SCIENCE 30 December 1966
Vol. 154, No. 3757

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

GRAPE GROWER

Index Issue

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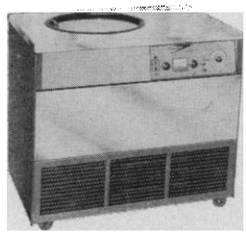

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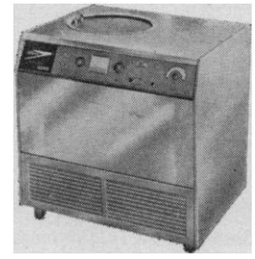

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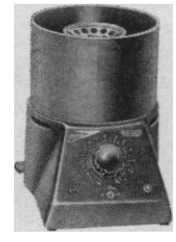

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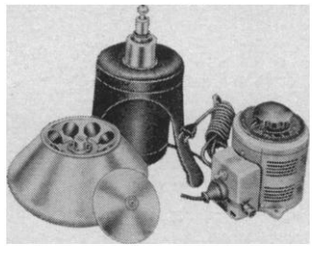

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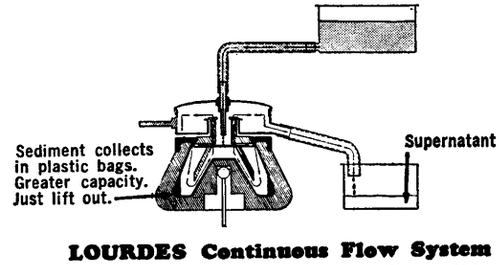

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COVER

Symbolized drawing of grape grower wearing the tools of his trade. See page 1621. [Engraving by Armessin (French), 1695; The Bettman Archive Inc., New York, New York]

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Long, useful life of an instrument depends on how up-to-date its capabilities remain as time accumulates. The entirely-new EMU-4 instrument anticipates yet-unimagined electronic innovations by including internal space and facilities to accept these ideas. These facilities are *modularized* electronics: functional grouping of the various circuits, packaged in plug-in modules. As the new ideas come to light, they'll be packaged in compatible modules. (Some 40 per cent of the module space within the instrument is reserved for future updating or expansion of the electronics.)

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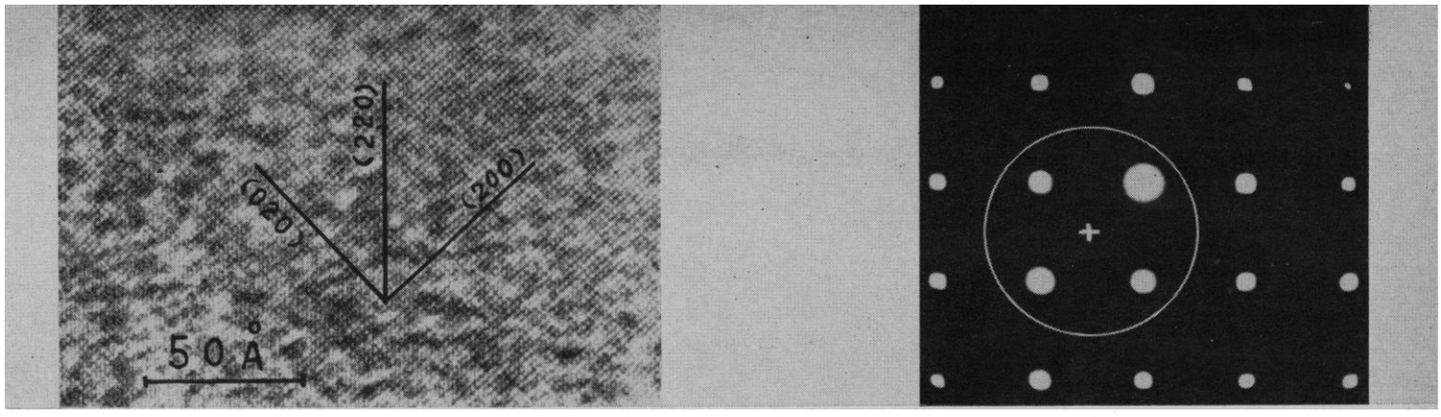

Electron micrograph and diffraction pattern taken on the HU-11C showing the crossed lattice images of the (200) planes of gold. The (020) and (200) planes = 2.04 Angstroms. The (220) plane = 1.44 Angstroms. All important factors such as contamination, stage drift, astigmatism and aberrations must be negligible to achieve this ultra-high resolution. The HU-11C was operated at an accelerating voltage of 100 KV and an electron optical magnification of 270,000 X. The illumination was tilted until the three reflections showed nearly equal intensity in the diffraction pattern; then the micrograph was taken.

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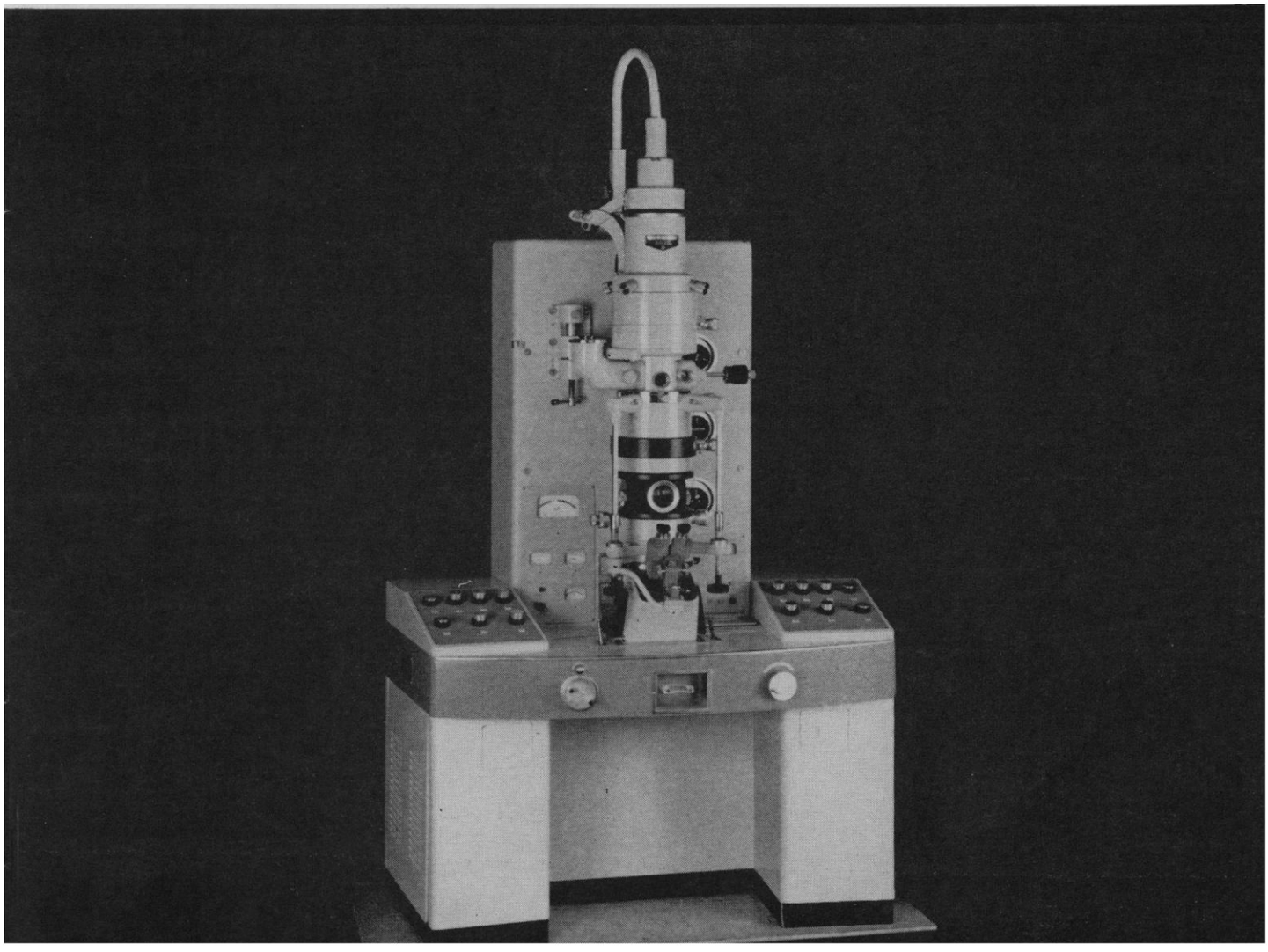

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SCIENCE

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Energy for the Future

Most of the energy needs of the United States are met by fossil fuels. In 1960, petroleum, natural gas, and related products supplied 71.8 percent of the energy consumed, while coal and lignite furnished 24.5 percent. Nuclear energy accounted for 0.1 percent.*

This pattern will change. The sudden emergence of competitive nuclear energy has been noted [see, for example, *Science* **152**, 703 (1966)]. Not so evident are trends in the availability and use of petroleum and related products. At one time the United States was a low-cost producer and exporter of petroleum. Today we are not competitive, and we import more than 20 percent of our needs, at an annual cost approaching $2 billion. Proved reserves of crude oil of 30×10^9 barrels are adequate for the next decade, and more oil will be found. However, the cost of finding oil is increasing, and the United States is no longer an attractive area for petroleum exploration. The most important petroleum discoveries are being made in the Middle East and Africa.

There is controversy over estimates of the amounts of oil likely to be found in the United States, despite the fact that 1.9 billion feet of exploratory holes have been drilled. Hubbert† has shown that present-day drilling is discovering less oil per foot of drilling than was found a generation ago. He estimates that, during the period 1930–35, each foot of hole drilled led to discovery of an average of 160 barrels of oil. He estimates that, during the period 1960–65, 39 barrels of oil were found per foot drilled. This comparison includes an estimate of the amount of oil to be added by development drilling and extensions.

Recently Robert O. Anderson, chairman of Atlantic Richfield Company, implicitly confirmed the view that prospects are not good for discovering petroleum in the United States. He warned that, by 1976, imports of petroleum could account for a third of total U.S. consumption, at a cost of $4 to $5 billion annually. This would aggravate an already serious problem in balance of payments and would place us at the mercy of Middle Eastern and other foreign suppliers.

Fortunately there are alternatives. The oil-shale deposits of the western United States could be exploited to produce more than 10^{12} barrels of oil. Hydrogenation of coal also could supply enormous quantities of liquid fuels. Government and industry have not made great efforts to develop these alternative sources. Estimated expenditures for energy research and development during 1963* for government and industry, respectively, were (in millions of dollars): coal, 11 and 11; oil and gas, 40 and 336; nuclear fission, 210 and 90.

Research and development work sponsored by the Office of Coal Research of the Department of the Interior looks promising. Notable are two developments being conducted by Consolidation Coal, now a division of Continental Oil Company. One involves solvent extraction of coal followed by hydrogenation to produce liquid fuels similar to gasoline. A second development is an improved process for synthesizing methane from lignite.

This nation has been slow to respond to a deteriorating position in petroleum exploration. There should be substantially increased effort to develop substitute supplies through research, development, and economic incentives.—PHILIP H. ABELSON

* "Energy R & D and National Progress" (Government Printing Office, Washington, D.C., 1965). † M. King Hubbert, *West Texas Geol. Soc. Pub. No. 66-53* (1966).

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and Ikeda investigated the proteins in the lens of several species representing fish, amphibians, reptiles, birds, and mammals by the techniques of immunoelectrophoresis, immunodiffusion, and a two-dimensional polyacrylamide gel electrophoresis. They found that the crystallins are specific for the lens. Alpha, beta, and gamma crystallins are present in fish, amphibians, and mammals while alpha, beta and delta crystallins are characteristic of reptile and bird lenses. The most complex of these are the beta crystallins which, in the chick, comprise eight or nine proteins of similar size and antigenic properties but with different electrophoretic mobilities.

Alexander Kenny and G. Noel Currie (West Virginia University) reported on calcium and phosphorous metabolism in the rat lens. It had previously been established that calcium concentration increases in lenses with either spontaneously occurring or experimentally produced cataracts. This shift in calcium is counterbalanced by a drop in phosphorous, and is accompanied by a decrease in dry weight and an increase in water content in the lens. Earlier workers had suggested that the parathyroid glands were involved in the regulation of lens calcium in the dog, chronic thyroparathyroidectomy resulting in an increase in lens calcium. Kenny and Currie failed to confirm this finding in the rat. However, they were able to show that a chronic respiratory infection in rats caused fluctuations in the normal levels of calcium and phosphorous in the lens. When rats were treated with a long-acting penicillin preparation, it was possible to stabilize the levels of these elements in the lens at normal values. Under these conditions, neither parathyroidectomy nor thyroparathyroidectomy resulted in any change in calcium or phosphorous levels in the lens.

Edward Cotlier and Jean Fox (Washington University) described the isolation of rubella virus from the lens of human congenital rubella syndromes. Congenital cataracts were among the many anomalies noted in infants born to mothers who had been infected with rubella virus during the first trimester of pregnancy. Tissue culture and Echo-11 interference techniques were used to demonstrate that the rubella virus was recoverable from the lens and aqueous humor of children as old as 9 to 10 months of age. From the times at which the mothers of affected children were known to have contracted the virus, it is possible to conclude that the virus particle must have traversed the lens capsule in order to infect the lens. Experimental infection of pregnant rats and hamsters with human rubella virus resulted in a wide range of congenital anomalies, including cataracts, among the offspring.

One of the most important considerations in the analysis of the cell population dynamics of the vertebrate lens is the factor, or complex of factors, which controls mitotic activity in the epithelium of this structure. Two of the papers in the last session of the conference directed attention to this aspect of lens development. Nancy Rafferty (Johns Hopkins University) reported on injury-associated changes in the epithelium of the frog lens. This investigator confirmed her earlier findings that injury to the epithelium results in a marked increase in its proliferative rate. Studies of cell density were coupled with autoradiography of three regions at different distances from the center of the epithelium. By studying changes in these three regions as a function of time following injury to the center of the lens epithelium, it was possible to show that injury to the epithelium shortens the G_2 from 6 hours to 2½ or 3 hours. DNA synthesis and the ensuing cell divisions begin in the cells of the proliferative zone near the equator following injury to the center of the epithelium. DNA synthetic activity and mitosis sweep centrally toward the wound as time elapses. This observation indicates either that the stimulated cells of the proliferative zone actually migrate toward the wound as they continue to proliferate, or else that the injury stimulus proceeds from the proliferative zone toward the wound, stimulating new cells along the way to divide.

Clifford Harding, W. L. Wilson, and Jean Wilson (Oakland University) also considered the control of mitosis in the lens epithelium. They have demonstrated a large and rapid increase in mitotic activity in explanted lenses of the rabbit which are exposed to serum. This increase in mitotic activity is preceded by a latent period. Dialysis of the serum yielded two fractions, neither of which was capable of stimulating mitotic activity in the epithelium of the rabbit lens. Recombining these

fractions reconstituted the mitogenic activity of the serum.

The last item in the conference was in marked contrast to the preceding biochemical discussions. This was a demonstration by T. W. Williams (West Virginia University) of stereophotomicrographs of the major structures of the primate eye and its adnexa. Many of these were of specially injected preparations which showed the major vessels of the eye. Others demonstrated the iris, the ciliary body, and the relations of the fibers of the ciliary zonule to ciliary body and lens.

The several themes represented by the different papers presented in this conference are examples of the diverse approaches used in the study of the developing vertebrate lens. It is an indication of the speed with which this field is moving that, even after the passage of only 2 years between the first and the second conference, very little in the second conference was a repetition of anything presented in the first. This conference was supported by grant (No. GB-4845) from the National Science Foundation. The participants would like to acknowledge this support with thanks.

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Forthcoming Events

January

20–21. **Blood**, 15th symp., Wayne State Univ., Detroit, Mich. (W. H. Seegers, Dept. of Physiology, Wayne State Univ. School of Medicine, Detroit 48207)

20–2. International College of **Surgeons**, 3rd Caribbean surgical congr. and cruise. (S. E. Henwood, 1516 Lake Shore Dr., Chicago, Ill. 60610)

22–3. **Electron Microscopy**, workshop, Northeastern Univ., Boston, Mass. (M. D. Maser, Millard Fillmore Hospital, 3 Gates Circle, Buffalo, N.Y. 14209)

23–24. **Avionics**, symp., Montreal, Canada. (Secretary, Canadian Aeronautics and Space Inst., 77 Metcalfe St., Ottawa, Ont.)

23–24. **Coupled Reactor Kinetics**, natl. mtg., Texas A&M Univ., College Station. (C. G. Chezem, Dept. of Nuclear Engineering, Texas A&M Univ., College Station 77843)

23–25. **Aerospace Science**, 5th mtg., American Inst. of Aeronautics and Astronautics, New York, N.Y. (Manager of Public Information, AIAA, 1290 Sixth Ave., New York 10019)

23–25. Society of **Thoracic Surgeons**, mtg., Kansas City, Mo. (F. X. Byron, The Society, City of Hope Medical Center, 1500 E. Duarte Rd., Duarte, Calif. 91010)

23–27. **Relativistic Astrophysics**, symp., New York, N.Y. (A. G. W. Cameron, Belfer Graduate School of Science, Yeshiva Univ., New York 10033)

24–27. **Comparative Pharmacology**, intern. symp., Natl. Inst. of Health, Bethesda, Md. (G. J. Cosmides, Room 5B29, Bldg. 31, NIH, Bethesda 20014)

25–27. American **Crystallographic** Assoc., mtg., Georgia Inst. of Technology, Atlanta. (W. L. Kehl, Gulf Research and Development Co., P.O. Drawer 2038, Pittsburgh, Pa. 15230)

25–27. American **Mathematical** Soc., 73rd annual mtg., Houston, Tex. (The Society, P.O. Box 6248, Providence, R.I.)

25–28. American **Group Psychotherapy** Assoc., New York, N.Y. (Mrs. M. Schiff, 1790 Broadway, New York 10019)

26–28. **Mathematical** Assoc. of America, 50th annual mtg., Houston, Tex. (H. L. Alder, Univ. of California, Davis)

28–30. **Radiology**, southern conf., Point Clear, Ala. (M. Eskridge, P.O. Box 4097, Mobile, Ala.)

28–1. American Acad. of **Allergy**, Phoenix, Ariz. (J. O. Kelley, 756 North Milwaukee St., Milwaukee, Wis. 53202)

29. **Mössbauer Effect Methodology**, 3rd annual symp., New York, N.Y. (P. A. McNulty, New England Nuclear Corp., 575 Albany St., Boston, Mass. 02118)

29–3. **Power**, mtg., Power Group, Inst. of Electrical and Electronics Engineers, New York, N.Y. (E. C. Day, IEEE, 345 E. 47 St., New York 10017)

30. American Soc. of **Heating, Refrigerating, and Air Conditioning Engineers**, semi-annual mtg., Detroit, Mich. (Miss J. I. Szabo, 345 E. 47 St., New York 10017)

30–1. **Personnel Radiation Dosimetry**, symp., Chicago, Ill. (J. H. Pingel, Argonne Natl. Laboratory, Bldg. 301, 9700 S. Cass Ave., Argonne, Ill. 60439)

30–2. American **Physical** Soc., annual mtg., New York, N.Y. (The Society, Executive Secretary, Columbia Univ., New York 10027)

30–2. American Assoc. of **Physics Teachers**, New York, N.Y. (A. B. Arons, Physics Dept., Amherst College, Amherst, Mass.)

30–3. **Zodiacal Light and the Interplanetary Medium**, intern. symp., Honolulu, Hawaii. (F. E. Roach, Aeronomy Lab., Inst. for Telecommunication Sciences and Aeronomy, Environmental Science Services Administration, Boulder, Colo. 80302)

31–2. Ciba Foundation symp. on **Cell Differentiation**, London, England. (Ciba, 41 Portland Pl., London W.1)

31–3. **Reinforced Plastics**, 22nd conf., Soc. of the Plastics Industry, Washington, D.C. (The Society, 250 Park Ave., New York 10017)

31–4. American College of **Radiology**, mtg., Los Angeles, Calif. (American College of Radiology, 20 N. Wacker Dr., Chicago, Ill.)