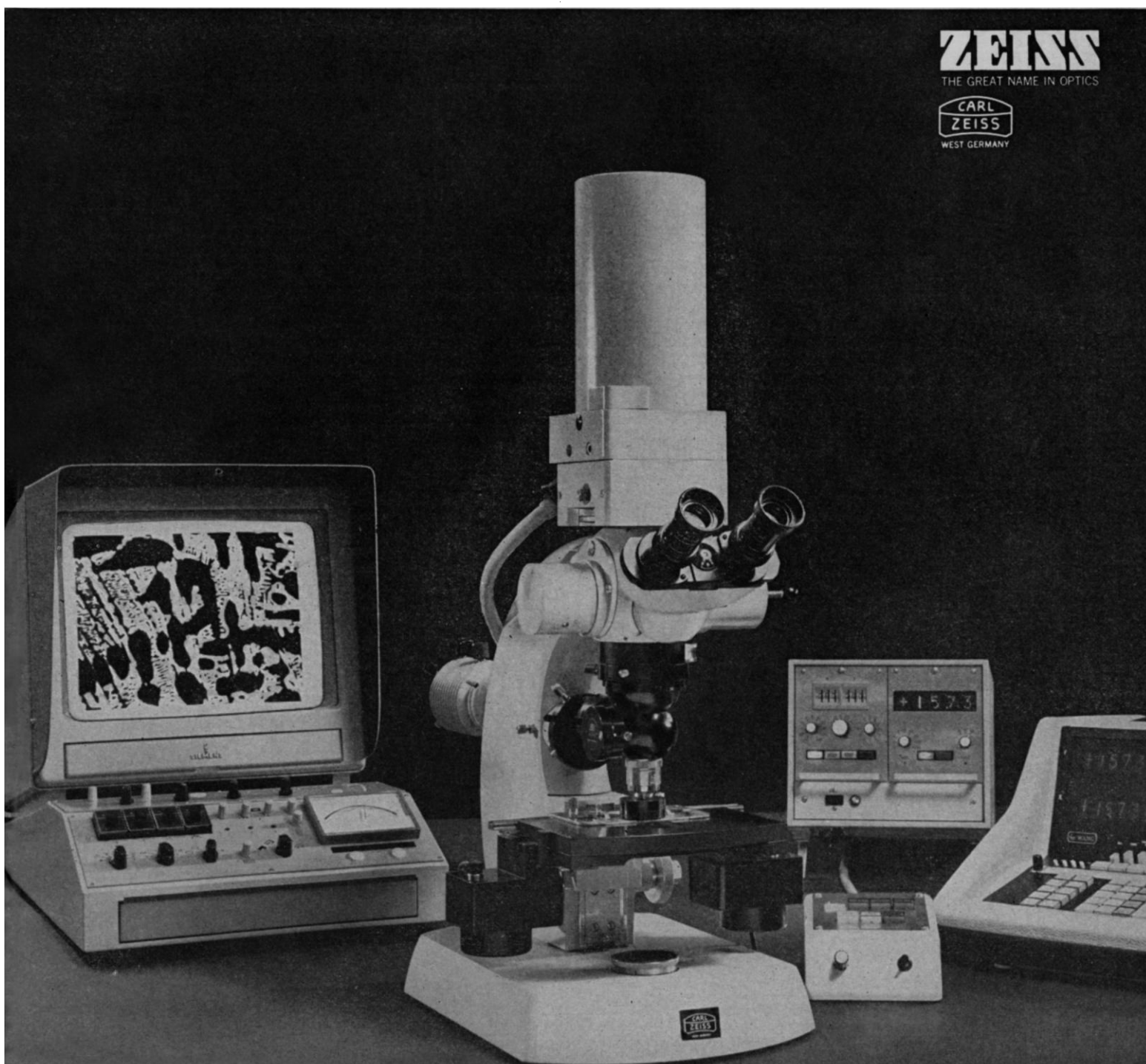
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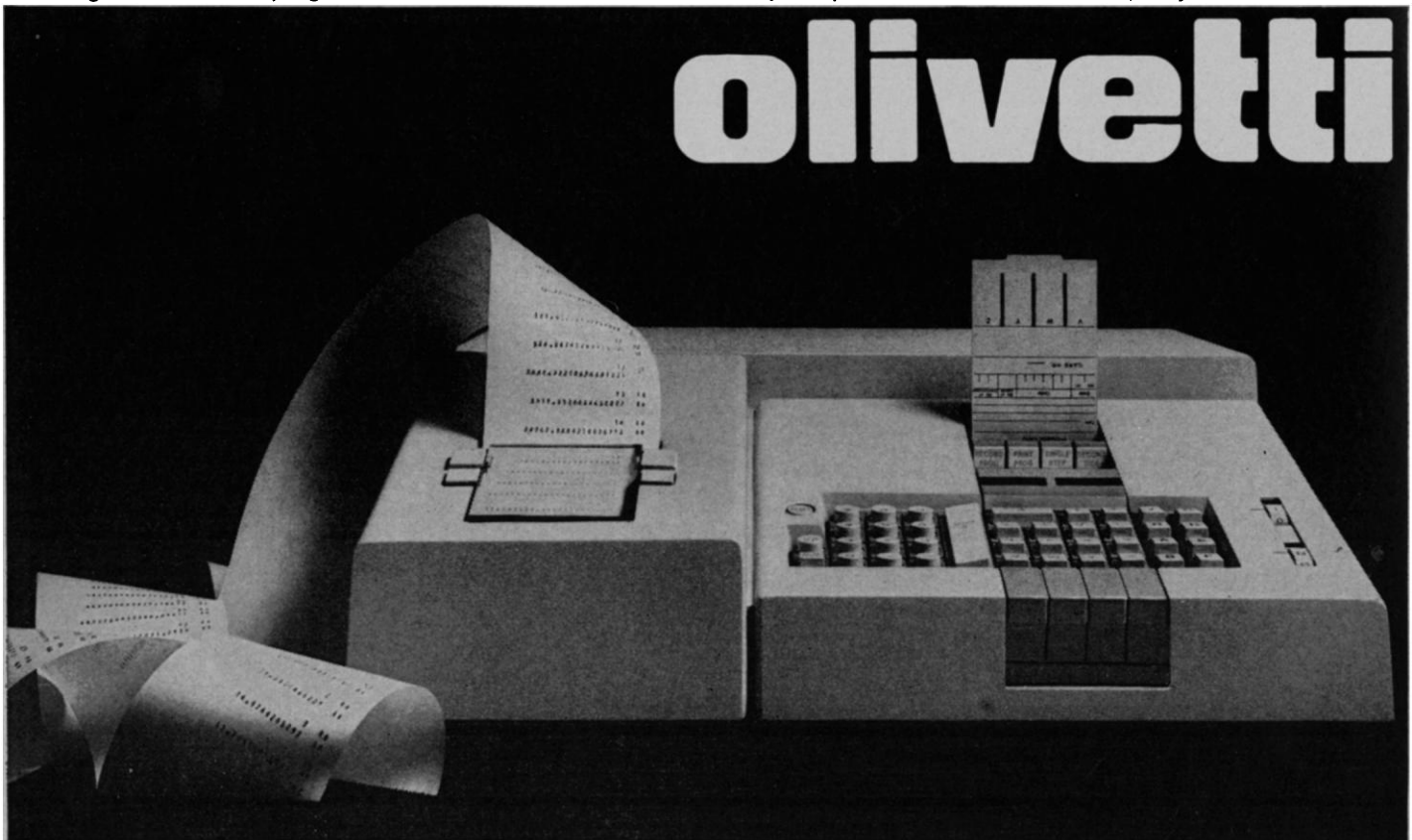
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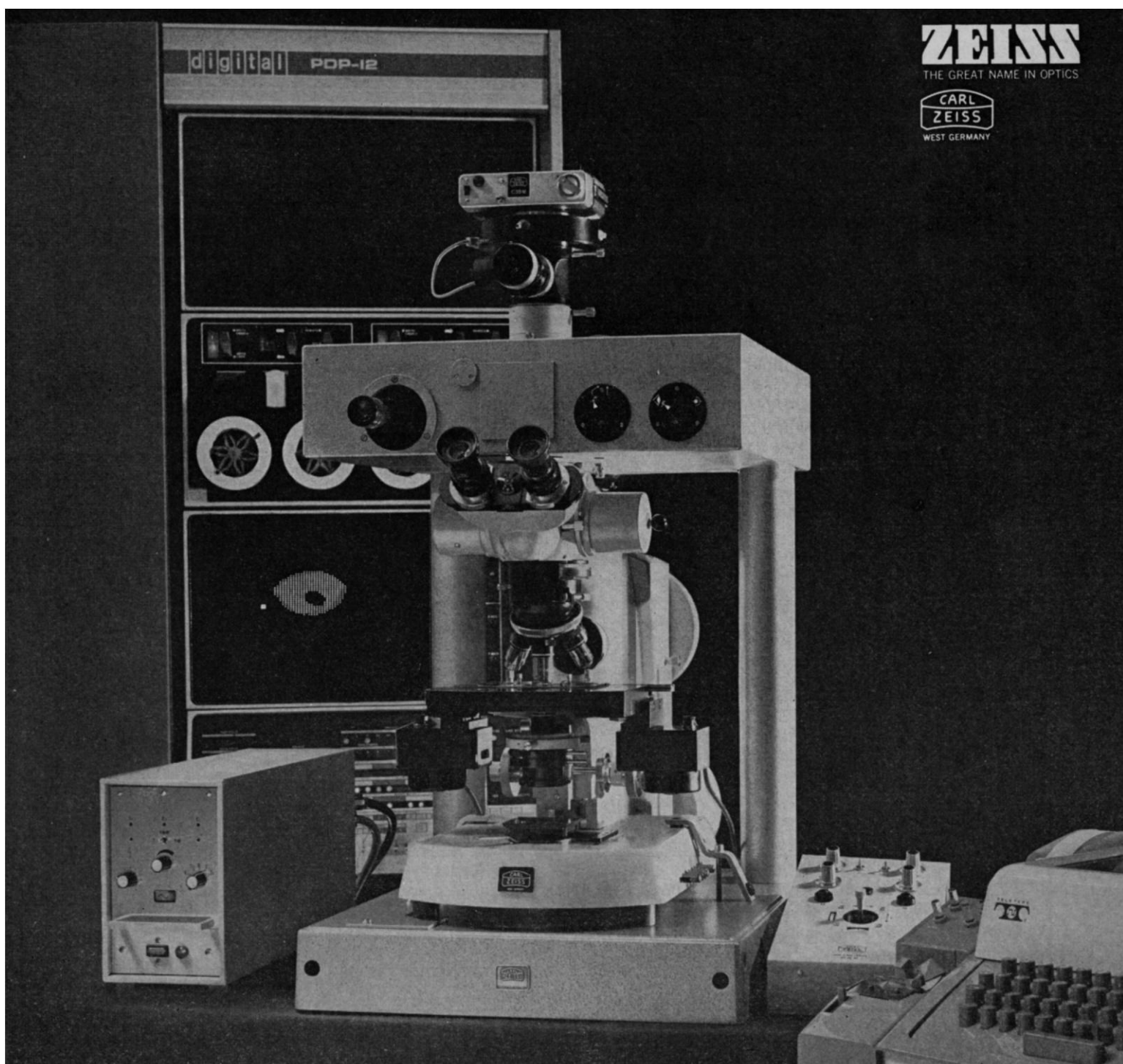
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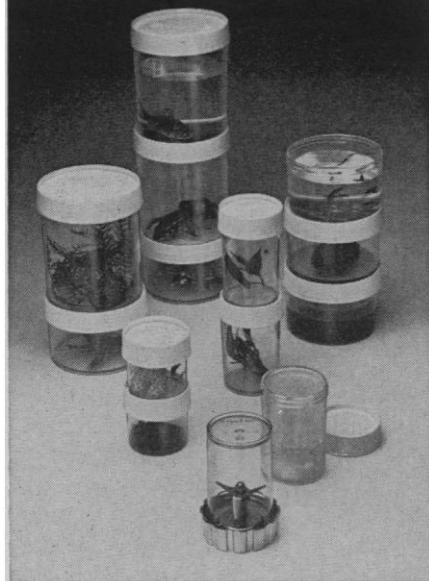
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Science, as distinguished from technology, is a common intellectual endeavor. The emphasis must be on "common." We stand on the shoulders of our predecessors, we support one another, and our successors stand in turn on our shoulders. Personal insight alone is not enough in this endeavor. We have to communicate our findings and our thoughts in language and symbolism that are as unambiguous as we can devise. The goal of scientific investigation is not simply to gain personal insight, but to gain it in such terms that we can, ideally, transmit it undiminished to another mind. Perhaps this mode of communication, which seeks to inform and to cement mutual insights in specific guise, can be contrasted with poetry. A poem that stimulates can be great even if its intended meaning is in doubt. Books can be written debating its meaning, and its value is only enhanced. In the case of a great scientific theory, matters are qualitatively different. Books can be written about its uncertain implications, or about its failings in fact or logic, but uncertainty as to its intended meaning must reflect an inherent flaw. If it is ambiguous, it cannot form the basis for common knowledge.

If raw sensuality is to be injected formally into the scientific endeavor, the challenge, then, is to devise means not only to gauge its import initially, but also to communicate its import in terms precise enough to provide a common ground for agreement. The obvious hazard is that an incomplete attempt will only provide grist for controversy among individuals whose senses differ for biological or cultural reasons. The extreme difficulty of avoiding this posture must be recognized. Public decisions to ignore, modify, amplify, or discount specific scientific insights or judgments for humanistic or political reasons, both moral and expedient, are commonplace. Sensuality of one kind or another plays a large role, and inevitably so, in these actions. Until the force of this sensuality can be expressed in a fashion more concrete than the sort of vague imagery that is customary, it would only cloud issues further to suppose that the sensuality is an integral part of the related scientific edifice under either construction or attack.

Make no mistake. I do not reject sensuality. All science is based on sensory observation or detection of some kind. I merely contend that to welcome sensuality in the abstract is

to beg the question. This question is whether or how sensuality, as Blackburn uses the term, can be made systematic and communicable enough to become a part of common endeavor, rather than personal quest, for which it is assuredly the indispensable factor.

WILLIAM R. DICKINSON

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Blackburn has helped me express thoughts that I had been unable to formulate for years.

Science teaching in the universities and in the high schools has become increasingly abstract during the past 20 years. Far from becoming more modern, we are dangerously approaching the scholastic mentality of the Middle Ages.

The general biology courses that are taught at the beginning of a scientific or liberal arts curriculum give information on abstract concepts which the students cannot comprehend because of lack of practical experience with specimens. Freshmen who take these courses must memorize and learn to manipulate abstract concepts and even come to logical conclusions without ever comprehending the contents of the exercises. Indeed, very few teachers truly understand the contents of these courses. The end results of the lifelong labors of great scientists are presented in ready-made form.

Educators have forgotten that those scientists who have made the modern discoveries could not have accomplished their feats without a thorough familiarity with nature, which begins in childhood, in backyards, woods, and fields. Intelligent, meaningful science gradually develops with the observable world around us. This is the world of visible, audible, smellable, touchable, dissectible organisms, rocks, and minerals, the visible stars and clouds, and the feelable atmosphere.

Students ought to be guided from the "sensuously" perceivable to the theoretical explanation of the observable. This is the path along which all science has evolved and the only "relevant" road for teachers of science. It is impossible to awaken enthusiasm for science when the beginning is also the end result.

HANS ELIAS

Department of Anatomy,
Chicago Medical School,
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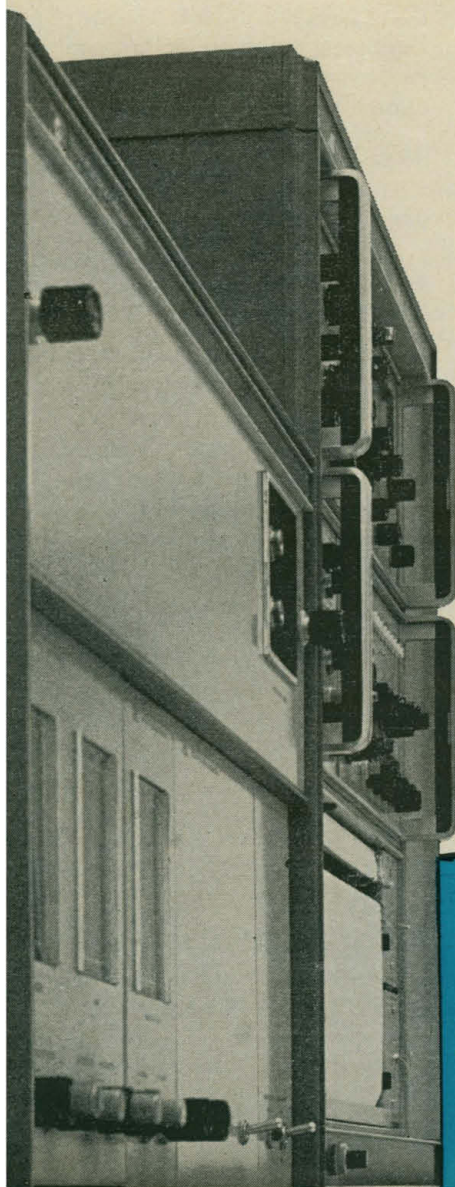
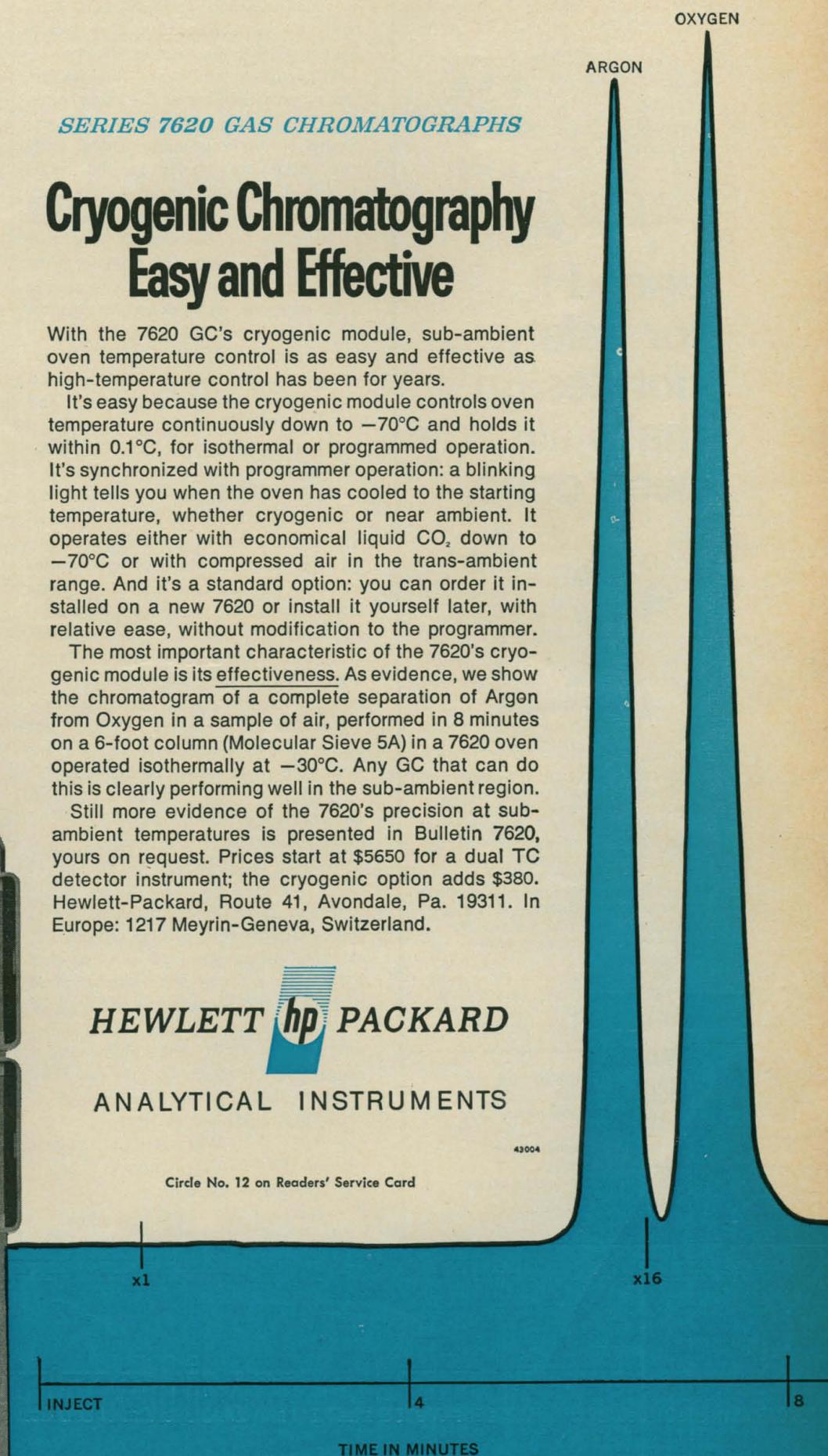
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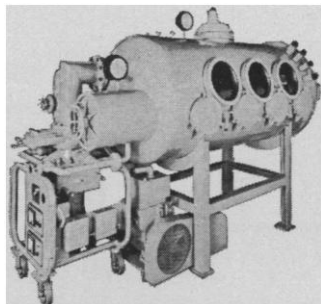
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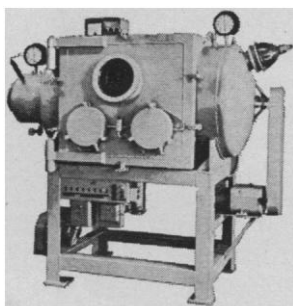
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Analogy may be fruitful. Unsupported by logical argument it can be misleading, as Blackburn has indicated with his non sequiturs. To argue for a sensuous science from Bohr's principle of complementarity does justice neither to the idea nor to the man.

The particle and wave theories are two ways of looking at the same thing, but both were formulated and extended by rigorous mathematical analysis. Both are clearly in the mode described as "quantitative science," and their example provides no analogical support for Blackburn's leap into an alternative, sensuous domain. Furthermore, by equating intuition simply with sensuous experience, he ignores the whole history of scientific inquiry in the intellectual domain. Creative investigation has always been nurtured by intuitive insights, guesses, and hunches, but these have been tested later as rigorously as possible. After all, intuition can be wrong.

Finally, Blackburn is quite wrong when he excludes the holistic naturalist from the act of simplifying reality for the sake of intellectual comprehension. No one can define, let alone understand, the numbing complexity of reality. We are all of us quantifiers and feelers (and what emotion-laden words these are), homomorphic or many-to-one mappers and modelers. We select certain things and filter out the rest. The question is whether we should be more aware of the filters.

PETER R. GOULD

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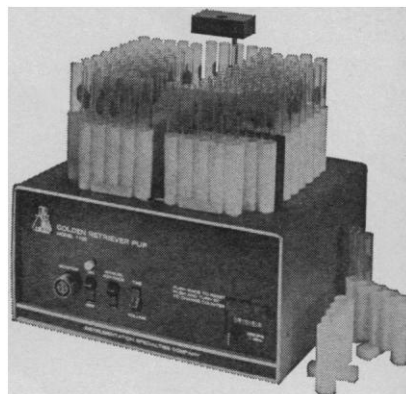
If the idea of complementarity is generalized from its precise, operational meaning in quantum physics, so that it becomes a broad philosophical tenet that takes into account the behavior of the human observer, it is wholly indistinguishable from the philosophical concept of pluralism as advocated by William James in *A Pluralistic Universe*, first published in 1909.

WALTER M. ELSASSER

*Institute for Fluid Dynamics
and Applied Mathematics,
University of Maryland,
College Park 20742*

I had no intention of advocating unseemly leaps into alternative domains; that would be as big a mistake as to deny the human and scientific importance of sensuous experience. It is to the second error that I addressed my-

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self, feeling that the first was relatively unlikely to occur within the house of science. Rather than reasoning by analogy from physical to sensuous-intellectual complementarity, I tried to generalize the idea of complementarity, and then to show that both types may be examples of a fundamental epistemological phenomenon—an enterprise, by the way, that Bohr himself pursued for the last 30 years of his life.

I agree entirely with Dickinson. Our codification, so to speak, of sensuous knowledge is centuries behind our analytical systems. In fact, as embodied in art and poetry, it has indeed become embedded in "personal quests," where it has shown, in capable hands, a very powerful precision. However, since at least the era of Goethe, Coleridge, and Faraday, the sensuous and the analytical have followed different concerns—to the detriment of both.

THOMAS R. BLACKBURN
Department of Chemistry,
Hobart and William Smith Colleges,
Geneva, New York 14456

Artichokes

I refer to the technical comment by Eisner and Halpern (25 June, p. 1362) on the article by Whittaker and Feeny (26 Feb., p. 757), on chemical interactions between organisms.

A less dramatic distortion of taste occurs after one eats artichokes, the flower heads of *Cynara scolymus*: things taste sweet.

W. M. WOODS
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Oak Ridge, Tennessee 37830

Reciprocity

Sev S. Fluss (Letters, 11 June, p. 1083) complains that Russian scientific authors in citing non-Russian sources fail to give the original (that is, Latin) spelling of names along with the transliteration. Before the AAAS adopts his suggestion that it urge this worthy practice on the Russians, it might urge the editors of *Science* (and other American journals) to adopt the practice of including the Cyrillic spelling of Russian authors' names in citing them.

ROBERT G. GLASER
Department of Physics and
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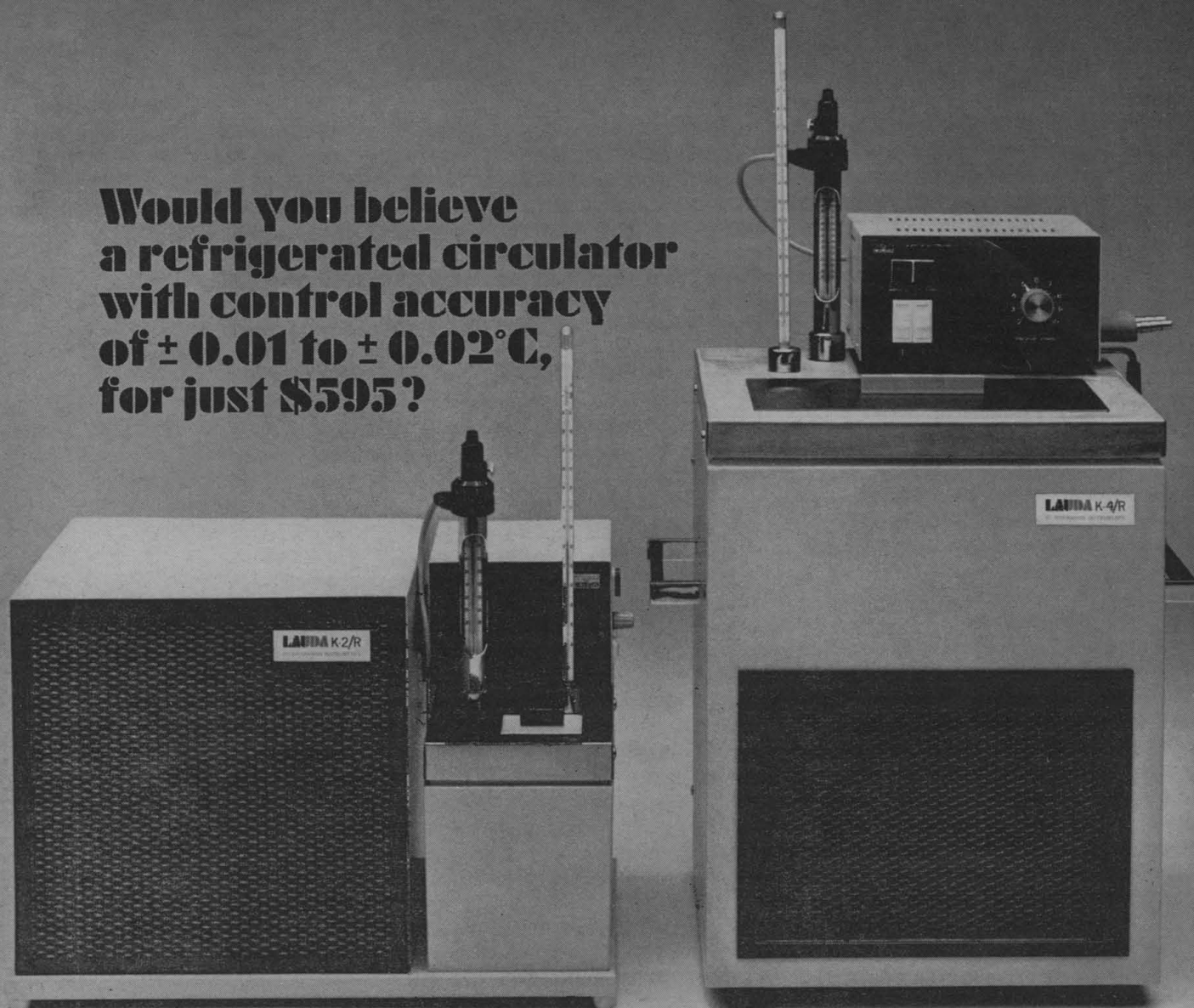


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Open Admissions: The Real Issue

When the City University of New York announced late in 1969 that it would admit all 1970 graduates from city high schools, an intensive controversy about "open admissions" was set off. What was largely overlooked by those on both sides of the debate was that several of the largest state systems of higher education have been operating under such a policy for many years. As other states and municipalities expand their higher educational facilities, open admissions as such will probably become a dead issue.

Indeed, the real issue all along has been not *who* gets in, but *who* gets in *where*. This question is particularly sensitive in those cities or states that have a hierarchical arrangement of institutions, whereby only the most able students may attend a few select colleges or universities, while the least able are shunted to junior or community colleges. This arrangement, which evolved within the private sector more or less by accident, has been adopted by some public systems (notably California) as a matter of policy, and now many states seem to be drifting toward some kind of hierarchical model. In the minds of many planners, the two-year college is appealing not only because it preserves and protects the selectivity of institutions at the top of the hierarchy but also because it is generally cheaper to operate.

Those who support the idea of keeping the least able students in separate institutions argue that it enhances the educational development of both the bright and the dull student. So far, the empirical evidence has failed to support this contention. It is clear, however, that such sorting of students has a number of unfortunate side effects, the most obvious being racial and socioeconomic segregation. For this reason, if for no other, the trend toward uncritical acceptance of the hierarchical model is to be deplored.

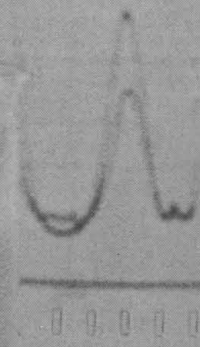
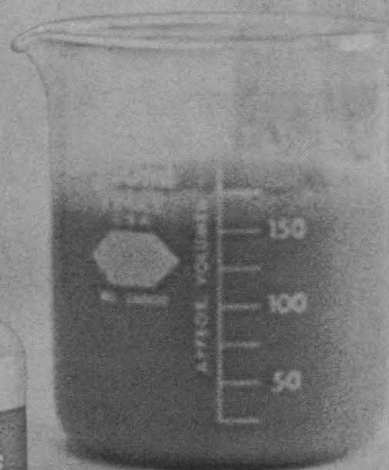
The idea that a previously selective college will be "wrecked" (as was recently alleged in one nationally syndicated column) if it moves to accept mediocre or poorly prepared applicants is simply not supported by the facts. For many years, a few of the country's major public universities have, apparently without suffering ill effects, been able to accommodate students who vary widely in ability. The transition from selective to open admissions will, no doubt, require certain curricular changes, but it can be done, although a long history of predictive studies shows that it would be folly to expect the student with relatively poor high school grades and low test scores to perform as well as the better-prepared students in the same courses. In certain respects, this would be like requiring the typical new freshman to take senior-level courses and expecting him to do as well as the seniors.

There are, of course, many structural models other than the hierarchical or vertical one that could and should be explored (a horizontal arrangement of institutions differentiated along curricular lines, for example). However, as institutional administrators and planners continue to scramble for limited funds, they are likely to pay less and less attention to the matter of alternative structures. This is not to suggest that new institutional forms will not be tried out (the "university without walls," for example), but that the existing hierarchical arrangement within state or city systems will be perpetuated and strengthened and that innovative forms will be merely added, like so much decorative gingerbread, to the main structure.—ALEXANDER W. ASTIN, *American Council on Education, Washington, D.C. 20036*

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mitter agents. With a sensitive radio-assay, histamine was shown in highest concentration in the hypothalamus, was localized to synaptosomes with slightly different density than norepinephrine- or γ -aminobutyric acid-containing nerve terminals, was decreased by inhibition of histidine decarboxylase (turnover half-life only 5 minutes), and was affected by stress. It is clear that such transmitters as acetylcholine and norepinephrine account for only a very small percentage of all the synapses in the central nervous system; therefore, the evaluation of additional potential transmitter substances is an active field. No defined genetic diseases have been associated yet with an abnormality in neurotransmitter metabolism.

R. Rosenberg (University of California, San Diego) presented data on neuronal differentiation *in vitro*. He used both dissociated normal brain cells from neonatal BALB/c mice and transformed mouse neuroblastoma cells and found that morphologically differentiated neurons appear in culture with characteristic spike potentials upon stimulation and that several neurotransmitter-related enzymes can be detected, though synaptosomes and synaptic transmission have not yet been demonstrated. The effects of serum, of protein synthesis inhibitors, and of the microtubule-protein-binding substance colchicine can be evaluated in culture. Cells seem to become highly differentiated only as they slow their rate of cell division. Acetylcholinesterase activity increases rapidly as neuronal processes appear, while catechol-*O*-methyltransferase and other enzymes do not share the same pattern of regulation. Since there is evidence for both norepinephrine and acetylcholine in these clonal cultures, it will be very interesting to learn whether a single neuron can produce only one or the other of these neurotransmitters when it becomes highly differentiated.

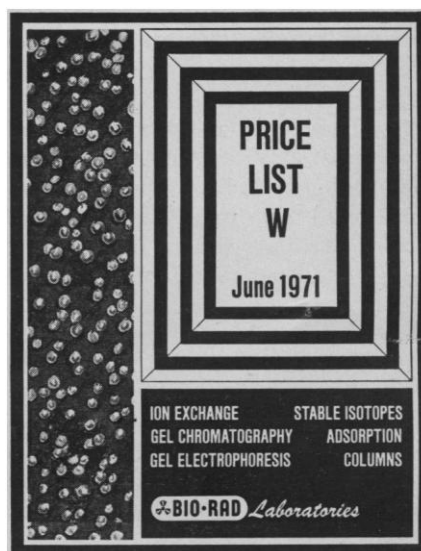
Specialized processes of differentiation in brain may be engrafted upon those common to other tissues, and environmental modification leads to complex behavioral phenotypes, particularly in man. Nevertheless, there was optimism that experimental approaches of the type discussed can unravel some of the mystery of gene action in the nervous system.

G. S. OMENN
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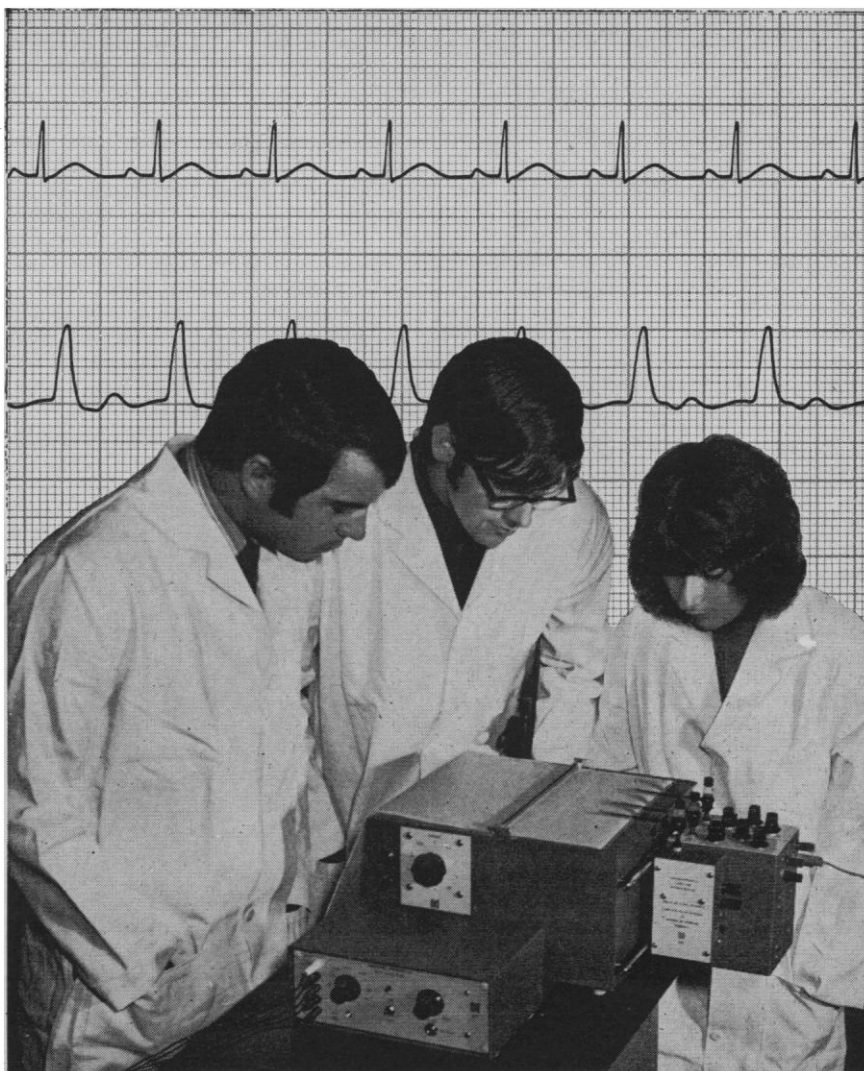
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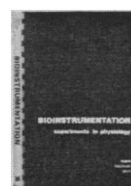
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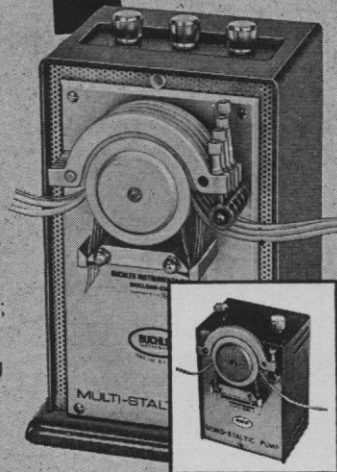
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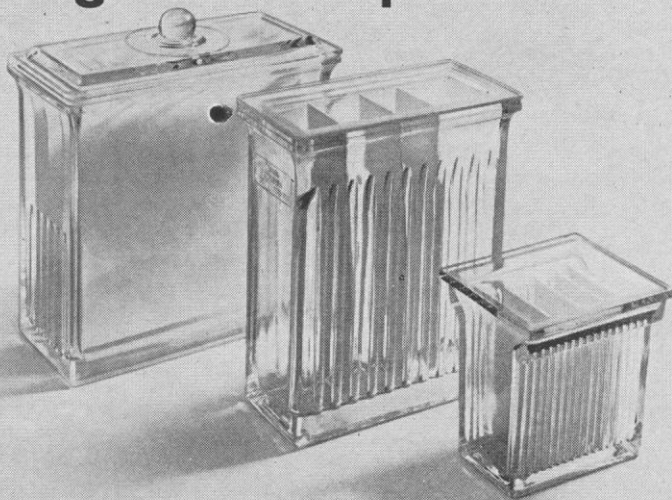
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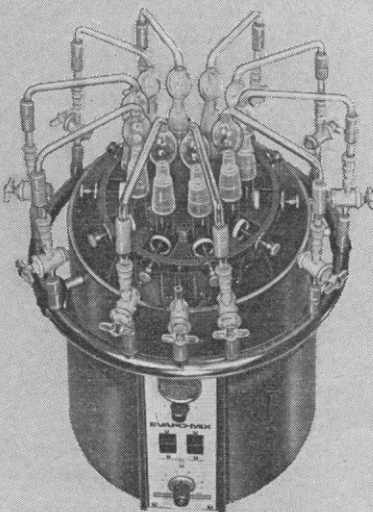
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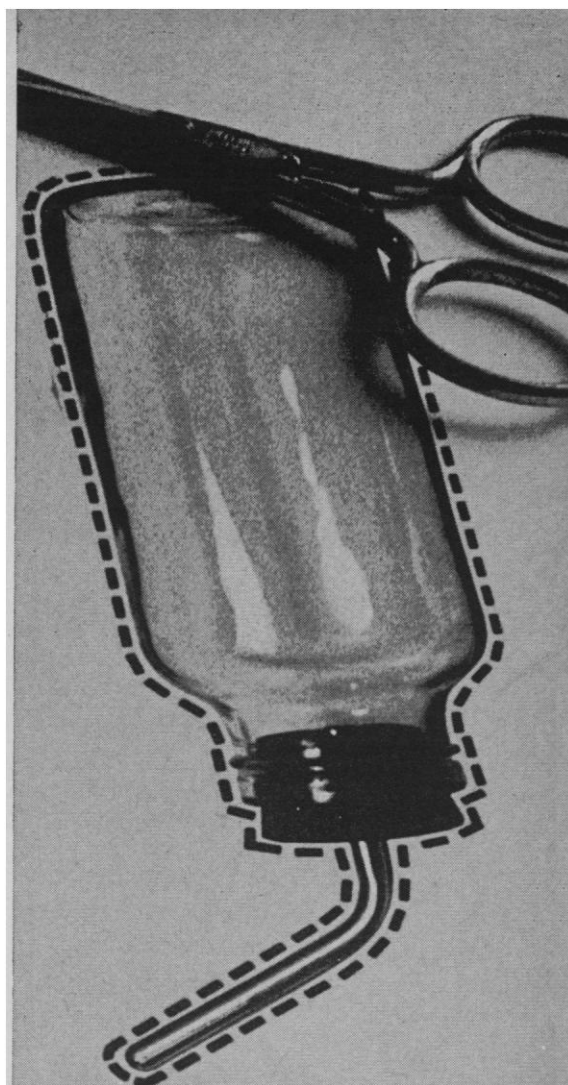
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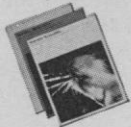


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A Staff Report on Cantometrics

Editor: Alan Lomax

384 pp., 7½ × 10¼, Illustrations, Bibliography, Index, 1968. 2nd Printing 1971. AAAS members' cash orders \$14.50. Regular price \$16.75.

Working with a large sample of recorded songs and filmed dances from all world culture areas, the Cantometrics Project has discovered some of the ways in which song and dance style vary by culture area. Strong statistical relationships have been established between a set of basic factors of social and economic structure and performance style. The book reports on an imaginative yet rigorous exploration of the paralinguistic and parakinesic realms and a thoroughgoing test of the hypothesis that factors of culture style are primary forces in shaping all human behavior. Performance style here becomes a psychocultural indicator, and, for the first time, the social and cultural import of the expressive act is firmly established.

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