SCIENCE

20 May 1960

Vol. 131, No. 3412

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

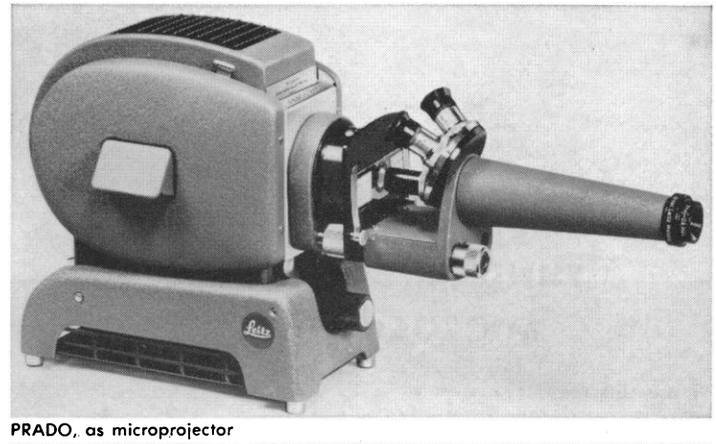
Leitz **first in precision optics**

PRADO
MICROPROJECTOR

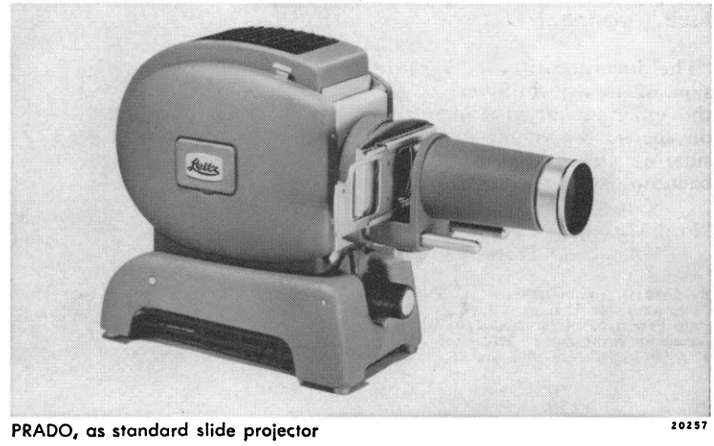
The extreme brilliance, clarity and definition in screen images from the well-known PRADO make it readily convertible from standard 2"x2" (Model 500) or 2¾"x2¾" (Model 66) slide projector to microprojector.

This portable unit may be carried easily from room to room and used wherever there is an electrical outlet. Light from the 500-watt lamp, projected through aspheric condensers in the blower-cooled PRADO, gives an image quality ideal for use in classroom or conference room.

For microprojection, the special micro-attachment simply slides onto the power-condenser housing. The attachment provides an object stage and adjustable condenser lens with helical focusing. A similar attachment is available which allows the stage to be placed in a horizontal position to accommodate wet mounts. The revolving nosepiece holds three objectives: 3.5x, 10x, and 25x. The high power objective is equipped with a spring-loaded mount.



PRADO, as microprojector



PRADO, as standard slide projector

20257

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This advanced instrument gives more usable information ...faster...than any other infrared instrument or method

You'll find Perkin-Elmer's new Model 221-G Prism/Grating Spectrophotometer unequalled in accuracy, speed, convenience, reliability.

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Work with the Model 221-G will give you continuing assurance you have purchased the finest infrared instrument available... with an unmatched combination of features:

automatic gain control–for accurate measurements in regions of reference beam solvent absorption

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wide wavelength range–unlimited freedom to work from .5 to 40 microns

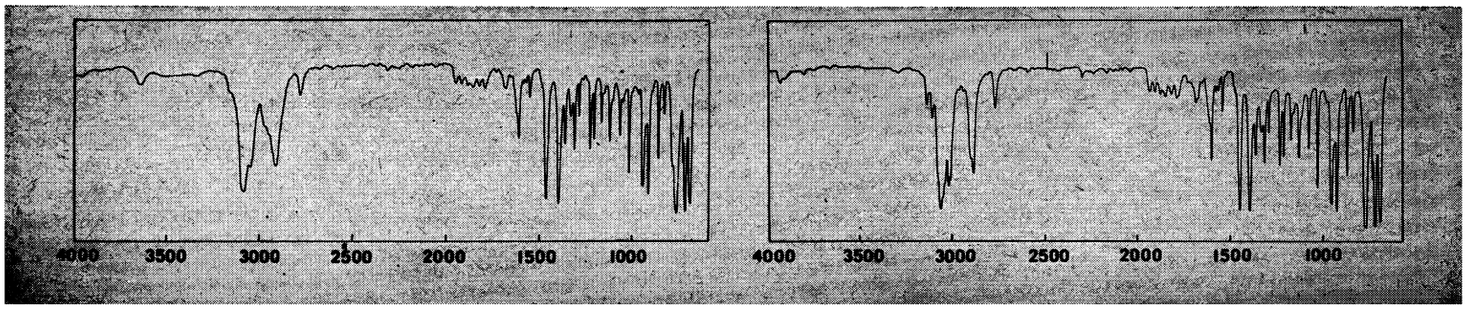
In addition, you have available the widest range of sampling accessories; P-E's Applications Engineering backup; fast, expert service.

Complete details have appeared in recent issues of P-E's quarterly INSTRUMENT NEWS. For your copies of these articles, write us at 910 Main Avenue, Norwalk, Connecticut.

INSTRUMENT DIVISION
Perkin-Elmer *Corporation*
NORWALK, CONNECTICUT

This spectrum of Indene, 99% pure, was run on the standard NaCl prism infrared spectrophotometer. The thickness of the sampling cell was .025 mm. Spectral presentation is linear in wavenumbers.

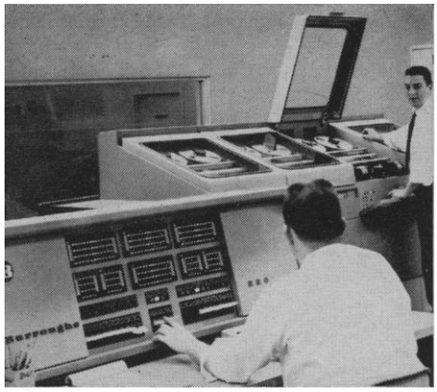
Linear wavenumber spectrum of the same sample, same cell thickness, run on a new Perkin-Elmer Model 221-G prism/grating spectrophotometer. Note improvement in resolution over that obtained in other run.

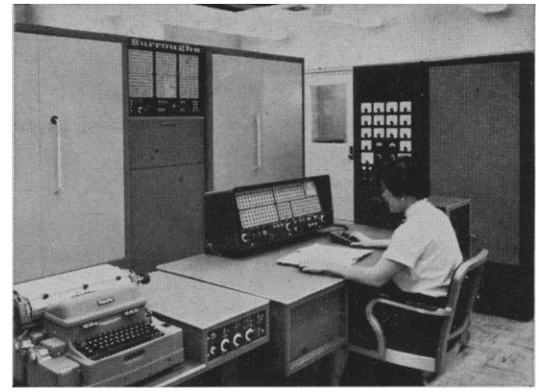


20 May 1960, Volume 131, Number 3412 **SCIENCE**

For the Babcock & Wilcox Company:

a Burroughs 205 computer backed the team that introduced atomic power to the merchant fleet...





nother Burroughs computer 's helping build one of the world's largest steam boilers...

and still another is speeding a vast research and development program

listory has already earmarked July 21, 1959, a remembrance of launching the N. S. avannah—the world's first nuclear merchant hip. This graceful queen of the seas may ell be the precursor of a vast atomic merhant fleet—ships operating quietly and effiiently on nuclear engines.

et months before touching water, the avannah's nuclear propulsion system was btaining hundreds of "trial runs" on a urroughs 205 computer at The Babcock & Vilcox Company's Atomic Energy Division a Lynchburg, Virginia.

ong before the vessel was launched these omputer runs predicted changes that were o take place in the heart of the nuclear reacor. With the aid of these data, decisions were ade as to the optimum size of the reactor, ie lifetime of the fuel elements, amount of iel needed, approximate costs and myriad ther specifications.

f course, a simulated run could have been ade with a desk calculator—but it would ave taken one year to complete a single run. he 205 has completed the same job in just few hours.

his is the latest installment in a success ory that started in November, 1955—the stallation date of the Burroughs 205 at the tomic Energy Division. Aside from the . S. Savannah project, the same computer ontributed immeasurably to other reactor esigns, and other engineering work involvg stress and thermal calculations, plus cost accounting data processing.

A recognized pioneer in the application of electronic data processing equipment, B&W was one of the first companies to develop its own automatic programming system. The effect of this powerful programming aid—called DUMBO—is to extend the capabilities of the 205 to hundreds of engineers without special knowledge of computer characteristics and techniques.

B&W engineers at Lynchburg are now able to write a plan for the computer to follow; DUMBO then automatically translates the plan into 205 language for electronic data processing.

With valuable 205 experience on design problems of a different nature, B&W's Boiler division (at Barberton, Ohio) has now installed a larger Burroughs 220 computer system to handle its increasing activities. Now in the design stage, with the aid of the 220, is one of the largest steam boilers ever conceived. When finally erected, the new steam boiler will stand as high as a 22-story skyscraper, produce 4,900,000 pounds of steam per hour, and generate sufficient power to light a city of 5,000,000 population.

Whether designing mammoth power equipment or a small industrial boiler, the Burroughs 220 has become a vital tool from initial bid through final design. The Burroughs 220 is helping to win orders with fast-but-realistic proposals, slashing costs and lead time at every possible opportunity.

B&W, whose product range includes tubular products, refractories, and marine boilers, as well as stationary steam generators, is also spearheading the development and construction of nuclear stationary and marine propulsion power plants. In all these programs, B&W depends upon the most modern analytical processing equipment.

At the company's Research and Development Center based in Alliance, Ohio, a third Burroughs computer has recently gone "on the air." This Burroughs 205 was purchased to process data for a variety of research experiments in the fields of heat transfer, fluid flow, stress analysis, and thermodynamics. Its immediate impact has been to free creative engineering talent from routine calculations and to reapply valuable human resources to the pursuit of new sources of economical energy. This 205 has already developed research data otherwise inaccessible.

All three Burroughs computers are helping B&W to meet a wide range of the nation's power requirements in the most efficient and economical way possible. Hundreds of other industrial and commercial users are confirming similar experiences.

Burroughs' complete line of electronic data processing equipment is backed by a coast-to-coast team of computer specialists, able to advise on how Burroughs can help you in your business. For additional information, write General Manager, Data Processing Systems Group, Detroit, Michigan.

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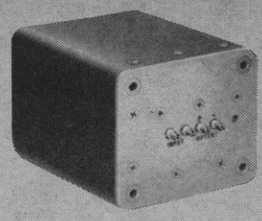
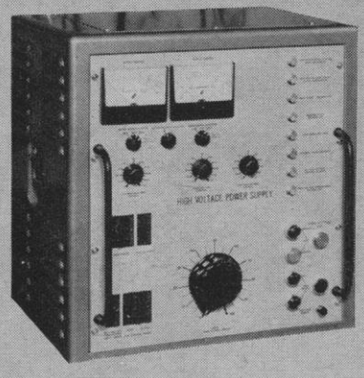


Model QM6.3-.32. Miniature Transistorized Regulated D-C Supply features regulation to ±0.05% for combined line and load variations. This is one of more than 180 miniature component-type power packs offered by Sorensen. They include, in addition to highly regulated d-c supplies, dc-to-ac inverters and dc-to-dc converters.

Model Q12-15A. One of the 15 Sorensen Q Series high-precision transistorized low-voltage supplies, features voltage regulation to ±0.05% for combined line or load variations. Models for 6, 12, 28 vdc out, with power capacities up to approximately 240 watts. Similar QR Series features precision regulation with wide output voltage adjustment range. Two models: 0-75vdc at 2 amps max and 0-36vdc at 4 amps max.



Model 2150-5 (Control Section). This is just one of a tremendous variety of Sorensen high-voltage d-c supplies, high-voltage a-c and a-c/d-c testers, and electrostatic generators. Models completely cover the voltage range from 1000 to 600,000 volts. Power outputs range up to 60 kilowatts.

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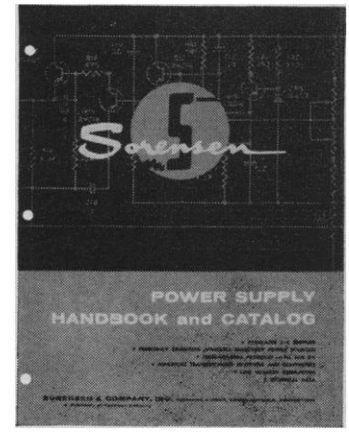
More than 400 models are covered . . . plus important technical selection and application data. Write for your copy of the new Sorensen catalog today. Sorensen & Company Inc., Richards Avenue, South Norwalk, Connecticut. o.12



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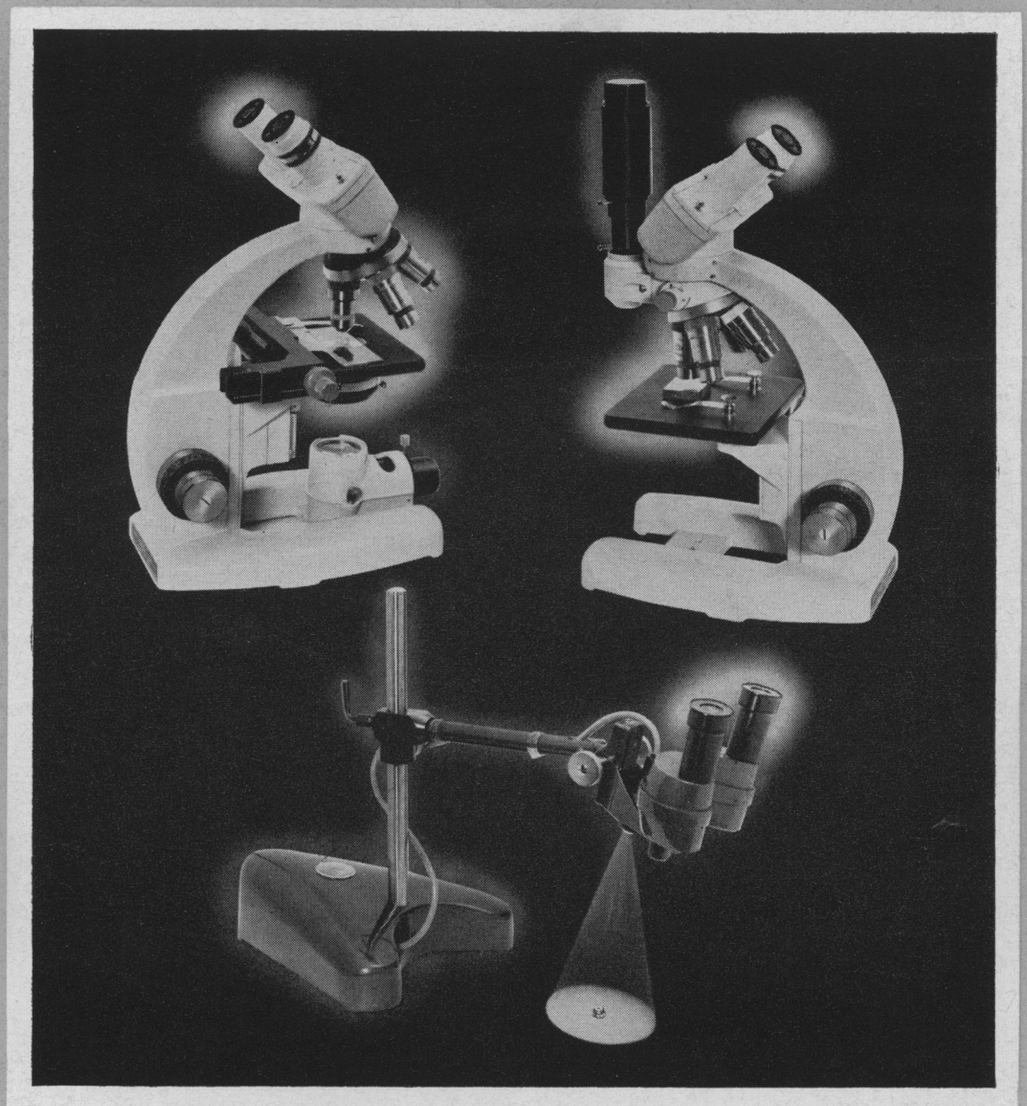

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BIOLOGICAL BY2L (illustrated upper left), 30X to 1000X, $435.

METALLURGICAL BT2 (illustrated upper right), 100X to 1000X, $489.

STEREOSCOPIC B1683, 20X fixed magnification, built-in focusable illuminator, $165.

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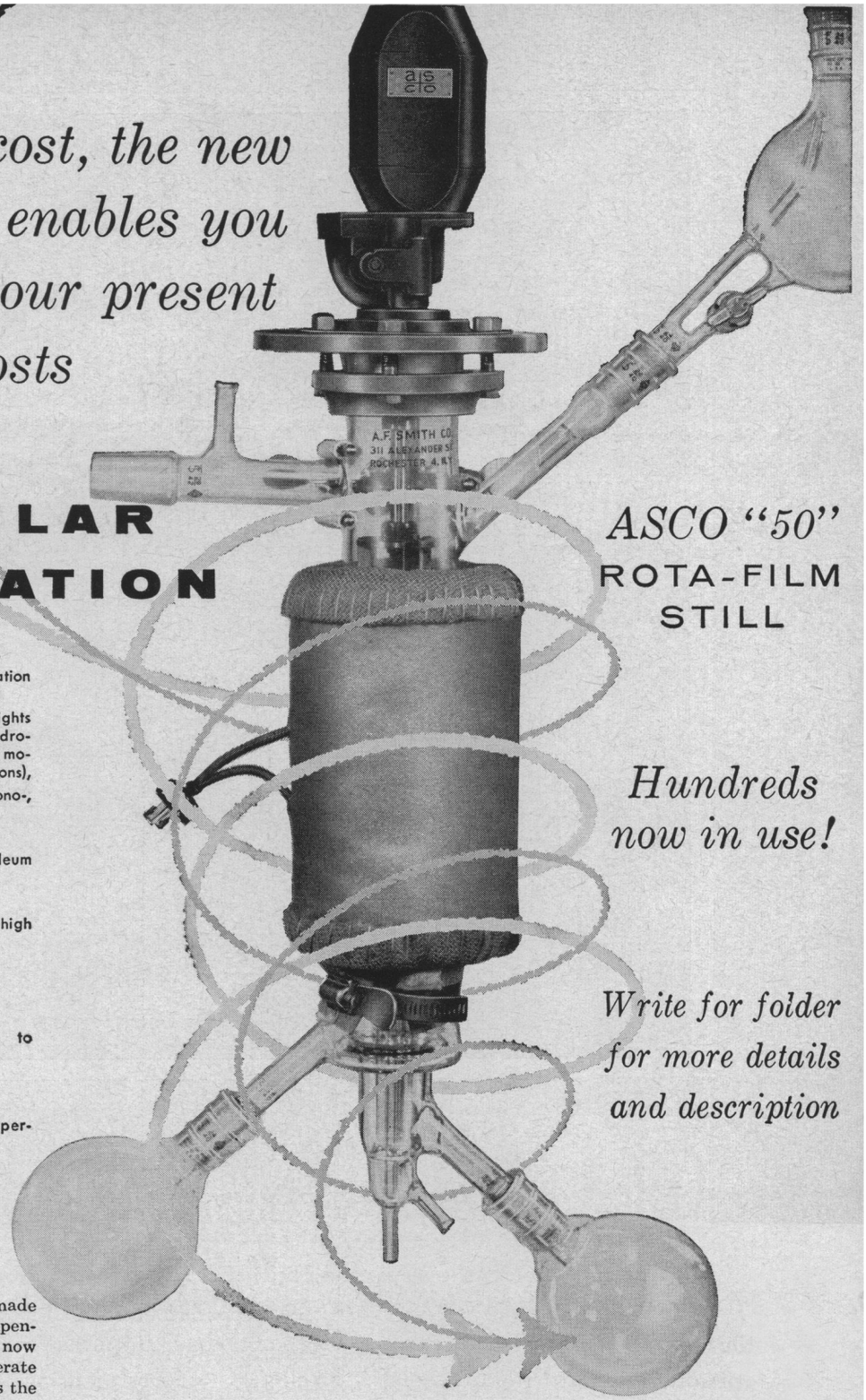
now, at low cost, the new ASCO "50" enables you to compare your present processing costs with those of

MOLECULAR DISTILLATION



ASCO "50"
ROTA-FILM STILL

Hundreds now in use!

Write for folder for more details and description

With this simple-to-operate still you may...

- explore falling agitated film evaporation and distillation,
- distill materials with molecular weights ranging from 200 to 1250 weight (hydrocarbons) and some materials to 4000 molecular weight (silicones and halocarbons),
- deglycerinate and distill mixtures of mono-, di- and tri-glycerides
- distill tall oil
- distill paraffin from slack wax or petroleum residue
- deodorize oils,
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FEATURES

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- Vacuum range from atmospheric to 1 micron Hg.
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- UNITS MAY BE COUPLED FOR FRACTIONATION.

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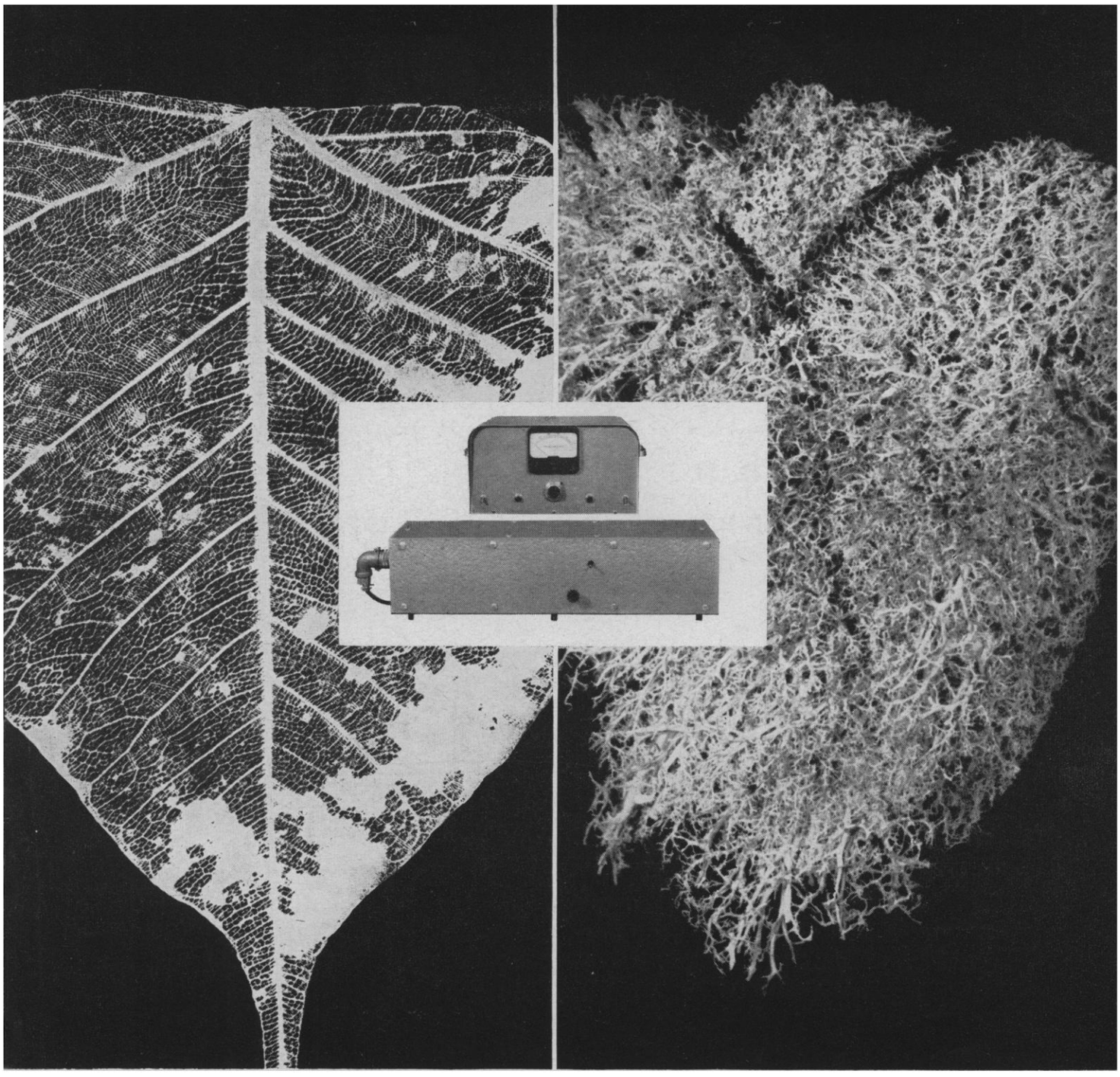

Dual tool for botanical-physiological research... the Beckman Model 15-A Infrared Analyzer is a versatile instrument of high accuracy, quick response. In photosynthesis studies for sensitive measurements of minute quantities of CO_2 or H_2O... in clinical medicine for measurements of CO and acetylene in pulmonary diffusion capacity studies... the 15-A has established itself as the standard instrument, because of these important advantages: Response speed of 0.5 sec. to 90%... usable with a galvanometer data recorder... accuracy is ±1% of scale... sensitivity up to 0.1 ppm with full scale ranges from ppm to 100%... choice of window materials and sample cell lengths to suit any analysis... simplified design for continuous operation with minimum maintenance. ¤ For information on specific applications, contact your Beckman sales office. Or write today for Data File 38-21-10.

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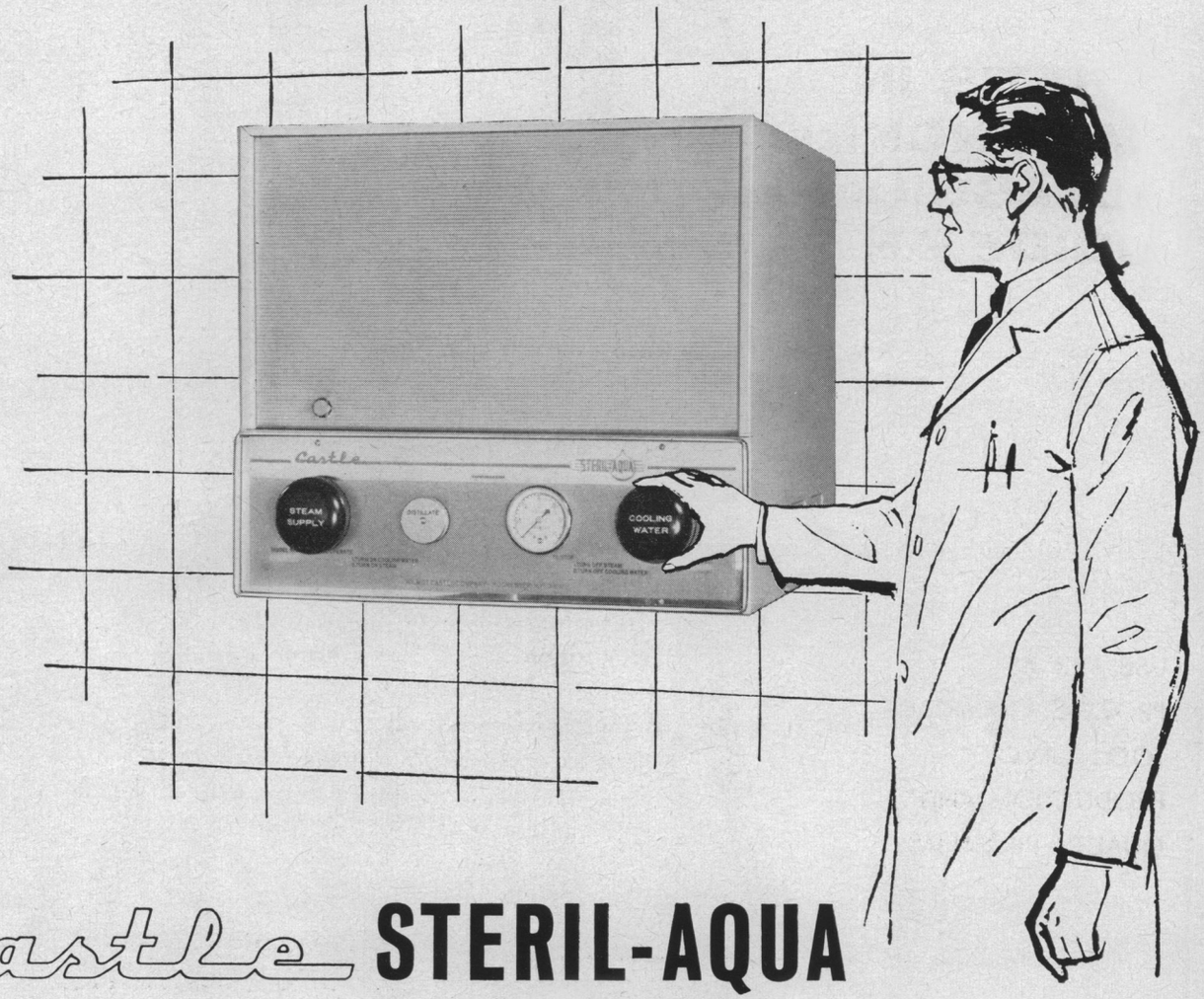
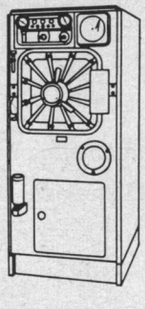


Castle STERIL-AQUA



Write, too, for details on Castle's new Orthomatic Steam and (shown above) Sterox - O - Matic Ethylene Oxide Gas Sterilizers.

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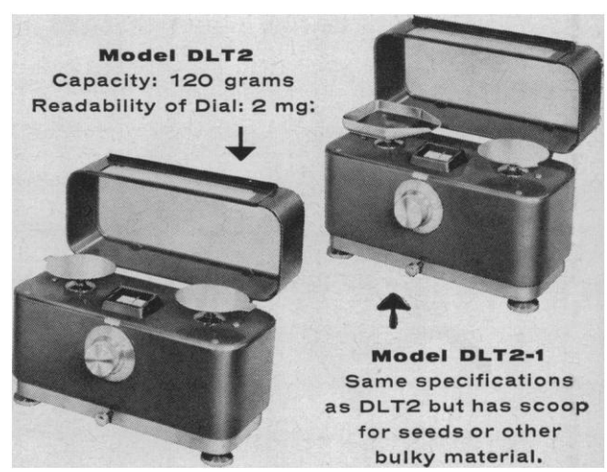
Capacity: 500 grams
Readability of Dial: .02 grams

Other Torsion Dial Balances



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TB162

AUTOMATIC RECORDING TITRATOR

SCIENTIFIC INSTRUMENTS MODEL AT-2A

now — RECORD all potentiometric titrations AUTOMATICALLY!

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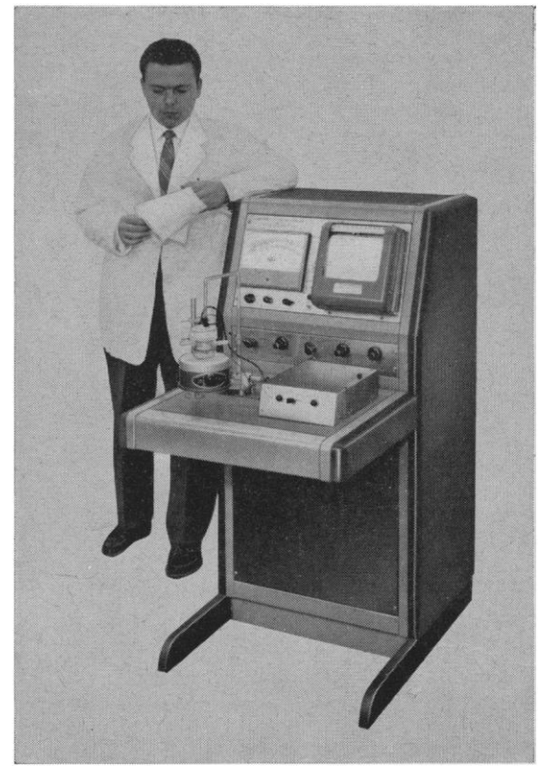
Speeds time-consuming measurements to free chemists for more productive efforts. And it's accurate to ±0.02 pH units or ±1.2 millivolts.



CAPABILITIES

* Automatic recording pH stat for reaction rate studies
* Records variation in pH or EMF as a function of titrant added
* Titrates to any pre-set end point
* Records first and second derivative titration curve
* Performs automatic titrations in aqueous or non-aqueous media: Acid-base reactions — Oxidation-reduction reactions — Precipitation reactions — Complex-ion reactions
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FEATURES

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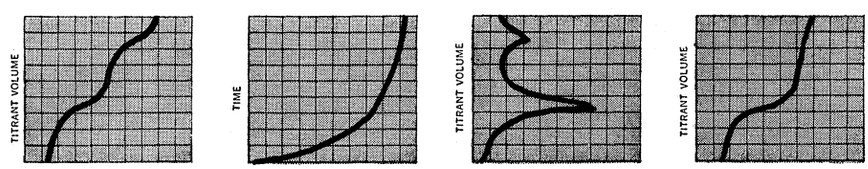
records of typical functions - by model AT-2A



Typical Variable pH Titration | Typical Constant pH Titration | Typical First Derivative Titration | Typical Precipitation Titration

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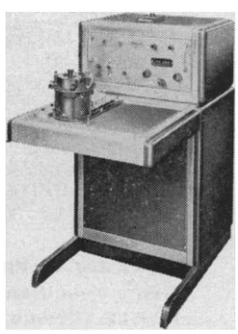
for true intrinsic viscosity measurements at extremely low shear rates...

SCIENTIFIC INSTRUMENTS MODEL RV-2



* Coaxial rotating cylinders distribute shear rate evenly
* Convenient sample changing
* Electrostatic restoring torque eliminates torsion wire and mechanical spring problems
* Rapid, simple changing of shear rates

Here is a Couette viscometer so sensitive, it measures viscosity on the plateau approaching zero shear rate, virtually eliminating the need to extrapolate to zero.

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☐ **Model RV-2 Rotating Cylinder Viscometer**

My application is_____

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Name_____ Title_____ Dept._____

Company_____

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City_____ Zone_____ State_____

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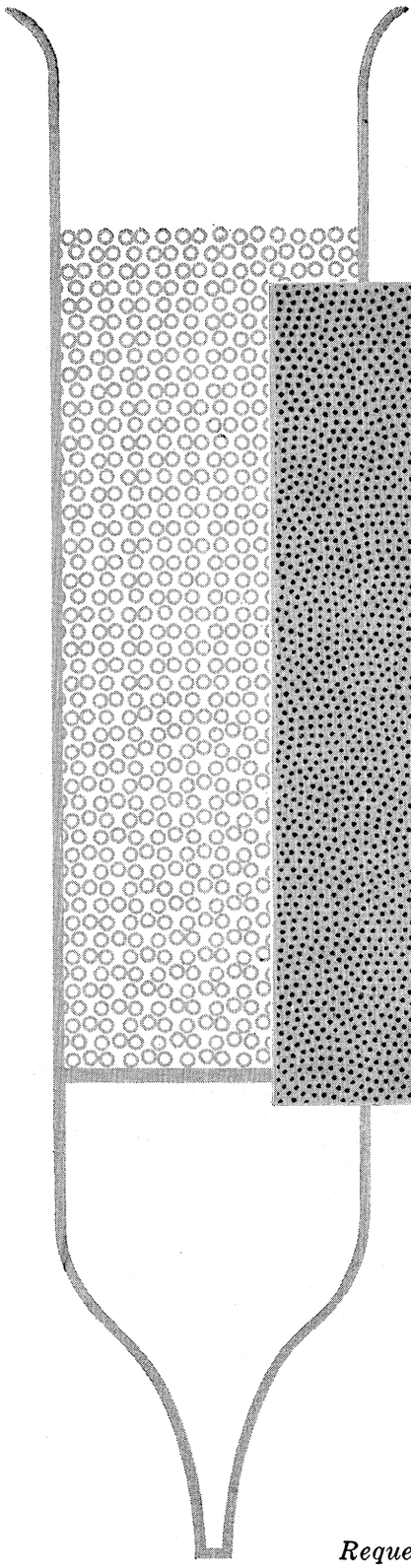

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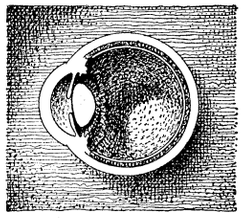
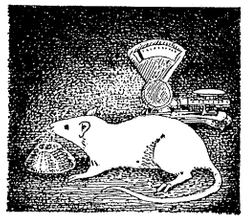
IT HAPPENED THIS MONTH...

a glance at yesterday in relation to today



IN MAY—(1878)—W. Kühne, of Heidelberg, discusses the recently discovered photosensitive pigments of the retina. "If one considers the extremely widespread occurrence in the animal kingdom of the black pigment of the eye, and other similarly stable pigments, it is scarcely possible to repress the idea that these, in addition to visual purple, also represent visual excitants. . . . Now as I have convinced myself by prolonged observations, partly on myself, and partly on animals... that even after the disappearance of the visual purple acute vision is still perfectly possible, I have come to the hypothesis that the visual purple, which is the most unstable visual excitant known at the present time, serves for the perception of feeble light, while the other pigments whose occurrence has been observed in the eye serve for that of more intense light."[1]

It was almost 80 years before Kühne's hypothesis of multiple visual pigments was verified. DPN was shown to occur in the retina and to play an important role in the metabolic processes activated by the bleaching of visual pigment. To help shed strong light on this and related processes, Schwarz BioResearch supplies DPN and other important metabolic cofactors, such as adenylic acid, ATP, cocarboxylase, and flavin adenine dinucleotide.



IN MAY—(1943)—Rose and his associates at Urbana, Illinois continue their important experiments on the role of amino acids in human nutrition. Threonine, leucine, isoleucine, and phenylalanine are reported to be necessary constituents of the diet of man. Although histidine was previously shown to be essential for rats and dogs, it is apparently not required for maintenance of nitrogen equilibrium in humans.[2]

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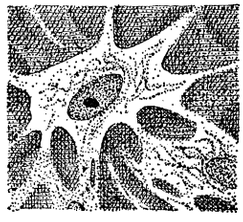

IN MAY—(1954)—Healy, Fisher and Parker[3] of the University of Toronto describe a chemical method for estimating cell multiplication in tissue cultures. The procedure is based upon the determination of desoxyribonucleic acid phosphorus (DNAP). It involves a modified Schmidt and Thannhauser separation of DNA from RNA, followed by the spectrophotometric estimation of the orthophosphate. Good correlation is found between nuclear counts and DNAP values in natural and synthetic media.

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1. Kühne, W.: Addition to the article "On the stable colours of the retina." J. Physiol. *1*:189, 1878-1879. 2. Rose, W. C.; Haines, W. J.; Johnson, J. E., and Warner, D. T.: Further experiments on the role of the amino acids in human nutrition. J. Biol. Chem. *148*:457 (May) 1943. 3. Healy, G. M.; Fisher, D. C., and Parker, R. C.: Nutrition of animal cells in tissue culture. VIII. Desoxyribonucleic acid phosphorus as a measure of cell multiplication in replicate cultures. Can. J. Biochem. Physiol. *32*:319 (May) 1954.

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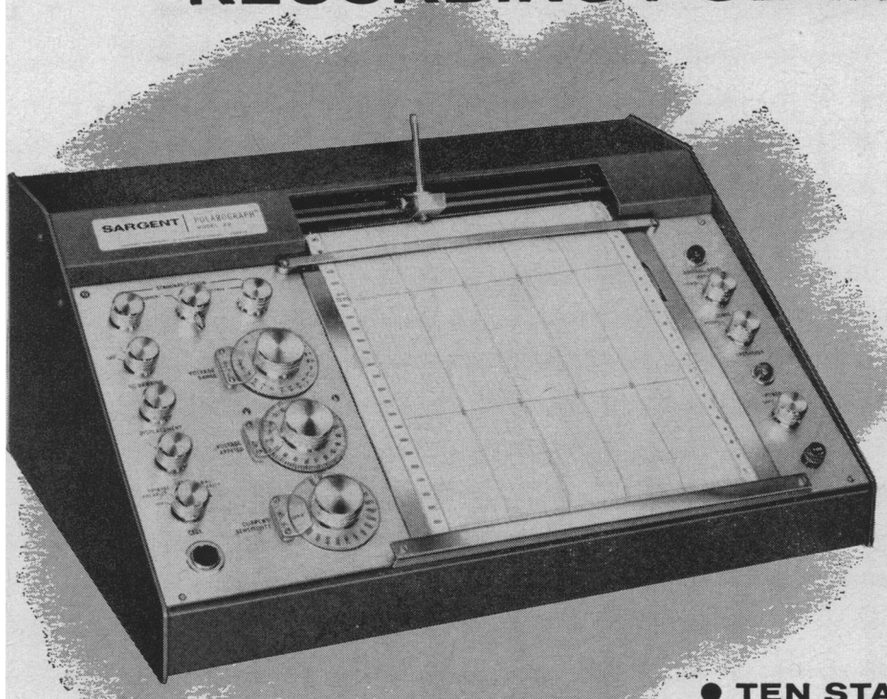

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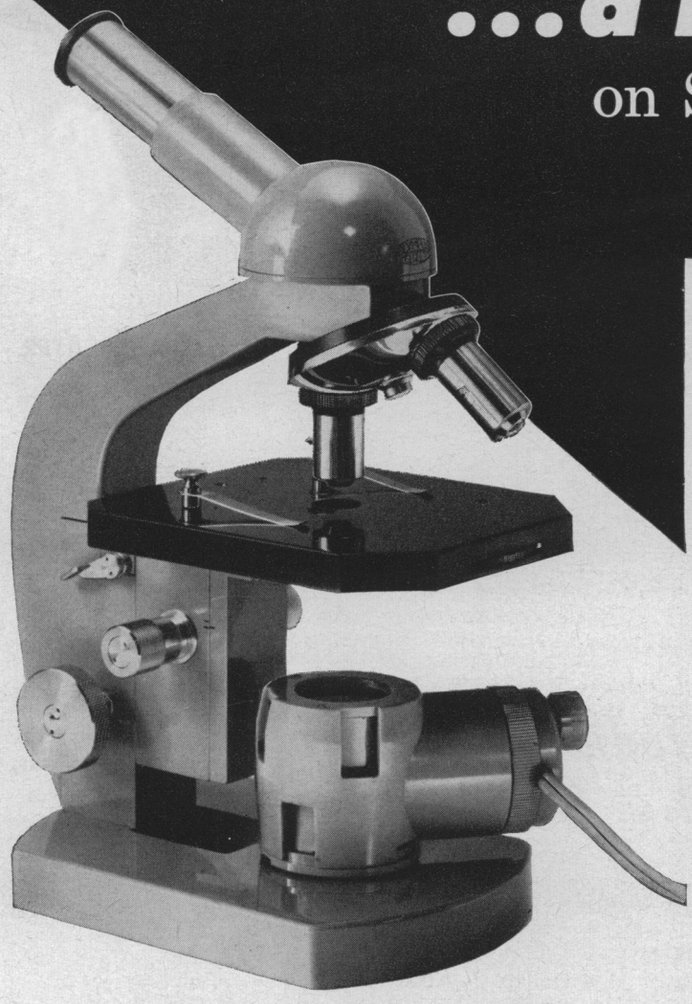

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20 May 1960, Volume 131, Number 3412 **SCIENCE**

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Popularization of Science

The aims of the popularization of science are numerous and of considerable significance. It continues, corrects and fills the gaps in school education which inevitably lags behind the march of progress; it arouses the desire to take up research and is thus of direct benefit to creative science; it likewise benefits creative science by acquainting the public at large with its power and efficiency, thus providing science with a hearing and with the support of public opinion; it creates a link between specialists in different disciplines, since it is popularization which ensures that the physicist is not altogether unaware of what is happening in biology nor the biologist of what is going on in the realm of physics; it keeps—or could keep—politicians informed—and politicians have an ever greater need to be familiar with scientific developments.

But indeed it is undeniable that these various functions, however important, do not take into account the true and specific function of popularization which is purely and simply to introduce the greatest number of people into the sovereign dignity of knowledge; to ensure that the great mass of people should receive something of that which is the glory of the human mind and not be kept apart from the momentous adventure of our kind; to bring man closer to man by striving to reduce the terrible if invisible gulf of ignorance; to struggle against mental starvation and the resulting under-development by providing every individual with a minimum ration of spiritual calories. . . .

In a word, the ideal of the popularization of science (and here lies its moral value) is to develop and assist a community of thought. It is the reverse of Renan's aristocratic concept whereby an uncultivated multitude should become the ward of a handful of the "informed". . . .

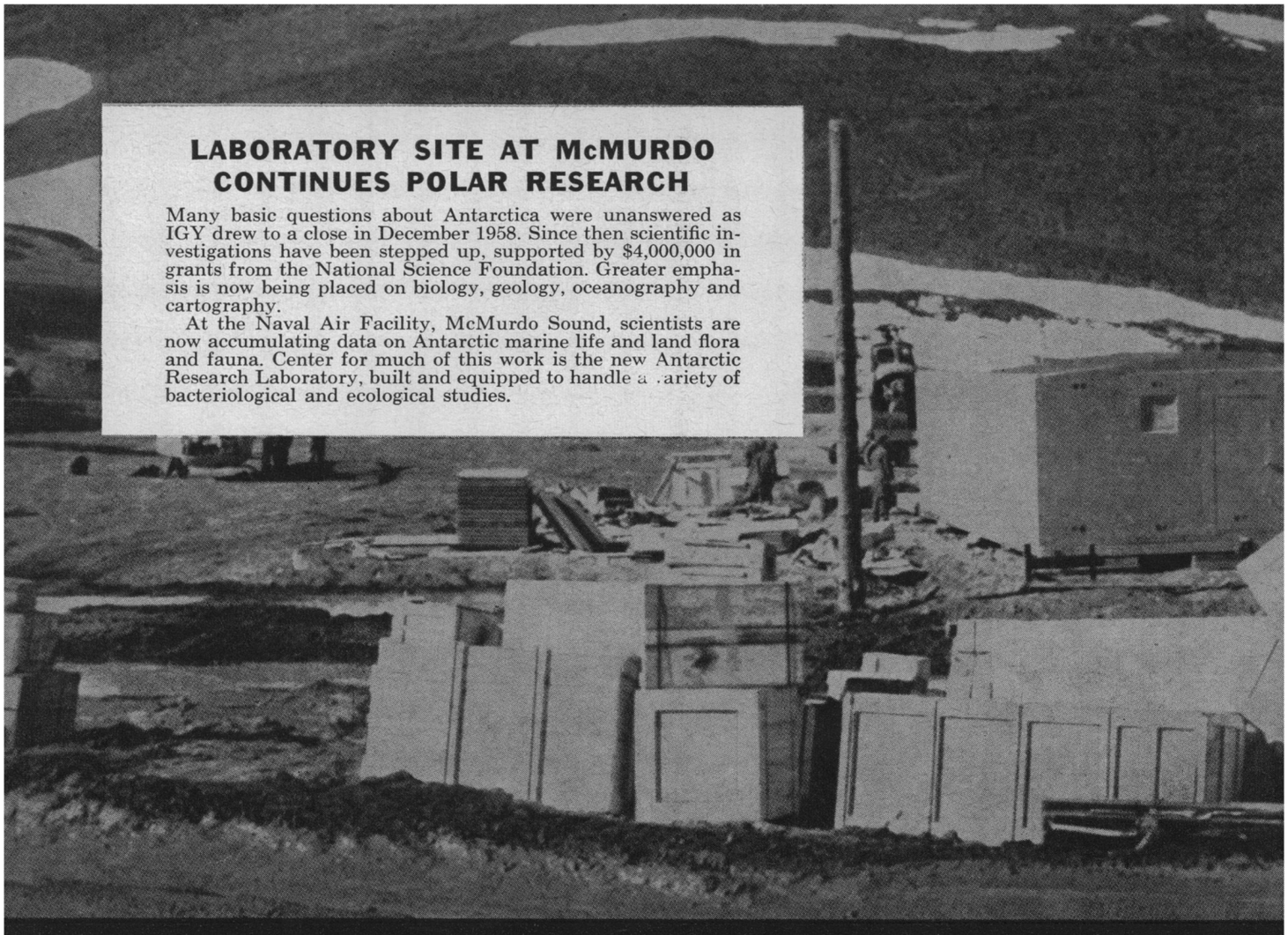
Its mission is still more exacting and we must be that much more demanding with regard to the way in which it is carried out. We are entitled to expect a rigorous impartiality, an unfailing objectivity, an absolute philosophic honesty. There is no question of using the mantle of science to indoctrinate minds or force them to conform to a pattern; there is no question of implanting in them any cramping and constricting dogmas; it is a question of "converting them to unquestionable truths," as the philosopher Guyau so admirably put it, so that, using the basic materials honestly provided, each individual may freely build his own small universe.

Any distinction between the man of science and the ordinary man is no longer admissible, any more than a form of segregation based on an inequality of knowledge. Whether we like it or not, the laboratory henceforward opens right onto the street. Science not only affects us at any given moment of our day-to-day existence, it dogs us, it pursues us. Have we not, all of us, been transformed into involuntary guinea pigs ever since atomic fission, without asking our opinion, began to plant harmful particles in our bones?

The obligation to endure gives us the right to know.

The time is clearly coming when the man in the street will have his say with regard to the great social, national, international and moral issues latterly raised by certain applications of science; and it may be that the specialist himself, weary of bearing on his own the weight of his too-heavy responsibilities, will rejoice at finding understanding and support in public awareness.—JEAN ROSTAND

[Excerpt from M. Rostand's address on the occasion of his accepting the 1959 Kalinga Prize for "outstanding contributions to the dissemination of scientific knowledge to the general public," 21 April 1960]

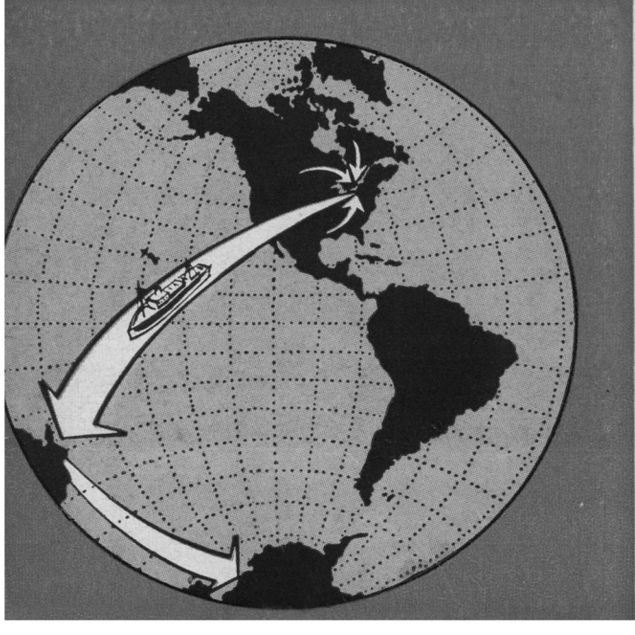


LABORATORY SITE AT McMURDO CONTINUES POLAR RESEARCH

Many basic questions about Antarctica were unanswered as IGY drew to a close in December 1958. Since then scientific investigations have been stepped up, supported by $4,000,000 in grants from the National Science Foundation. Greater emphasis is now being placed on biology, geology, oceanography and cartography.

At the Naval Air Facility, McMurdo Sound, scientists are now accumulating data on Antarctic marine life and land flora and fauna. Center for much of this work is the new Antarctic Research Laboratory, built and equipped to handle a variety of bacteriological and ecological studies.

WILL CORPORATION ELECTED TO EQUIP ANTARCTIC RESEARCH LABORATORY



Equipping the Antarctic Research Laboratory at McMurdo Sound with all its original scientific instruments, apparatus and other equipment and then supplying additional items after its operation was underway, has called for a new type of exercise in logistics for Will Corporation.

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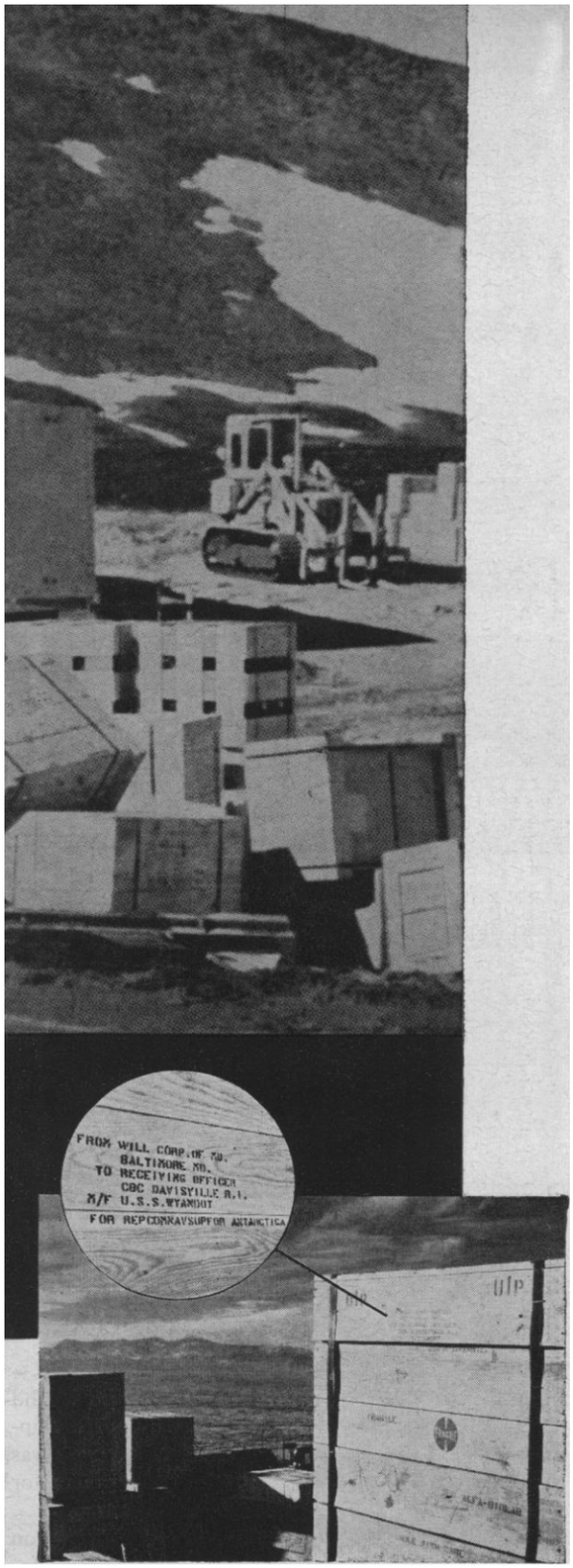

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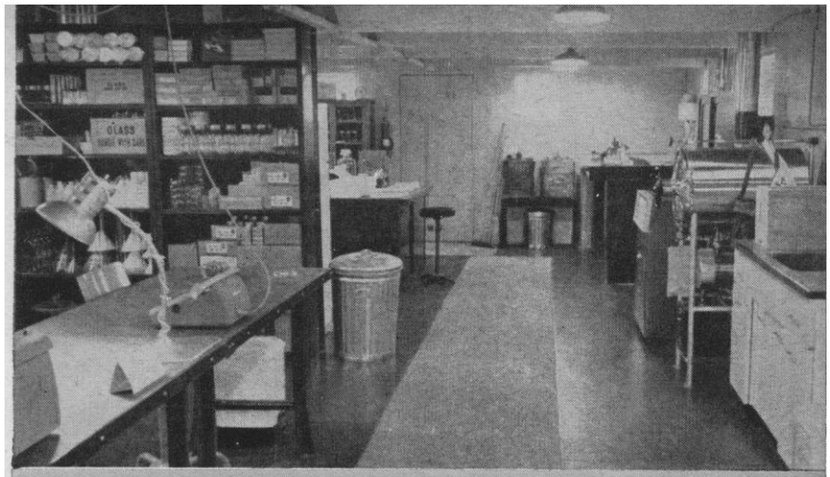

Part of the lab facility devoted to microbiological research. Careful planned in minute detail in advance, the Arctic Institute's laborato layout is outstanding example of efficient use of available space.

Chemical supplies stored at left. Cabinet at right houses collection marine invertebrate specimens. Supplies necessarily stored inside t lab itself and variety of projects planned presented unique problems laboratory layout.

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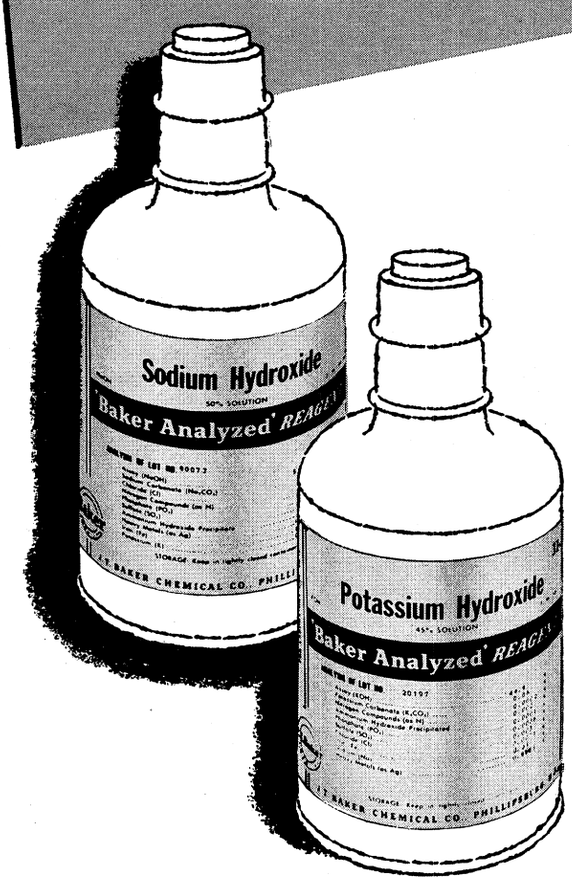

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Meetings

Near Eastern Prehistory

A seminar on "The Early Appearance and Development of Agricultural Communities in Iran and Southwestern Asia" was held in the Institute of Archeology of the University of Tehran, 15–25 February 1960, under the chairmanship of Dean A. A. Siassi, with Robert J. Braidwood and Ezat O. Negahban as co-chairmen. The session was organized to take advantage of the presence, in or near Tehran, of a number of prehistoric archeologists and natural historians, both foreign and Iranian, and to consider new evidence bearing on Near Eastern prehistory (*1*). Background papers were submitted by Pierre Bessaignet (UNESCO), Linda and Robert J. Braidwood (Chicago), M. L. Dewan (FAO), M. H. Ganji (Tehran), R. Ghirshman (Delegation Archéologique Français en Perse), Bruce Howe (Harvard), Indu Shekhar (Tehran), Ezat O. Negahban (Tehran), H. Pabot (FAO), Charles A. Reed (Illinois), E. H. Rieben (FAO), D. Sheikhnia (Tehran), M. L. Smith and L. Aksoy (CENTO Institute of Nuclear Science), L. Van den Berghe (Ghent), P. J. Watson (Chicago), and R. A. Watson (Minnesota).

In the general sessions, beginning with the appearance of Acheulean type hand-axes (in Iran as well as in southwestern Asia generally) about 100,000 years ago, Howe described a trend towards increasing cultural complexity and variety as time went on. Following Acheulean types of tools of wide distribution and uniform type, there came the Mousterian industry, which begins to vary regionally. A date might center around 60,000 years ago. Next came the even greater variance in industries of the Upper Paleolithic blade tool tradition, ending in a flourish of microlithic tools. This stage covered the remainder of the last glacial period, from about 40,000 to 15,000 or even 12,000 years ago. Howe then considered the archeological traces of the very interesting transitional range of the next 2000 years, for which little open sites yield traces of intensified food collection. In a theoretical sense this transitional period must contain the incipient phases of plant and animal domestication. However, the archeological evidence for this period is so slight that its elements of food production cannot yet be defined. Indeed, the artifactual material appears still to be a part of the previous tradition associated with food collectors. It is rather by hindsight from the next stage that we postulate this incipient stage.

In his account of the first bona fide traces of the village farming communities Braidwood wondered if a reversal of the trend towards regional intensification might not now be observed. In considering archeological evidence for the earliest village farming communities the following factors must be borne in mind.

1) Increased size and depth of accumulation, including house structures, indicating permanence, stability, and at least eventual population increase. Ethnological data suggest that there may be a few exceptions to a general rule that these features imply food production.

2) The so-called "neolithic" traits—ground stone (for example, celts and milling stones), pots, weaving, and so on—probably suggest new species and genera of tools which attend establishment of the village farming community. Certain of these traits now appear to have entered the record at different times, either before or after the achievement of food production; but, Braidwood asked, "Would a constellation of these traits have been possible without (i) an assured and surplus food supply, (ii) circumstances which allowed the rise of specialist craftsmen, (iii) a blurring of Howe's regional specialization as trade, and even an exchange of ideas beginning to be evidenced?"

3) Obvious proof of the village farming community stage depends on the contextually certain traces of the plant and animal domesticates.

4) Slightly weaker evidence of the village farming community stage would be artifacts for which the simplest explanation suggests techniques of food production.

Along with the immediate consequences which these four points suggest, there must have come vast changes in other realms of human culture. Matters of art, religion, politics, law, the moral order are at issue, but we have much more to learn before significant reconstructions of these can be made.

Next Negahban approached the question of whether the formative and earliest stages of the village farming community way of life may be identified on the Anatolian and Iranian plateaus. Strong typological suggestions of this early stage have been gathered from the Iranian plateau, but their serious study is impeded by lack of excavation into deposits of this stage. He next explained the archeological evidence of the well-formed village farming communities known from some eight sites in two subdivisions of cultural development, a northern and a southern one. He then posed certain questions regarding factors in the transition from food collecting to food production. He asked: (i) What was the effect of cli-

matic change, *if* it occurred on the activities of man in developing this new way of life? (ii) What was the effect of a deterioration of plant and animal resources, *if* it occurred, and did it impel man towards a new type of food quest? Considering these points, one asks: To what degree had man as an increasingly successful food collector become a destroyer of the natural environment?

Shekhar then painted a picture of the brilliant achievement of a later, and urban, civilization in the Indus Valley. Again, lack of information prevents our knowing what were the antecedents of this civilization. The question of the formation of the Indus Valley civilization is one of the great challenges facing archeology today, and work in India, Pakistan, and Iranian Baluchistan will be required before it is met. The available materials from both northern and southern Baluchistan suggest directions for further research.

Next, as the seminar turned its attention to the paleo-environment, P. J. Watson took up the artifactual and nonartifactual traces of food production in southwestern Asia. This discussion was based upon her ethnological investigations into present-day nonmechanized agricultural procedures as well as on her knowledge of the archeological record. Such artifacts as digging stick weights, stone sickle blades, grindstones, and wheat and barley were singled out. The point was made that these last two items as domesticates were, in fact, artifacts and no longer nonartifactual material. Combining her impressions of present-day nonmechanized procedures with the implications to be drawn from the artifacts, she arrived at a reconstruction of early food production that shares many elements with today's practices of planting, reaping, threshing, and winnowing. Such items as the animal-drawn plow, the rotary quern, and the metal sickle, are, of course, not present in the earliest stages.

Further exploration of the paleo-environment followed in Reed's consideration of the animals of the pertinent area and time range (*2*). Provocatively describing man's place in nature from the zoologist's point of view, Reed emphasized the importance of the natural habit of social behavior among those animals which became domesticated. The cat appears to be a single exception. Reed defined domestic animals as those whose reproduction man controls. It follows that they also are artifacts. Since the social behavior of the potential domesticates must be assumed to be some millions of years old, it is striking that, with this preadaptation, domestication was so long delayed. Reed favored the uplands about the Fertile Crescent as the locale for early domestication and, on the archeological record to date, showed that the dog and the goat were present in domesticated form at both Jarmo in Iraq and Jericho in Palestine at a date which he took to be about 8500 years ago. On present evidence, Reed rejected both the notion of climatic change and changes in human physical type as determinative factors in animal domestication. He saw the achievement of a necessary but unspecified level of cultural evolution as the requisite for domestication, thereby throwing the problem back upon the archeologists. He also concluded that animals were domesticated after permanent human settlements were achieved and that plant domestication may well have preceded animal domestication.

Next followed a joint consideration of the physical factors in the paleo-environment by R. A. Watson, Dewan, and Ganji. Watson supposed that archeologists expect aid of geologists in geochronological dating and in the reconstruction of past climate and physical environments. Before adequate geological aid can be given, he averred, two things would be needed. Much further study and description of the general geomorphological features of southwestern Asia will be necessary. This will also involve reassessment of the

older, simplistic generalizations on such features as end-Pleistocene lakes, sand dunes, fluvial and marine terraces, and glacial and periglacial phenomena.

Dewan emphasized that, of the whole range of soils to be found in southwestern Asia, those most pertinent to early agriculture would be the alluvial soils and the brown soils. He described their characteristics, properties, and distribution. These data he covered in much more detail in his very useful background paper.

In elaborating on his own useful background paper, Ganji also emphasized the limitations of present climatic data in arriving at a detailed picture of present climate for southwestern Asia. Thus, the projecting of climate into the past is that much more difficult. However, it is clear that gross climatic change within the last 10,000 to 15,000 years is not evidenced, although frequent minor cyclic variations can be traced. Ganji urged attention to the paleobotany of grains as a clue to understanding past climates. He summarized his observations on Iran in two detailed maps, one of rainfall and one of his adaptation of the Koeppen system for delineating the climate as applied to Iran.

Although diffident about discussing paleobotanical matters, Pabot made stimulating contributions to the central question of the seminar. He suggested that the wild wheats may have a distribution slightly further to the southeast of the Kermanshah area than those shown on Helbaek's map of 1959 (*3*). He also stated that he had never observed wild wheat throughout the country of the Syrian saddle except below the latitude of the Beirut-Damascus road. Southern Turkey is not under consideration here. He further stated that he would not expect the plant communities of the lush East Mediterranean strip or those of the Caspian or Black Sea littorals to have included the wild wheats, although he added that, in his opinion, the presently suggested prototypes of wheat are not yet proved to have been the ancestors of the domesticates. Pabot was firmly convinced that the present natural habitat of the wild wheats lies above approximately 1000 meters. He also made stimulating comments about how the wild grains may have been taken into domestication and first utilized. He remarked that the wheats under primitive conditions may have been rather rare grains and are adapted to areas of disturbed soil conditions. Furthermore, the reaping process could have involved plucking plants out by the roots. Interestingly, Pabot concurred with the notions of Reed and of the archeologists that the transition to cereal domestication may have taken about 2000 years.

Sheikhnia then emphasized the importance of the forest trees and of fruit trees and viticulture in the development of the village farming community way of life.

Rieben posed a very interesting problem which he realized was not immediately relevant to the purpose of the seminar but which is, nevertheless, of potentially great importance. He described nearly horizontal layers of mud and gravel just east of Tehran. These features might represent either an extinct lake beach or the trace of a more recent large artificial canal.

Smith discussed in general terms the potential contribution to archeology of the physical sciences, considering matters of identification, utilization of materials, and physical chronologies. He clearly described the radioactive carbon method of age determination, noting the degree of physical and statistical error which is necessary in expressing the age determination. Even more important is the possibility of contamination of samples *in situ* which might result in larger degrees of error than those expressed by the statistical formula. The still remote possibilities for dating baked-in-place pottery by means of the earth's magnetism were discussed. The possibilities for identification of materials by neutron activation and beta-ray back scatter were also considered.

Bessaignet introduced the subject of the pertinence of social-anthropological studies to archeological interpretation, noting the cautions necessary in extrapolating backwards from present-day tribal behavior to a reconstruction of past social organization.

In originally proposing the seminar the co-chairmen had hoped that it might clarify understanding of how and under what circumstances man, for the first time in his history, achieved food production and settled community life in southwestern Asia. One of the most important challenges in any scientific research is that of finding how to pose the questions properly for further research, and it was the firm conviction of the organizers of this seminar that the *questions* had become more clear. The proceedings of the seminar will be published by the Institute of Archeology of the University of Tehran.

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References

1. R. J. Braidwood, *Science* **127**, 1419 (1958).
2. C. A. Reed, *ibid.* **130**, 1629 (1959).
3. H. Helbaek, *ibid.* **130**, 365 (1959).

Forthcoming Events

June

8–10. Canadian Federation of Biological Societies (Canadian Physiological Soc., Pharmacological Soc. of Canada, Canadian Assoc. of Anatomists, Canadian Biochemical Soc.), 3rd annual, Winnipeg, Manitoba. (E. H. Bensley, Montreal General Hospital, 1650 Cedar Ave., Montreal 25, P.Q.)

8–11. National Soc. of Professional Engineers, annual, Boston, Mass. (P. H. Robbins, NSPE, 2029 K St., NW, Washington 6)

8–12. American College of Chest Physicians, Miami Beach, Fla. (M. Kornfeld, 112 E. Chestnut St., Chicago 11, Ill.)

9–10. American Geriatrics Soc., Miami Beach, Fla. (R. J. Kraemer, 2907 Post Rd., Warwick, R.I.)

9–10. Canadian Inst. of Food Technology, 3rd annual conf., Winnipeg, Manitoba. (W. J. Eva, Box 846, Winnipeg, Manitoba)

9–10. Society of Women Engineers, 10th annual conv., Seattle, Wash. (Mrs. J. A. Troxell, 3613 E. 43 St., Seattle 5)

9–11. Acoustical Soc. of America, Providence, R.I. (W. Waterfall, ASA, 335 E. 45 St., New York 17)

9–11. Endocrine Soc., Miami Beach, Fla. (H. H. Turner, 1200 N. Walker, Oklahoma City 3, Okla.)

9–11. National Speleological Soc., annual, Carlsbad, N.M. (G. W. Moore, U.S. Geological Survey, Menlo Park, Calif.)

9–12. American Medical Women's Assoc., Miami Beach, Fla. (Mrs. L. T. Majally, 1790 Broadway, New York 19)

9–12. American Rheumatism Assoc., annual, Hollywood-by-the-Sea, Fla. (F. E. Demartini, Presbyterian Hospital, 622 W. 168 St., New York 32)

9–12. American Therapeutic Soc., Miami Beach, Fla. (O. B. Hunter, Jr., 915 19 St., NW, Washington 6)

10–12. American College of Angiology, Miami Beach, Fla. (A. Halpern, 11 Hampton Court, Great Neck, N.Y.)

10–12. American Electroencephalographic Soc., Boston, Mass. (G. A. Ulett, 1420 Gratten St., St. Louis 4, Mo.)

10–12. Society for Biological Psychiatry, Miami Beach, Fla. (G. N. Thompson, 2010 Wilshire Blvd., Los Angeles 57, Calif.)

11. American Acad. of Tuberculosis Physicians, Miami Beach, Fla. (G. P. Bailey, P.O. Box 7011, Denver 6, Colo.)

11–12. American Diabetes Assoc., Miami Beach, Fla. (J. R. Connelly, 1 E. 45 St., New York 17)

11–16. American Soc. of X-ray Technicians, Cincinnati, Ohio. (G. J. Eilert, 16 Fourteenth St., Fond du Lac, Wis.)

12. Society for Vascular Surgery, Miami Beach, Fla. (G. H. Yeager, 314 Medical Arts Bldg., Baltimore 1, Md.)

12–15. American Nuclear Soc., 6th annual, Chicago, Ill. (O. Du Temple, ANS, c/o John Crerar Library, 86 E. Randolph St., Chicago 1)

12–15. American Soc. of Agricultural Engineers, Columbus, Ohio. (J. L. Butt, P.O. Box 229, St. Joseph, Mich.)

12–16. Cancer Research, 4th Canadian conf., Honey Harbour Ontario, Canada. (R. L. Noble, Collip Research Laboratory, Univ. of Western Ontario, London, Ontario, Canada)

12–17. Association for Research in Ophthalmology, Miami Beach, Fla. (L. V. Johnson, 10515 Carnegie Ave., Cleveland, Ohio)

13–14. Technical Writing Improvement Soc., 5th Southern Calif. Industrial Writing Inst., Los Angeles, Calif. (J. L. Kent, TWIS, P.O. Box 5453, Pasadena, Calif.)

13–15. American Neurological Assoc., Boston, Mass. (M. D. Yohr, 710 W. 168 St., New York 32)

13–15. American Soc. of Heating, Refrigerating and Air-Conditioning Engineers, 67th annual, Vancouver, B.C. (E. R. Searles, ASHRAE Journal, 234 Fifth Ave., New York 1)

13–15. Chemical Inst. of Canada, 43rd conf., Ottawa, Ontario. (CIC, 48 Rideau St., Ottawa 2, Ontario)

13–15. Herpetologists League, Eugene, Ore. (A. M. Woodbury, 248 University St., Univ. of Utah, Salt Lake City 2)

13–15. International Powder Metallurgy Conf., New York, N.Y. (K. H. Roll, Metal Powder Industries Federation, 60 E. 42 St., New York 17)

13–15. Microscopy, natl. symp., Chicago, Ill. (Walter C. McCrone Associates, 501 E. 32 St., Chicago 16)

13–15. Society for Investigative Dermatology, 21st annual, Miami Beach, Fla. (H. Beerman, SID, 255 S. 17 St., Philadelphia)

13–17. American Medical Assoc., Miami Beach, Fla. (F. J. L. Blasingame, 535 N. Dearborn St., Chicago 10, Ill.)

13–17. Canadian Medical Assoc., 93rd annual, Banff, Alberta. (CMA, 244 George St., Toronto, Canada)

13–17. International Conf. of Physio-Pathology of Animal Reproduction and Artificial Insemination, Amsterdam, Netherlands. (J. Edward, Milk Marketing Board, Thames, Surrey, England)

13–17. International Cong. of Clinical Pathology, Madrid, Spain. (J. A. Garrido, Sandoval 7, Madrid)

13–17. Molecular Structure and Spectroscopy, symp., Columbus, Ohio. (R. A. Oetjen, Dept. of Physics and Astronomy, Ohio State Univ., Columbus 10)

13–18. AAAS Pacific Div., Eugene, Ore. (R. C. Miller, California Acad. of Sciences, Golden Gate Park, San Francisco 18)

13–2 Sept. Gordon Research Confs., Meriden and New London, N.H. (W. G. Parks, Univ. of Rhode Island, Kingston)

14–16. American Meteorological Soc., Eugene, Ore. (K. C. Spengler, AMS, 45 Beacon St., Boston 8, Mass.)

15–17. American Physical Soc., Montreal, Quebec, Canada. (K. Darrow, APS, Columbia Univ., 116 St. and Broadway, New York, N.Y.)

15–17. Mechanisms of Peroxide Reactions, conf., Providence, R.I. (J. O. Edwards, Metcalf Research Laboratory, Brown Univ., Providence 12)

15–24. International Union for Conservation of Nature and Natural Resources, Warsaw and Cracow, Poland. (H. J. Coolidge, National Research Council, Washington 25, D.C.)

15–25. Large Electric Systems, intern. conf., Paris, France. (British National Committee, Thorncroft Manor, Dorking Rd., Leatherhead, Surrey, England)

15–29. Nuclear Congress and Exhibition on Electronics and Atomic Energy, 7th intern., Rome, Italy. (Secretariat, Rassegna

Elettronica, Nucleare e della Cinematografia, Via della Scrofa 14, Rome, Italy)

16–17. National Colloid Symp., 34th, Bethlehem, Pa. (B. R. Ray, Dept. of Chemistry, Washington State Univ., Pullman)

16–18. American Scientific Glassblowers Soc., 5th annual conf., Pittsburgh, Pa. (W. E. Barr, Gulf Research & Development Co., P.O. Box 2038, Pittsburgh 30)

16–18. Growth; Molecule, Cell, and Organism, intern. symp., Lafayette, Ind. (M. X. Zarrow, Dept. of Biological Sciences, Life Science Bldg., Purdue Univ., Lafayette, Ind.)

17–19. American Soc. of Icthyologists and Herpetologists, Chicago, Ill. (R. Conant, Philadelphia Zoological Garden, 34 St. and Girard Ave., Philadelphia 4)

19–22. American Inst. of Chemical Engineers, Mexico City, Mexico. (F. J. Van Antwerpen, AICE, 25 W. 45 St., New York 36)

19–22. American Soc. of Mammalogists, annual, Tacoma, Wash. (B. P. Glass, Dept. of Zoology, Oklahoma State Univ., Stillwater)

19–24. American Soc. of Medical Technologists, Atlantic City, N.J. (Miss M. C. Wethington, 4221 Ann St., Saginaw 3, Mich.)

19–25. American Library Assoc., Montreal, Canada. (D. H. Clift, ALA, 50 E. Huron St., Chicago 11, Ill.)

19–25. American Soc. of Civil Engineers, Reno, Nevada. (W. H. Wisely, 33 W. 39 St., New York 18)

20–22. Medicinal Chemistry, 7th natl. symp., Kingston, R. I. (J. J. DeFeo, Dept. of Pharmacology, Univ. of Rhode Island, Kingston)

20–July 30. Mathematical Statistics and Probability, 4th symp., Berkeley, Calif. (Dept. of Statistics, Statistical Laboratory, Univ. of California, Berkeley 4)

20–22. Society for the Study of Development and Growth, 19th symp., Waltham, Mass. (L. Jaffe, Biology Dept., Brandeis Univ., Waltham 54)

20–23. Society for Applied Spectroscopy, 11th annual symp., Chicago, Ill. (H. Wilson, Continental Can Co., Inc., 7622 So. Racine Ave., Chicago 20)

20–24. American Soc. for Engineering Education, Lafayette, Ind. (W. L. Collins, Univ. of Illinois, Urbana, Ill.)

20–24. International Acad. of Pathology, London, England. (G. J. Cunningham, Royal College of Surgeons of England, London, W.C.2, England)

20–24. National Inventions Exhibition and Creativity Conf. (Cleveland Engineering Soc.), Cleveland, Ohio. (Cleveland Engineering Soc., 3100 Chester Ave., Cleveland 14)

20–26. Congress on Nuclear Energy, Rome, Italy, (Comitato Nazionale per le Richerche Nucleari, Via Belisario 15, Rome, Italy)

20–1. Air Force Missile Development Center and Univ. of New Mexico, series of seminars, Cloudcroft, N.M. (J. R. Foote, P.O. Box 1053, Holloman AFB, N.M.)

22–24. Standards and Electronic Measurements, conf., Boulder, Colo. (J. F. Brockman, National Bureau of Standards, Boulder)

22–25. Society of Nuclear Medicine, Estes Park, Colo. (T. P. Sears, V.A. Hospital, Denver 20, Colo.)

25–5. First Intern. Cong. on Automatic Control, Moscow, U.S.S.R. (R. Oldenburger, Mechanical Engineering Dept., Purdue Univ., Lafayette, Ind.)

26–1. American Physical Therapy Assoc., Pittsburgh, Pa. (Miss J. Bailey, 157 N. 79 St., Milwaukee 13, Wis.)

26–1. American Soc. for Testing Materials, Atlantic City, N.J. (R. J. Painter, 1916 Race St., Philadelphia 3, Pa.)

26–1. Mass Spectrometry, 8th annual, Atlantic City, N.J. (V. H. Dibeler, National Bureau of Standards, Washington 25)

26–1. National Education Assoc., Los Angeles, Calif. (W. G. Carr, 1201 16 St., NW, Washington 6)

26–2. American Physical Therapy Assoc., Pittsburgh, Pa. (Miss L. Blair, 1790 Broadway, New York 19)

27–29. Military Electronics, 4th natl. conv., Washington, D.C. (C. M. Crenshaw, Dept. of Army, Office of the Chief Signal Officer, R. & D. Division, SIGRD-2, Washington 25)

27–30. Institute of the Aeronautical Sciences, Los Angeles, Calif. (R. R. Dexter, IAS, 2 E. 64 St., New York 21)

27–30. National Assoc. of Power Engineers, annual conv., San Francisco, Calif. (E. J. Schuetz, NAPE, 176 W. Adams St., Chicago 3, Ill.)

27–1. International Assoc. for Bridge and Structural Engineering, 6th cong., Stockholm, Sweden. (P. Lardy, IABSE, Ecole Polytechnique Fédérale, Zurich, Switzerland)

27–1. Reading Conf., 2nd annual, Syracuse, N.Y. (R. A. Kress, Reading Center, Syracuse Univ., Syracuse 10)

28–1. American Home Economics Assoc., Denver, Colo. (Miss M. A. Warren, School of Home Economics, Univ. of Oklahoma, Norman)

29–1. Health Physics Soc., 5th annual, Boston, Mass. (E. E. Anderson, Health Physics Div., Oak Ridge National Laboratory, Oak Ridge, Tenn.)

July

3–5. American Assoc. of Colleges of Pharmacy, Boulder, Colo. (G. L. Webster, College of Pharmacy, Univ. of Illinois, Chicago 12)

4–8. Polarization Phenomena of Nucleons, symp., Basle, Switzerland. (K. P. Meyer, Physikalisches Institut der Universität Basel, Klingelbergstr. 82, Basle, Switzerland)

5–9. Goiter Conf., 4th intern., London, England. (J. C. McClintock, 149½ Washington Ave., Albany 10, N.Y.)

6–15. Entomological Conf., 7th Commonwealth, London, England. (Commonwealth Inst. of Entomology, 56 Queen's Gate, London, S.W.7)

10–14. Pan American Tuberculosis Cong., 12th, Bahia, Brazil. (F. D. Gómez, 26, de Marzo, 1065, Montevideo, Uruguay)

11–15. British Dental Assoc., annual, Edinburgh, Scotland. (Secretary, British Dental Assoc., 13 Hill St., Berkeley Sq., London, W.1, England)

11–15. Royal Medico-Physiological Assoc., annual, London, England. (A. B.

Monro, 11 Chandos St., Cavendish Sq., London, W.1)

11–18. Earthquake Engineering, 2nd world conf., Tokyo and Kyoto, Japan. (K. Muto, Organizing Committee, 2nd World Conf. on Earthquake Engineering, Science Council of Japan, Ueno Park, Taito-ku, Tokyo)

11–22. Grassland Cong., 8th intern., Reading, Berks, England. (British Grassland Soc., Grassland Research Inst., Hurley, North Maidenhead, Berks)

15–22. Mycology, 6th Commonwealth conf., London, England. (Commonwealth Mycological Inst., Ferry Lane, Kew, Surrey, England)

18–22. International Conf. on Congenital Malformations, London, England. (S. E. Henwood, Intern. Medical Congress, Ltd., 120 Broadway, New York 5)

18–23. Endocrinology, 1st intern. cong., Copenhagen, Denmark. (G. Pincus, 1st Intern. Cong. of Endocrinology, Worcester Foundation, Shrewsbury, Mass.)

18–25. French Assoc. for the Advancement of Science, 79th cong., Grenoble. (Association Française pour l'Avancement des Sciences, 28 rue Serpente, Paris 6°)

19–22. International Conf. on Scientific Problems of Crop Protection, Budapest, Hungary. (Z. Király, Research Inst. for Plant Protection, Budapest)

21–27. Medical Electronics, 3rd intern. conf., Olympia, London, England. (Secretary, Institution of Electrical Engineers, Savoy Pla., London, W.C.2)

23–28. Otolaryngology, 7th intern. cong., Paris, France. (H. Guillon, 6, avenue MacMahon, Paris, 17°)

24–29. American Assoc. on Mental Deficiency (London Conf. on the Scientific Study of Mental Deficiency), London, England. (H. A. Stevens, P.O. Box 3128, Madison 4, Wis.)

25–29. Occupational Health, 13th intern. cong., New York, N.Y. (I. R. Tabersham, ICOH, 375 Park Ave., New York)

25–9. International Union of Geodesy and Geophysics, 12th general assembly, Helsinki, Finland. (Organizing Committee, c/o Institut Géodésique, Bulevardi 40, Helsinki)

25–6. International Assoc. of Physical Oceanography, 13th general assembly, Helsinki, Finland. (B. Kullenberg, c/o Oceanografiska Institutet, P.O. Box 1038, Goteborg 4, Sweden)

26–28. Poliomyelitis, 5th intern, conf., Copenhagen, Denmark. (S. E. Henwood, International Poliomyelitis Congress, 120 Broadway, New York 5)

27–12. Mathematical Statistics and Probability, symp., Berkeley, Calif. (A. P. Burroughs, Air Force Office of Scientific Research, Presentations Div., Research Information Office, AFOSR/USAF, Washington 25)

28–29. Computers and Data Processing, 7th annual symp., Estes Park, Colo. (W. H. Eichelberger, Denver Research Inst. Univ. of Denver, Denver 10, Colo.)

31–5. Alchol and Alcholism, 26th intern. cong., Stockholm, Sweden. (A. Tongue, Bureau International contre l'Alcoolisme, Case Gare 49, Lausanne, Switzerland)

31–5. Photobiology, 3rd intern. cong., Copenhagen, Denmark. (A. Hollaender, Biology Div., Oak Ridge Natl. Laboratory, Oak Ridge, Tenn.)

New Products

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Neither Science *nor the writer assumes responsibility for the accuracy of the information. A coupon for use in making inquiries concerning the items listed is included in the post card insert. Circle the department number of the items in which you are interested on this coupon.*

■ SHOCK TESTING MACHINE for small electronic, electromechanical, and mechanical components accommodates specimens weighing up to 20 lb. and occupying an 8-in. cube. The machine utilizes the free-fall principle. Half-sine, saw-tooth, and square-wave pulses are produced. Drop heights may be preset for both manual and automatic cycling. When half-sine pulses are used, the specimen table is caught at the peak of rebound. (Barry Controls Inc., Dept. Sci516, 700 Pleasant St., Watertown 72, Mass.)

■ SOLVENT EVAPORATOR combines a controlled temperature-vacuum system with rotary vibration. Test tubes or centrifuge tubes from fraction collectors are processed in groups of ten in the apparatus. Typical evaporation rates cited are 0.75 ml/min for water and 7.5 ml/min for acetone in each tube. Vacuum is furnished by a water aspirator and is controlled for each test tube by a separate stopcock. The instrument is 15 in. in diameter and 21 in. high. (Laboratory Glass and Instruments Corp., Dept. Sci517, 514 W. 147 St., New York 31)

■ PUNCHED-TAPE READER and companion spooler mechanism is a completely transistorized read-out system with output said to be compatible with most data-processing systems. Reading speeds up to 200 characters per second are possible with the spooler, which accommodates paper or Mylar tape up to 1 in. in width on reels 8 in. in diameter. Without the spooler, reading rates up to 1000 characters per second are possible. (Potter Instrument Co., Inc., Dept. Sci521, Plainview, N.Y.)

■ PORTABLE RECORDER is a 6-in. strip-chart potentiometer type with selectable 9- to 120-mv span. Optional features include ball-point pen, 1-mv span preamplifier, and resistance-bulb bridge for temperature measurement. Balance time is 0.8 sec; sensitivity is ±0.25 percent of full scale. Gear-shift selection of chart speed is provided. (Systron Corp., Dept. Sci522, 950 Galindo St., Concord, Calif.)

■ FLUORINE ANALYZER employs nuclear-magnetic-resonance techniques. Fluorine can be detected in liquids down to 3 mg in any sample size from 0.2 to 40 ml. An integrator accessory provides linear response in terms of mass of

fluorine present. When chemical shift is great enough, each peak in an unknown mixture can be separately integrated. Precision of the analyzer is said to be ±1 percent of the signal. Sweep amplitude is 0.1 to 20 gauss in a choice of eight settings; sweep time is 0.5 to 4 min. (Schlumberger Well Surveying Corp., Dept. Sci 520, Ridgefield, Conn.)

■ SILICON CARBIDE HEATING ELEMENTS for temperatures up to 1575°C are fabricated in one piece with the hot zone in the form of a spiral. Elements are available with over-all lengths up to 63 in. and hot-zone lengths from 7 to 40 in. A double-spiral hot-zone model requires connection at one end only. (Morganite Incorporated, Dept. Sci524, 3302–3320 48th Ave., Long Island City, N.Y.)

■ COUNT-RATE METER is a completely transistorized unit with eight scale ranges extending to 600,000 count/min. Three time constants, 1, 5, and 10 sec, can be selected with a front-panel switch. Input is sensitive to a 250-mv negative pulse; output is provided for 0-to-1-ma or 0-to-10-mv recorder. (Interstate Electronics Corp., Dept. Sci525, Anaheim, Calif.)

■ TARGET SIMULATOR for radar calibration furnishes delays continuously variable from 100 to 300 μsec and simulates target velocity to 20,000 ft/sec. Bandwidth is 45 percent of center frequency of up to 40 Mcy/sec. Rise time is 0.1 μsec or better. Variation is servo controlled. (Andersen Laboratories Inc., Dept. Sci528, 501 New Park Ave., West Hartford 10, Conn.)

■ CONSTANT RATE BURETTE consists of a ground-glass solution barrel and plunger driven by a synchronous motor. Neoprene rings held in stainless-steel collars are used for sealing. Drive, transmitted by a lead screw and nylon follower, is self-limiting at both ends. A separate motor provides rapid motion for refilling and for discharging excess titrant and flushing. (E. H. Sargent & Co., Dept. Sci526, 4647 W. Foster Ave., Chicago 60, Ill.)

■ MICRO SYRINGE BURETTE is graduated in 0.0001-ml units. Capacity of the syringe is 0.25 ml. A lock nut permits repeated deliveries of identical volumes. Replacement of the hypodermic needle with a special glass tip converts the device into a microburette. The syringe can be emptied completely except for the volume of the 27-gage needle. (California Laboratory Equipment Co., Dept. Sci527, 1717 Fifth St., Berkeley 10, Calif.)

■ LUBRICANT TESTING MACHINE can be adapted to testing either dry or liquid lubricants, at ambient or high temperatures, with oscillatory or rotary motion and with a range of velocity and loads. Operation with friction coefficients of 0.5 at full load can be maintained. Instrumentation is mounted in a separate cabinet. (Alpha-Molykote Corp., Dept. Sci529, 65 Harvard Ave., Stamford, Conn.)

■ THERMISTOR PSYCHROMETER is a portable instrument that measures moisture content of air by means of wet and dry thermistor beads. The instrument has three scales to cover the temperature range −10° to +80°C. Accuracy is said to be ±0.5 percent of relative humidity. Reading of both wet-bulb and dry-bulb temperatures can be accomplished in 10 sec. A spring coil motor can be supplied in place of the battery-operated motor for hazardous locations. (Atkins Technical, Inc., Dept. Sci531, 1276 W. Third St., Cleveland 13, Ohio)

■ SIGNAL GENERATOR furnishes 20 cy/ to 20 kcy/sec sine or square waves for audio, and 20 kcy/ to 12 Mcy/sec sine and 20 kcy/ to 2 Mcy/sec square waves for video signal and video sweep, with the latter at a 60-cy/sec sinusoidal sweep rate. Outputs of a high-fre-

quency, 30 to 42 Mcy/sec, variable oscillator and a sweep oscillator are also available. The sweep oscillator can be set to sweep at ±6 Mcy/sec at any center frequency between 36 and 42 Mcy/sec. Output levels are 10 volts for both sine and square waves. (General Radio Co., Dept. Sci532, West Concord, Mass.)

■ PLASMA FLAME SPRAY GUN is said to be capable of applying coatings of any material that can be melted without decomposition. An electric arc and inert gases are used to produce temperatures said to be as high as 30,000°F. Nitrogen with 5 to 10 percent hydrogen is used to form the plasma. Both the gun body and nozzle are water cooled. (Metallizing Engineering Co., Dept. Sci530, 1101 Prospect Ave., Westbury, N.Y.)

■ PROJECTOR PROGRAMER is a modified slide projector that handles magazines of 40 slides each. A 12-bit photoelectric pickup device has been installed to read holes punched in the cardboard portion of standard 35-mm slides, permitting selection of 4096 binary codes. The magazine can be advanced or reversed by remote cable or by the output of a switching device controlled by the punched-hole reader. The device can accommodate programs 80 units in length if two magazines are taped together. (Davis Scientific Instruments, Dept. Sci533, 12137 Cantura St., Studio City, Calif.)

■ PRESSURE SWITCH combines a Ni-Span-C pressure capsule and a snap-action switch in a housing of less than 1 $in.^3$ volume and with total weight slightly over 1 oz. Pressure setting is adjustable; ranges up to 200 $lb/in.^2$ are available. (Bristol Co., Dept. Sci534, Waterbury 20, Conn.)

■ DIFFERENTIAL D-C AMPLIFIER is said to provide stability of ±0.05 percent. The transistorized amplifier operates with input and output isolated from each other and from ground. Common mode rejection is said to be 10^8 to 1. Gain is variable in eight steps from 10 to 500. (Neff Instrument Corp., Dept. Sci540, 2211 E. Foothill Blvd., Pasadena, Calif.)

■ ANALOG MULTIPLIER-DIVIDER operates on the quarter-square principle in which the difference between the squares of the sum and difference of two signals is proportional to their product. Bandwidth is 350 kcy/sec and solution time less than 2 μsec. Phase shift is 1 deg at 12 kcy/sec. Output range is ±50 volts at ±10 ma, and accuracy is said to be ±0.25 percent of full scale. (GPS Instrument Co., Inc., Dept. Sci541, 180 Needham St., Newton 64, Mass.)

■ COUNTER furnishes both digital and analog readout for operating printers and chart recorders. The instrument includes two counting sections. The first, designed for data identification, counts to 10^2 and provides digital output and two analog outputs, 0 to 100 volts and 0 to 10 mv positive. The second section for 10^5 counts, provides digital output and one analog output 0 to 10 mv. A range selector switch permits full-scale range selection for 10^3, 10^4, or 10^5 counts. Resolution is 5 μsec for pulse pairs. (Victoreen Instrument Co., Dept. Sci536, 5806 Hough Ave., Cleveland 3, Ohio.)

■ TURNTABLE CONTROL for fraction-collection turntables permits them to be operated on either a time or volume basis. The control operates with a contactor actuated by air pressure from a calibrated siphon in which the fraction is being caught. The contactor actuates the turntable to move an empty test tube under the siphon. Siphons in any size from 1 to 100 ml can be used. Operation on a time base is accomplished by allowing the control siphon to fill from a constant-head Mariotte bottle while the fractions are caught directly by the receivers. (Organomation Associates, Dept. Sci537, P.O. Box 5, Shrewsbury, Mass.)

■ DENSITOMETER for photographed spectra is designed for comparing unknown spectra with master spectra and for measuring percentage transmission or density of spectrum lines. It accommodates both film and plates. Scanning in forward and reverse directions at four selectable rates is controlled by a foot switch. The instrument resolves lines 10 μ apart and provides horizontal and vertical magnifications of 15. Zero drift is said to be less than ± 0.2 percent, full-scale drift less than ± 0.5 percent, repeatability better than ± 0.5 percent, and scattered light less than 1 percent. Readings are recorded on a 9½-in. wide chart moving at 3 in./min. Reading speed is up to 6 lines per minute. (Applied Research Laboratories, Inc., Dept. Sci538, P.O. Box 1710, Glendale 5, Calif.)

■ EMERGENCY OXYGEN UNIT that provides approximately 7 gal of gaseous oxygen measures 11-in. high by 3-in. in diameter and weighs 20 oz. Oxygen can be administered by pressing a button on the top of the container. A disposable face mask is included with the unit. (Linde Co., Dept. Sci544, 420 Lexington Ave., New York 17, N.Y.)

■ FREQUENCY STANDARD provides frequency signals stable to 5×10^8/wk and 3×10^8 over short intervals. Output includes six sinusoidal signals at decade intervals from 10 cy to 1 Mcy/

sec and four pulse signals from 10 cy to 10 kcy/sec. A timing comb is included for calibration and for measurement of sweeps and time intervals. A built-in oscilloscope permits Lissajous comparisons. Rated load is 50 ohm at 1 Mcy/sec and 100 kcy/sec and 5000 ohm at lower frequencies. (Hewlett Packard Co., Dept. Sci539, 275 Page Mill Rd., Palo Alto, Calif.)

■ SAMPLING TOOL for taking pin samples from solid materials is essentially a drill with a hollow bore that cuts into metal, leaving a center core or pin standing. A companion device shears the pin at its base for removal. The drilling chips produced are also available for analysis. Pins are nominally 3/16 in. in diameter and ½ to 1 in. long. (Laboratory Equipment Corp., Dept. Sci535, St. Joseph, Mich.)

■ ATMOSPHERIC CONTAMINATION ANALYZER measures traces of gases or vapors that will ionize in water. The sample is bubbled through demineralized water, and the conductivity of the water is measured before and after the bubbler. Purity of the water is restored by self-contained ion-exchange columns. Alarm and indication are provided. (Industrial Instruments Inc., Dept. Sci-542, 89 Commerce Rd., Cedar Grove, N.J.)

■ CENTRIFUGE for acceleration testing of products accommodates two matched objects up to 5 lb and larger than 3 in.^{3} Acceleration up to 100 grav is provided. Accuracy of rate of rotation is said to be better than ±1 percent. Eight slip rings are rated at 2 amp for continuous duty. (Gyrex Corp., Dept. Sci543, 3003 Pennsylvania Ave., Santa Monica, Calif.)

■ CONSTANT CURRENT SUPPLY furnishes 0.04 to 5.00 amp at 0 to 8.0 volts. Regulation is ±0.01 percent for 10 percent line change or 8 volts load change. Hum is 0.01 percent. Operation is on 105 to 125 volts a-c. Shorting of output does not cause damage. An ammeter is included. (Industrial Measurements Laboratory, Dept. Sci545, 40 Great Jones St., New York 12, N.Y.)

■ ELECTRON SPIN RESONANCE SPECTROGRAPH records the first derivative of the electron-spin-resonance absorption as well as direct absorption of the observed sample as a function of magnetic field. Magnetic field coils are of the air-core type in a Helmholz configuration. Coils for fields of 0 to 10 and 0 to 100 oer are supplied, and a unit for 0 to 1000 oer is available as an accessory. Operating frequencies of the basic instrument are 60 and 90 Mcy/sec; 10, 30, and 1000 Mcy/sec sensors are available. Frequency stability and magnetic field

stability are said to be better than 10^{-5}. The instrument accommodates samples 12 mm in diameter and 25 mm long; larger volumes and flow designs are available. Sensitivities cited as typical are 5×10^{13} electron spins at 1000 Mcy/sec and 5×10^{16} electron spins at 60 Mcy/sec. Scanning speeds range from 0.005 to 10 oer/sec. Oscilloscope display and strip-chart recording are provided. (Elion Instruments, Inc., Dept. Sci548, 430 Buckley St., Bristol, Pa.)

■ SURVEY METER is a self-contained gamma-ray responsive instrument using an 8-in.-diameter plastic scintillator as detector. Sensitivity is 15,000 count/min above 0.15 Mev for natural sea-level background of 0.01 mr/hr. Indication is provided by a meter with choice of full-scale values up 0.4 mr/hr. Preamplifier and amplifier are transistorized. (Franklin Systems, Inc., Dept. Sci546, 2734 Hillsboro Rd., West Palm Beach, Fla.)

■ RECORDER provides full-scale voltage ranges of 10 and 100 mv and 1, 10, and 100 volts with 1 megohm input resistance and current ranges 1, 10, and 100 μa and 1 and 10 ma. Operation can be with zero at left, right, or center. Four-times chart width expansion is provided on all ranges. Recording is rectilinear by means of a galvanometer and chopper bar clamped every 2 sec on a chart 2.31 in. wide. Chart speeds are 1 and 15 in./hr with auxiliary gears available for other speeds. Accuracy is said to be ± 2 percent on all ranges. (Yellow Springs Instrument Co., Inc., Dept. Sci547, Yellow Springs, Ohio.)

■ PLANT GROWTH CHAMBER permits variation of light intensity from 700 to 3000 ft-ca and control of temperature from 45° to 110°F with full light load. An aluminum roof immediately above the fluorescent lamps is cooled by three fans to eliminate a large part of the heat load. Inside dimensions are 98¾ by 62¾ by 85⅝ in. high. Fluorescent lights, incandescent lights, and temperature are individually adjustable. Filtered air is provided, up to 12 changes per hour. (Percival Refrigeration and Manufacturing Co., Dept. Sci553, Boone, Iowa)

■ GAUSSMETER is a rotating coil type that develops an a-c voltage proportional to the magnetic field and compares this in a null-deflection system with a locally generated reference voltage. Range of the instrument is 0 to 10,000 gauss when null deflection is used and 0 to 120,000 gauss with meter indication. Accuracy is said to be ± 0.1 percent between 1000 and 10,000 gauss with use of null technique. Probe

dimensions are ¼ in. in diameter and 17 in. long. Rotating-coil diameter is approximately ⅛ in. (Rawson Electrical Instrument Co., Dept. Sci550, 101 Potter St., Cambridge, Mass.)

■ COUNT RATE METER is completely transistorized. Eight scale ranges extend to 600,000 count/min. Three time constants, 1, 5, and 10 sec, can be selected with a front-panel switch. Input is sensitive to 250 mv negative pulse. Outputs are available for 0 to 1 ma or 0 to 10 mv recorder. (Interstate Electronics Corp., Dept. Sci551, 707 E. Vermont Ave., Anaheim, Calif.)

■ PHOTOELECTRIC MICROMETER MICROSCOPE can be used to read scales and circles marked with lines from 0.0001 to 0.0015 in. wide. Accuracy over the total range of 0.05 in. is said to be ±0.00004 in. The instrument eyepiece incorporates a photocell preceded by a vibrating slit. A setting is made by rotating a micrometer drum until the slit oscillates symmetrically about one of the engraved lines at which point an indicating meter reads null. Settings are said to be repeatable to within 20 μin. (Hilger and Watts, Ltd., Dept. Sci554, 98 St. Pancras Way, Camden Road, London, N.W.1)

■ AUTO COLLIMATOR comprises a sensing unit, an amplifier, and an indicator. Indicating range of the sensing unit is ±25 sec with a working distance up to 30 ft between sensing unit and reflecting surface. Response time is 20 msec. Drift is said to be less than 1 percent in 24 hr after initial warmup. An optical wedge permits checking of indicator calibration. Sensitivity is said to approach 0.02 sec. Output is suitable for chart-recorder operation. (Keuffel and Esser Co., Dept. Sci561, Third and Adams Sts., Hoboken, N.J.)

■ RELAY designed for squib-firing applications operates on 28 volts d-c and delivers 50 amp for a period of 50 msec. Pickup time is said to be 4 μsec and dropout time 20 μsec with no contact bounce. Open-contact resistance is 5 megohms, and closed-contract resistance is 0.04 ohm. All components are solid-state types with no moving parts. Operating temperature range is −85° to +257°F. (Curtiss-Wright Corp., Dept. Sci549, Wood-Ridge, N.J.)

■ PULSE HEIGHT ANALYZER is an automatic-scanning, single-channel type that presents data in both digital and analog form. Scanning capacity is 100 channels with capability of being set to recycle automatically at 10-percent points. Counting time for full scan is variable between 1.0 and 100,000 min. Major components include a linear amplifier, analog and digital readout scaler, electronic timer, printer and recorder, and power supply. (Victoreen Instrument Co., Dept. Sci558, 5806 Hough Ave., Cleveland 3, Ohio.)

■ DUST HOOD allows full visibility and unimpeded movement of arms and hands for performing laboratory operations under dust-free conditions. A blower at the top of the unit forces air into the transparent plastic hood through a large-area filter maintaining a positive pressure that prevents room air from entering the open front. Working volume is 34 by 24 by 19¼ in. The opening is 34 in. wide by 8¾ in. high. (Air Shields, Inc., Dept. Sci556, Hatboro, Pa.)

■ VOLTAGE MEASURING SET compares d-c voltages with preset limits and displays and records results. Input voltages up to 1000 volts are handled in four decade ranges. Input signals in ten manually selected channels are converted to frequency and compared digitally with panel-set values. Over-all accuracy is said to be ±0.1 percent of input range plus 1 count. (Hewlett-Packard Co., Dept. Sci557, 395 Page Mill Rd., Palo Alto, Calif.)

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Letters

Small High Schools

James B. Conant concludes from his survey of the American public high school system that it is burdened with far too many small schools. He says, "The country over, something like a third of our youth are attending high schools that are too small. As a result, one of the most precious assets of our nation is being squandered—the potential talent of the next generation. It is almost impossible for students graduating from many of the small schools later to become members of learned professions [*The Child, the Parent and the State* (Harvard Univ. Press, Cambridge, Mass., 1959), p. 37]. . . . The elimination of the small high school through district reorganization and consolidation should have top priority" (*ibid.* p. 39). Conant's studies lead him to believe that comprehensive high schools with graduating classes of fewer than 100 students inevitably provide an inferior education.

Conant's analyses and arguments, which are based upon his observations of the curricula, the organization, and the staffing of high schools, seem reasonable. But considering how little we really know of the consequences of various educational practices and arrangements, one wishes for data on how students turn out. Some data on this point have come to hand in a recent issue of *Science*.

Harmon [*Science* **130**, 1473 (1959)] in connection with another analysis of public high school graduates, reports data showing that 35 percent of the science doctorates awarded in 1957 and 1958 went to persons who had been educated in small high schools (schools with fewer than 100 graduates each year), and that 6 percent of the degrees were earned by the graduates of very small high schools (schools with fewer than 20 graduates each year). Statistics assembled by the U.S. Office of Education (*Statistics of Public Secondary Day Schools, 1951–52)* show that when most of these 1957–58 science doctors were graduating from high school, about 36 percent of all public high school students attended small schools, as defined above, and 5.5 percent attended very small schools.

Some estimation is necessary here, for Harmon reports class size and the Office of Education reports school size, and the time of graduation from high school of the 1957–58 doctors is not known with precision. The figures given are based upon 1946, the best estimate of the year of graduation for which data are available; the estimates would

not be appreciably changed if data for 1938 were used.

At any rate, it seems clear that the number of science doctorates awarded the graduates of these small schools is in line with the total number of students educated in these schools. How can it be that the small high schools of 1946, that presumably possessed all the curricular, instructional, and material deficiencies said to go with smallness, produced their full quota of scientists in 1957 and 1958?

Is the situation different today?

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Importance of Chinese for Scientific Communication

During recent years the number of scientific journals and the total volume of scientific literature published by the People's Republic of China appear to have increased considerably. Evidence cited by Wilson (*1*) on the magnitude of the effort in scientific education and research leads one to expect that the increase will continue. According to a sampling of journals received by the Harvard-Yenching Institute, Cambridge, Mass., the vast majority of Chinese scientific publications appear only in the Chinese language and normally are not translated. However, two journals published in Peking, *Scientia Sinica* by the Academia Sinica and *Science Record* by the Science Press, consist of papers in Western languages, principally English. These papers, representing various fields of science, often appear previously in other Chinese-language journals.

In view of the rapidly increasing importance of Chinese scientific literature it is desirable that some scientifically trained persons now begin learning to read scientific Chinese. Only when knowledge of the language is widespread can Chinese scientific progress be evaluated accurately. The task may soon be too great for exclusive reliance on the few American scientists who speak Chinese as their native tongue.

Most of the difficulties associated with learning to read scientific Chinese are not associated with the language itself and seem to reflect a lack of interest on the part of Western scientists. According to a study that I have made the following problems stand out.

1) Because of present world unrest, publications of the People's Republic of China do not circulate freely in the United States.

2) No textbooks and selected read-

ing materials specifically prepared as aids in learning to read scientific literature are yet available.

3) There appear to be no technical Chinese-English dictionaries, such as exist for German, French, and Russian. The existing specialized dictionaries of technical terms, intended mainly for those who speak Chinese, are not easily used by the Western student.

4) Class instruction in Chinese for the scientist is not currently offered by universities in the United States (the Massachusetts Institute of Technology is planning a course in scientific Chinese for September 1960).

Learning Chinese is not as insuperable a problem for the Western scientist as many tend to believe. The grammar of the language is simple; words are not inflected as in Western languages, and number, tense, case, and person are all indicated by the context. Furthermore, an active interest in teaching Chinese to Western students in nonscientific fields already exists, and much of this experience would be of value in the teaching of scientific Chinese. An increase in interest and an organized effort on the part of individuals aware of the growing need for scientists with a reading knowledge of scientific Chinese could overcome most of the problems.

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1. J. T. Wilson, "Red China's hidden capital of science," *Saturday Review of Literature* (8 Nov. 1958); *One Chinese Moon* (Hill and Wang, New York, 1959); "Geophysical institutes of the U.S.S.R. and the People's Republic of China," *Trans. Am. Geophys. Union* **40**, 3 (1959).

The Scientist and Moral Values

The two letters concerning animal research [*Science* **131**, 263 (29 Jan. 1960)] by implication raise issues of fundamental importance to the role of science and to the respect it may claim in the world of tomorrow.

The first is a question one would like to see squarely answered: Are there any moral limits at all to animal experimentation? Or is it the responsible and considered opinion of today's biologists and psychologists that any experiment, no matter how cruel, is permissible as long as it is scientifically worth while?

The second is a scientific problem that has been surprisingly—and significantly—little investigated: that of the psychology of scientists. Who are the people who will choose lines of research leading them to ever more cruel and, to

an outsider, seemingly barbaric experiments? What are their motives and the conscious and subconscious satisfactions they derive from their work? What else would they be capable of doing if given the opportunity?

In the popular view of science, the scientist too often appears as a kind of impersonal superman, investigating with cold detachment, and with concern only for truth. But surely this is preposterous. The scientist as a human being is very much a part of the picture of science, and science cannot be adequately understood without an understanding of the scientist; this line of research has been surprisingly shunned by scientists themselves.

With respect to animal experiments, I venture the hypothesis that, as the intrinsic scientific value of experiments decreases and the cruelty to animals increases, a critical point is reached beyond which the driving force is no longer scientific curiosity but sadism pure and simple. "Research" becomes a legalized outlet for pathological drives. Placing no moral limitations whatsoever upon research is an open invitation for this.

If the scientific community were to condone this, it could only lead to justifiable distrust of scientists in the long run. Indeed, the great claims of science in the last analysis boil down to this: that science is a form of service to mankind. But the very idea of service to mankind is a moral ideal that is intimately linked with the whole of human morality, of which reverence for life is an essential part.

If, under the guise of science, that reverence for life were entirely discarded, the resulting moral debasement of scientists might well raise fears that, given the opportunity, they might turn against man himself in a sort of scientific folly. After all, it has already happened at least once: in Nazi Germany, where scientists performed "scientifically worth while" experiments on human beings they elected to consider "subhuman." In the modern world, scientists should not be the last to learn the lesson that, whenever the ends are thought to justify any means whatsoever, it is the means that will utterly corrupt the ends. Or, to put it in the words of a wise old Frenchman, Montaigne: *"Science sans conscience n'est que ruine de l'âme* (knowledge without conscience is nothing but the ruin of the soul)."

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A recent exchange of letters on animal research left me puzzled. Can the painful problem of what constitutes proper animal experimentation be solved by the magic of words?

R. B. Kelman objects on moral grounds to experiments published by V. H. Denenberg and G. G. Karas, in which animals were starved to death to measure their resistance to stress under certain conditions. Denenberg in his reply gives *relevancy*, *sensitivity*, and *precision* as his criteria in selecting a dependent variable. "Any variable which satisfies these demands is scientifically valid and may be used to study subhuman organisms." He points out that in starving animals to death survival time is a relevant dependent variable for measuring resistance to stress; that it is precise, because the same general findings can be obtained on different occasions; and that it is sensitive, since it uncovered statistically highly significant differences between different groups of animals. He concludes that survival time is a scientifically valid measure of resistance to stress; that it is specific, since "it is based upon the preservation of life"; and he adds that to him his data are most interesting.

Denenberg's criteria for scientific validity are explicit and sufficient. They help one think up other vaild experiments to measure resistance to stress, such as immersion into chemically inert hot liquids. Unlike starvation, an all-or-none affair, thermal stress can be varied in degree. Survival time in total body thermal stress (TBTS) probably depends upon the degree of stress and the surface area of the animal, or, perhaps, a surface-volume relationship; one might get a family of curves for animals of different size when plotting survival time as a function of temperature. Simple refinements of these experiments might include a one-lead electrocardiogram, to show the combined effect of nonspecific stress and rising temperature on myocardial conductivity. Or the electrical activity of the brain could be recorded during these conveniently shortened (as compared to starvation) tests for resistance to stress; a simultaneous temperature curve of the cerebrospinal fluid obtained through a needle thermocouple in one of the cerebral ventricles would provide convenient arbitrary landmarks in the gradual transition from being into nonbeing. The brief survival time would lead to a greater number of experiments, improving their reliability and increasing efficiency in utilizing scientific manpower.

Such experiments would fully satisfy the stated requirements for scientific validity, yet one would not wish to maintain that boiling them alive in mineral oil is a proper way of testing resistance to stress in mice, rats, or other "subhuman" mammals. Our criteria let us down, for at least two reasons: they have no circumscribed meaning and they are not pertinent to the issue, which is a moral one. *Relevancy* of survival time in indicating resistance to stress is assured by definition; no matter what we do to shorten the life of our animals, survival time will remain relevant in measuring resistance to what we are doing to them. The same is true of *specificity*. *Sensitivity* and *precision*, as used in this context, can be interpreted rather broadly to fit almost any experiment in biology worth reporting; they do not describe the experiments as much as the frame of mind of the person talking about them. In general, applying such terms to one's own results amounts to little more than saying, "I like what I am doing," in different words. Admitting this in public is proper and may even have didactic value, but it is a pity to conceal an essentially noble message behind inappropriate words.

The problem of what constitutes humane experimentation on animals is painful and difficult, and most of us are reluctant to think it through. Like other moral problems, it probably cannot be solved by rules that are simple, consistent, and always uniquely applicable. Even if rules were set up they

would have to be interpreted in doubtful cases; ultimately it must be the scientist concerned who decides whether work he is about to undertake is sound intellectually and morally, and we had better select our scientists so that we can entrust them with such decisions. On occasion, a scientist may feel the need to show the rest of us his work as a source of excitement, delight, or inspiration, but the justification of what he is doing—its agreement with a given set of standards, scientific and moral—rests in itself; the record is all that is needed, and nothing else will do. Calling one's results relevant, sensitive, specific, precise, significant, and scientifically valid adds nothing to them.

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More about Nomenclature

I have just read K. E. Boulding's letter in [*Science* **131**, 874 (1960)]. I don't think that it will be necessary to waste any space on the proposed astronomical classification since, like his "Bimbambim" it probably won't be used by anybody.

But I do wish to protest three statements: (i) that names like selenium, tellurium, or, for that matter, Rhynchocephalia are "unscientific"; the history of science happens to be a science too; (ii) that it is "fortunate" that most scientists are not acquainted with the "dead" languages from which nomenclature is drawn. I, for one, consider this most unfortunate, provided it were true; (iii) that the letter *x* cannot be used to begin a syllable. Boulding may have heard of St. Xavier at one time. To be more personal about it, my younger daughter is named Xenia, and even in grade school her classmates had no trouble learning the proper pronunciation, Ksay-niya.

WILLY LEY

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As an old S-F fan I am flattered by Willy Ley's attention to my excursion into the grain-of-truth-among-chaff business. But the history of science is not science but History, an appalling mishmash of unrepeatable accidents, quite unfit company for the respectable readers of this journal. Selenium has nothing to do with the Greeks, the moon, or the metal, just as (to cover his second point) irony has nothing to do with Fe. And in a world in which so much information has to be carried in such little sculls, there is a real problem of Economy in language.

But I am sorry about *x*. It has always