

SCIENCE

5 May 1967
Vol. 156, No. 3775

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

COVER

Inner surface of mammalian myocardial cell. The projections represent the broken stumps of the invaginations which form the transverse tubular system. (Freeze-etching and electron microscopy, $\times 40,000$). See page 656. [D. G. Rayns, Medical Research Council of New Zealand; F. O. Simpson, University of Otago Medical School, Dunedin, New Zealand; and W. S. Bertaud, Department of Scientific and Industrial Research, Lower Hutt, New Zealand]

EMU-4...The "New Look" in Electron Microscopes



Front-loaded magazine holds 6 cassettes

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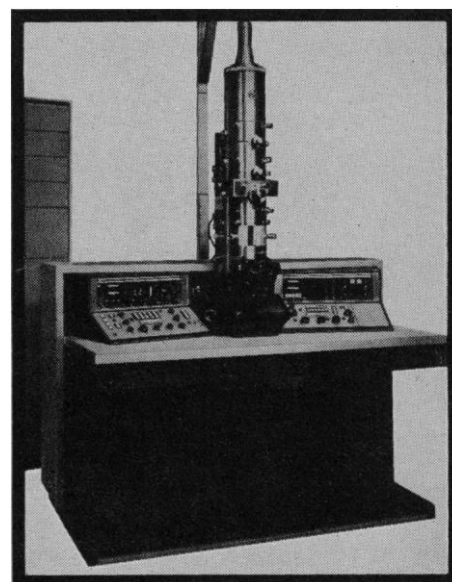
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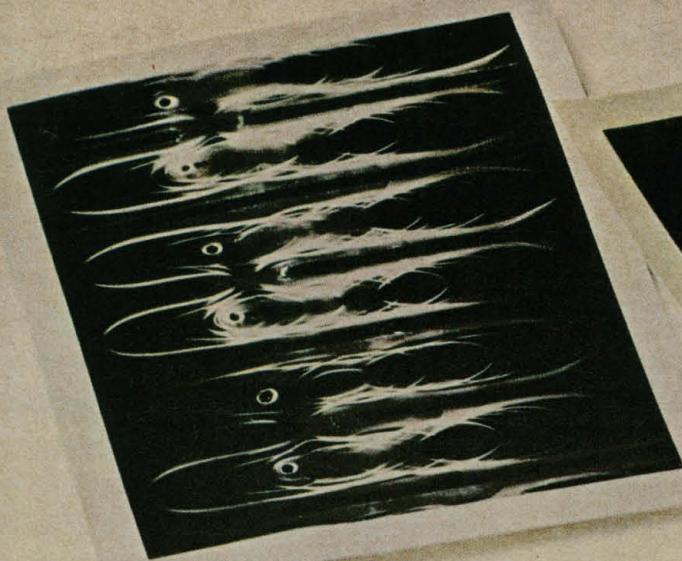


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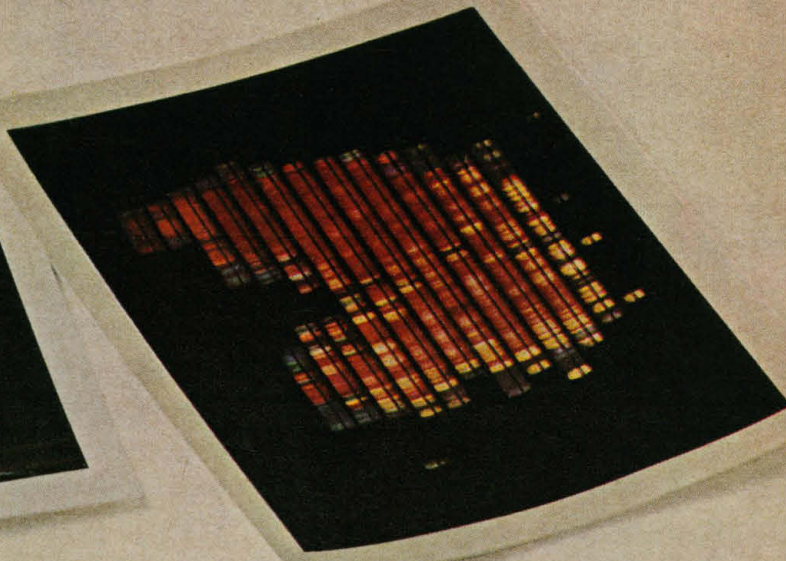


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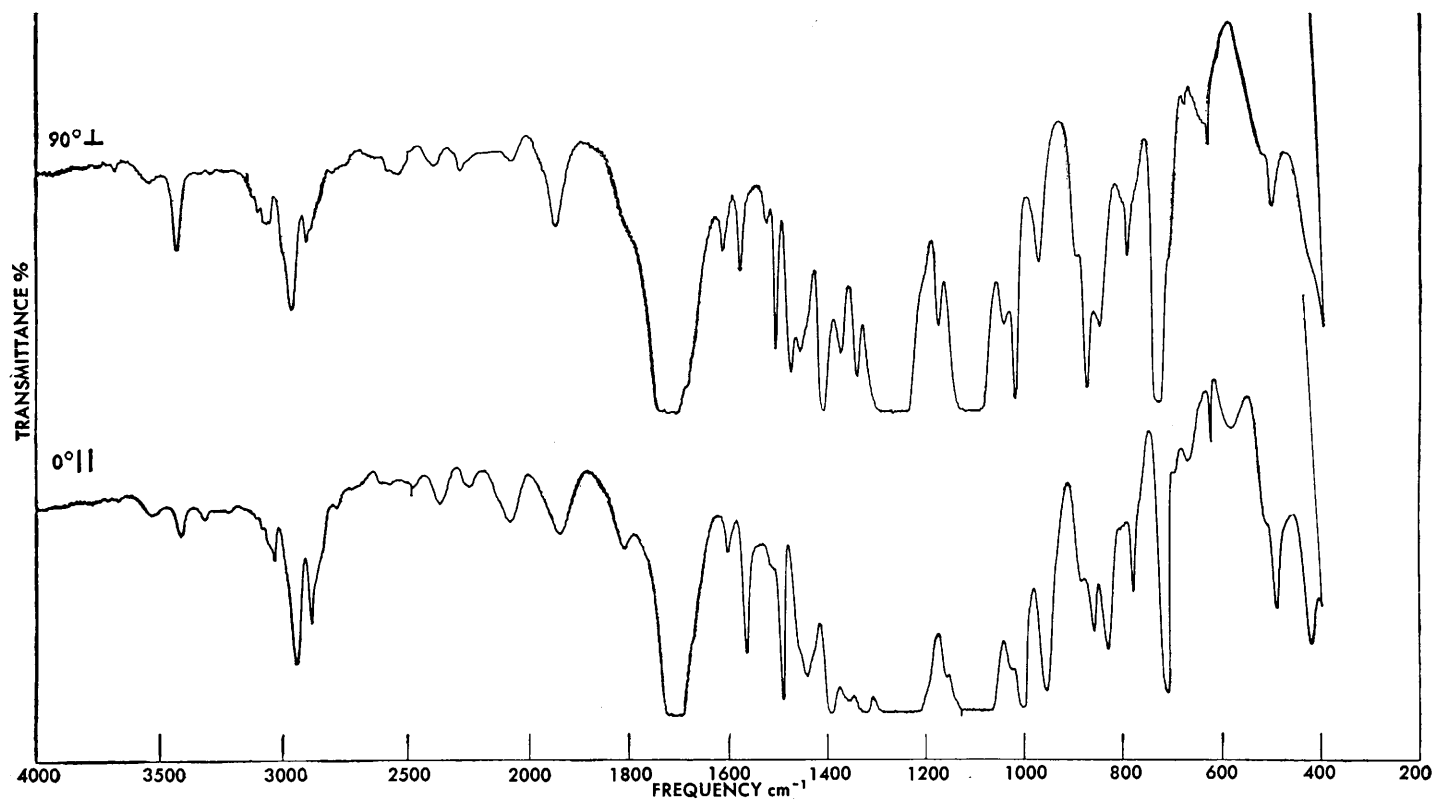
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These spectra, of a piece of rolled polyester film only 1.5 mm square, were taken with the aid of two P-E accessories: a wire-grid polarizer and a 1 X 4 refracting beam condenser (see illustration). They show how polarized radiation can be used to obtain fundamental information on even the smallest polymer samples. From the dichroic behavior of two absorption bands, it can be seen that the polymer chains are preferentially aligned parallel to the machine, or rolling direction. Here's how: the two spectra were taken with the wire grid polarizer at orientations 90°

apart. The relative intensities of the C=O band at 1725 cm⁻¹ and the aromatic carbon-hydrogen bending vibration at 1500 cm⁻¹ can be used to determine the relative orientations of the transition moments associated with these vibrations. The 1725 cm⁻¹ band has its maximum intensity when the polarizer is oriented to transmit radiation perpendicular to the machine direction of the film: i.e., the band exhibits perpendicular dichroism. On the other hand, the 1500 cm⁻¹ band shows parallel dichroism. The Model 621 makes this kind of analysis easy to do.

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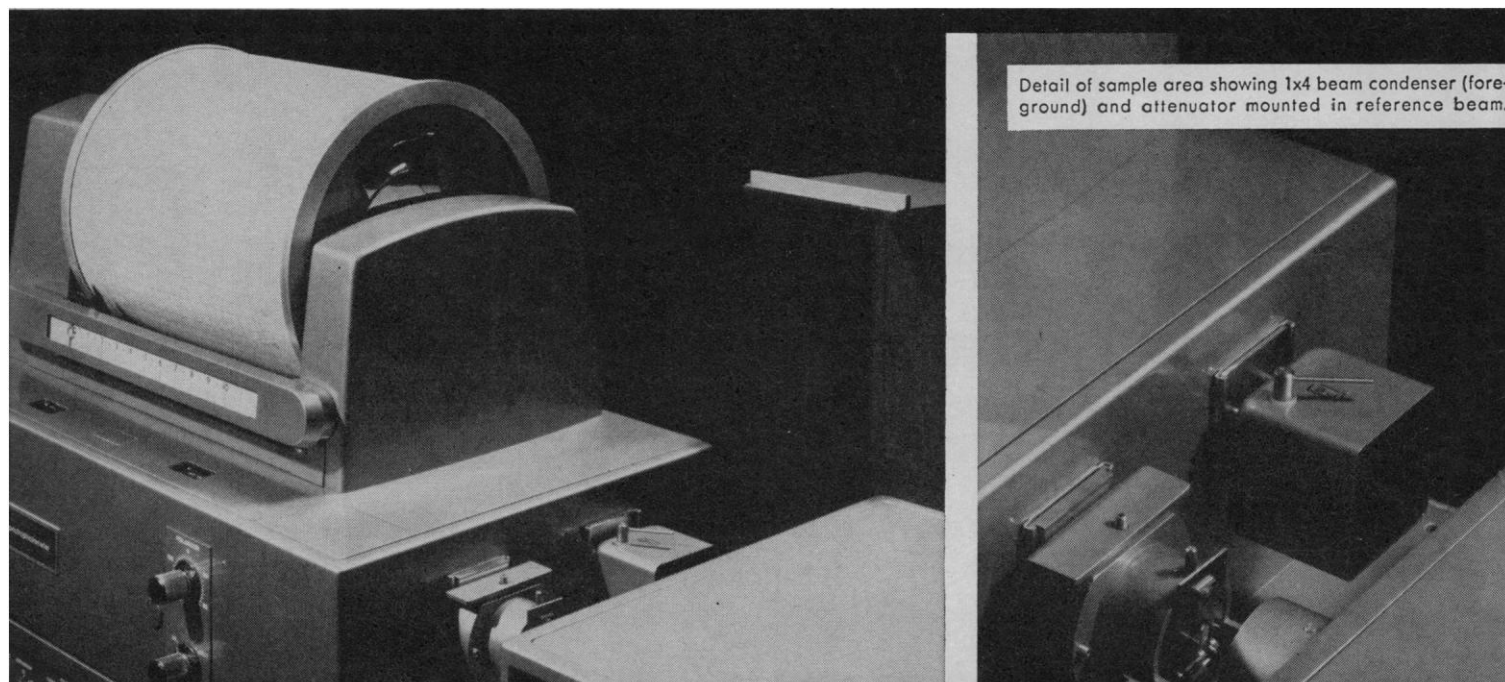
We've designed special accessories to give you optimum micro-performance. We offer a micro-cell and beam-condenser combination, an ultra-micro 6X beam condenser, and a micro-specular reflectance attachment. The spectra show how a new Perkin-Elmer accessory, the Wire Grid Polarizer, is used in conjunction with a beam condenser to reveal orientation of the functional groups in a polyester film.

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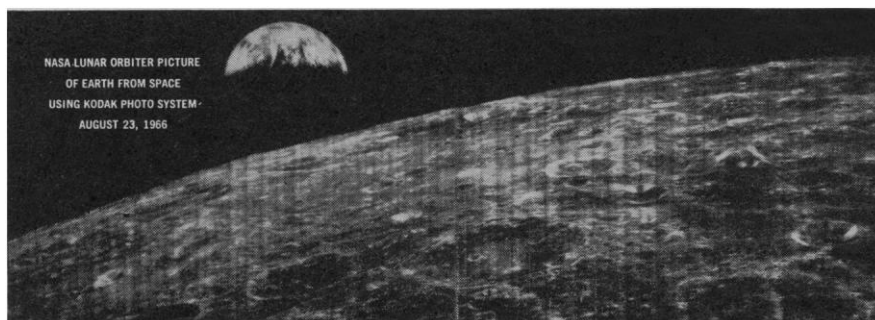
analyzing chromatographic fractions. But it hasn't been designed for microanalysis alone. We've built in every possible convenience and technical improvement for rapid, precise work. You can also handle ordinary samples faster and easier. The Model 621 gives you unparalleled sensitivity over its entire range.

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The hope of doing each other some good prompts these advertisements



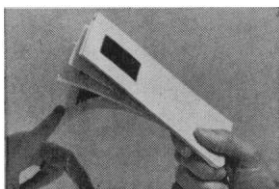
Earth photography: what to do with it

When we displayed this now familiar photograph in 18 x 60-foot size in New York's Grand Central Terminal, more than one scurrying commuter was overheard speculating as to which was the moon and which the earth. In stimulating widespread thought about questions like that, the picture was fulfilling a purpose. For the moment it also fixes one end of the scale for available photography of the earth's surface. For such other purposes as urban and agricultural planning, photogeology, ecological studies, resource assessment, and all the rest, photography of a less majestic scale is also available and more serviceable.

As the camera gets closer and detail becomes easier to resolve, another problem presses in: the sheer physical volume of film to keep track of. More and more of the earth's surface is being photographed in finer and finer detail for more and more purposes.

For those perversely glad that coverage is not more complete because theirs is the responsibility of making sure that existing coverage is available for use, there is still time to take steps while the men in airplanes assiduously fill more warehouse space with more long rolls of aerial negative.

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firmed it experimentally. All we do is make the compound. The discovery and demonstration of its usefulness have been a contribution to science by a physician who likes to work at the interface between physical chemistry and sick people. He published it in the *Journal of Lipid Research* for January, 1967.

His paper mentions that the compound as obtained from us is a yellow, viscous oil, that while a colorless preparation of the same compound can be made from Tetraheptylammonium Iodide (EASTMAN 7630), the further elegance is unnecessary. This is worth knowing. For a scientist to report on the usefulness of a commercially available product is as much a service to his fellows as to the manufacturer. For the manu-

Mars photography: what to do it on

Film for photographing the face of the earth is mighty big business, but plates for photographing Mars are mighty small business. This does not excuse us from doing our best for the Mars photographers (or at least so we choose to interpret our obligations).

Mars photographers have been at it for a long time; their pace slackens not, but quickens. For this year's opposition, the Observatory of New Mexico State University is photographing the planet in six spectral bands every two hours. The most fluctuation in appearance and the most bafflement to explain it occur in the band centered at $550m\mu$. For this band Dr. Bradford A. Smith, the observatory's director, has chosen KODAK "Spectroscopic" Plates, Type III-G, which establish the long-wavelength limit of sensitivity at about $600m\mu$, have high speed for the job, and are not too grainy to show detail in the 1 to 3-millimeter image of the planet's disk formed by the observatory's 30-meter focal length instrument.

Elsewhere other astronomers maintain a watch on Mars also, whatever arrangements the space travel agencies have in mind for closer looks than the one that earthbound astronomers will be given at the midsummer '69 opposition and the considerably closer one of September, 1971. After that there will be a 15-year wait for another really close opposition.

Dr. Smith's need has pulled Type III-G plates out of the limbo to which we had prematurely abandoned the type. Astronomy with feet firmly planted on the ground still has vigils to keep photographically.

Inquiries about specialized photographic plates for scientific purposes should be directed to Eastman Kodak Company, Industrial Photo Methods, Rochester, N. Y. 14650.

facturer to lift that report out of the scientific literature and give it wider currency through commercial communications like this may be as much of a service as manufacturing the chemical in the first place.

The helpful hints are also delivered to us in person, by phone, and by mail. When told that we are free to pass them along, we do so as best we can. This communicators' role has been sort of bestowed on us as a result of the position occupied by the EASTMAN Organic Chemicals catalog. A copy of the latest edition, List No. 44, can be obtained from Distillation Products Industries, Rochester, N. Y. 14603 (Division of Eastman Kodak Company).

Kodak

Spinner Magnetometer



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the Remanent
Magnetic Moment
and Anisotropic
Susceptibility
of Geological
Samples**

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Price: \$8,000 for complete system; with automatic digital readout (as shown in the photograph) to monitor the orthogonal components of the moment alternately, \$9,750. Export price approximately 5% higher, except Canada.

Write for Bulletin No. T-133 to Princeton Applied Research Corp., Dept. G, P.O. Box 565, Princeton, N. J. 08540. Telephone: (609) 924-6835.



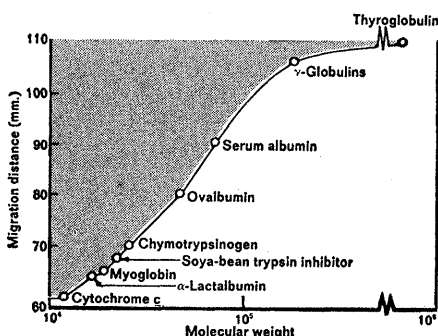
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Correlation between the molecular weight of 9 proteins and their migration rate in thin-layer gel filtration on Sephadex Superfine G-100 was investigated. Measurements from separate experiments were correlated by expression on the common basis of 6 cm. migration by cytochrome c. (Andrews, P., *Biochem. J.* (1964) 91,222, by permission of the author.)

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community to print such biased partisan propaganda as this brings serious discredit upon it. . . . I view Reagan as a breath of fresh air and common sense in a country gone tragically awry. You should be thankful that we can still produce such men and recognize them by placing them in positions of authority. It's dirty business to print such snide distortions of the facts as you have in this article. . . .

WILLIAM B. ELMER
113 Pinckney Street,
Boston 14, Massachusetts

Langer is an excellent reporter, although I don't always agree with her judgments, but she performs an important journalistic service for those of us who live here. Our newspapers are so bad that I have to wait until *Science* arrives in order to learn what our local situation actually is.

ROBERT H. SOMERS
Department of Sociology,
University of California, Berkeley
94720

I am very distressed about the implication that we here at the University of Southern California have been unresponsive to the problems at the University of California. The following excerpts from a resolution of the Academic Senate of USC, approved and passed on 15 February, truly reflect the feeling of the faculty here. The delay in this resolution was due to the fact that this was the first university senate meeting after the events at the University of California.

The University Senate of the University of Southern California wishes to thank Clark Kerr for his contributions to higher education in California and the United States.

The University Senate of the University of Southern California conveys to the Universities of California support in their fight for academic freedom and excellence in education.

WALTER WOLF
School of Pharmacy,
University of Southern California,
University Park, Los Angeles 90007

Langer's report implied that Governor Reagan's ill-advised attack on higher education in general and the University of California in particular somehow originated, was motivated, or at least, was condoned by the University of Southern California. This, of course, is totally untrue (I know because I earned my Ph.D. there). The "local cogno-

scenti" quoted in her article, whoever they may be (although I can't help but think that they are from UCLA), are obviously attempting to find someone to blame for a situation which has been generated in part by the total lack of attention to undergraduates at UCLA (I know because I earned my B.S. there).

JOSEPH ARDITTI
Department of Organismic Biology,
University of California, Irvine 92664

Humanitarianism and CBW

The three letters (10 Mar.) defending chemical and biological (and, by implication, nuclear) warfare employ essentially similar justifications. Alpert confesses "this issue" [of university research on CBW] "is muddy in my mind"; I find all the authors' logic likewise. Their viewpoints are egocentric or narrowly nationalistic based on the unwritten premise of the right of American intervention in Vietnamese affairs.

First, they ignore the fact that, in contrast to all previous wars, warfare today is no longer a question of the extermination of a clan, a walled town, a religious group, or a nation, but involves the existence of the entire human race. The ultimate escalation could occur with explosive suddenness. It should be obvious that we must take every reasonable step to avoid the experiment of finding out whether 50, 10, or zero percent of humanity can survive an all-out war. The first step would be not to make wars on nations far or near but to negotiate the peaceful end of those now in progress.

Second, the writers of the aforementioned letters justify CBW by reference to the legitimate needs of defense. But defense today is a word that includes aggression! Is it really necessary to destroy the ecology of Vietnam in order to protect American lives—lives of people who do not have to be there anyway—and to defend the faraway folk in America? It may, of course, be difficult to understand the immorality of ruining a "rich biological area" and starving its population when the individual himself, or his son, is an actual or potential combatant. But there are those who are able to transcend this subjective view and, fortunately, some who act accordingly.

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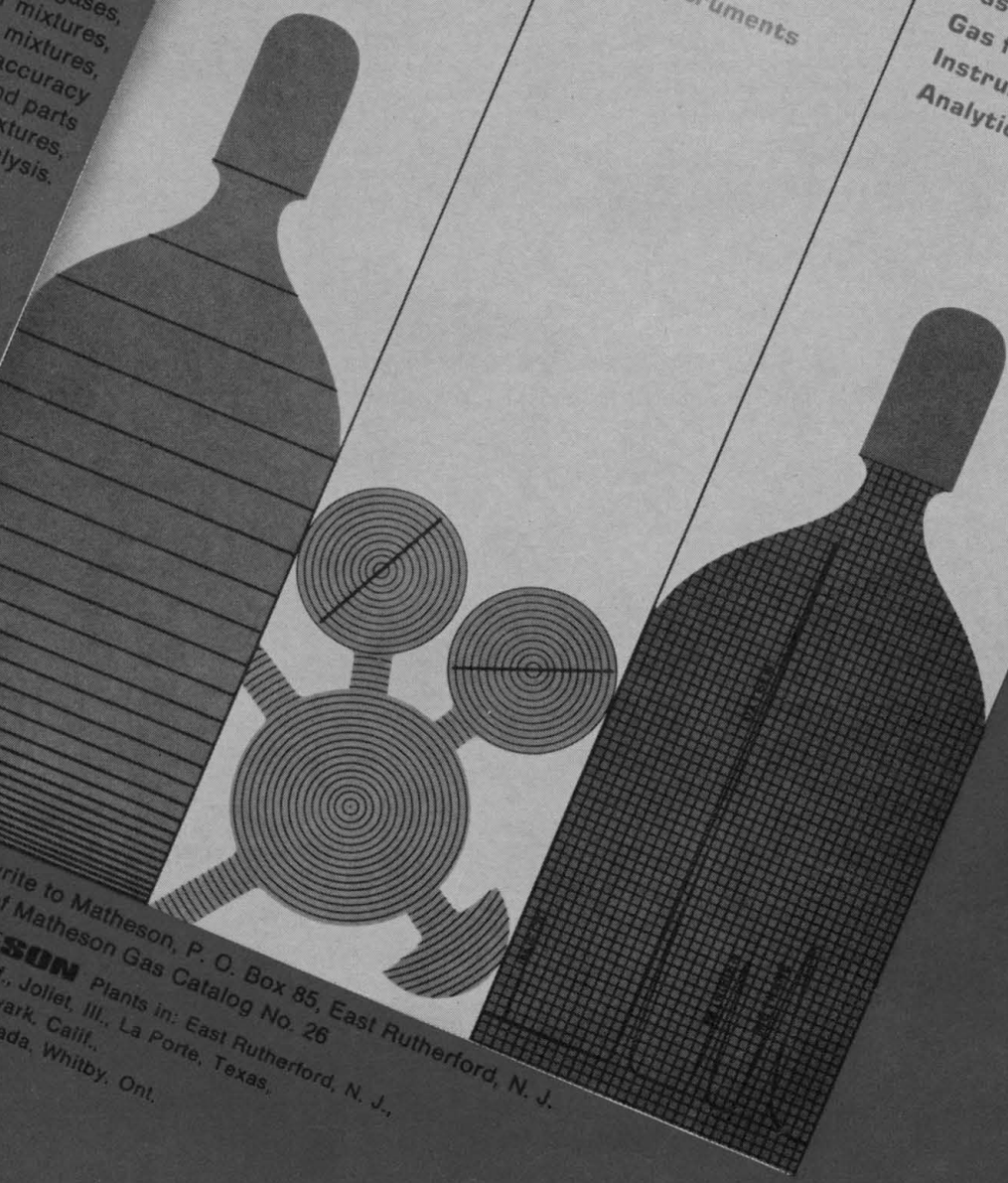
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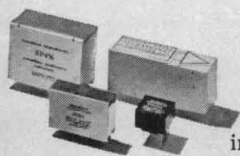
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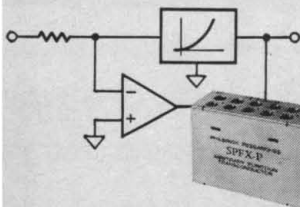
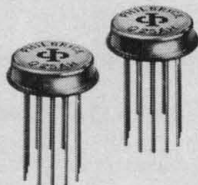


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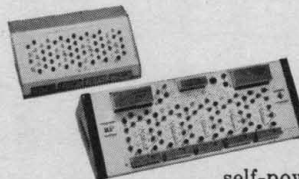


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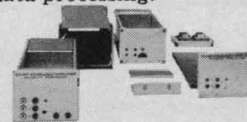


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Public-Private Organizations

President Johnson's committee to review Central Intelligence Agency support of private organizations that operate abroad submitted two basic recommendations: that covert support of educational and private voluntary organizations be stopped, and that a public-private mechanism be developed to provide open governmental support of overseas activities of selected private organizations.

The President's committee concentrated on overseas activities, but the question of public support of private organizations that work for the public good is a wider one. In the 1966 annual report of the Carnegie Corporation, Alan Pifer advocated governmental support of selected scholarly and professional associations, health and community action agencies, nonuniversity research and educational institutions, defense advisory organizations, and agencies providing technical assistance. There is little doubt that it is desirable to have strong, independent organizations of all these types, but financing is a problem. Their own resources are often inadequate. Foundations cannot supply permanent help. Project-by-project support endangers independence. Pifer concludes that continuing government support is the only solution: "If we want to avoid an ever more extensive and powerful Federal Government, it would seem that we must now, paradoxically, use federal money to ensure that we have a viable alternative—a network of vigorous, well-financed nongovernmental organizations ready to serve government but able, in the public interest, to maintain their independence of it."

In response to his committee report, the President has now appointed a new committee, under the chairmanship of Secretary Rusk, to study ways of achieving the proposed mechanism for using public funds to assist private organizations that serve public purposes.

The provision of open and continuing support of organizations that operate overseas, as the President's committee recommended, or of a wider range of agencies, as Pifer proposed, presents a problem which Great Britain has solved more satisfactorily than the United States has. "It is no longer a bishop or a queen or a merchant-prince, but the little man in the street, who is the patron of learning. The little man in the street is very powerful. He is liable to exercise what de Tocqueville called the despotism of the majority." Sir Eric Ashby wrote these words about universities, but they apply as well to the institutions Pifer and the President's committee had in mind. That the despotism of the majority has not been exercised over British universities, Ashby continued, is due "to a very simple but remarkable device which has been invented in Britain for subsidizing intellectual activity without endangering its independence. It is a political invention of the first importance. It is simply this: Parliament entrusts financial control of science and other intellectual activities to bodies of men whose sympathies and interests lie less with Parliament than with those whom they are controlling."

This political invention is exemplified in Great Britain by the University Grants Committee and the British councils, and in several other countries by comparable institutions. A U.S. example is the peer system of evaluating research proposals submitted to government agencies. Pifer and the President's committee want to extend the principle so that we may avoid the dangers of covert support and government control while we gain the advantages of strong, independent nongovernmental organizations that serve the public interest.—DAEL WOLFLE

Making voices from the depths sound deeper

Bell Telephone Laboratories has had a long-term interest in speech research—tracing back, indeed, to the work of Alexander Graham Bell. It was for this reason that the U. S. Navy asked us to investigate a

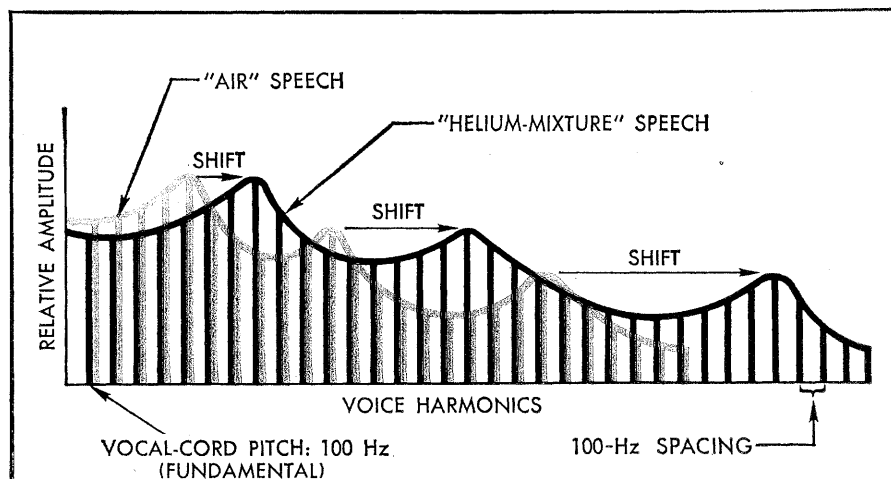
problem encountered in Sealab II. To prevent "bends" and nitrogen narcosis, the divers breathe a pressurized mixture of oxygen, nitrogen and helium, but the helium gives their voices an unnatural,

squeaky, Donald-Duck-like quality. As a result, voice communications between divers and people on the surface are seriously impaired.

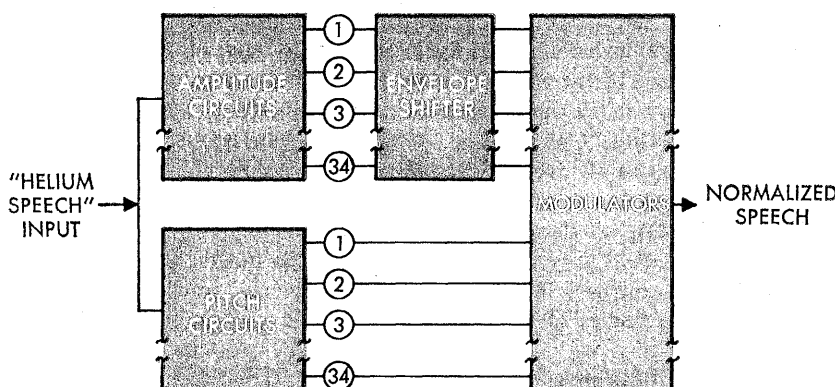
THE MAJOR PROBLEM is that the velocity of sound in the helium mixture is much higher than in air. This does not appreciably affect vocal-cord frequency, but does strongly affect the acoustic resonances of the vocal tract—which give the voice its characteristic sound quality. So, though fundamental voice pitch remains approximately the same (about 100 Hz in men), the amplitudes or loudness values of the various harmonics change markedly. Specifically, the pattern of these resonances (the envelope) shifts toward the higher frequencies (see graph), and voice timbre is grossly distorted.

THE SOLUTION to this problem was found at Bell Laboratories by research scientists M. R. Schroeder, J. L. Flanagan, and R. M. Golden. The distorted "helium speech" is separated into harmonic frequencies and their amplitudes are measured (see diagram). Then the envelope of the harmonic amplitudes is shifted back toward the more normal or low-frequency condition. In other words, the amplitudes of the harmonics are adjusted to match a more normal envelope.

As a test, the technique has been used on recordings of helium speech made in the U. S. Navy's Sealab II. The processed voices are readily understandable and sound enough like the speaker's "air" voice to be identifiable.



Fundamental pitch and harmonics (vertical bars) for normal "air" voice sound (color) and "helium speech" sound (black). Note that the frequencies of the fundamental and harmonics do not change very much, whereas the envelope of the amplitudes shifts toward the right. Note also that the magnitude of the shift increases with increasing frequency.

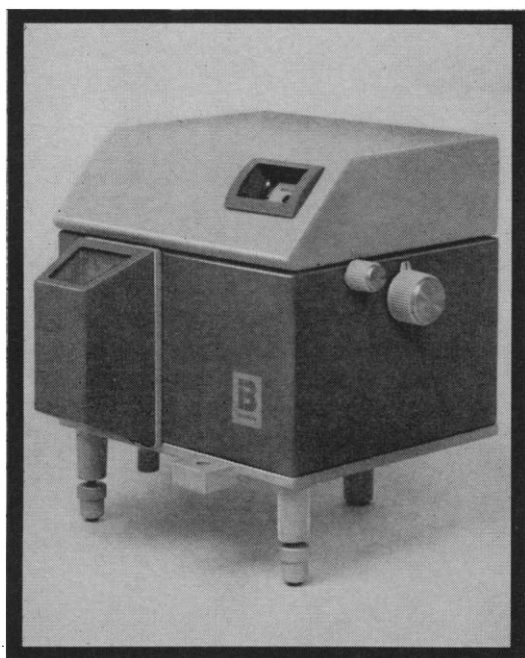


Block diagram of system for restoring helium speech to normal voice quality. Helium speech is fed to amplitude and pitch circuits. In the pitch circuits, the frequencies of the 34 lowest harmonics are determined. In the amplitude circuits, the power levels within each of 34 150-Hz intervals of the speech spectrum are determined. The amplitudes are shifted and applied to harmonics of lower frequency. In the modulators (right), these power levels control the loudness of the 34 harmonic frequencies...thus producing a pattern or envelope closely corresponding to the envelope of normal speech.



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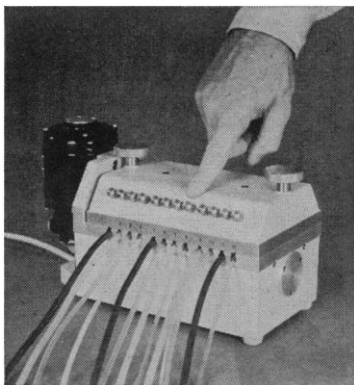
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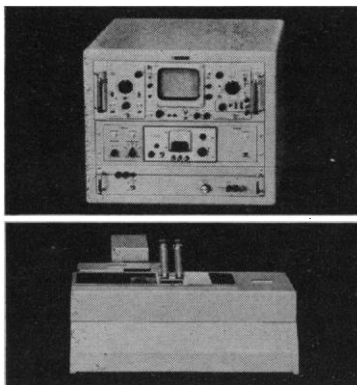
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22-24. **Conference on Frequency Generation and Control for Radio Systems**, London, England. (J. L. Regan, Inst. of Electrical Engineers, Savoy Pl., London, W.C.2)

22-25. **Institute of Electrical and Electronics Engineers**, joint technical conf., Cleveland, Ohio. (Office of Technical Activities Board, The Institute, 345 E. 47 St., New York 10017)

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22-26. **Drug Metabolism**, 2nd workshop, George Washington Univ., Washington, D.C. (Dept. of Pharmacology, School of Medicine, George Washington Univ., 1337 H St., NW, Washington, D.C. 20005)

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24-26. **Fourteenth Canadian High Polymer Forum**, Laval Univ., Quebec City. (J. F. Henderson, Research and Development Div. Polymer Corp. Ltd., Sarnia, Ont., Canada)

24-27. **Teratology Soc.**, 7th annual mtg., Estes Park, Colo. (M. D. Runner, Inst. for Developmental Biology, Univ. of Colorado, Boulder 80302)

25-26. **Drug Information Assoc.**, 3rd annual, Philadelphia, Pa. (P. de-Haen, The Association, 11 W. 42 St., New York 10036)

26-27. **Surface Physics**, 5th annual symp., Washington State Univ., Pullman. (E. E. Donaldson, Dept. of Physics, Washington State Univ., Pullman 99163)

29-1. **Special Libraries Assoc.**, New York, N.Y. (B. M. Woods, The Association, 31 E. 10 St., New York 10003)

29-2. **Congress of Canadian Engineers**, Montreal, P.Q., Canada. (Office of Technical Activities Board, Inst. of Electrical and Electronic Engineers, 345 E. 47 St., New York 10017)

31-2. **American Soc. for Quality Control**, 21st annual technical conf. and exhibit, Chicago, Ill. (R. W. Shearman, The Society, 161 W. Wisconsin Ave., Milwaukee, Wis. 53203)

31-2. **Instrument Soc. of America**, 13th natl. analysis instrumentation symp., Los Angeles, Calif. (The Society, 530 William Penn Pl., Pittsburgh, Pa. 15219)