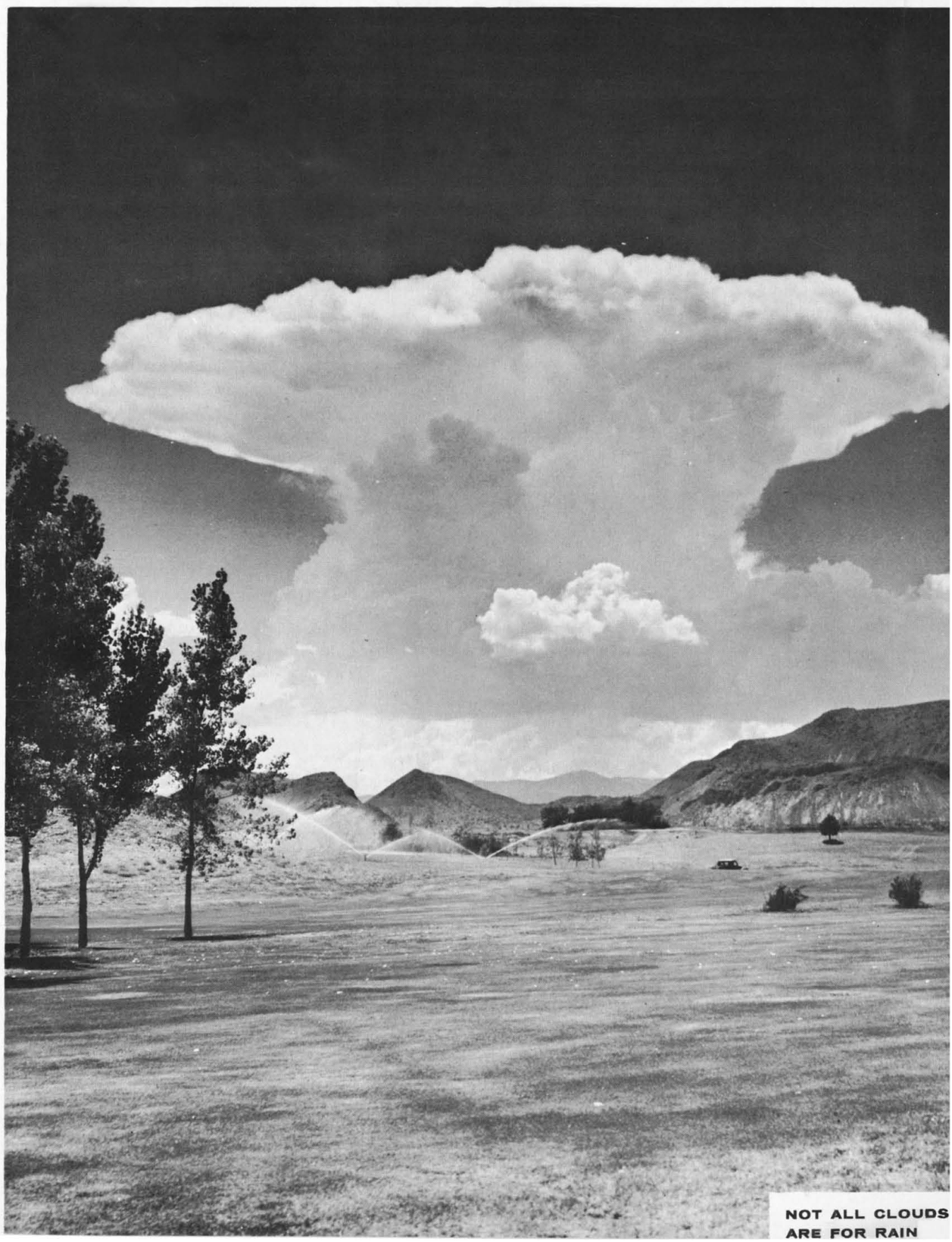
SCIENCE

19 October 1962

Vol. 138, No. 3538

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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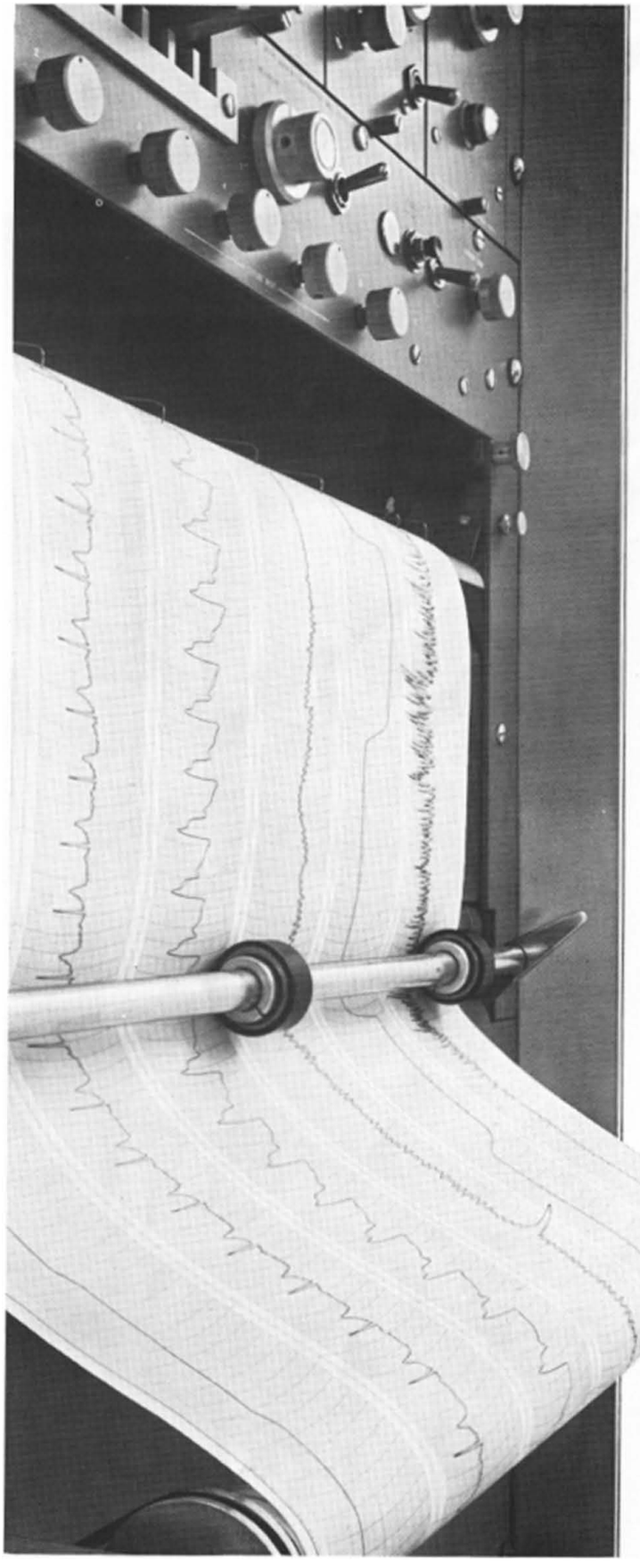

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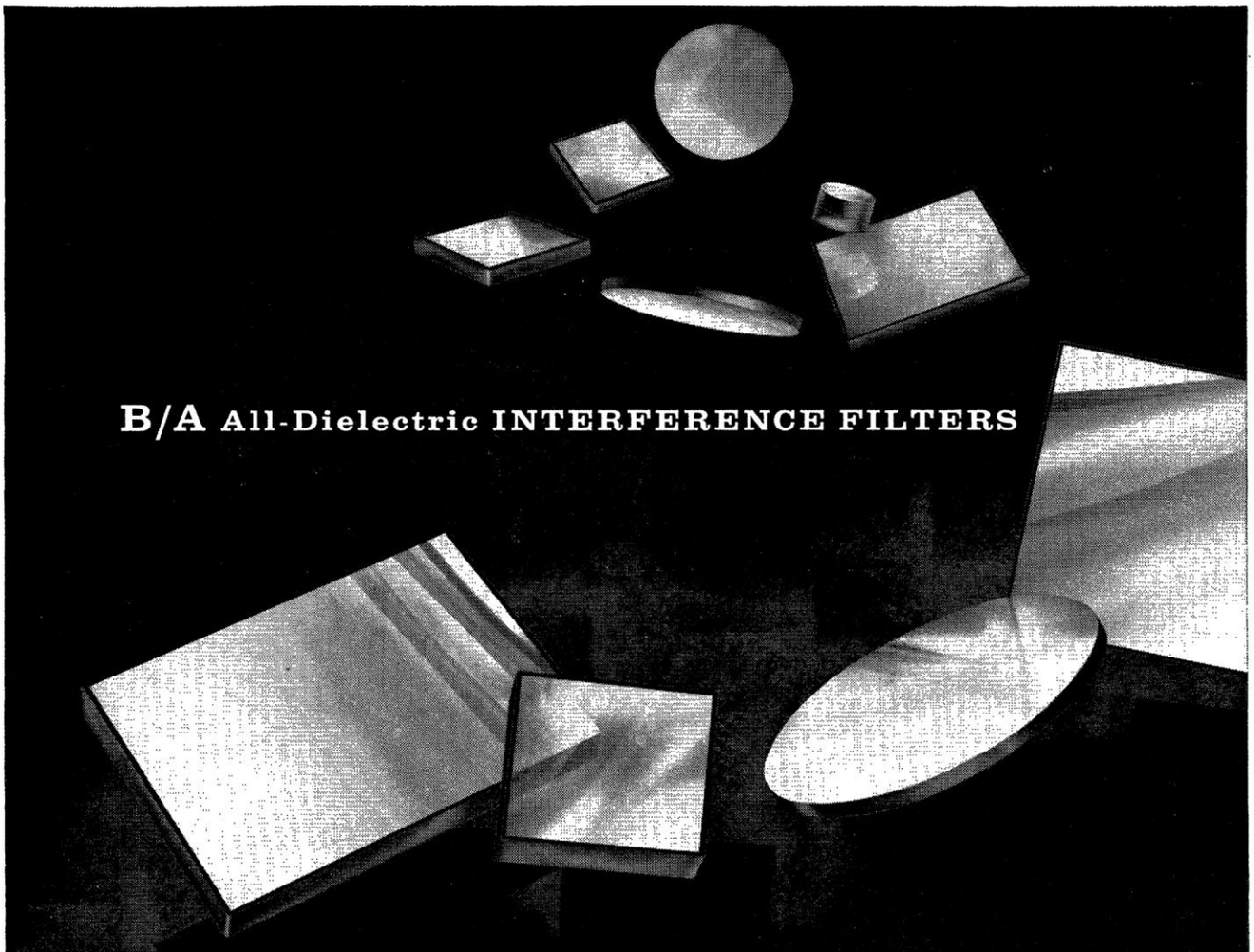

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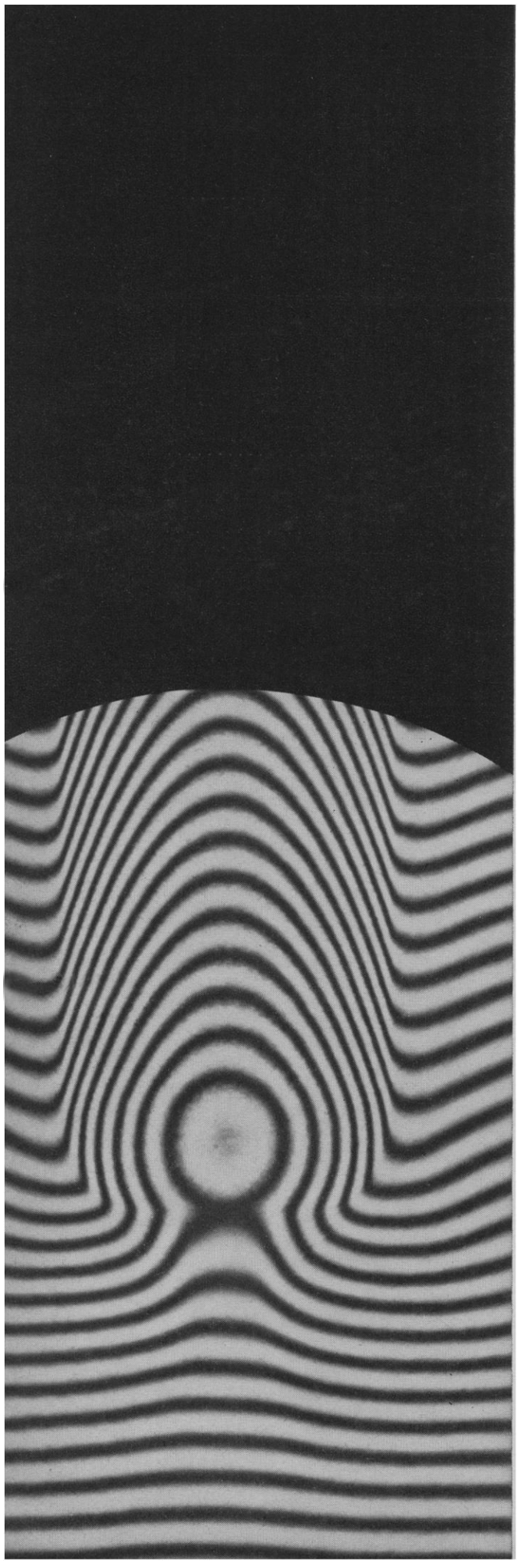
SCIENCE

Cover

Cloud over the Magdalena Mountains (elevation 10,700 feet) 17 miles west of Socorro, New Mexico. Two factors contributed to the failure of this cloud to produce rain: (i) the air was abnormally dry, as is indicated by the weight of the cloud base above the mountain; (ii) winds aloft moved the top of the cloud toward the east, producing a shearing action that broke the alignment of the columns in the cloud. See page 407.



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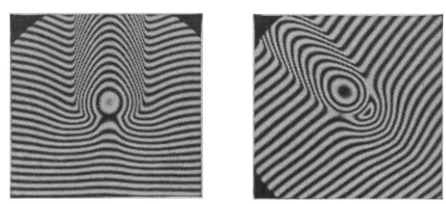

Ball track across copper crystal is narrower, harder and has higher friction in a cube diagonal direction (right interferogram) than in a cube edge direction.

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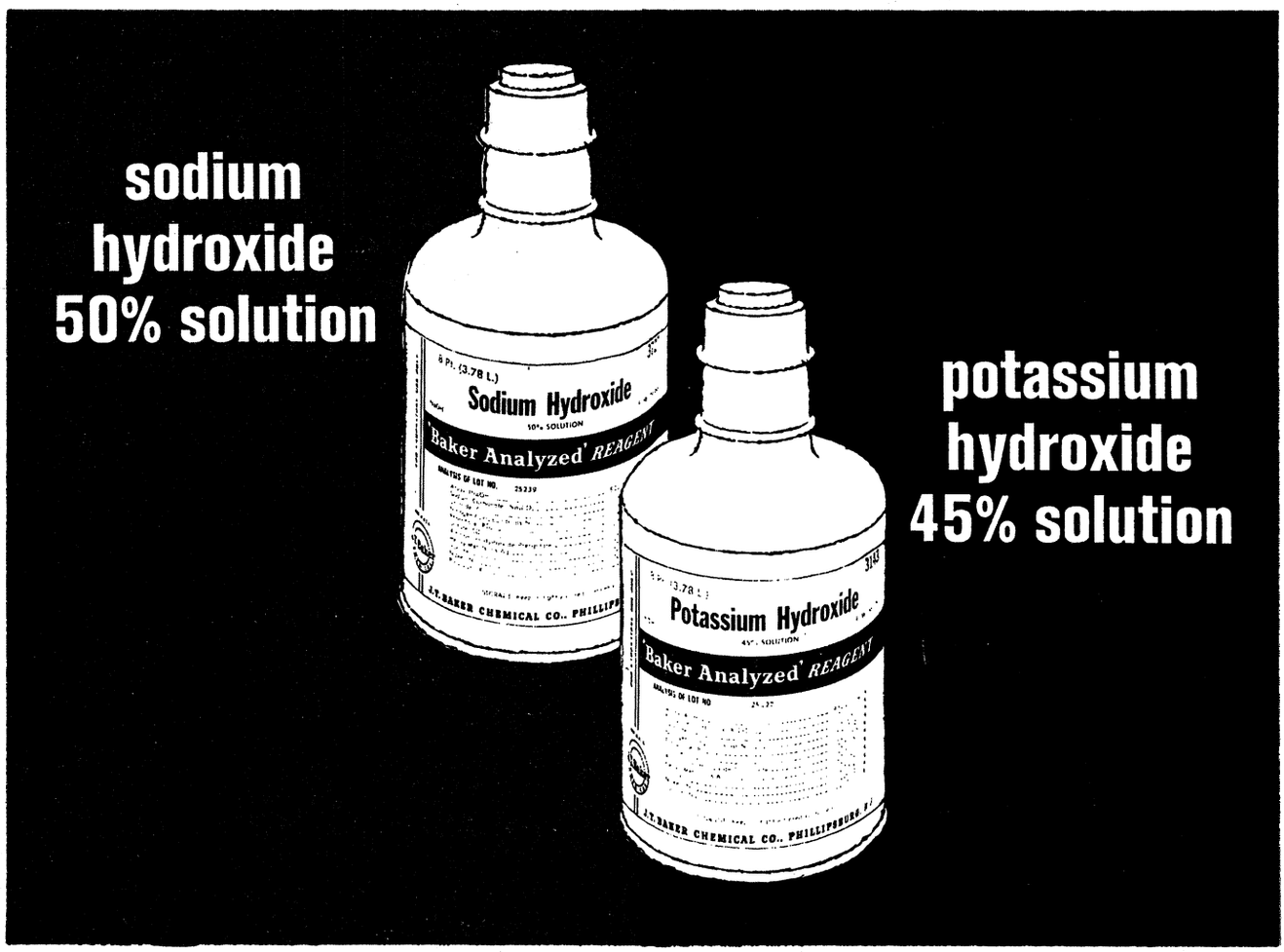

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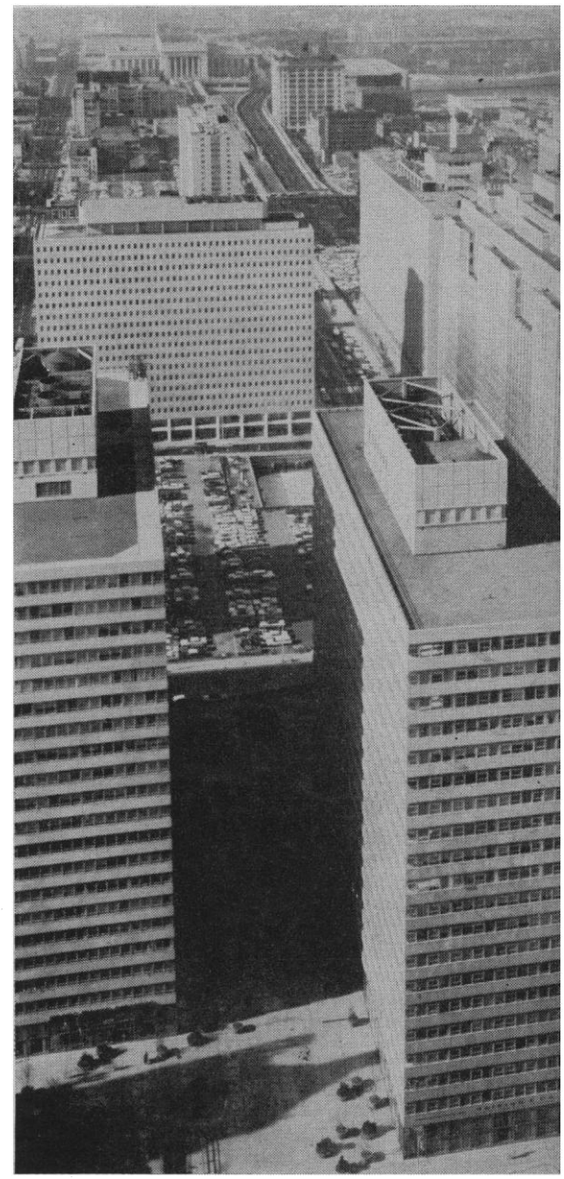

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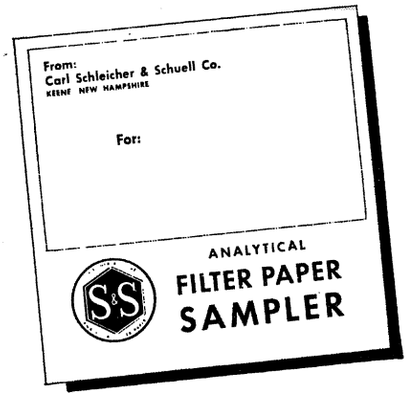

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these conditions, could be attributed directly to the similarity of the receptacle in which animals were placed initially to the test receptacle used for the feeding period. This would constitute a demonstration of the delayed feeding effect.

ROBERT H. DUFORT
Department of Psychology,
Wake Forest College,
Winston-Salem, North Carolina

References

1. J. B. Best, *Science* **137**, 454 (1962).
2. D. Davenport, *ibid.* **137**, 452 (1962).
3. J. B. Best and I. Rubinstein, *ibid.* **135**, 916 (1962).
4. G. H. Zimny, *Method in Experimental Psychology* (Ronald, New York, 1961), chap. 3.
5. B. J. Underwood, *Psychological Research* (Appleton-Century-Crofts, New York, 1957).

Social Science Research

In a recent issue of *Science* [**136**, 509 (1962)] there appeared a joint review by Kenneth Boulding of Clarence Ayres's *Toward a Reasonable Society* and Marshall Dimock's *The New American Political Economy*. Boulding dismisses Dimock's book as a study in the pathology of rhetoric. He is somewhat kinder to Ayres, whom he classifies as the outstanding representative of the school of institutional economics. Then he goes on, "For all the enormous difference in quality in these two works . . . [each] represents, in a sense, a personal philosophy of society. . . . But [this type of intellectual activity] does not have that peculiar property of securely based information and carefully tested prediction which is the identifying mark of the scientific process." Then follows this patronizing comment: "Political Non-Science is not necessarily nonsense, though it seems to have a bias in that direction. It should not, however, be mistaken for that *political science based on quantitative data and testable theory, which is now in the making*" (italics mine).

May I remind Boulding of Aristotle's dictum that each field carries a method appropriate to the material it is examining. Paul Lazarsfeld is much more modest in his claims. He refers to the hostile outsiders who ask, "What has social research all added up to in the last fifty years? Is there any sociological finding that has not been anticipated by philosophers or novelists? The answer has to be qualified. True, it is unlikely that any surprising 'discoveries' will be made for quite some time to come."

I am certain that the work of Dimock and Ayres will survive Boulding's review. What is disturbing is the implication that the methods of the physical sciences are the sole key to unraveling the mysteries of the social disciplines. This is not an entirely new point of view. Herbert Spencer was able to gain a widespread audience for nonsense disguised as sociology by trading on the language of Darwin. Just as physics-thinking dominates our intellectual climate today so Darwinian thinking dominated the late-19th century cultural climate.

May I suggest that the social researchers who are engaged in quantitative research be somewhat less aggressive in proclaiming their virtues until they are able to come up with some insights not previously arrived at by other methods.

It is distressing that this quasi-scientific group, despite the poverty of the results thus far gleaned from their labors, demand control of all research in the social disciplines.

There is room for both traditions in our intellectual investigations. It is unfortunate that the physics-oriented group seem to have the inside track where funds from federal sources and from the private philanthropic foundations are concerned.

However, in the area of social research, despite all the financing and all the grants, we have yet to see men of the stature of Veblen or Commons or Mitchell emerge.

The whole field of social studies is in a serious state of flux. If social studies are to receive federal support, then the criterion of choice should be broader than the National Science Foundation's narrowly conceived ideas of what basic social science research is. The kind of intellectual authoritarian arrogance portrayed is doing well enough without additional federal funds to encourage it.

WILLIAM GOMBERG
Wharton School of Finance and Commerce, University of Pennsylvania, Philadelphia

Gomberg is reading things into my review which I did not say. I did not say, nor do I believe, that the methods of the physical sciences are the sole key to unraveling the mysteries of the social disciplines. I have always maintained that the methods of the humanities gave us true knowledge and important knowledge, and I have main-

(Continued on page 456)

Basic Research at Honeywell
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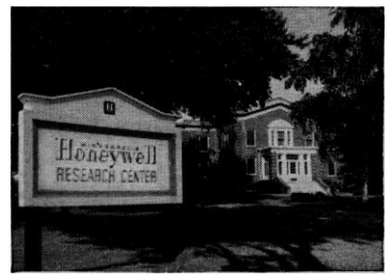


Studies of the Visual Processes Underlying Color Perception

Precise psycho-physical measurement techniques appear to clarify conflicting theories on the color receptor system of the human eye, possibly confirming an additive four-component receptor system as underlying color and brightness perception.

Scientists have been trying to understand how the eye sees color and to duplicate this process ever since the time of Sir Isaac Newton, who proposed that there were as many neural processes as there were discriminable colors. Thomas Young in 1801 recognized that if three primary colors, when mixed in different proportions, can be made to match any color of the spectrum, then a system of three independent receptors would be adequate. Von Helmholtz amplified the Young theory by suggesting that the brightness of colors was the sum of the responses of the three classes of color receptors. This has been termed an "additive" theory.

An alternate theory is the "opponents" theory proposed by Hering and based largely on psycho-physical data. He proposed that two antagonistic (or opposed) pairs of receptor mechanisms provide "color aspect" of color vision. These pairs are blue-yellow and red-green. Brightness in this theory is independent of the color mechanism but is dependent on a third black-white process.

The conflict in theories is sharpest on two empirical questions: (1) Is yellow the combined response of the red and green mechanisms (additive) or does it have an independent response mechanism (opponents)? (2) Is brightness the summed response of the color receptors or an independent mechanism?

Honeywell psychologists are using a very sensitive technique utilizing psycho-physical responses of human subjects. By refining techniques of chromatic adaptation in combination with threshold measurement they have succeeded in isolating microstructure in the human foveal spectral sensitivity curve.

There now appears to be evidence that there are sensitivity peaks corresponding to red, yellow, green and perhaps blue. By adapting the eye to very narrow wave bands in the red, yellow and green parts of the spectrum it is possible to reduce these sensitivity peaks selectively supporting an additive theory but with at least four components.

In the Honeywell experiments, a seated subject fixates a small circle in a large surround field which carries the adaptive light. After adapting the eye to the surround field the subject fixates the small center circle where a narrow band stimulus from the various bands of the spectrum is flashed. The threshold energy for detecting this flash is measured. Measurements indicate (see fig. 1-a) that when the eye is neutrally adapted, there is a main peak in the green at 550mμ and sub maxima at 570mμ (yellow) and at 600mμ through 690mμ in the red.

When the eye is adapted to red (fig. 1-b) the red shoulder or sub maximum at 600mμ to 690mμ is greatly reduced.

When adapting the eye to yellow (fig. 1-c) the 570mμ peak is almost eliminated.

Using a green adaptation (fig. 1-d) the main peak at 550mμ appears somewhat reduced.

It is important to note that in each case the adjacent shoulder is unaffected.

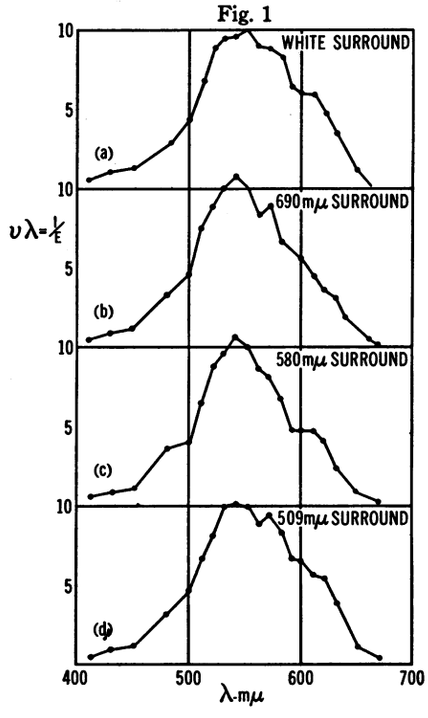
These techniques demonstrate that spectral sensitivity may be a composite of several underlying chromatic mechanisms which above 500mμ have three independent components with peak sensitivities to green, yellow and red light.

Further work is underway at Honeywell's Research Center to relate these findings to brightness perception and to explore more intensely the nature of the yellow response mechanism. Of obvious interest and concern to the medical and human factors field, a deeper understanding will also make possible significant advances in the technology of color measurement leading to mechanical simulation of color reception.

If you are engaged in scientific work in color perception and wish to know more about Honeywell's research in this area, you are invited to correspond with Dr. Harry Sperling, Honeywell Research Center, Hopkins, Minnesota.

If you are interested in a career at Honeywell's Research Center and hold an advanced degree you are invited to write Dr. John Dempsey, Director of Research at this same address.

Fig. 1



THRESHOLD ENERGY REQUIRED TO DETECT COLOR STIMULI

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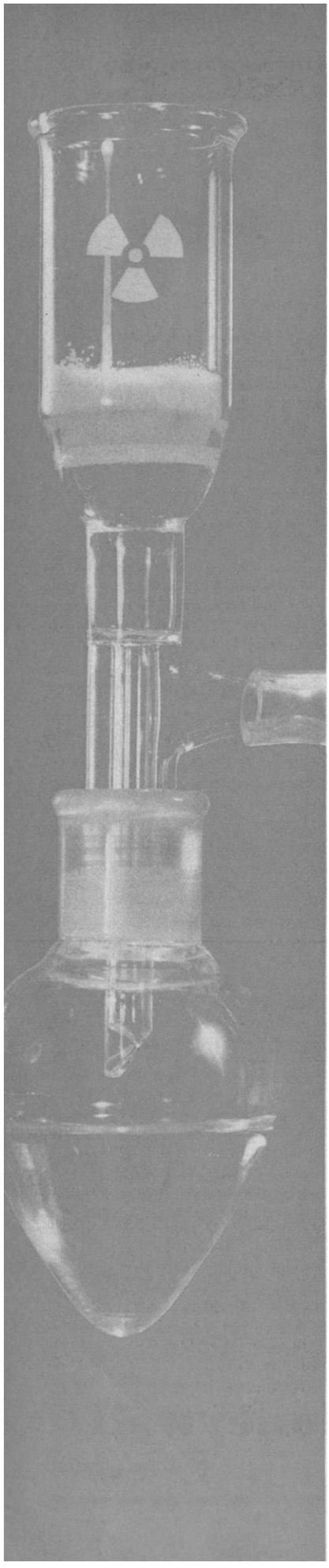

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CLINICAL APPLICATIONS OF ALDOSTERONE IN VIVO SECRETION RATE
Bernard Kliman: Associate in Medicine, Harvard Medical School

ISOTOPIC METHODS FOR STEROIDS IN HUMAN BLOOD
James F. Tait: The Worcester Foundation for Experimental Biology

USE OF ISOTOPIC TRACERS FOR THE EVALUATION OF THE RATES OF SECRETION AND OF INTERCONVERSION OF STEROID HORMONES
Erlio Gurpide: Departments of Biochemistry and Obstetrics and Gynecology, Columbia University

ESTIMATION OF ALTERNATIVE METABOLIC PATHWAYS OF CATECHOLAMINES IN MAN
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Plans for *Science*

In becoming editor of *Science* I am in the position of one who has been made custodian of a uniquely valuable property. With a circulation approaching 80,000, the journal reaches all segments of American science. Many scientists turn to it before scanning the publications of their specialties. With an excellent editorial staff and efficient printing arrangements, *Science* can provide fast publication. Thus the News and Comment section has a deadline of Tuesday; the journal is printed on Wednesday and is usually in the mail by midnight. Location of the editorial offices in Washington, together with this speed, permits effective handling of news of special import to readers.

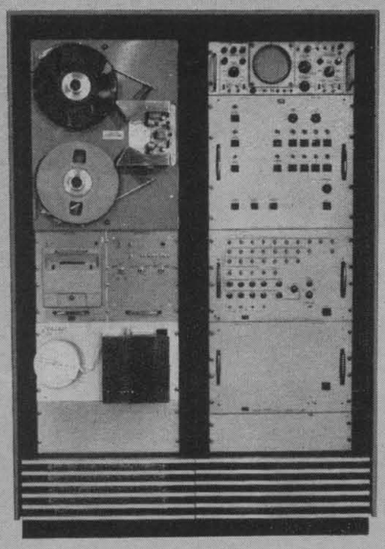
Our plans call for no drastic revision of the present content. We will build on the existing structure. This is already occurring in our Reports section, which is being expanded to achieve a balance of material from the biological and physical sciences. Biology is an exciting area these days, and we will continue to publish about the same number of reports in biology as we have heretofore. We are increasing the number of papers in the physical sciences. Simultaneously we have reduced our median publication time. This has been cut to something less than 3 months, and we expect to reduce it to 2 months. Some material appears in less than a month. In attaining this speed, quality has not been sacrificed. Indeed, the reviewing process has been reinforced and outside referees are being employed more intensively.

Another section which is being expanded is Meeting Reports, particularly reports of symposia. At a time when criticism is being directed toward large meetings, much of the important work in science is being reported in small closed gatherings. We are inviting participants or organizers of selected symposia to prepare summaries for us, and we hope thus to cover many important events.

The content of a scientific journal ordinarily is determined by the material that is passively received from authors. The editor exercises judgment by choosing from what is in hand. Such a process tends to leave content to chance, for one cannot print that which is not received. In principle, at least, the situation can be altered by supplementing the voluntary mechanisms by recruiting. For this purpose our Editorial Board has been expanded and its functions have been altered. Members' duties are to identify significant new discoveries and developments and to initiate steps leading to their disclosure in *Science*. Members are men of broad interests and wide acquaintance, and we believe their efforts will have considerable impact on the journal. Their names are listed at the left.

Most of the other features of *Science* will go on as before. Your editor has not been writing many editorials. He has opinions, some strong, many unorthodox, but he feels that he can best foster *Science* by employing his energies on technical content.

With passage of time and further consideration and consultation, additional plans and other attitudes will doubtless evolve. As of the moment we are pleased with the evidence of progress, and especially with the cooperative attitude of all who have been asked to help.—P.H.A.



New approaches to problems in technical measurement

Nuclear structure studies can now be made in greater detail than ever, by physicists using the TMC 4096-channel time-of-flight analyzer. As the target material is bombarded by neutrons, nuclear particles may be displaced and scattered hither and yon. The time-of-flight analyzer detects these particles, measures their flight time from target to detector and stores the information in an appropriate channel of the unit's computer memory. With a capacity of 4096 channels* each storing 10^5 "bits" of data and ability to record flight times in the nanosecond range, this new analyzer provides resolution that permits more critical research analyses than ever before. In addition, the instrument can be set up to make pulse height analyses of gamma radiation simultaneously with time-of-flight studies.

This is one of many TMC innovations in nuclear physics research instrumentation. And TMC subsidiaries are equally important in their fields . . . Mnemotron Corporation in medical and industrial research; Telemetrics, Inc. in advanced ground station telemetry. For details on TMC capabilities in solving your technical measurement problems, write Technical Measurement Corp., 441 Washington Avenue, North Haven, Connecticut.

*also available with 16384 channel capacity.

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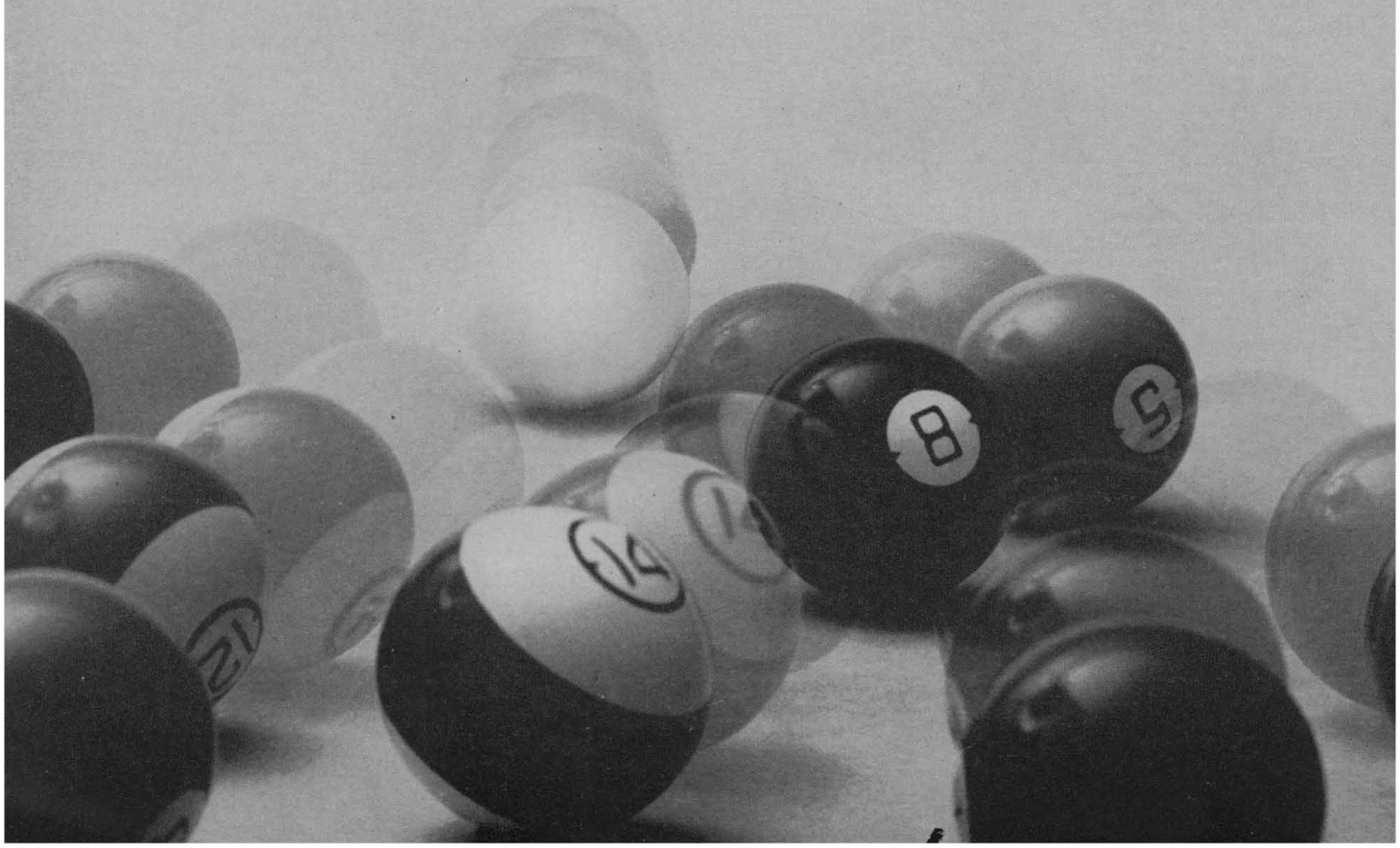


NEW FOR INSTRUMENTATION

HONEYWELL 8100

PORTABLE TAPE RECORDER

HONEYWELL 8100

PORTABLE OR RACK MOUNTED
One man can carry the 75 lb. 8100 in its functional case. For rack mounting, case slips off, chassis fits standard rack (19″).

FOUR SPEEDS
One switch controls selection of 30 ips, 15 ips, 3¾ ips, or 1⅞ ips, and automatically switches center frequencies.

LIGHTED PUSH BUTTONS
Honeywell MICRO SWITCH precision switches are backlighted to quickly indicate control mode in use.

SIMPLIFIED TAPE TENSIONING
Constant current divider to supply and take-up printed-circuit motors maintains constant tape tension without follower arms, potentiometers, or servos.

EXTREMELY SHORT TAPE PATH
Flutter is minimized.

HIGH RELIABILITY HEADS
Manufactured by Honeywell to exact standards for the 8100.

DC CAPSTAN MOTOR
Tape capstan motor with printed-circuit armature controlled by tone wheel and phase comparison servo for speed accuracy.

END-OF-TAPE SENSING
Photocell control stops all functions at end of tape, upon tape breakage, or at intermediate points as desired.

EXTERNAL MONITORING
Conveniently located terminals provide plug-in monitoring from any distance.

MONITOR SCOPE
Optional scope for monitoring input or output.

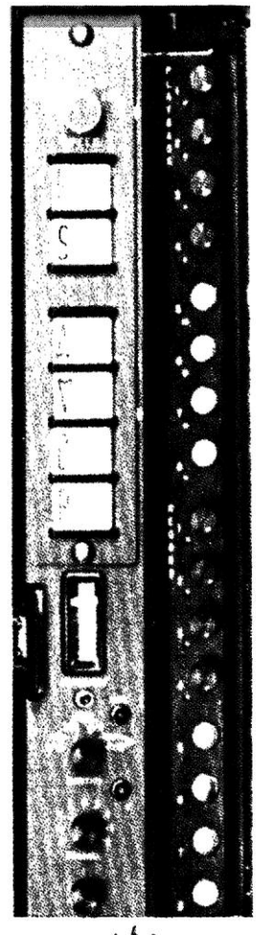
A TRULY PORTABLE INSTRUMENTATION RECORDER

DC TO 10,000 CYCLES ✲ AND REASONABLY PRICED

If you have been denying yourself the benefits of tape instrumentation because of size, weight, or price considerations, the compact, versatile Honeywell 8100 warrants your serious attention. Several new concepts in recorder design make it the most advanced portable instrument in its price range ($5,900 to $11,300, depending upon configuration).

Automatic Switching

The 8100 is the only portable recorder with automatic switching of all recording oscillators at all 4 speeds, eliminating manual change of plug-in cards. Automatic switching of any 2 of 4 playback speeds.

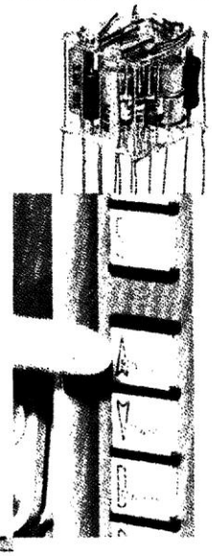


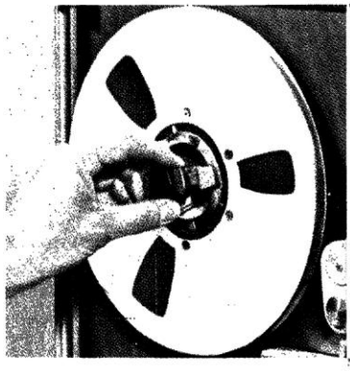
Built-in Calibration

The 8100 is the only portable recorder which accomplishes all necessary calibration with integral controls; no other calibrating instruments are required.

Welded Modules

The Honeywell 8100 is the first recorder to use welded modules and solid state electronics throughout.





NEW IDEA IN HUBS

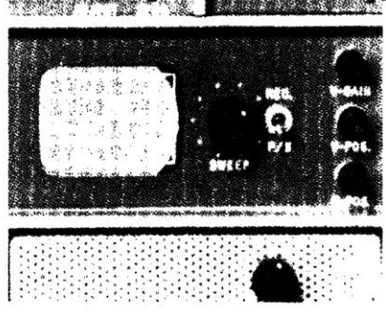
The unique Honeywell hold-down hubs make possible one-hand reel locking and unlocking.

OPERATOR CONVENIENCE

Control of the 8100 has been engineered for maximum usefulness with speed and versatility.

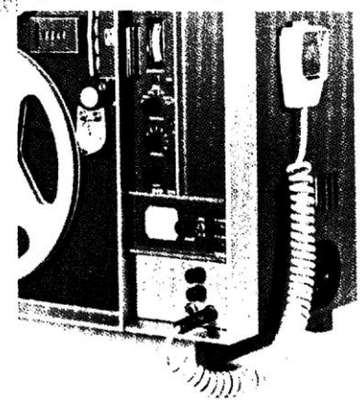
MONITOR SCOPE

Consistent with operator-designed features, the optional scope is a part of control panel.



VOICE CHANNEL

Optional voice channel uses outside track, has integral speaker and microphone.



SPECIFICATIONS AND SYSTEMS SUGGESTIONS ON NEXT PAGE

Honeywell 8100 Specifications

WEIGHT: 64 to 82 lbs., depending upon configuration. Average weight (IRIG) is 75 lbs.

DIMENSIONS: In portable case: 19⅜" x 24" x 10"; chassis for rack mounting: 19" x 22¾" x 10".

POWER REQUIREMENTS: 110V or 220V AC ± 10%. 50-400 cps; 40 watts maximum standby, 175 maximum operate (8 channel) or plus-minus 12V DC ± 10%.

REEL SIZE: 10½" x ¼" or ½"; NAB Hub.

TAPE SPEEDS: 30, 15, 3¾, and 1⅞ inches per second.

FIELD ENVIRONMENT: Although designed for laboratory use, the 8100 will withstand the rigors of field use if properly handled. Provision for standard operation from two 12V DC storage batteries.

MONITOR SCOPE: Optional oscilloscope integral with cabinet; local or remote monitoring via terminals provided.

FRONT DOOR: Tape reels, tape drive and heads protected by Plexiglass door.

FREQUENCY RESPONSE, DC TO:

10KC at 30 ips	1.25 KC at 3¾ ips
5KC at 15 ips	0.625 KC at 1⅞ ips

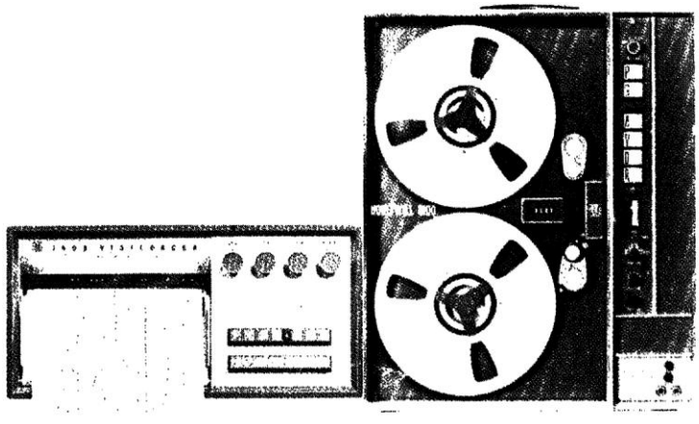
CONFIGURATIONS:

Model	*Tape Width*	*Maximum Number of Channels*		
8104	¼"	4 FM Data	1 Voice	1 Compensation
8105*	½"	4 FM Data	1 Voice	1 Compensation
8107	½"	6 FM Data *or*	1 Voice	1 Compensation
IRIG		7 FM Data	1 Voice	.....
8108	½"	8 FM Data	1 Voice	1 Compensation

*Field expandable to Model 8108.

Choice of Playback Configurations for all Models:
1. One uncompensated monitor playback channel only.
2. One compensated playback channel and channel selector
3. Full complement of compensated playback channels.

USE THE HONEYWELL 8100 WITH YOUR VISICORDER FOR EXCEPTIONAL DATA ACQUISITION CAPACITY



TYPICAL BENCH SYSTEM. The 1508 Visicorder oscillograph makes a perfect companion for the 8100. Data up to 10KC, recorded on the 8100, may be read out on the Visicorder without additional amplifiers. Both units are portable, hook-up is simple and quick. A typical 4-channel 8100-1508 system would price at less than $9,000.

ANOTHER MEMBER OF THE HONEYWELL FAMILY OF DATA ACQUISITION SYSTEMS

THE LAR 7400 MAGNETIC TAPE SYSTEM

FEATURES:

VERSATILITY OF FM data handling.

EXTENDED RESPONSE makes possible recording of one hour of 10KC FM data on one reel, or frequencies as high as 100 KC at 30 ips.

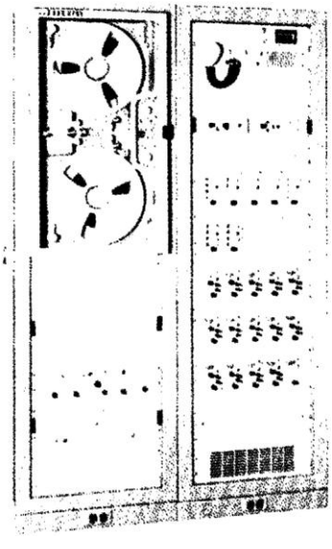
MAXIMUM PROTECTION of tape against breakage in transport.

HUMAN-ENGINEERED TRANSPORT virtually eliminates the chance of operator errors.

ALL SOLID STATE FM COMPONENTS for maximum reliability and durability of components.

INTERCHANGEABILITY of subcomponents such as oscillators and discriminators.

ECONOMY of operation and LONG EQUIPMENT LIFE.



Honeywell Tape Systems exploit the full range of FM capacity, which covers almost the entire field of instrumentation recording. Environmental testing, spectral analysis, process simulation, medical research, seismic studies, and wind tunnel analysis are but a few of the areas dominated by FM data handling methods. A pioneer in this field, Honeywell has established a reputation for high reliability and outstanding competence in the design and manufacture of FM tape systems.

Be certain to consider Honeywell Tape Systems in every proposal involving Data Acquisition.

For more information, write to
HONEYWELL DATA ACQUISITION SYSTEMS,
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Denver 10, Colorado.

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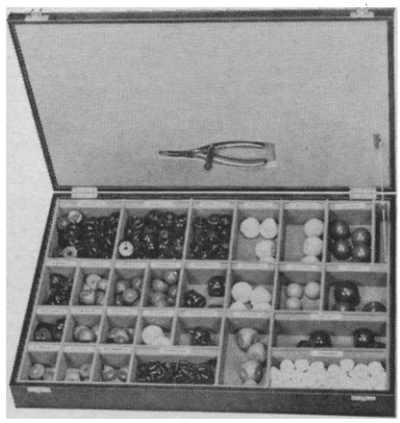

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molecular model set

Catalin Models consist basically of distinctively colored spheres and comprise eleven elements in their various valency states:

HYDROGEN
CARBON
NITROGEN
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FLUORINE • CHLORINE
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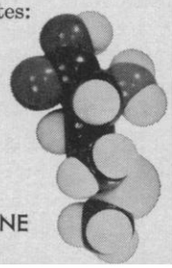

All elements are designed to give appropriate representation to the three basic dimensions of the atom:

Bond Length • Bond Angle • Spherical Diameter

Each model set is supplied complete with rubber pegs for joining atoms to form molecules, pliers for extracting pegs, and an engineering drawing showing dimensions and facial angles of each atom, in lined and partitioned cabinet.

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Additional Atoms **.90** EACH

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Forthcoming Events

November

16–17. **Communications**, symp., Montreal, P.Q., Canada. (A. B. Oxley, Canadian IRE Symp. on Communications, Box 802, Station B, Montreal)

17. American **Mathematical** Soc., Los Angeles, Calif. (AMS, 190 Hope St., Providence 6, R.I.)

18–21. American **Speech and Hearing** Assoc., New York, N.Y. (K. O. Johnson, 1001 Connecticut Ave., NW, Washington 6)

18–21. **Brain** Mechanisms for External Inhibition (closed meeting), Los Angeles, Calif. [Air Force Office of Scientific Research (attention: SRL), Washington, D.C.]

19–20. Mid-America **Electronics** Conf., Kansas City, Mo. (J. Warfield, Dept. of Electrical Engineering, Univ. of Kansas, Lawrence)

19–21. European **Packaging** Federation, congr., Paris, France. (EPF, 3 rue La Boétie, Paris 8°)

19–23. **Radioactive Dating**, intern. symp., Greece. (Intern. Atomic Energy Agency, 11 Kärntner Ring, Vienna 1)

19–26. Paris Intern. **Dental** Sessions, Paris, France. (G. Delbart, 3 place de la Gare, Mantes, S.-et-O., France)

20. Manufacturing **Chemists'** Assoc., mid-year conf., New York, N.Y. (MCA, 1825 Connecticut Ave., NW, Washington 9)

20–24. **Fish Diseases**, intern. symp., Turin, Italy. (R. Vittoz, Intern. Office of Epizootics, 12 rue de Prony, Paris 17°, France)

22–23. International Waste **Rubber** and **Plastics** Federation, conf., Antwerp, Belgium. (R. G. Kirkpatrick, Moorgate Hall, Moorgate, London, E.C.2, England)

22–24. Central Assoc. of **Science and Mathematics Teachers**, St. Louis, Mo. (J. Kennedy, Indiana State College, Terre Haute)

22–24. National Council for **Geographic Education**, Chicago, Ill. (L. Kennamer, Univ. of Texas, Austin)

22–27. **Automation** and **Instrumentation**, congr., Milan, Italy. (Federazione delle Associazioni Scientifiche e Techniche di Milano, Via del Politecnico 10, Milan)

22–27. **Thermotechnology**, intern. conf., Milan, Italy. (A Barbieri, Via Marcona 15, Milan)

22–3. Latin American **Forestry** Commission, Santiago, Chile. (U.N. Food and Agriculture Organization, Regional Office, Casilla 10095, Santiago)

23–24. American **Mathematical** Soc., Chicago, Ill. (AMS, 190 Hope St., Providence 6, R.I)

23–24. American **Physical** Soc., Cleveland, Ohio. (K. K. Darrow, APS, Columbia Univ., New York 27)

23–24. American Soc. of **Animal Science,** Chicago, Ill. (C. E. Terrill, Animal Husbandry Research Div., Agricultural Research Center, Beltsville, Md.)

24–25. American College of **Chest Physicians**, Los Angeles, Calif. (ACCP, 112 E. Chestnut St., Chicago 11, Ill.)

26–28. **Atomic** Industrial Forum, annual clinical meeting, Los Angeles, Calif. (Circulation and Records Dept., AMA, 535 N. Dearborn St., Chicago 10, Ill.)

25–30. American Soc. of **Mechanical Engineers**, New York, N.Y. (ASME, 345 E. 47 St., New York 17)

25–30. **Radiological** Soc. of North America, annual, Chicago, Ill. (M. D. Frazer, 1744 S. 58 St., Lincoln, Neb.)

26–27. **Combustion** Inst., western states section, Sacramento, Calif. (G. Fenech, Combustion Inst., 16902 Bollinger Dr., Pacific Palisades, Calif.)

26–28. **Atomic** Industrial Forum, annual, Washington, D.C. (R. Barlow, AIF, 850 Third Ave., New York 22)

26–29. American **Nuclear** Soc., Washington, D.C. (O. Bizzell, Isotope Technology, Development Branch, Div. of Isotopes Development, U.S. Atomic Energy Commission, Washington 25)

27–28. **Medical** Conf., North Atlantic Treaty Organization, Paris, France. (NATO, Information Service, Port Dauphine, Paris 16°)

27–29. **AtomFair**, American Nuclear Soc.–Atomic Industrial Forum, Washington, D.C. (R. Barlow, Atomic Industrial Forum, 850 Third Ave., New York 22)

27–30. **Biological** Future of Man, symp., London, England (by invitation only). (Ciba Foundation, 41 Portland Pl., London, W.1)

28–30. **Human Factors** Soc., annual, New York, N.Y. (G. E. Rowland. Rowland and Co., Box 61, Haddonfield, N.J.)

28–30. National Foundation **Birth Defects Centers**, conf., Miami, Fla. (Science Information Div., National Foundation, 800 Second Ave., New York 17)

28–30. Reinforced **Plastics**. intern. conf., London, England. (British Plastics Federation, 47–48 Piccadilly, London, W.1)

28–30. Technical Progress in Communication **Wires and Cables**, annual symp., Asbury Park, N.J. (H. F. X. Kingsley, U.S. Army Signal Research and Development Laboratory, Fort Monmouth, N.J.)

28–30. **Ultrasonics** Engineering, symp., New York, N.Y. (R. N. Thurston, Bell Telephone Laboratories, Murray Hill, N.J.)

28–30. Vocational **Rehabilitation**, seminar, Manila, Philippines. (D. J. Tablan, Philippine Foundation for the Rehabilitation of Disabled, Philippine Natl. Red Cross Bldg., corner of Gen. Luna and Victoria, Intramuros, Manila)

29–1. Homogeneous and Heterogeneous **Catalysis**, symp., Rostock, Germany. (Institut für Organische Katalyseforschung, Deutsche Akademie der Wissenschaften zu Berlin, Buchbinderstr. 5–6, Rostock)

29–1. **Legal Medicine** and **Forensic Science**, 1st interamerican conf., Rio Piedras, Puerto Rico. (L. A. Bear, First Interamerican Conf., P.O. Box 12065, University Station, Univ. of Puerto Rico, Rio Piedras)

29–1. Physical Factors Modifying Response to **Radiation**, conf., New York, N.Y. (E. P. Cronkite, Medical Research Center, Brookhaven Natl. Laboratory, Upton, L.I., N.Y.)

29–1. Texas Acad. of **Science,** Austin. (D. E. Edmondson, Mathematics Dept., Univ. of Texas, Austin 12)

30–1. Connective **Tissue**: Intercellular Macromolecules, symp., New York, N.Y. (S. J. Farber, c/o New York Heart Assoc., 10 Columbus Circle, New York 19)

Kodak reports on:

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Autoradiography at various levels

Science is a way of life. Business is another way of life. The two depend on each other, and frequently they wear each other's clothes. They try to avoid grating on each other's nerves.

One of their innumerable areas of contact concerns photographic materials. Practical, immediately applicable knowledge of how to make all kinds of effective photographic products has grown up under the auspices of business. Science needs the products. Life science, for example, has turned to the photographic technique of autoradiography as one of the most fruitful and convenient for its high purposes. Molecular biologists have no time, background, desire, or need to prepare autoradiographic products. We, a business house, gladly do it for them. That we do it has become known largely through communications between scientists. We are prompted to do it by a certain feeling of obligation beyond ordinary business motivation. (There, that didn't grate too badly, did it?)

Currently we can make four levels of autoradiographic sensitivity. Type NTB3, the highest, records all charged particles moving through it because the curve of spatial rate of energy loss against energy for each kind of charged particle passes through a minimum, and NTB3 responds down to the lowest of the minima. Naturally, this maximizes trouble with background density. At the other end of the scale stands Type NTA, where exposure times may be of the order of months, to the astonishment of casual photographers accustomed to 1/50-second shutter settings.

Detailed inquiries for autoradiographic products are welcomed by Eastman Kodak Company, Special Sensitized Products Division, Rochester 4, N. Y.

Windows have to be more than transparent

Word comes that KODAK IRTRAN 2 optical material is doing just fine in the rocket-propellant industry. The propellant crowd needs something transparent out to 14μ to hold their brews for i-r studies. Hydrofluoric acid plays a considerable role in their brewing operations, and IRTRAN 2 cells stand up to it.

But don't expect an IRTRAN 2 window or cell to stand up to liquid Br_2. It will get chewed up. Nor does IRTRAN 2 make out very well with molten chlorides. But they don't bother IRTRAN 1 much.

KODAK IRTRAN 1 windows adequately resist a molten LiCl-KCl eutectic at 410 C, are much easier than MgO to repolish as necessary, can take a lot more shock than BaF_2, and don't bulge like AgCl.

In this infrared window stuff, enthusiasm is a poor substitute for facts—even inconvenient facts. If you consult Eastman Kodak Company, Special Products Division, Rochester 4, N. Y., we won't pretend to know everything. Nevertheless, we do know quite a bit and might join you in finding out more. Provided we can discern a little golden ray of sunshine down at the end of the road.

How to keep a double bond

We have a very useful oxidizing agent which acts with such a light touch that it converts hydroxyls on very fragile steroids into carbonyls without bothering any of the double bonds, thioether linkages, or acid-sensitive groups present on the molecule. The name is *Bis(pyridine)chromium(VI) Oxide.*

The man who makes it didn't have time to invent the reagent. (He has many other EASTMAN Organic Chemicals to make, and he also has to manage the Synthetic Chemicals Division softball and basketball teams.) But by making it for sale as EASTMAN 8560 ($4.75 for 25 grams), he reduces the fire hazard in biochemical laboratories.

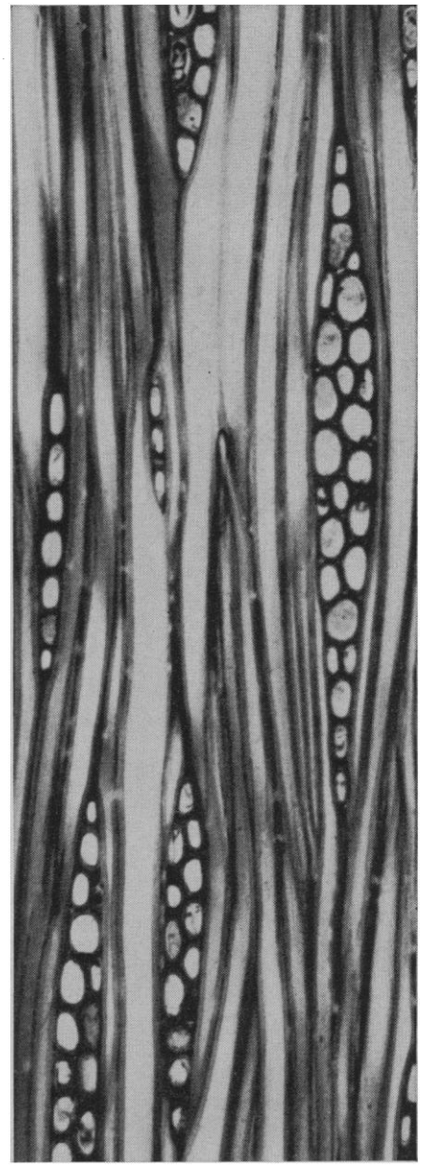
Without certain precautions during the mating of the wildly electron-avid chromium oxide to the eagerly electron-pushing trivalent nitrogen "a fire resulted with regularity," says the 1953 paper (*J.A.C.S., 75,* 422) that set off a long string of publications on this reagent by steroid chemists. These people shouldn't have to play with fire. They can feel safe with the reagent, if not with its preparation.

Despite the enthusiasm with which the union is consummated, it is not notably stable. If the bottle cap stays on tight, the complex will probably keep all right as the pyridine vapor drifts in and out of the chromium oxide. Since the function of the pyridine is to tie down the oxidizing potency of the CrO_3, the contents of this particular bottle may not weaken with age.

The material has recently been found to be a good room-temperature oxidizing agent even outside the steroid fraternity. It converts benzylic and allylic alcohols to their corresponding aldehydes, and simple aliphatic and aromatic secondary alcohols to ketones. Source: *J. Org. Chem. 26,* 4814.

Source for the reagent at the above price is Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company).

What makes hickory the way it is



This photomicrograph shows the basic structure of hickory wood. It was taken on a plain, ordinary microscope with a BROWNIE Camera. For details on this use of BROWNIE Cameras, request a copy of "Photomicrography with Simple Cameras" from Eastman Kodak Company, Sales Service Division, Rochester 4, N. Y. Everybody knows what a BROWNIE Camera is.

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The material in this section is prepared by the following contributing writers:

Robert L. Bowman (R.L.B.), Laboratory of Technical Development, National Heart Institute, Bethesda 14, Md. (medical electronics and biomedical laboratory equipment).

Joshua Stern (J.S.), Basic Instrumentation Section, National Bureau of Standards, Washington 25, D.C. (physics, computing, electronics, and nuclear equipment).

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EVOLUTION OF NERVOUS CONTROL FROM PRIMITIVE ORGANISMS TO MAN

Editor: Allan D. Bass

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From a review in the Psychiatric Quarterly, January 1960:

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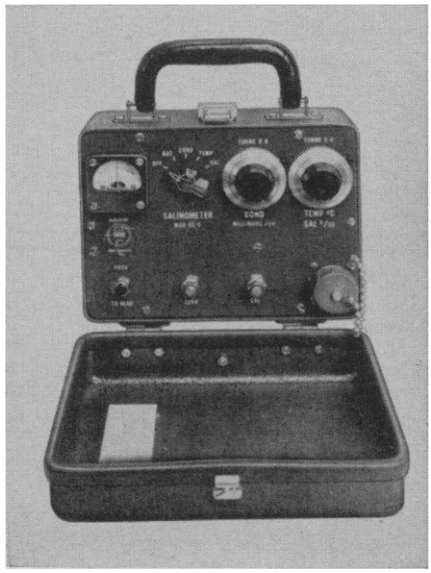
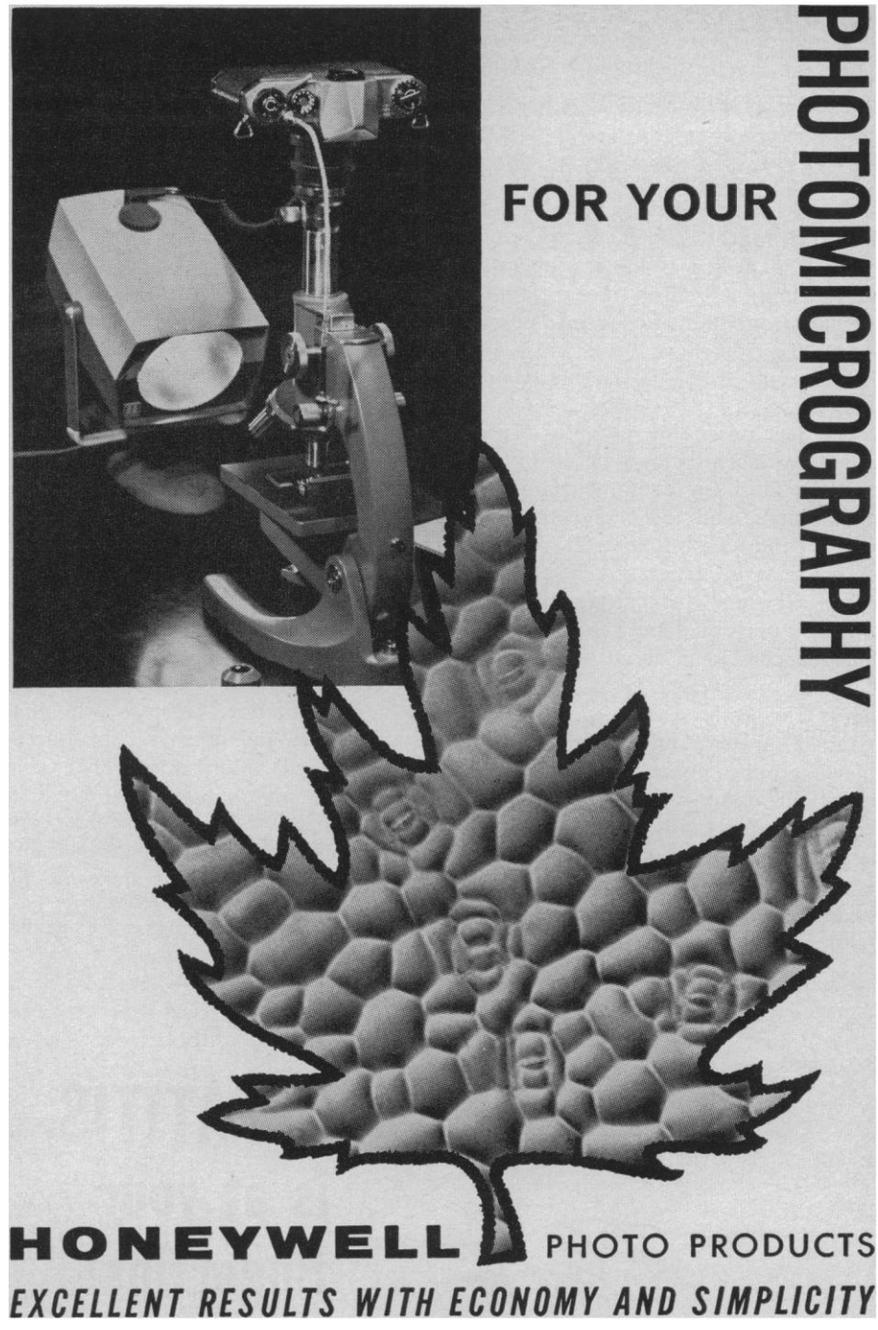


the current than does the surrounding water, the cell may be operated as close as 6 inches to obstructing surfaces. Less than 1 minute is said to be required by the measurement.—J.S. (Industrial Instruments, Inc., Dept. S433, 89 Commerce Rd., Cedar Grove, N.J.)



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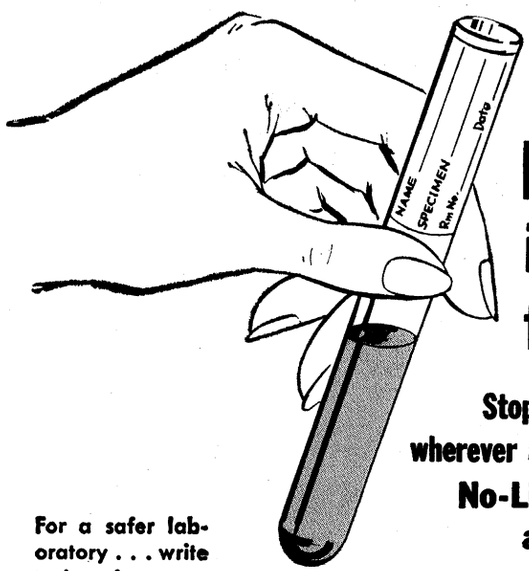

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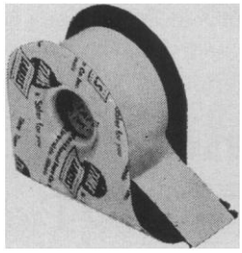

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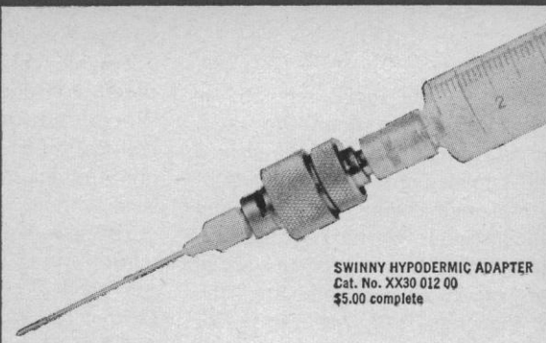

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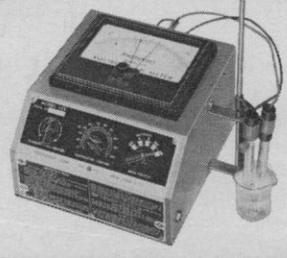

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Letters

(Continued from page 402)

tained also that the social sciences by their very nature are bound to be a mixture of humanistic studies, derived from the knowledge which man has of himself through being a man, and "scientific" studies, derived from careful observation, sampling of the social universe, measurement, indexing, and testable theories. I do not think, for instance, that all of economics is contained in econometrics, but I think we owe a great deal to those who pioneered in the measurement of economic variables, and our capacity to control depressions, for instance, has been substantially increased by our ability to measure at least the gross variables of the economic system. Nor do I think that political science is encompassed in the nascent discipline of politicometrics. Historically, however, the weight in political science has been wholly on the humanistic side of the study, and important contributions are still to be made on the other side. I believe this to be especially true in the conduct of international systems where the absence of accurate and well-sampled quantitative information is a serious handicap.

I agree entirely with Gomberg that there is room for both traditions. Where, however, as in the case of political science, the introspective and philosophical tradition has been pursued almost to the exclusion of the other, it is surely legitimate to call attention to this imbalance.

KENNETH E. BOULDING
Center for Research on Conflict Resolution, University of Michigan, Ann Arbor

Feedback and Nonfeedback

This is a comment on a comment [Moment, *Science* **136**, 1056 (1962)] on a comment [Li, *ibid.* **136**, 1055 (1962)] on a comment [Moment, *ibid.* **136**, 262 (1962)]. Moment considers that the "nonfeedback model" suggested by Li to account for the high degrees of polymorphism in species such as the brittle-star *Ophiolis aculeata* "assumes a *stable* diversity already in existence which does not change, while the proposed theory of protective variation assumes that any mutation producing a new pattern would enter the system with a selective advantage *which would decline as the frequency of the responsible gene increased*" (italics mine). On this basis, he visualizes the testability of the merits of the reflexive selection (feedback) model and the balancing selection (nonfeedback) model.

The two models may indeed yield testably different predictions, but in neither case is the selective value of a newly introduced allele unchanged as the allele increases in frequency.

In a randomly crossbreeding species, with heterozygote superiority at a locus (one form of "balancing selection"), a heterotic allele newly introduced, whether by mutation or immigration, will be present first in heterozygous condition and will remain so until its frequency, relative to population size, is high enough to create an appreciable probability that heterozygote-carriers will mate. From then on, its selective value will decrease from its initial maximum to the value determined by the equilibrium ratio of homozygotes to heterozygotes for the introduced allele, which value in turn will depend on the

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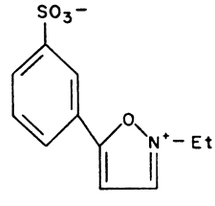

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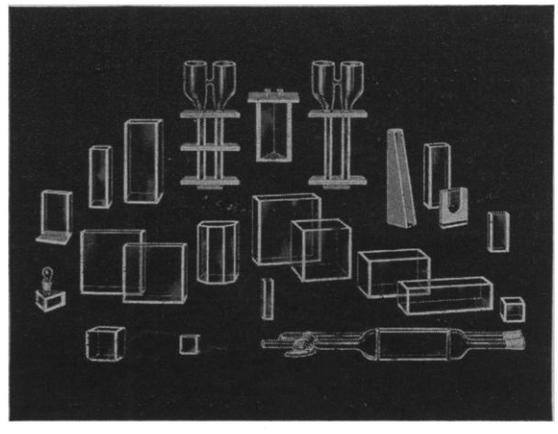

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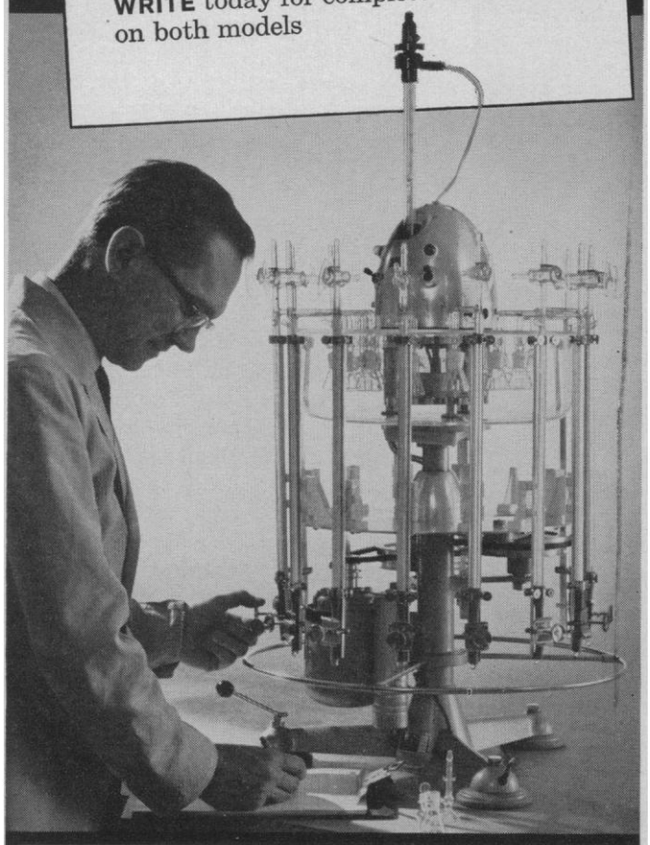

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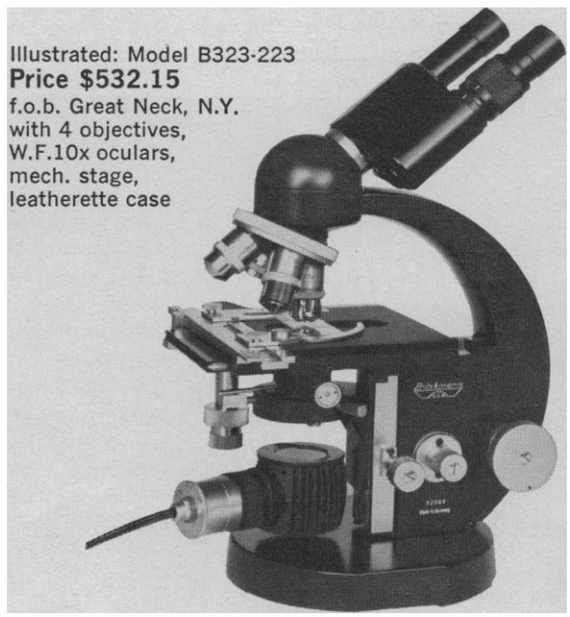

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selective value of the homozygote. In the simplest form of heterozygote superiority, let us consider a locus with multiple alleles with heterozygotes of equal selective value, arbitrarily set at 1, and homozygotes assigned selective values of less than 1 by an amount s_i, which may be different for each allele. The equilibrium frequency $\hat{p}_i$ of any one allele A_i is given by the formula presented by Li, initially derived by Wright [in *Genetics, Paleontology and Evolution*, Jepsen, Mayr, Simpson, Eds. (1949), pp. 365–386]:

$$\hat{p}_i = 1/[s_i \cdot \Sigma(1/s_i)]$$

and the proportion of zygotes homozygous for an allele to those heterozygous for it is

$$\hat{p}_i^2/2\hat{p}_i(1 - \hat{p}_i) = 1/2[s_i \cdot \Sigma(1/s_i) - 1]$$

a value which decreases with increase in the number of alleles and in the selective disadvantage of the homozygote. Until the new allele reaches its own equilibrium frequency, it will be selectively favored, vis à vis earlier alleles already present in equilibrium proportions in both homozygous and heterozygous conditions.

Furthermore, the whole population's net fitness ($\bar{W}$) will be increased by the acquisition of a new heterotic allele at the locus. The early improvement in fitness will be less than the ultimate equilibrium level, due to the temporary excess of homozygotes, for the preexisting alleles. The equilibrium fitness of the population is given by

$$\bar{W} = 1 - \Sigma s_i \cdot \hat{p}_i^2 = 1 - 1/\Sigma(1/s_i)$$

where the value of each $\hat{p}_i$ is substituted according to the earlier formula. Regardless of the value of s of the newly introduced allele, adding its reciprocal to the preexisting $\Sigma(1/s_i)$ will increase the value of the sum, decreasing the value of the fraction which is to be subtracted from 1; in other words, acquisition of a new allele at a heterotic locus makes the fitness of a population approximate more closely that of an ideal population composed solely of heterozygotes.

This increase in population fitness is similar to that arising from the addition of an allele to a system in which rarity is favored. Again employing the simplest example of this type from Li, let us consider a locus with n alleles each with frequency p_i and genotye selective values $1 - c \cdot f$, where f is the zygotic frequency of the genotype (p_i^2 for A_iA_i, and so on). At equilibrium, $p_1 = p_2 = \ldots = p_n = 1/n$. The fitness of the population attributable to this locus will be

$$\bar{W} = 1 - 5\,c/n^3$$

This again will increase as n increases.

Thus, the particular possibility for testing envisioned by Moment does not exist, both selective mechanisms (i) giving persistent genotypic diversity, (ii) serving to improve population fitness as the number of alleles increases, and, more importantly, (iii) giving the maximum selective advantage to the newly introduced, hence rare, allele. Only careful measurement of the change in proportions of (known) homozygotes to (known) heterozygotes in successive generations of populations initiated with arbitrary proportions will permit discrimination of the two models in any situation.

This is not intended to derogate the possibly, even probably, significant role of the selective value, to individuals and to populations, of visible diversity as such.

JANICE B. SPOFFORD
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