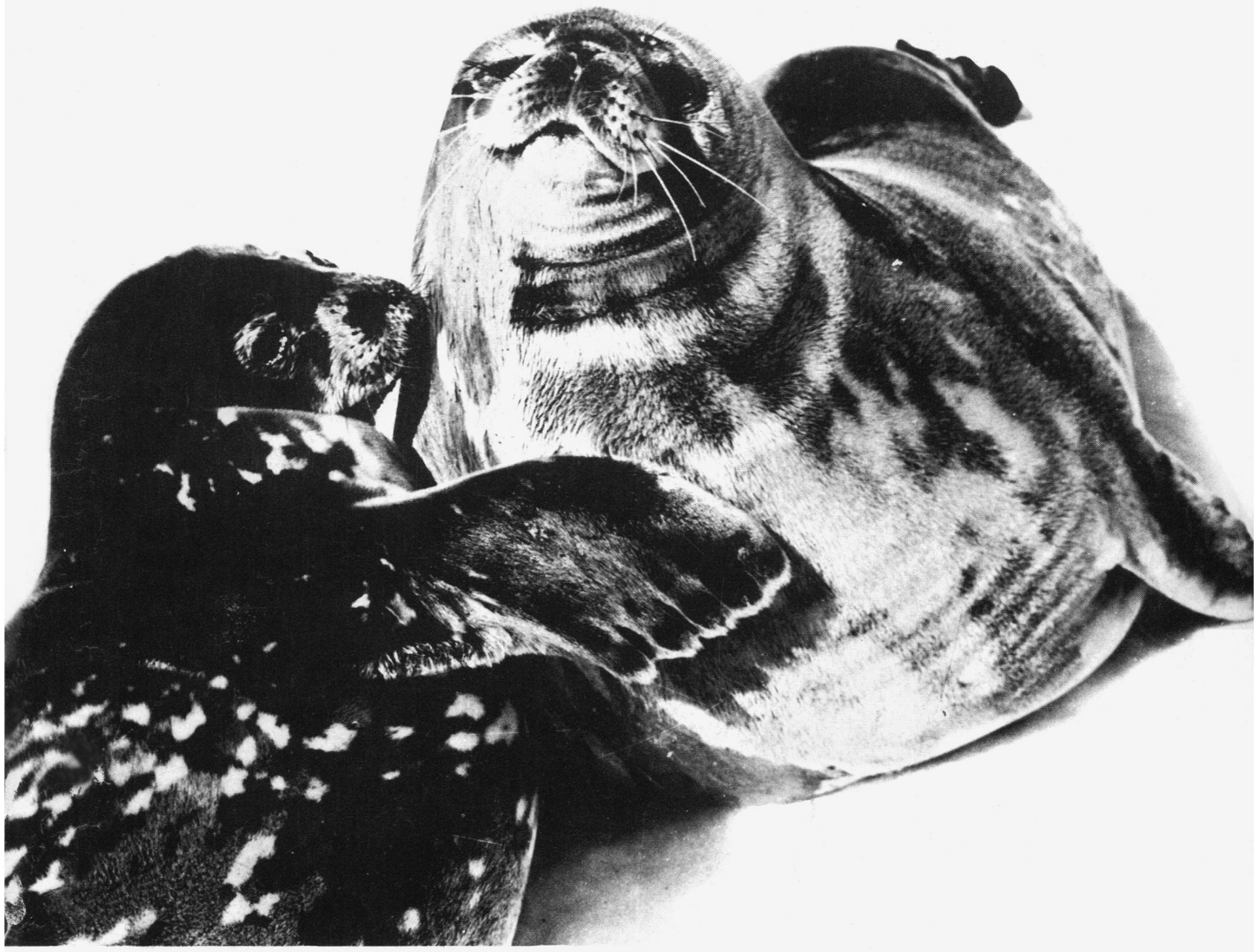
SCIENCE

26 September 1975

Volume 189, No. 4208

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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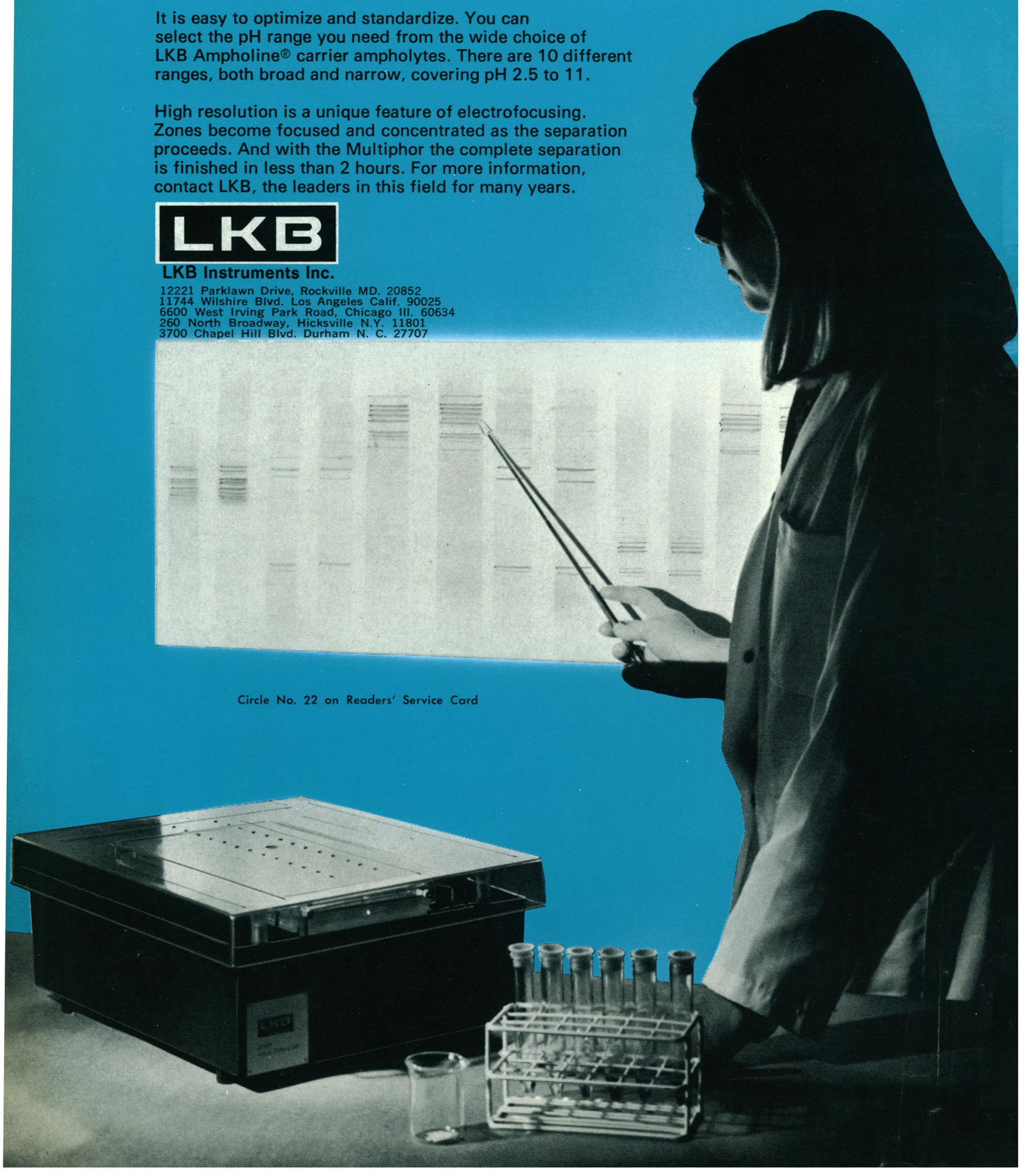

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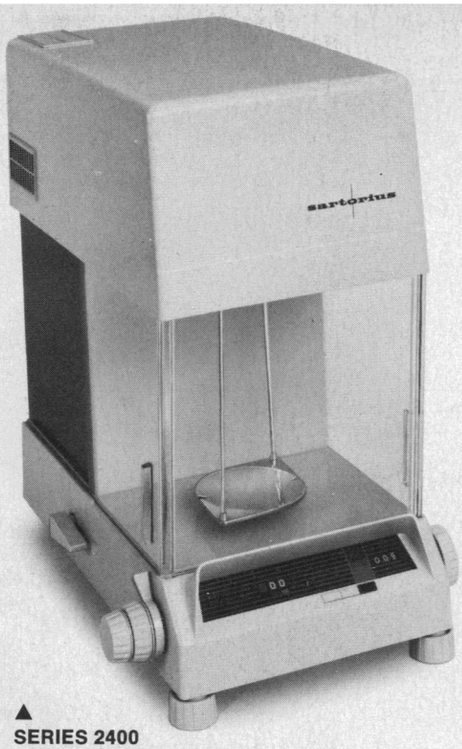

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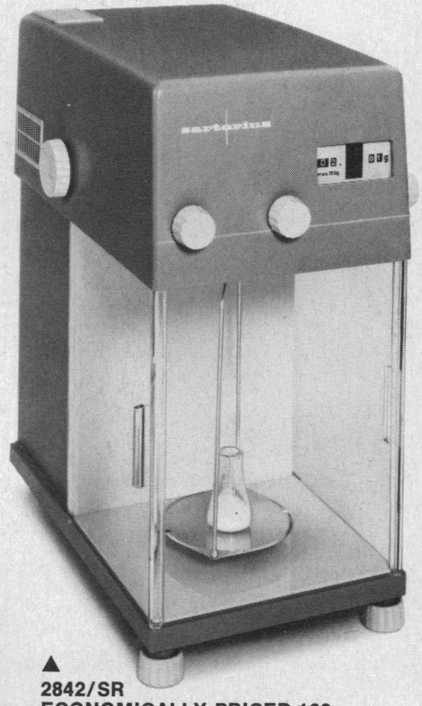

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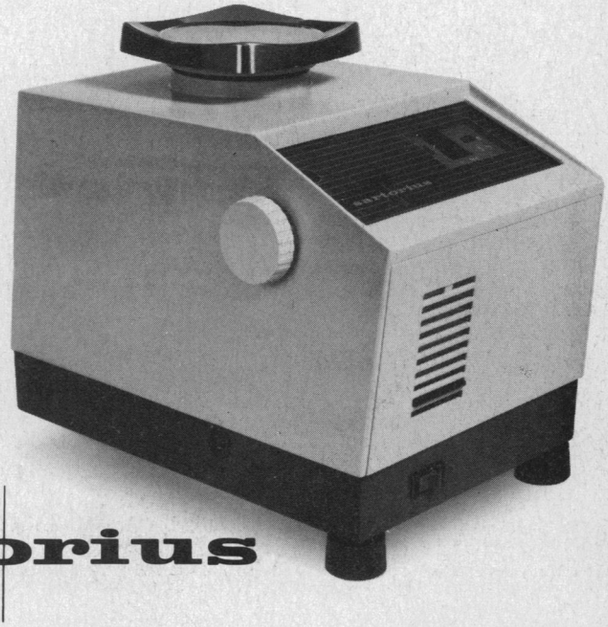

sartorius

26 September 1975

Volume 189, No. 4208

SCIENCE

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COVER

Female Weddell seal and her pup lying on the ice of McMurdo Sound, Antarctica. These animals are the most southerly ranging mammals and spend much of the year beneath the ice. When on land, thermoregulation, by dissipation of heat, is aided by the high density of arteriovenous anastomoses which occur superficially in the skin. See page 1100. [R. A. Tedman, University of Queensland, St. Lucia, Brisbane, Australia]

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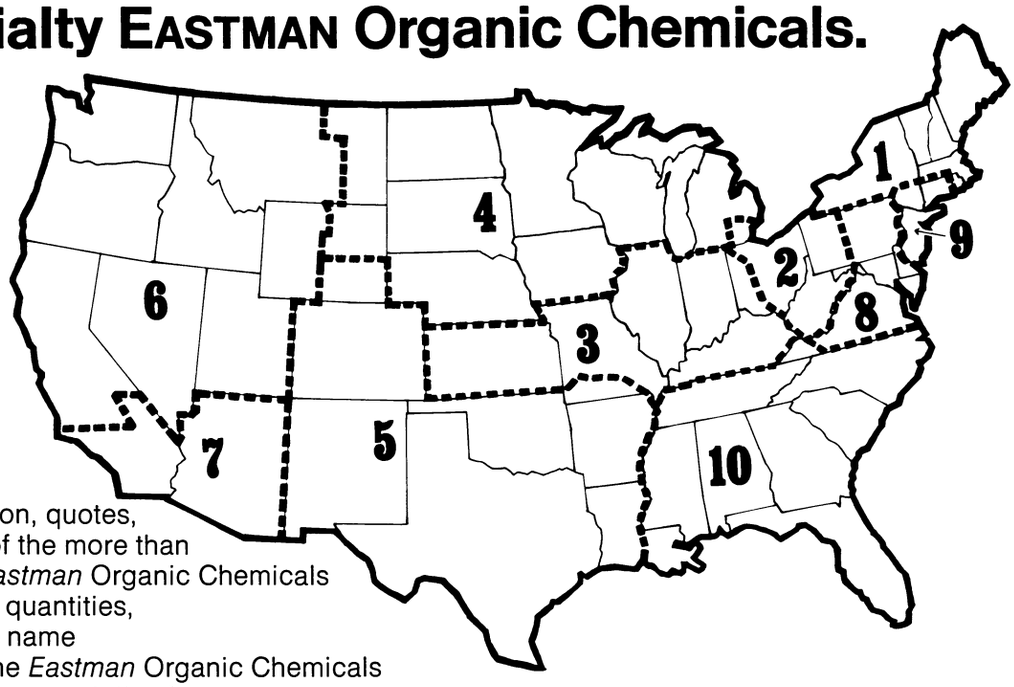

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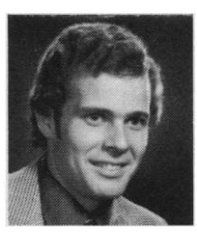

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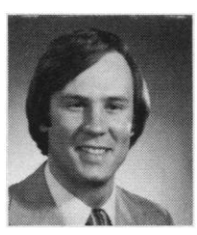

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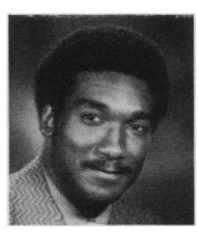

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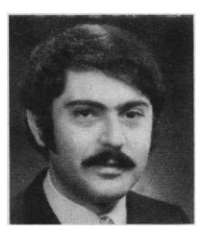

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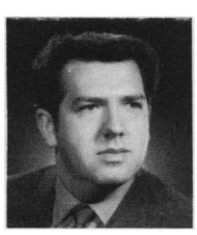

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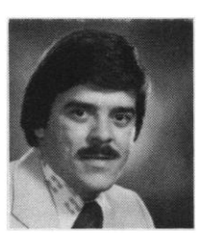

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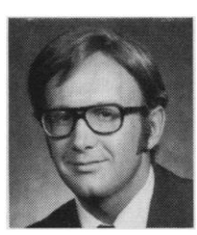

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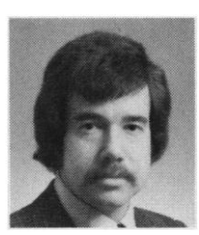

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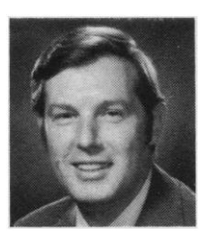

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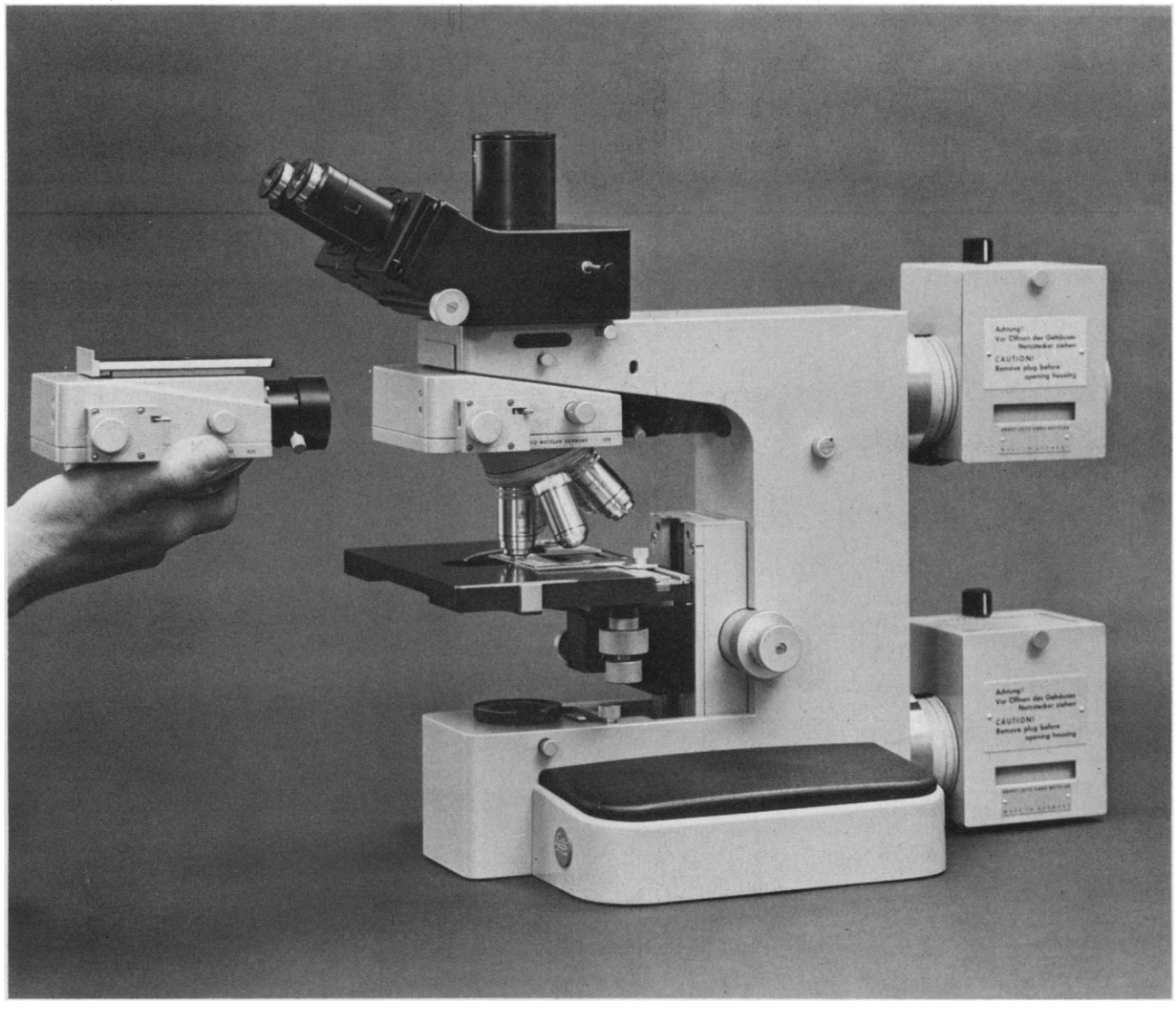

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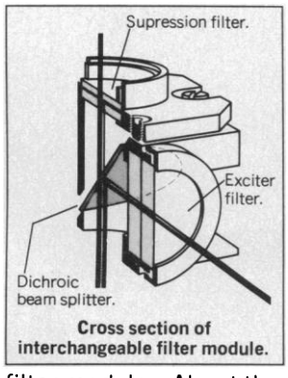

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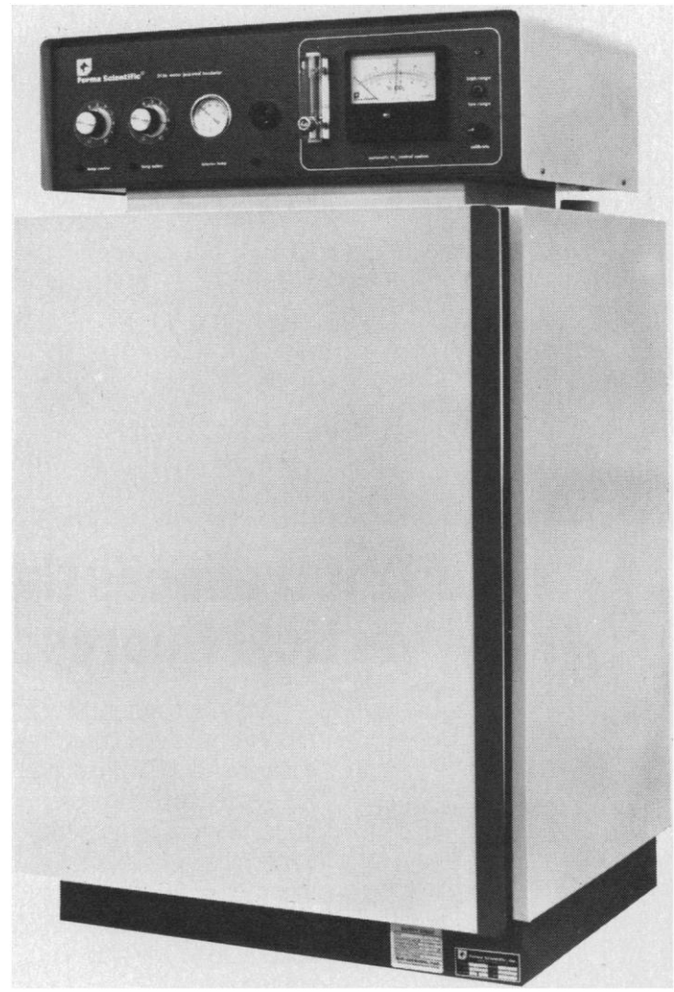

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LETTERS

XYY Genotype

Barbara J. Culliton, in an article about the suspension of XYY screening at the Boston Hospital for Women (News and Comment, 27 June, p. 1284), reports that the original XYY study was "premature" and that today "all responsible scientists insist that the XYY chromosome is quite innocent of causing any crime."

Let me attempt to set the record straight. The first survey that demonstrated an excess of men with an additional Y chromosome in an institutionalized population was conducted by myself and my colleagues (*1*) among a group of mentally subnormal male patients in a state hospital, an institution for patients "who require treatment in conditions of special security on account of their dangerous, violent or criminal propensities." We reported our observations on 197 such patients, 266 randomly selected newborn males, 209 randomly selected adult males, and an additional 1500 males whose chromosomes we had examined. We found seven males with an XYY chromosome constitution in the patient population, none in the 475 randomly selected males, and only one in the remaining 1500 males (χ_c^2 = 13.8, P = .0002). Our conclusion, "the finding that 3.5% of the population we studied were XYY males must represent a marked increase in frequency by comparison with the frequency of such males at birth," could hardly be considered premature by even the most conservative standards.

Further studies, both of men in mental and penal settings and of control populations were undertaken. The results of these investigations were excellently and exhaustively reviewed by Hook (*2*). Consideration of the facts show (i) that the original observations have been amply confirmed; (ii) that the excess of males with an abnormal chromosome constitution in mental-penal settings is not confined to XYY individuals but also applies to XXY men and, most dramatically of all, to men with an XXYY chromosome constitution, who are found 100 times more frequently in mental-penal settings than among the newborn; and (iii) that, while the excess of men with an abnormal sex chromosome constitution is most marked in mental-penal groups, it is also evident among men in exclusively penal and exclusively mental settings.

We know nothing as yet about the mechanism of action of the additional sex chromosomes nor their effects, if any, on the intelligence and behavior of the majority of affected individuals in the population at large. It seems reasonable to suppose that human behavior, like virtually all other human traits, is determined both by genes and environment and that the possession of an abnormal chromosome constitution may make its carrier particularly susceptible to the effects of an adverse environment.

Those who consider "the attempt to determine a genetic basis for antisocial behavior a diversion with harmful effects" have succeeded in suppressing a research project which was deemed by peer review to meet the rigorous ethical and scientific standards rightfully required of all research involving human subjects.

The suppression of this project denies to XXY, XYY, and XXYY men, their families, and society the liberty to understand and intelligently modify the behavioral effects of a high-risk genotype.

PATRICIA A. JACOBS

Department of Anatomy, University of Hawaii School of Medicine, Honolulu 96822

References

1. P. A. Jacobs, M. Brunton, M. M. Melville, R. P. Brittain, W. F. McClemont, *Nature (Lond.)* **208**, 1351 (1965).
2. E. B. Hook, *Science* **179**, 139 (1973).
3. P. A. Jacobs, M. M. Melville, S. Ratcliffe, A. J. Keay, J. Syme, *Ann. Hum. Genet.* **37**, 359 (1974).
4. A. G. Bell and P. N. Corey, *Can. J. Genet. Cytol.* **16**, 239 (1974).
5. W. M. Court Brown, *Int. Rev. Exp. Pathol.* **7**, 31 (1969).

Despite the implication in Culliton's article, there is a clear association of the XYY genotype with deviance, as judged from the frequency of XYY men in security settings compared to the rates in newborn or adult populations. While the nature and extent of this association are still not defined, the first report (*1*) has been amply confirmed and would be better described as "seminal" rather than "premature" [see (*2*) for review]. Those who deny evidence for a "link" between this genotype and criminality can only mean that there is still no direct evidence for a causal connection between the two; there is no question that there is an association. But Culliton appears to endorse an even stronger view when she states "all responsible scientists insist that the XYY chromosome is quite innocent of causing crime." The issue is, however, a complex one not subject to such simple generalizations, and revolves about our understanding of causality and human behavior. The XYY genotype may well contribute to the eventual problems of the affected male by resulting in patterns of neural organization that affect cognitive function or produce other behavioral "difficulties" (of the type Walzer and others have described) which tend to make it harder for such individuals to cope with environmental stress-

es. While there is no direct evidence for this view, the data that are accumulating appear to make it increasingly plausible. (Such a model does not assume that preventable or remedial environmental factors make no contribution to either behavioral difficulties in earlier life or deviance in later life.) The connection postulated between the genotype and deviance is not an inevitable one; whether it is "causal" awaits universal agreement on the definition of the term as applied to human behavior genetics.

Statements such as Culliton's or debate as to whether the XYY genotype is "guilty" or "innocent" only polarize the issues without addressing them. The important questions concerning the XYY, XXY, and XXYY genotypes are what factors—physiological, psychological, social, and their interactions—are associated with the increased frequency of affected males in security settings and mental institutions, and what we may learn about the possible contribution of such factors to the ultimate behavior of all individuals, irrespective of genotype.

ERNEST B. HOOK
New York State Birth Defects Institute
and *Albany Medical College,*
Albany 12208

References

1. P. A. Jacobs, M. Brunton, M. M. Melville, R. P. Brittain, W. F. McClemont, *Nature (Lond.)* **208**, 1351 (1965).
2. E. B. Hook, *Science* **179**, 139 (1973).

Bicentennial Bells

Constance Holden, in her article "The Bicentennial: Science loses out" (News and Comment, 8 Aug., p. 438), mentions the American Revolution Bicentennial Administration's plan for 4 July 1976: "The afternoon is to be devoted to town meetings and speeches, and at 4 p.m. (11 a.m. Hawaii time) all the bells in the nation will ring out simultaneously."

Has anyone considered what the effect might be of all that simultaneous sound vibration?

DARLENE C. SCHMIDT
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Journal Reviews

It has long struck me as odd that scientific journals are not reviewed in "journal review" sections of scientific magazines somewhat analogous to the book review sections that are so familiar.

Critical reviews of journals would be of interest to the scientists who read them or publish in them. They would also be of value to librarians and others who must decide which journals to take on subscription. Librarians currently have little to go on except citation counts, the significance of which is controversial.

I would like to see a respected scholarly or professional organization, one free of financial interest in the journals that would be reviewed, undertake to publish critical reviews of scientific journals at intervals of, say, 5 years. The organization that comes immediately to mind is the AAAS, and *Science* is the obvious publication in which the journal reviews should appear. If each issue of *Science* carried reviews of 5 journals, 260 journals could be reviewed each year, or 1300 in 5 years.

The scientist invited to review a journal obviously should be a person of distinction and should not have an ax to grind. On the other hand, complete innocence of involvement with any journal as an editor or member of an editorial advisory or publication board is unlikely to be found in the case of many persons of the requisite scientific distinction. A listing of current or recent connections of that type, following the name of the reviewer, would make plain at least some of his current entanglements.

The journal review should include certain standard information about the journal's history, sponsorship, size, circulation, and cost, which should be furnished to the reviewer by staff, but the heart of the review would lie in qualitative assessment of what function the journal is serving, what clientele it caters to, where it stands with respect to comparable journals, and what trends of emphasis or quality can be discerned.

JOSEPH F. BUNNETT*
University of California,
Santa Cruz 95064

*The author is editor of *Accounts of Chemical Research*, published by the American Chemical Society.

Particle Discoveries at SLAC

Martin Deutsch and Samuel C. C. Ting wrote letters published in the 5 September issue of *Science* (p. 750) with respect to the exciting discoveries in high energy particle physics. These letters contain selected references to conversations pertaining to the history of the new particle discoveries, reports of which were published in *Physical Review Letters* of 2 December 1974 (*1, 2*).

These developments have been among the most exciting events in the recent annals of physics. I personally was a witness during the weeks preceding the actual announcement of the spectacular sharp peaks (*1*), when the members of the Lawrence Berkeley Laboratory (LBL)–Stanford Linear Accelerator Center (SLAC) team struggled to understand the anomalous counting rates observed near a collision energy of 3.1 Gev. What finally became the now famous sharp peak initially manifested itself through a peculiarly high point at 3.2 Gev. Further scanning exhibited a lack of reproducibility of readings near 3.1 Gev, since the energy of the storage rings was not controlled commensurate to the sharpness of the peak and therefore malfunctions were suspected. After all relevant parameters were put under control, the spectacular peak initially of the 3.1 Gev particle, followed very soon thereafter by the discovery of the 3.7 Gev psi particle, became obvious.

There is no question that the Massachusetts Institute of Technology–Brookhaven National Laboratory discovery represented a very difficult and superbly instrumented piece of work in high-energy experimental physics, and the authors deserve full credit for that achievement. Similarly, the independent LBL-SLAC discoveries represented a spectacular demonstration of the powers of electron-positron storage rings in discovering new particle states and in exploring the spectroscopy and intrinsic properties of such particles. This should be a joyous occasion for all physicists.

WOLFGANG K. H. PANOFSKY
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References

1. J.-E. Augustin *et al.*, *Phys. Rev. Lett.* **33**, 1406 (1974).
2. J. J. Aubert *et al.*, *ibid.*, p. 1404.

Promising Chimpanzee

The important article "Putting a face together" by David Premack (18 April, p. 228) opens with the following statement: "Chimpanzees do not, so far as is known, construct copies of existing or imaginary figures by any device—drawing, assembling pieces of existing material, or otherwise." In fact, a paper published 66 years ago presented suggestive data that were recognized as theoretically important in comparing the mental abilities of apes and humans. This was an intriguing account by Witmer (*1*) of the remarkable performing chimpanzee, Peter. He was able to accurately copy, with chalk on a blackboard, the letter W drawn by Witmer. When asked to do so again, Peter complied. Witmer was a respected psychologist, and Peter's performance was observed by several other astonished persons. No differentiation was made, however, between copying the figure and copying the writing movements. S. J. Holmes, in his 1911 book (*2*), reproduced a photograph of a blackboard with the letters that Peter copied and stated in his review, "It is unfortunate that more extended and thorough experiments were not carried out with so promising a subject."

GORDON M. BURGHARDT
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References

1. L. Witmer, *Psychol. Clinic* **3**, 179 (1909)
2. S. J. Holmes, *The Evolution of Animal Intelligence* (Holt, New York, 1911), p. 272.

Those of us whose university libraries do not have the texts in question are indebted to Burghardt for calling them to our attention. It is not clear whether the animal copied the trainer's movements, visual product, or both, but in any case the example can be contrasted with that of Sarah, one of our chimpanzee subjects. Her visual production was not based on copying; she regularly reassembled the face without an external model.

The relation between copying an item and reconstructing it from memory is an interesting one. Certainly common sense suggests that it is possible to copy items which cannot be reconstructed from memory. On the other hand, we have some recent findings suggesting that, in some cases at least, if the subject cannot reconstruct an item from memory, it cannot copy it either.

In pursuing the matter of what one must know in order to be able to reassemble a face from memory, we gave Sarah disassembled pictures of faces different from previous ones. The parts were no longer eyes, nose, and mouth, but either (i) conjoint canonical parts, such as an eye joined to the nose; or (ii) disassembled canonical parts, such as an eye cut into four arbitrary pieces. Sarah reassembled the face from the conjoint pieces but failed to reassemble the disassembled eye. Moreover, when given an assembled eye (identical to the disassembled one) as a model, she was no more successful in copying the eye than she was in reassembling it from memory.

DAVID PREMACK
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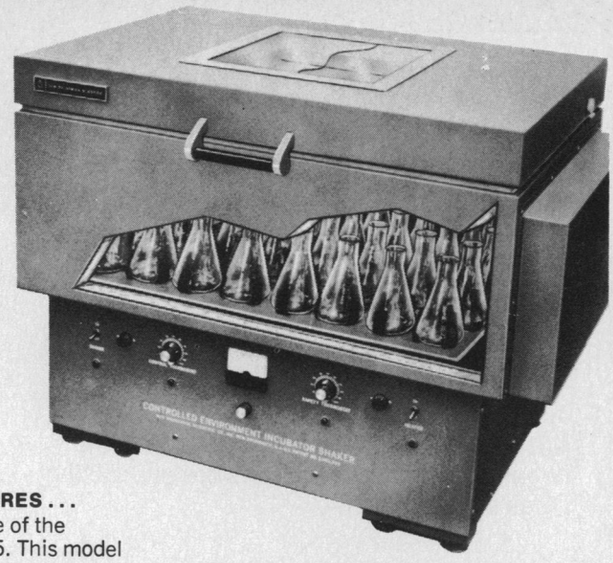

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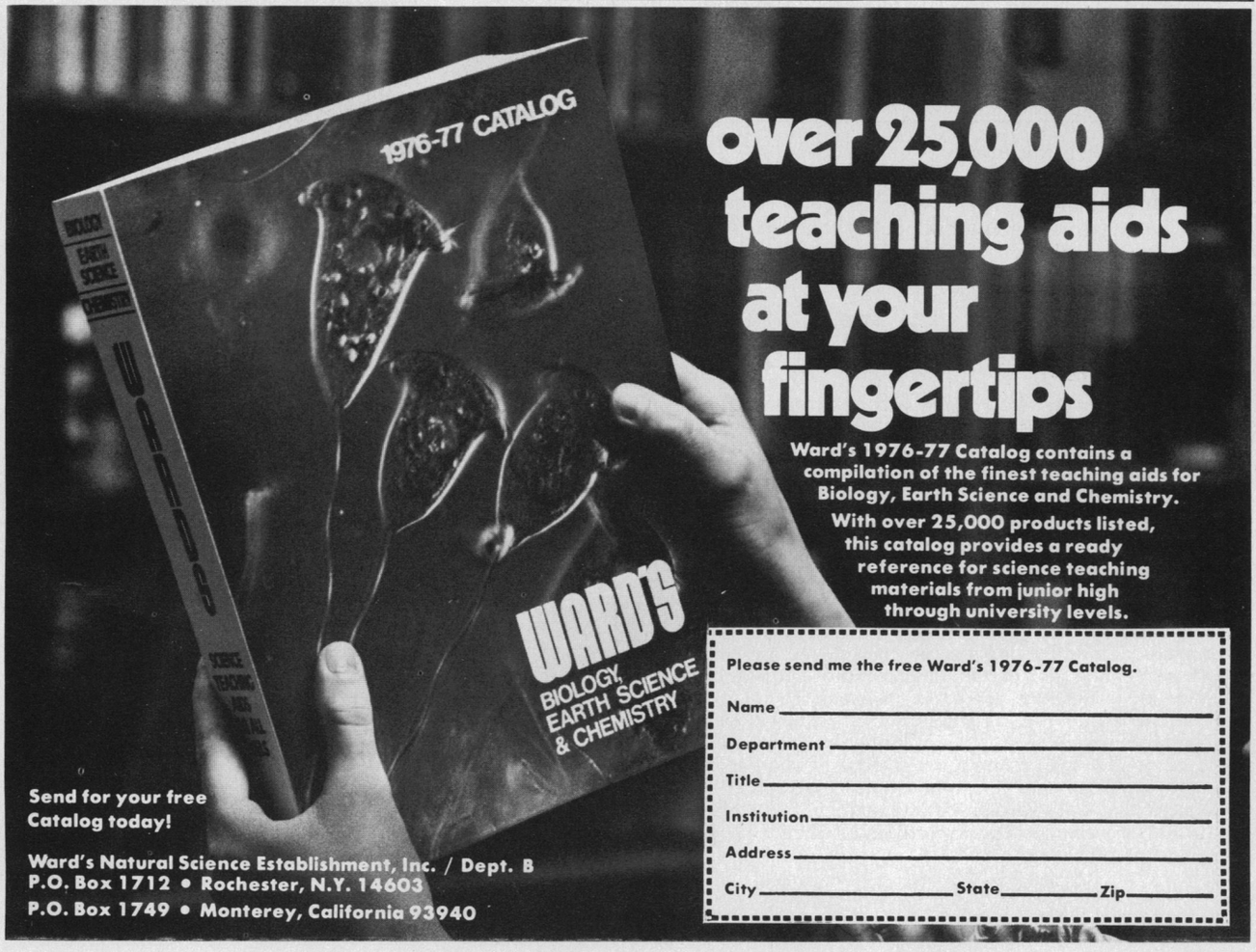

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SCIENCE

Social Determinism and Behavioral Genetics

The fusion of evolutionary theory with genetics has yielded several profound insights into the nature of man. We now know that most traits are determined by interaction between genes and the environment, rather than by either acting independently. Moreover, the traditional view of race, as a set of stereotypes with minor variations, has been invalidated by the knowledge that races differ statistically and not typologically in their genetic composition. Finally, the rapid evolution of our species implies wide genetic diversity, with respect to behavioral as well as to morphological and biochemical traits.

Unfortunately, the idea of genetic diversity has encountered a good deal of resistance. Some egalitarians fear that its recognition will discourage efforts to eliminate social causes of educational failure, misery, and crime. Accordingly, they equate any attention to genetic factors in human behavior with the primitive biological determinism of early eugenicists and race supremacists. But they are setting up a false dichotomy, and their exclusive attention to environmental factors leads them to an equally false social determinism.

Ironically, this opposition parallels that of theologians a century ago: both saw the foundations of public morality threatened by an implication of evolution. But neither religious nor political fervor can command the laws of nature. One might accordingly expect scientists, knowing this very well, to encourage the public to accept genetic diversity—both as an invaluable cultural resource and as an indispensable consideration in any approach to social equality. Yet in a recent "NOVA" program on the Public Broadcasting Service a distinguished population geneticist denied the legitimacy of human behavioral genetics, scorned the belief that musical talent is inherited, and even minimized the contributions of genetics to agricultural productivity. Similarly, members of a group called Science for the People, criticizing a study of possible behavioral effects of chromosomal abnormalities, wrote* of the "damaging mythology of the genetic origins of 'antisocial' behavior," as though one must choose between genetic and social causation rather than study their interaction.

To be sure, in behavioral genetics premature conclusions are all too tempting, and they can be socially dangerous. Moreover, even sound knowledge in this field, as in any other, can be used badly. Accordingly, some would set up lines of defense against acquisition of the knowledge, rather than against its misuse. This suggestion has wide appeal, for the public is already suspicious of genetics. It recognizes that earlier, pseudoscientific extrapolations from genetics to society were used to rationalize racism, with tragic consequences; and it has developed much anxiety over the allegedly imminent prospect of genetic manipulation in man. Hence one can easily visualize an American Lysenkoism, prescribing an environmentalist dogma and proscribing or discouraging research on behavioral genetics. But such a development would deprive us of knowledge that could help us in many ways: for example, to improve education (by building on the diversity of individual potentials and learning patterns), to decrease conflicts, to prevent and treat mental illnesses, and to eliminate guilt based on exaggerated conceptions of the scope of parental responsibility and influence.

In the continuing struggle to replace traditional myths by evolutionary knowledge the conflict over human diversity may prove even more intense and prolonged than the earlier conflict over special creation: the critics are no less righteous, the issues are even closer to politics, and guilt over massive social inequities hinders objective discussion. What the scientific community should do is not clear. At the least we might try to help the public to realize the value of scientific objectivity, separated from political convictions, in understanding human diversity. Long ago men began to understand chemical diversity when they gave up the search for a philosopher's stone, which they had hoped would transmute other elements into gold. Today in human biology we face a similar problem in learning to build on facts as well as on hopes.—BERNARD D. DAVIS, *Harvard Medical School, Boston, Massachusetts 02115*

*J. Beckwith, D. Elseviers, L. Gorini, C. Mandansky, L. Csonka, J. King, *Science* **187**, 298 (1975).

Why would a chemist want an engineer's liquid chromatograph?

What you value in a liquid chromatograph depends a lot on your point of view. A salesman may be proudest of a big name and classy styling; the engineer is mainly concerned with specifications; but the chemist first asks what it will do. Actually the engineer and the chemist aren't far apart. Good performance can only follow sound design and the right specifications.

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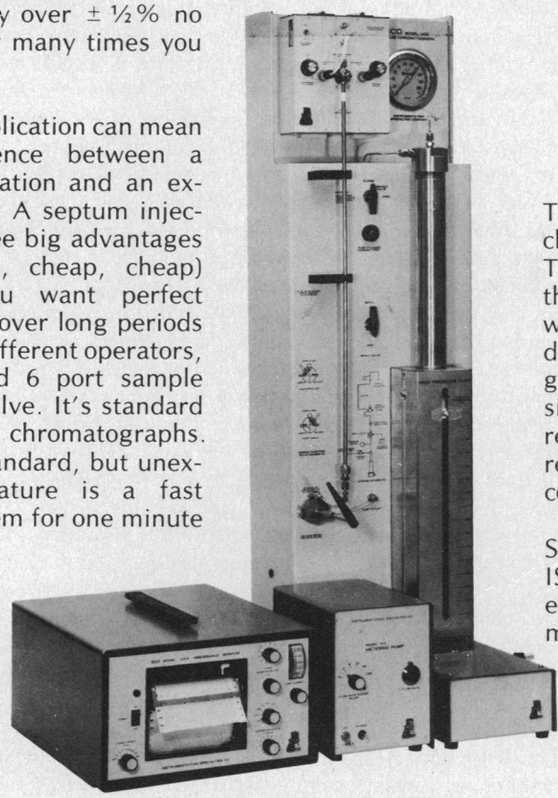

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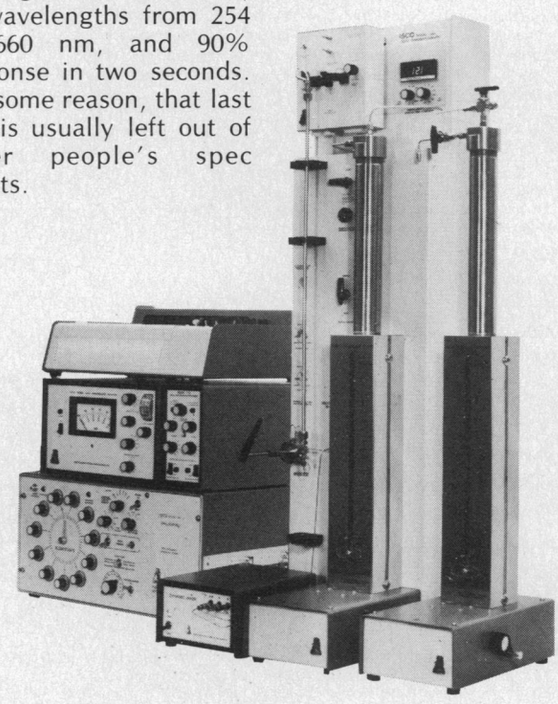

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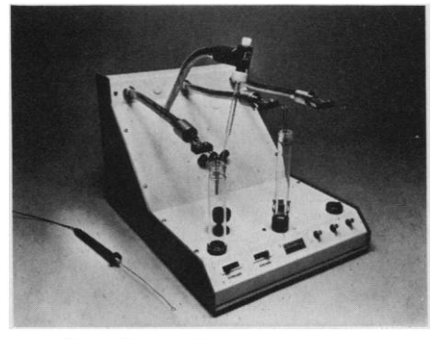

Fig. 1. Trans-a-Flex culturing station.

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Model LSC-1 permits the detection and measurement of organohalide pollutants in water in the parts per billion (micrograms per liter) range in conjunction with gas chromatography–mass spectrometry. A carrier gas such as helium or nitrogen is bubbled through a sample to carry organic pollutants to a trap where they are selectively absorbed on a porous polymeric material. After the sample is purged, the trap is heated and the trapped organic materials are thermally desorbed into the chromatograph injection port. Tekmar. Circle 712.

Rotational Viscometer

The Rheotron operates on a "couette" measuring principle. The outer cylinder rotates at a fixed or variable speed and shear stress is sensed at the fixed inner cylinder. The major advantage is its ability to measure instantly the effect of an applied deformation. The drive mechanism responds promptly to permit acceleration or deceleration at rates of 100 revolutions per minute in 20 milliseconds. The minimum deflection angle is 0.25° for full-scale response. Attachments allow the Rheotron to operate on the cone and the plate principle as well. The measuring chamber is jacketed and temperature may be controlled from -3° to 300°C. C. W. Brabender Instruments. Circle 713.

Hematocrit Centrifuge

Model C401 is designed for microhematocrit applications. It is available with a 24-place detachable head and an electronic brake. It also offers an interlock system for the cover which turns the device off when the cover is opened. Rotation speed is 13,000 revolutions per minute and a typical analysis would require approximately 4 minutes. Adam David. Circle 715.

Radioimmunoassay Instrumentation

RIA-pac (Fig. 2) is an assay system that includes an automatic gamma counter, a fluid aspirator, and an automatic small-volume pipet. The gamma counter offers a data printout unit and a five-digit display. It automatically counts each of up to 190 samples one, two, or three times. Counting modes include background preset counts, and preset time. It will accommodate a variety of tube sizes as well. The fluid aspirator serves as a ready source of partial vacuum suitable for many purposes. A disposable bag receives the waste fluid. The

device operates in any position at flow rates to 10 milliliters per second. The pipet is a two-channel unit capable of handling from 5 microliters to 1 milliliter with reproducibility and accuracy of ±4 percent at 5 microliters, ±1 percent at 50 microliters, and less than 1 percent at volumes exceeding 50 microliters. Pharmacia Laboratories. Circle 706.

Lyman Alpha Radiation Source

A miniature lamp emitting radiation at 121.6 nanometers features over 500 hours of operation, requires a 2-watt power supply, and is permanently sealed. This wavelength is used in vacuum test chambers to simulate the degradation of materials exposed to ultraviolet radiation in outer space. The lamp yields over 0.2 sun equivalent from the 8-millimeter clear aperture of its magnesium fluoride crystal window. This is sufficient for small-scale testing and as a source for vacuum ultraviolet spectroscopy. Artech. Circle 710.

Lyman Alpha Optical Filters

Multilayer interference filters permit peak radiation at 121.6 nanometers. These filters are stable and resistant to visible and ultraviolet radiation. Out-of-band rejection ratio is from 10^3 to 10^4 for narrowband two-cavity filters and from 10^2 to 10^3 for broadband filters. They are available in sets to fit a filter assembly suitable for mounting on spectrophotometers. Acton Research. Circle 711.

Particle Counter

The Prototron (Fig. 3) includes diffuse vertical illumination for visual identification of large particulates and a scanning laser beam for detection of small particulate matter. It makes in situ counts for containers with inside diameters ranging from 20 to 200 millimeters. It features a manual setting for threshold size and then counts particles with diameters that exceed the threshold. Spectrex. Circle 729.

Automated Tape Library

The model 7110 ATL provides on-line control of all magnetic tape processing functions. It provides physical storage, mechanical retrieval, mounting and storing, and software to facilitate control and management. It is modular: one unit includes a control module, two storage sections, and a reel selector and mounter to service one tape drive. It stores up to 746 reels. Expansion to service of 32 drives and storage of 6122 reels is feasible. Calcomp. Circle 730.

Ionized Calcium Analyzer

The SS-20 measures ionized calcium in whole blood in less than 3 minutes. An analysis requires the injection of a 500-microliter sample of serum or heparinized blood through a port. The operator activates an analysis button and the device does the rest. Results are in milliequivalents per liter. Orion Research. Circle 731.

Centrifuge

The CENTRX performs microhematocrit, serum preparation, and urine separation. It can accommodate eight 75-millimeter capillary tubes, four 15-milliliter test tubes, or four Vacutainer tubes. Speed is variable up to 10,500 revolutions per minute and there is an automatic timer and an electric brake. Phipps & Bird. Circle 732.

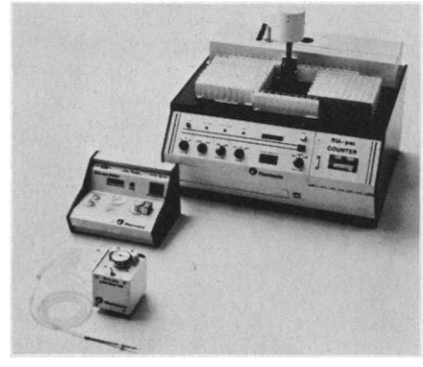

Fig. 2. RIA-pac is a complete radioimmunoassay system which will enable the operator to perform up to 800 analyses per day. Circuitry is designed for compatibility with computer peripherals.

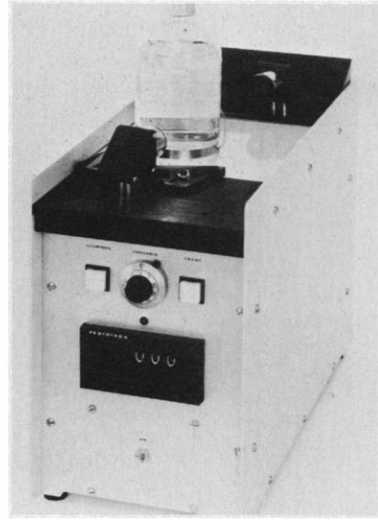

Fig. 3. The Prototron particle counter is adaptable to a variety of research, clinical, and industrial tasks.

Literature

Micro Memo is a pocket-book sized collection of technical data on microscopy. Wild Heerbrugg Instruments. Circle 724.

Water Baths are featured in a 20-page catalog devoted to applications in life science research and industrial testing. Hotpack. Circle 717.

Environmental Chambers includes over 200 models from reach-in to walk-in types with a wide variety of controlled parameters. Vista Scientific. Circle 718.

Disposable Recorder Pens are described in a data sheet. They increase the writing capacity of chart recorders. MSD Division, Graphic Controls. Circle 719.

Computer Equipment Directory is a monthly listing of new and used equipment available at $75 per year. The Computer Store. Circle 721.

Specific Ion Electrodes is a catalog that describes connectors, filling solutions, calibrating solutions, and meters and gives detection curves for each of several electrodes from ammonia to zinc. Chemtrix. Circle 698.

Measuring and Recording Instrumentation is a 12-page catalog of recorders and other electronic devices. Yokogawa of America. Circle 722.

Computer Systems describes a line of memory devices and peripherals as well as central processing units. Wang Laboratories. Circle 723.

Simplicity of Modern Voiceband Testing discusses measurements of transmission level, circuit noise, and battery voltage, among others. Wiltron. Circle 725.

Chemical Instrumentation is devoted to trace gas analysis. HNU Systems. Circle 726.

Laboratory Appliances and Accessories features the Tek-Pro line of products for counting, timing, heating, stirring, and rotating. Scientific Products Division, American Hospital Supply. Circle 727.

Explosion-Proof Refrigerators and Freezers lists typical questions of users about hazardous locations and atmospheric conditions. Kelmore. Circle 728.

Dissolved Oxygen Analyzers are described in a 7-page brochure. Rexnord Instrument Products. Circle 733.

Subsurface Electrical Resistivity features the R-50 Stratameter and the R-60 extended range resistivity meter for deep surveying. Soiltest. Circle 736.

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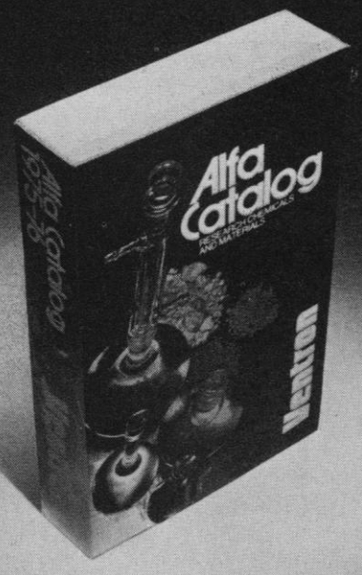

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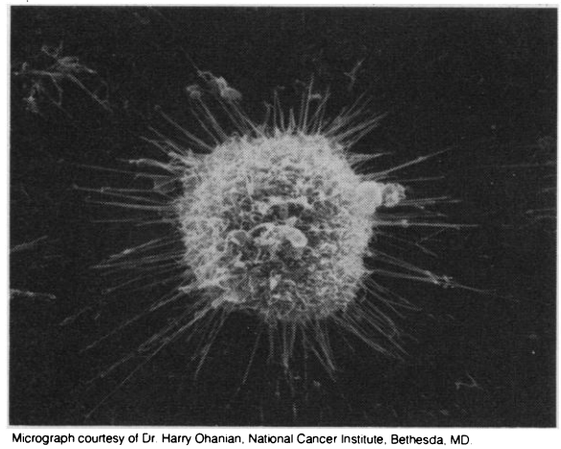
Guinea Pig Hepatoma Cell



Micrograph courtesy of Dr. Harry Ohanian, National Cancer Institute, Bethesda, MD

This 4000x micrograph of a Line 1 guinea pig hepatoma cell (induced by diethylnitrosamine feeding) shows detail normally masked by the heavy gold coating necessary to prevent charge effect interference in conventional SEM's. Coates & Welter's brighter field emission electron gun permits high-speed scanning . . . minimizing charge effect to allow micrography of uncoated (or lightly coated) specimens.

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RESEARCH NEWS

(Continued from page 1076)

(phosphorylcholine at NIH, a derivative of vitamin K at Johns Hopkins, and 2,4-dinitrophenyl groups at Argonne) compared to ordinary antigens, and they interact with only a few residues in the combining site. They might miss the ones involved in triggering conformation changes. Furthermore, the antibodies were studied in the crystalline state, and the results may not be applicable to what happens when the proteins are in solution.

At least one group of investigators, including I. Z. Steinberg and J. Schlessinger of the Weizmann Institute of Science in Rehovot, Israel, has evidence that antibodies in solution undergo a conformation change when they bind antigen. They determined the effect of antigen binding on the circular polarization of fluorescence of antibodies. The investigators observed changes only with large antigens and not with phosphorylcholine.

The picture of antibody structure emerging from all this is one in which certain segments of both variable and constant domains form a structural framework that has changed little throughout the course of antibody evolution. Several investigators pointed out that the resemblances in the three-dimensional structures of the different domains support the hypothesis that they all originated from duplication of a single primordial gene. When changes in amino acid sequences did occur in the framework regions, they were such as to not markedly disturb the basic folding pattern. On the other hand, alterations outside of this framework, for example, in the hypervariable regions of variable domains, can give rise to antibodies with different specificities. Alterations in the nonframework sequences of constant domains would permit the evolution of domains capable of performing different functions.

Because of the similarity between the Bence-Jones dimer and the Fab fragments, Edmundson thinks that the dimer may represent a prototype for a primitive antibody, and a possible intermediate in the evolution of the four-chain immunoglobulin molecule. He suggests that the rotation of the constant domain relative to the variable one was a critical step in the evolutionary process because it means that different amino acid residues would be needed for maintaining the association of each domain pair. Those not involved in the interaction would necessarily also be different and hence the domains could evolve to perform different functions. The eventual result would be immunoglobulins with the structures and functions that we know today.—JEAN L. MARX

Personnel Placement

POSITIONS WANTED

Biochemical Endocrinologist, 2-year postdoctoral experience in mechanism of hormone action, receptor binding, feedback regulation, enzyme induction and RIA. Seeks research, teaching position. Box 411, SCIENCE. 9/26; 10/3, 10

U.S. **Foreign Graduate,** M.S. with research and clinical experience in bacteriology, virology, parasitology, biochemistry, epidemiology, rural health delivery, seeks position in environmental health, preventive medicine, related field. Box 412, SCIENCE. X

Immunologist—Biochemist—Microbiologist: Ph.D. (immunology-immunochemistry); M.S. (microbiology); B.S. (chemistry). More than 12 years of postdoctoral research experience: antigens isolation—purification; antibody production—characterization; antigen-antibody interactions and assays (including radioimmunoassays); various immune responses and immunological-immunochemical techniques in both in vitro and in vivo systems; enzymes and membrane receptors; protein-protein and protein-drug bindings and interactions; protein chemistry and biochemical methods. Also, college teaching experience, radioisotopes license and publications. Desires position in research, teaching/research, research/teaching. Available immediately. P.O. Box 58, Rancocas, New Jersey 08073. X

M.D./Ph.D. (1976). **Neuroscientist.** Publications. Desires research/teaching position in university, industry, or government. Available summer 1976. E. E. Fahringer, Department of Physiology, University of Pittsburgh, Pittsburgh, Pa. 15261. X

Postdoctoral Research Fellowship: Ph.D. December 1975. Publications. Sound knowledge: spectroscopy and synthetic methods. Experience in pharmaceutical industry. Languages: English, French, and German. Seeks fellowship in chemistry or pharmaceutical department. Box 413, SCIENCE. X

Zoologist. Ph.D. Desires teaching position. Interests include invertebrate zoology, limnology, aquatic microbiology, parasitology, embryology, comparative anatomy. Dr. Wilson, Route 2, Box 575, Russell Springs, Kentucky 42642. X

POSITIONS OPEN

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