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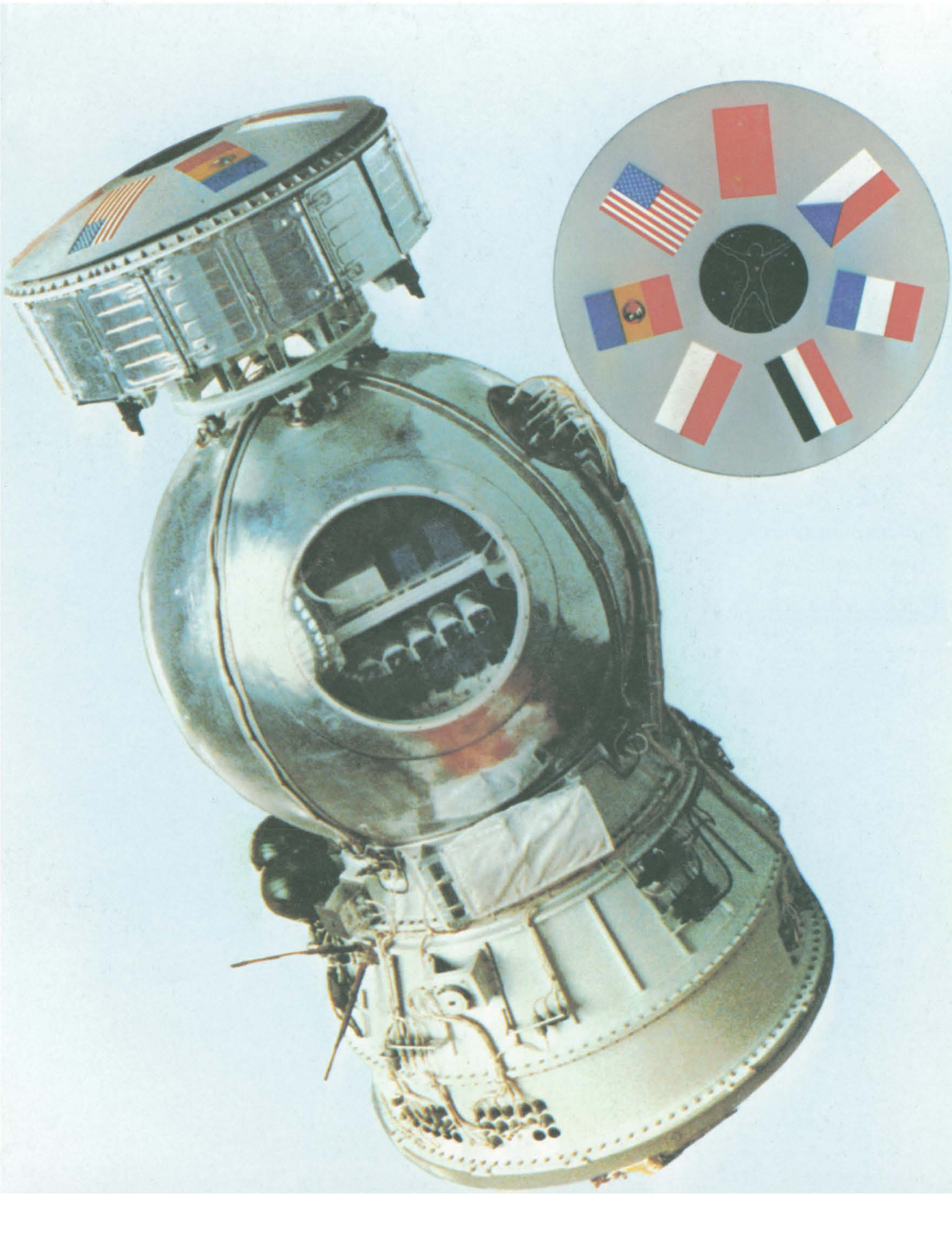

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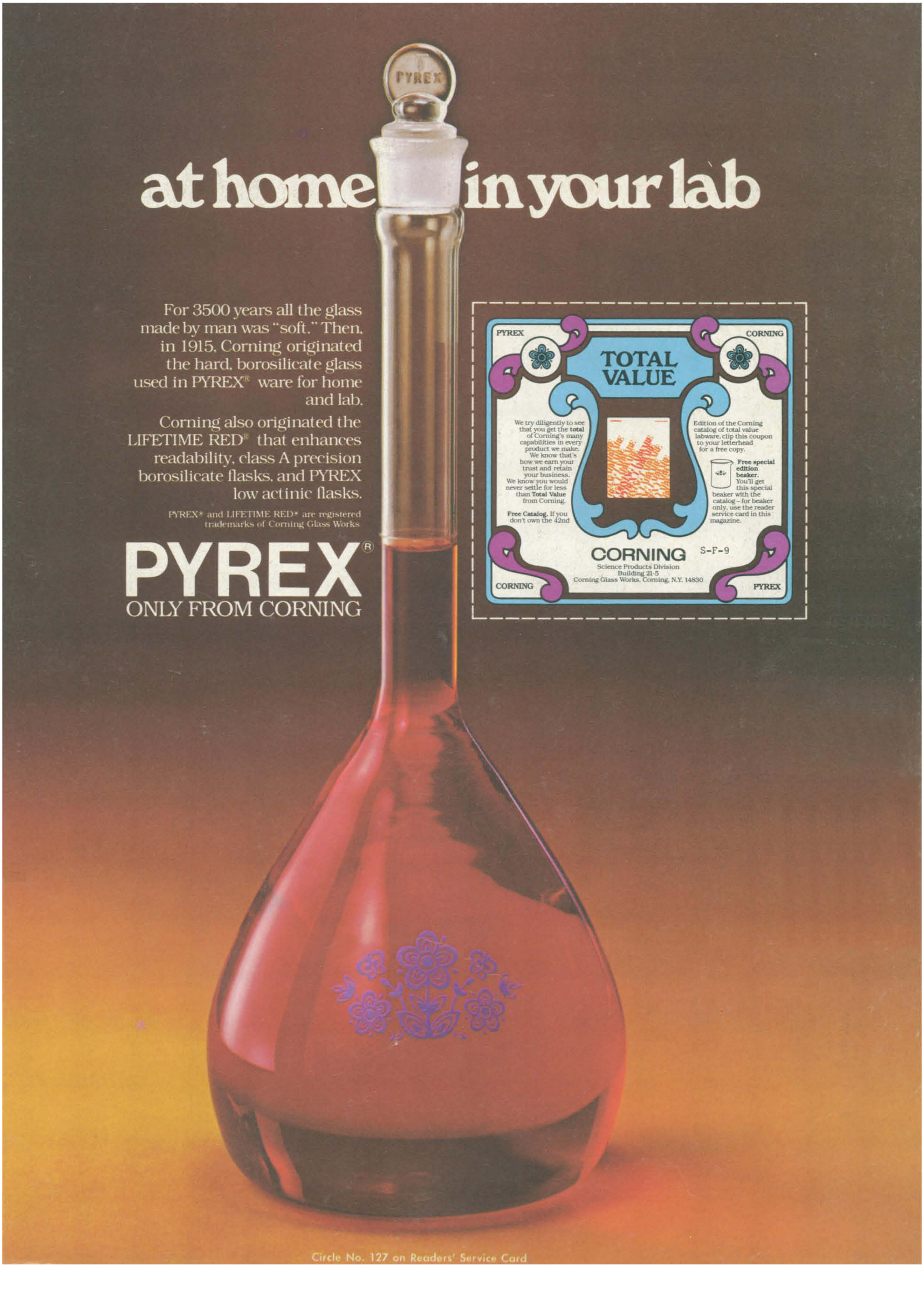

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SCIENCE

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COVER

Soviet spacecraft Cosmos 782, a sphere 8 feet in diameter with service and battery modules attached, was launched 25 November 1975 and was the first Soviet spacecraft to contain U.S. experiments. Flags of the seven countries which participated in this mission (United States, U.S.S.R., Czechoslovakia, France, Hungary, Poland, and Rumania) are displayed on top of the spacecraft. The main objective of the mission was to determine effects of space flight on a variety of animals, plants, and insects. See page 1138. [R. Mah, Soviet Space Museum]

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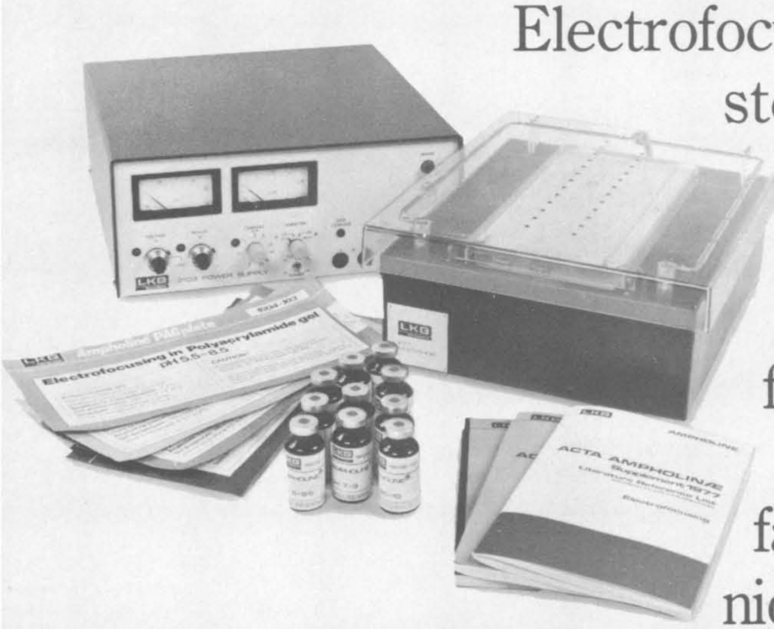

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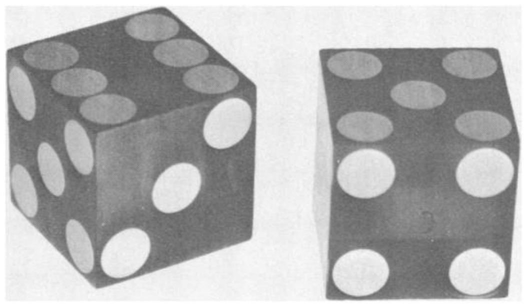

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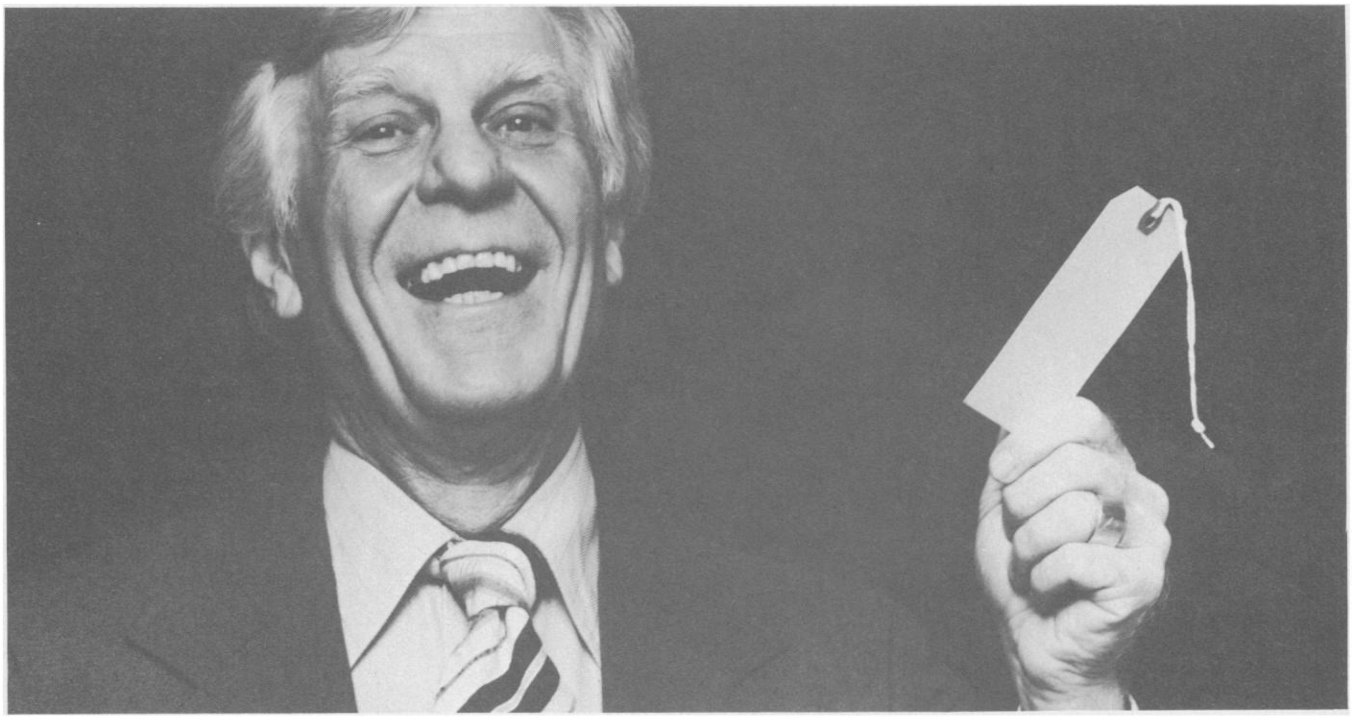

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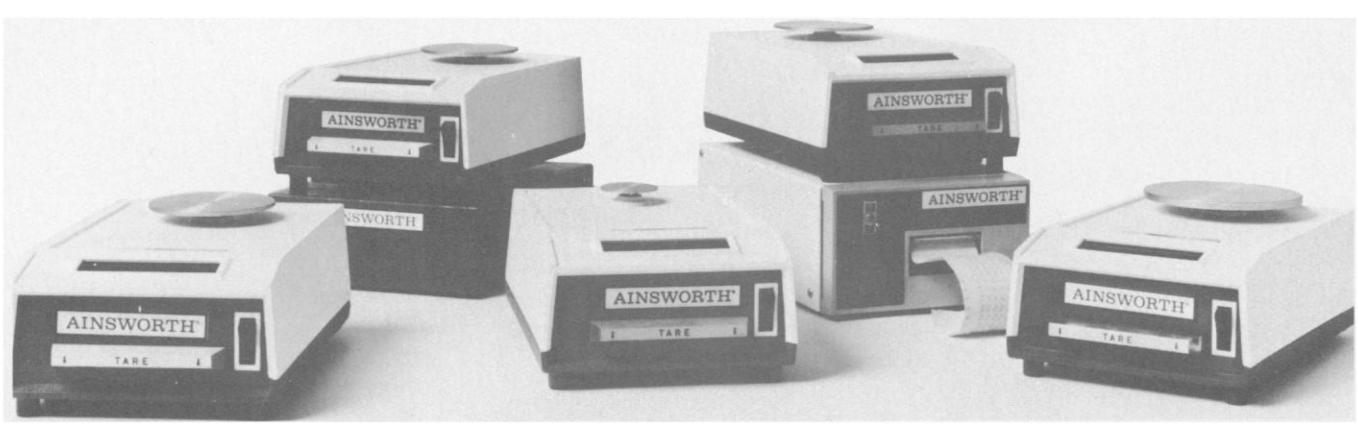
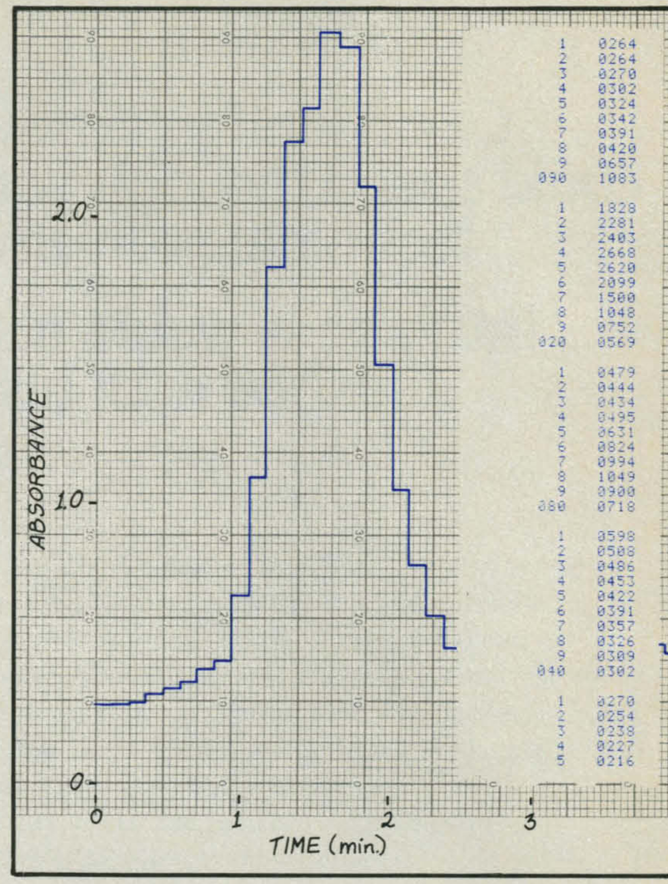


The recording shows the absorbance of fractions collected by molecular gel filtration from a separation of high and low molecular weight proteins. These were collected in a cold room and read at 280nm. The tape lists the absorbance value of every fraction and identifies each sample by its position on the transport.



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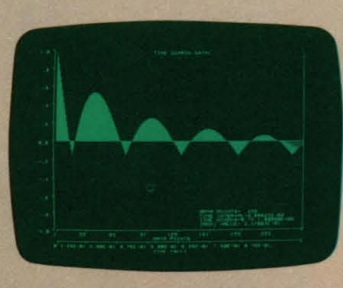
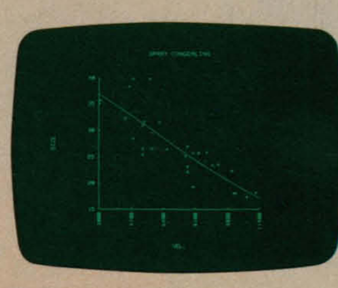
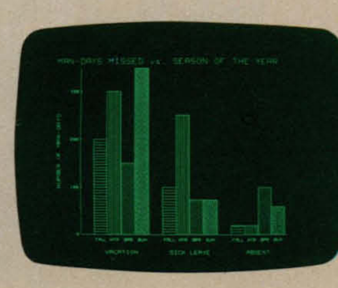


Waveform Analysis



Regression Analysis



Bar Chart

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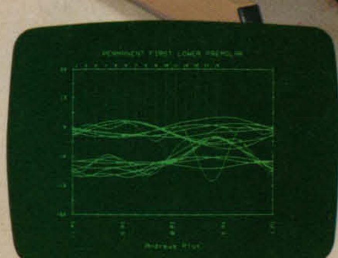
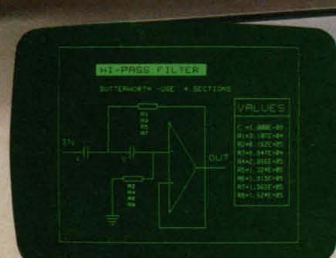
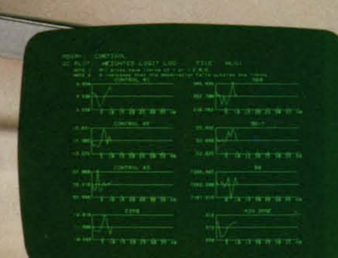


Andrews Plot



Active Filter Design



RIA QC Plot

The Second Translation Kit

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It will make your life easier and your results more reproducible

New England Nuclear offers the first reticulocyte lysate kit for use in studying protein synthesis. Not only does it save all of the trouble of preparing your own cell extract, it gives you a system free from endogenous mRNA, high in protein synthesis activity, with an optimized high-activity tracer and quality control that includes testing every lot of Methionine, L-[35S] using the kit.

The rabbit reticulocyte lysate system is reported to contain all factors required for translation of any eukaryotic mRNA.[1] But its use assumes the availability of suitable animals, preparation of the lysate extract, and inactivation of endogenous mRNA. And the meticulous tailoring of the salts, energizer, and amino acid mix. In short, it's a nuisance.

With our exclusive kit you bypass all that and concentrate on the study of protein synthesis. The kit contains:

A rabbit reticulocyte lysate—Treated with nuclease to inactivate endogenous mRNA, and tested to guarantee high protein synthesis activity.

The finest tracer available—NEG-009T, NEN's translation grade [35S]-Methionine, >500Ci/mmol, tested for incorporation into protein in cell-free translation systems. Each lot is optimized for compatibility with this system.

Translation cocktail—All the necessary components for proper translation conditions. 19 amino acids (excepting methionine) plus buffer, reducing agent, and energizer.

Control mRNA—Purified exogenous mRNA (adenovirus-infected HeLa cell mRNA) to check the biological activity of the system.

Salts and sterile deionized water—Selected and prepared to minimize potential ionic or enzymatic inhibition of the system.

And you can get rid of all those rabbits

The protocol is straightforward, and it includes suggested final assay procedures. So that's our message. Now add yours.

Call us toll free for details.

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First, Methionine...

Our first translation kit saved you the difficulty of preparing your own lysate for cell-free translation studies, gave you a system free of endogenous mRNA and high in protein synthesis activity, and assured you of components tested for compatibility and reproducible results. All told, it was an excellent excuse to stop cultivating rabbits.

Our second kit does all of the above, too. But, instead of Methionine, L-[^{35}S], the tracer is Leucine, L-[3,4,5-^{3}H]—specially optimized for use with this system. Here's what our Leucine Translation Kit contains:

Rabbit reticulocyte lysate Treated with micrococcal nuclease to inactivate endogenous mRNA and tested to guarantee high protein synthesis activity.

High activity ^{3}H tracer NET-460T, Leucine, L-[3,4,5-^{3}H], >110Ci/mmol. Special lots are prepared and tested for incorporation into protein using this cell-free translation system.

Translation cocktail All the necessary components for proper translation conditions, including buffer, biogenic polyamine, and energizer.

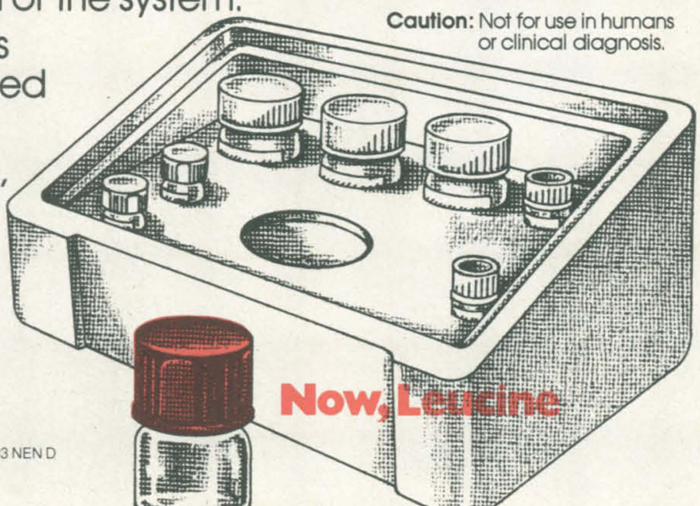
Control mRNA Purified mRNA to check the biological activity of the system.

Salts and sterile deionized water Selected and prepared to minimize potential ionic or enzymatic inhibition of the system.

Caution: Not for use in humans or clinical diagnosis.

Instructions for use The protocol is straightforward and includes suggested assay procedures.

So now there are two, and only two, translation kits. Call us toll-free for details on either or both.



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creased dependence on imported uranium and capital. It is thus all the more irrational to suggest that, without nuclear power, nations must war over oil.

As several thousand pages of critiques and responses on the soft-energy-path thesis show (*13, 19*), this is not the first time someone has decried "soft numbers" before verifying references. May I renew my earlier plea (Letters, 24 June 1977, p. 1384) that analysts get on with substantive refinement, extension, and application of soft-path concepts?

AMORY B. LOVINS
Energy and Resources Program, University of California, Berkeley 94720

References and Notes

1. A. B. Lovins, *Soft Energy Paths: Toward a Durable Peace* (Friends of the Earth and Ballinger, Cambridge, Mass., 1977), especially chaps. 3, 6, and 8.
2. ——, "Re-examining the nature of the ECE energy problem" [ECE(XXXIII)/2/I.G., U.N. Economic Commission for Europe, Geneva, 1978]; "Soft Energy Technologies," *Annu. Rev. Energy* 3, 477 (1978).
3. M. Carasso *et al.*, *The Energy Supply Planning Model* (Report to the National Science Foundation, Bechtel Corp., San Francisco, 1975), two volumes, acquisition Nos. PB-245 382 and PB-245 383 available from the National Technical Information Service, Springfield, Va.; facility data sheets and updates from M. Carasso and J. M. Gallagher, personal communications, 1976.
4. D. Sternlight (Chief Economist, Atlantic Richfield Corp., Los Angeles), personal communication (1978) of a detailed Arco estimate that the total present-valued investment (exploration, field cost, pipeline, Valdez terminal, and new tankers delivering to existing West Coast terminals), including interest, is about $17,500/bpd (1978 dollars) for the Sadlerochit field (lifetime ~30 years). I have deflated this estimate at 7 percent per year to 1976 dollars and added $4621/bpd for storage, refining, and distribution, all treated as marginal costs [Bechtel data (*1, 3*) converted to 1976 dollars with the Marshall and Stevens index (*6*)].
5. For illustration, if 30 percent of system investment were at the wellhead and 70 percent downstream, with respective lifetimes of 13 and 30 years, the present value of the stream of original plus replacement investments over 40 years, at a 5 percent per year real discount rate, would be only 30 percent above the total investment if all lifetimes were 40 years.
6. For a 1.1-GWe PWR, $585 per net installed kWe (1974 dollars) is converted to $929/kWe (1976 dollars) using the 1.26 per year index from a 35-plant multiple regression ($r^2 = 0.71$) by I. C. Bupp and R. Treitel, "The economics of nuclear power: De omnibus dubitandum" (Harvard Business School, Cambridge, Mass., 1976). For T & D—respectively $69 and $420 (1974 dollars) per net kWe of installed marginal generating capacity, taking into account supply diversity—the conversion to 1976 dollars is made with the 1.25 Marshall and Stevens Equipment Cost Index.
7. This is highly conservative. For example, a regression ($r^2 = 0.76$) on the 39 U.S. light water reactors (LWR's) completed through May 1977 reveals that, with each successive year of construction permit issuance (1967–1971), controlling for all other significant variables, real plant cost rose $141/kWe. If this kept up, a 1.1-GWe PWR ordered in 1976 (25th unit built by the architect-engineer, outside the northeast region, with a cooling tower) would cost ~$1474/kWe. Both these figures have been converted to 1976 construction dollars with the Handy-Whitman steam-plant construction cost deflator, and would be higher if they were in 1976 GNP dollars [W. E. Mooz, "Cost analysis of light water reactor power plants" (Report R-2304-DOE, Rand Corp., Santa Monica, Calif., 1978].
8. The assumed LWR cost is also probably too low. For example, the California Energy Commission's draft report to the state legislature on Assembly Bill 1852 [R. Knecht *et al.*, *Comparative Generation Costs* (California Energy Commission, January 1978), appendix 19] estimates $1027/kWe for the Sundesert plant, ordered in January 1976 (neglecting dedicated transmission and deflating to 1976 dollars at 6.5 percent per year). The August 1978 final draft (in press) estimates $1185/kWe.
9. The empirical average for all U.S. LWR's through 1977 was 60 percent (58 percent if weighted by unit size), 53 percent for units over 0.8 GWe. Exhaustive regressions on the entire U.S. data base lead to a predicted average, levelized over the first 10 years of operation of a new 1.1-GWe PWR, of 60 percent, taking account of a new vintage correlation that emerged during 1977 (55 percent without it). See C. Komanoff, *Nuclear Plant Performance Update 2* (Komanoff Energy Associates, New York, 1978). Komanoff and V. Taylor have also prepared an improved analysis of the Mooz data (*7*).
10. Also assumed are Bechtel's (*3*) $61/kWe for marginal fuel-cycle facilities—probably ~ 3 to 5 times too low—updated to 1976 dollars and ordering with the Marshall and Stevens index (*6*), and $100/kWe, calculated (*1*) in 1976 dollars, for the initial core.
11. Bechtel (*3*) assumes 16.4 percent at the margin.
12. The omitted terms are: real escalation after 1976 ordering; marginal investment in reserve margin, land, future services such as waste management and decommissioning, and past or present services such as federal R & D, regulation, and security services; and the ~ 6½ to 8 percent of electric output currently needed to run the fuel cycle. Terms omitted from both the $3495/kWe and the ~$5000/kWe totals include costs of end-use devices, externalities, dynamic net-energy considerations, and any "miscellaneous" items.
13. U.S. House of Representatives, Committee on Government Operations, Subcommittee on Environment, Energy and Natural Resources, *Nuclear Power Costs* (Government Printing Office, Washington, D.C., 1978), part 2, pp. 1103–1115.
14. For example, if one uses Bechtel data (*3*), a 0.8-GWe coal-electric system with a scrubber but no fuel cycle would cost $2200/kWe delivered (1976 dollars) at 0.62 capacity factor (*1, 9*). If James's oil-fired plant cost the same, an oil-system cost of $30,000/bpd (capital charge at 0.12 per year = $9.9/b, too much to clear the market), divided by 0.46 First Law plant efficiency, would imply a system cost of $3172/kWe—generously assigning the whole oil-system cost to the residual rather than the light fractions (*15*).
15. J. Harding, in (*13*), part 2, pp. 1778–1802. The rationale for considering such a combined-cycle plant at the margin is that California is to have an embarrassing glut of residual oil from refining Alaskan crude oil extracted for its light fractions. Saving residual oil (nearly all of the 15 percent of California oil now burned in power stations) would probably not save crude oil; the residual oil is a by-product, not a motive. California is also considering gasifying residual oil.
16. The ratio of present electricity supply to electricity-specific needs approaches 2 in the United States today, and may exceed 3 after long-run end-use efficiency improvements.
17. J. Carter, remarks to Opening Conference, International Nuclear Fuel Cycle Evaluation, Washington, D.C., 19 October 1977.
18. V. Taylor (Pan Heuristics, Los Angeles), personal communication, May 1978. The proportional import reduction would be greatest in the United States, not in Europe or Japan.
19. U.S. Senate, Select Committee on Small Business and Committee on Interior and Insular Affairs, *Alternative Long-Range Energy Strategies* (Government Printing Office, Washington, D.C., 1977), two volumes [this contains all published critiques and responses except the exchange with Forbes in (*13*)].

Light on the Shroud?

Sindonologists may find the following paragraphs (*1*) of interest.

To make a reinforced plastic that will last for thousands of years, soak a strip of linen in oil of lavender that contains Syrian asphalt and let the fabric dry in the sun. Light will cause chemical bonds to form between adjacent molecules of the tar, converting the sticky

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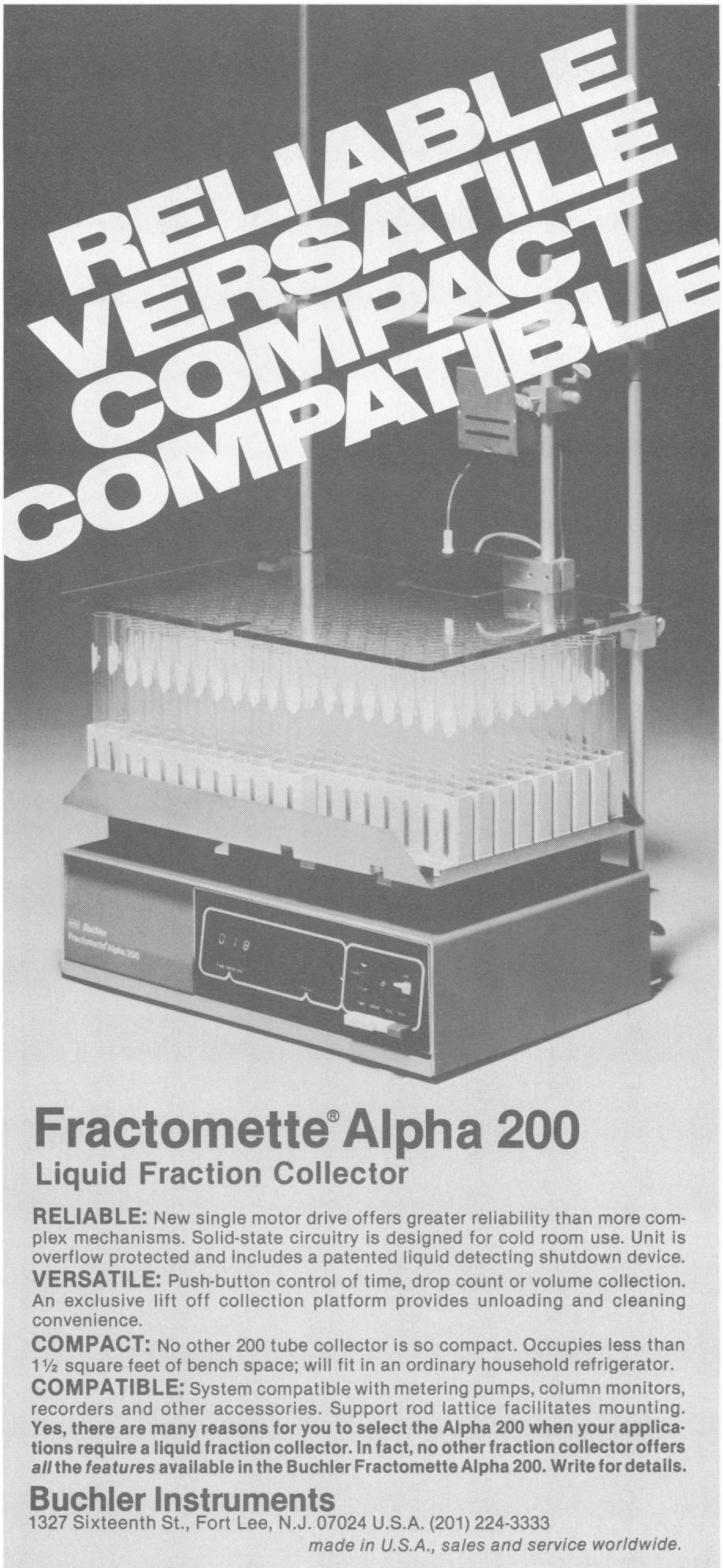

mass into a durable solid. The reaction would be regarded by organic chemists as an example of photocrosslinking, but to the artisans of ancient Egypt it was merely a way to make good mummy wrappings. Syrian asphalt, which is also known as bitumen of Judea, is a naturally occurring mineral tar of high molecular weight that, according to the Bible, was used for caulking both Noah's ark and the rush basket of the infant Moses.

Other experiments can be made with the material. For example, in 1824 Joseph Nicéphore Niepce, a French physicist and amateur Egyptologist, coated a glass plate with the same mixture of oil and tar and exposed it to a brightly lighted scene with a camera obscura that he constructed according to the design of Leonardo da Vinci. When Niepce subsequently washed the plate with oil of lavender, the unexposed tar dissolved but the light-struck portions, which were photocrosslinked, adhered to the glass, forming an image of the scene. The plastic film served as a lithographic surface for greasy links, thus yielding the first permanent photograph.

Such an image is three-dimensional, with a thickness proportional to the intensity and duration of the incident light; it may appear as either a photographic positive or negative depending upon the lighting and the nature of the surface material.

ROBERT A. GORKIN
Department of Pharmacology, Mayo Foundation, Rochester, Minnesota 55901

References and Notes

1. C. L. Strong, *Sci. Am.* **221**, 128 (December 1969).

Solar Energy: Ignored Predictions

In News and Comment coverage of the recent Council on Environmental Quality report, which projected that an accelerated development of solar energy technologies could result in their contributing 20 to 30 quadrillion Btu's per year by the year 2000 (12 May, p. 627), it is stated that "No federal agency has ever previously held out even the possibility of so rapid a growth of solar energy. . . ."

As a matter of fact, 4 years ago, the extensively documented but largely ignored Project Independence Task Force on Solar Energy suggested that accelerated solar technology implementation would yield almost exactly this amount of energy by the year 2000 (*1*).

BRUCE L. WELCH
Welch Associates, One Investment Place, Baltimore, Maryland 21204

References and Notes

1. Federal Energy Administration, *Project Independence Blueprint, Final Task Force Report: Solar Energy* (Government Printing Office, Washington, D.C., 1974).

The Need for Materials

Philip H. Abelson, in his 7 July editorial "Domestic exploration for materials" (p. 7), begins with the sentence "A civilization with a high standard of living is dependent on adequate supplies of many kinds of materials." He ends with "[This country] must begin to develop a more vigorous materials policy." The entire editorial reads as if it were written by the American Mining Congress, and its assumptions and proposals only perpetuate the kind of thinking that has led to our current difficulties.

The major fallacy in Abelson's argument is the assumption that a high standard of living is closely linked to the production of virgin raw materials. This is indeed true in a once-through, throwaway economy where materials are dug from the earth, fabricated, used briefly, and then dumped in landfills. It has often been pointed out that recycling could reduce the demand for virgin materials were it not for subsidies that favor primary extraction, such as discriminatory freight rates, depletion allowances, and the free use of public lands. Abelson's proposals would further favor primary extraction by providing public funds for research and exploration, thus hastening the exhaustion of our remaining nonrenewable resources.

What is really needed is a national materials management policy that would minimize the use of virgin materials. Such a policy would reduce the present inflationary pressure caused by reliance on ever lower grades of ore with their ever higher materials production costs. Elimination of subsidies for primary extraction would be only a first step. Creation of subsidies favoring recycling would be the next logical step. These measures, however, can lead to only limited materials savings because low-quality alloys tend to result from the agglomeration which occurs in present-day recycling.

In the longer term, policies are needed that will specifically encourage the design of products that are durable and can be easily repaired and recycled. These goals pose unusual scientific and engineering challenges that individual companies may find little economic incentive to meet. If public funds are to be used to solve our resource problems, this is where such monies would best be spent for the benefit of the general public.

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SCIENCE

Engineering Technology: New International Role

In three decades of assistance to education in less developed countries (LDC's), the United States has exported with varying effectiveness models of science-based engineering curricula. These efforts have created a few national centers of excellence in advanced engineering education, which are oriented by and large to solving the problems of the modern industrial sector and are sustained by disproportionately large investments by national ministries of education. The "scientist engineers" produced by these elite centers migrate to and perform well in overseas universities, but only a small percentage of them return home. At the other extreme of the technical manpower spectrum, many LDC's have an improved local capacity for training skilled and semiskilled workers for industrial employment. International development banks, foundations, and bilateral programs of the Agency for International Development have contributed to these efforts.

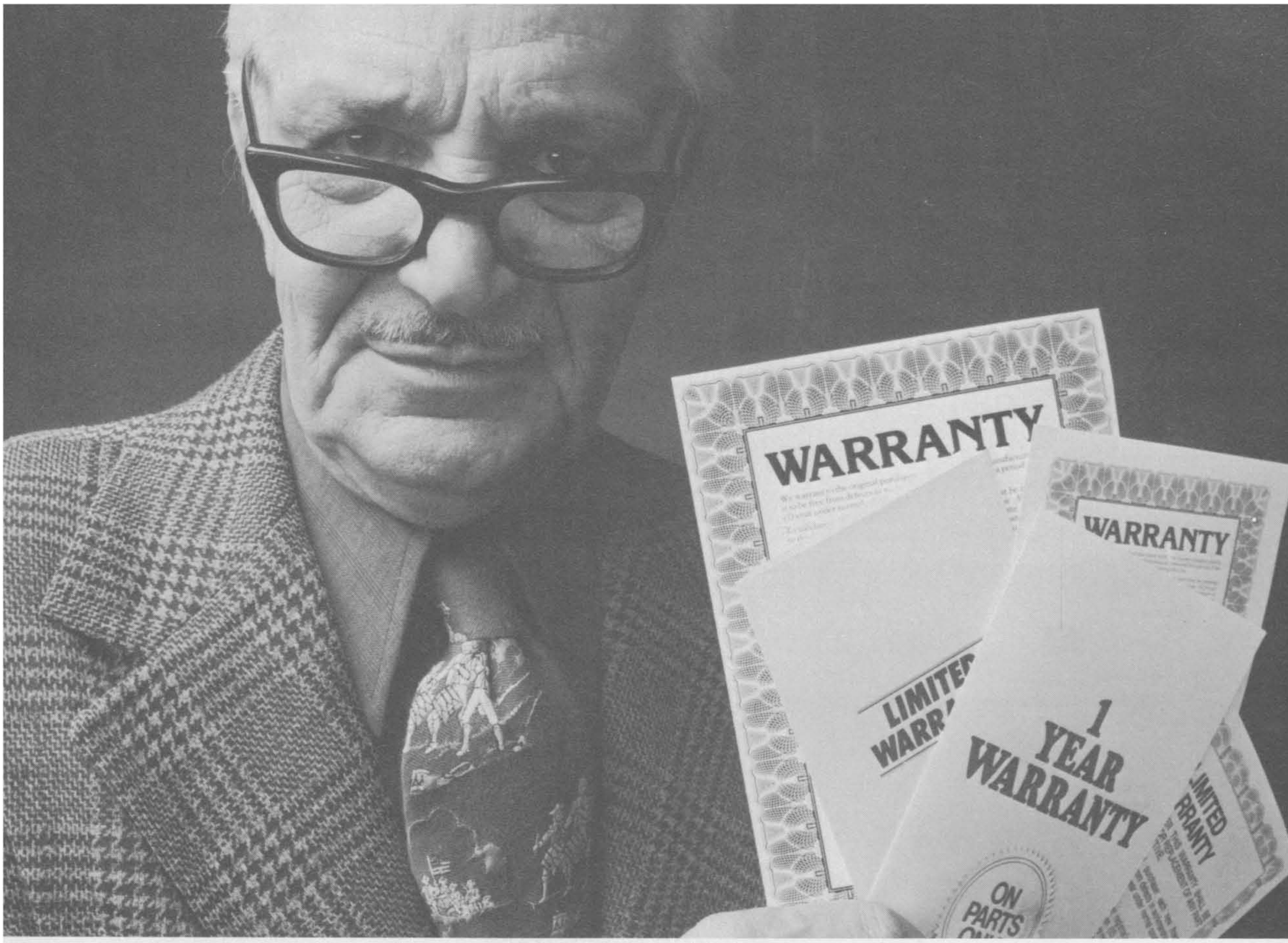
Much greater national efforts are still needed to improve the training of skilled workers for agriculture and industry in the LDC's. Manpower studies in the LDC's repeatedly point to the relative abundance—in fact, oversupply—of engineers and to the shortage of middle-level engineering and industrial technicians. They also show a pattern of distribution of these high-level human resources that is detrimental to regional and especially rural development. Urgently needed are middle-level engineering and industrial technicians who are able to implement and manage the more sophisticated technological systems now entering or being developed by countries that are rapidly becoming industrialized.

During the same 30-year period, profound changes have taken place in technological education in the developed countries, especially the United States. The technician was rediscovered in the United States in the late 1940's. Since then, programs for the training of engineering and industrial technicians with different levels of skills and knowledge have been developed in various institutional and organizational settings. When properly paired to the needs of LDC's in different stages of development, they will be able to respond to these needs. Their distinguishing characteristic is the emphasis placed on technical problem-solving and hands-on experience with the tools of modern industry.

More than 700 U.S. institutions are engaged in these programs. The outstanding ones are the 89 2-year technical colleges, accredited by the Engineers' Council for Professional Development, which offer associate degrees in engineering technology and industrial technology. Also accredited are another 30 colleges offering associate and bachelor's degrees and 35 colleges offering only a bachelor of science in technology.

Other institutions include community and junior colleges, technical institutes, and some universities and secondary-level schools offering post-secondary advanced technical programs. Until now, colleges and institutes of engineering technology have been used only sporadically in U.S. bilateral assistance activities. These institutions, especially those with experience in international work, are now considering how to pool their resources. They have the capacity and maturity to speak to LDC's that are demanding the sharing of technological resources. Such requests and demands are likely to come up at the 1979 U.N. Conference on Science and Technology for Development in Vienna.

It is essential that international policy-makers bring these resources to the attention of LDC's. High priority should be given to their development under new organizational initiatives supported by the proposed U.S. Foundation for International Technological Cooperation. This opportunity to match these appropriate resources with evident needs should not be missed. —LAWRENCE L. BARRELL, *President, Hartford State Technical College, Hartford, Connecticut 06106,* and K. NAGARAJA RAO, *Senior Research Associate, Center for Policy Alternatives, Massachusetts Institute of Technology, Cambridge 02139*



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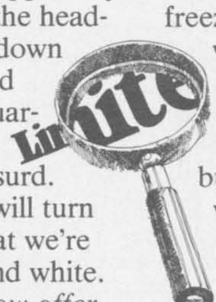

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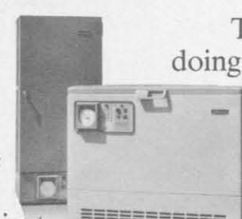

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The OWA series of gas chromatograph–mass spectrometers performs analysis of water for organic pollutants in monitoring compliance with the Clean Water Act and in other laboratory applications. Microprocessor control and programmed parameters are two of the system's advantages. These instruments exceed the present requirements for specificity, sensitivity, and reproducibility and, additionally, they present the data in a format compatible with EPA standards for reporting. Finnigan Instruments. Circle 681.

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Anaerobic Chamber

Model XPL 855-AC is constructed of acrylic sheet to eliminate leakage of oxygen into the chamber through its walls. The chamber is a benchtop model that may be transported within the laboratory. Features include transfer chamber, canisters for indication of moisture and the primary desiccant, catalyst chamber for palladium pellets, quick-disconnect shutoff valves, and an interchangeable pump system. Plas-Labs. Circle 685.

Cabinets for Analysis of Fluorescence

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Microscope Camera Attachment

System MC 63 is for photomicrography with 35-milliliter cameras, 4 by 5 plates, or Polaroid apparatus. Corrected eyepieces in the phototube increase the field of view and maintain the quality of the photographed image from edge to edge. The cameras are focused for visual observation. Thus, the operator may see the object while it is photographed. The shutter is free of vibration for exposures from 1/6 second to 30 minutes. Carl Zeiss. Circle 687.

Literature

Balances describes devices for laboratory weighing equipment for loads from 1 milligram to 100 grams and from 100 grams to 1200 kilograms. August Sauter of America. Circle 688.

Teflon Lab Ware lists a complete line of equipment for the laboratory and classroom. Berghof/America. Circle 691.

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BOOKS RECEIVED

(Continued from page 1118)

nado, Eds. Wiley-Interscience, New York, 1978. xiv, 174 pp., illus. $19.95.

Etudes for Programmers. Charles Wetherell. Prentice-Hall, Englewood Cliffs, N.J., 1978. viii, 200 pp., illus. Paper, $12.95.

Every Child a Wanted Child. Clarence James Gamble, M.D., and His Work in the Birth Control Movement. Doone and Greer Williams. Emily P. Flint, Ed. Francis A. Countway Library of Medicine, Boston, 1978 (distributor, Harvard University Press, Cambridge, Mass.). xviii, 446 pp., illus. $14.95.

Exploring the Galaxies. Simon Mitton. Scribner, New York, 1978. 206 pp., illus. + plates. Paper, $4.95. Reprint of the 1976 edition.

Faunes de Mammifères du Paléogène de 'Eurasie. Papers from a colloquium, Montpellier, France, Sept. 1976. Département de Géologie de l'Universite Claude-Bernard, Lyon, France, 1977. 242 pp., illus. Paper, $42. *Geobios*, Mémoire Spécial No. 1.

Fear. Learning to Cope. Albert G. Forgione and Richard S. Surwit with Daniel G. Page. Van Nostrand Reinhold, New York, 1978. xii, 176 pp. $9.95.

Guide to Pre-Arranging the Sex of Offspring. Bhairab Chandra Bhattacharya. Applied Genetic Laboratories, Omaha, Neb., 1977. viii, 112 pp., illus. Paper, $10.50.

A Guide to the Birds of Venezuela. Rodolphe Meyer de Schauensee and William H. Phelps, Jr. Plates by Guy Tudor and H. Wyne Trimm, John Gwynne, and Kathleen D. Phelps. Line drawings by Michel Kleinbaum. Princeton University Press, Princeton, N.J., 1978. xxii, 424 pp. + plates. Cloth $50; paper, $19.95.

Handbook of Treatment of Mental Disorders in Childhood and Adolescence. Benjamin B. Wolman, James Egan, and Alan O. Ross, Eds. Prentice-Hall, Englewood Cliffs, N.J., 1978. xvi, 476 pp. $29.95.

Handbook of Turbulence. Vol. 1, Fundamentals and Applications. Walter Frost and Trevor H. Moulden, Eds. Plenum, New York, 1977. xviii, 498 pp., illus. $49.50.

Health Statistics. A Manual for Teachers of Medical Students. C. R. Lowe and S. K. Lwanga, Eds. Oxford University Press, New York, 1978. xviii, 140 pp. Paper, $8.95. Handbooks Sponsored by the IEA and WHO, No. 1.

Illustrated Glossary for Solar and Solar-Terrestrial Physics. A. Bruzek and C. J. Durrant, Eds. Reidel, Boston, 1977. xviii, 208 pp. $26. Astrophysics and Space Science Library, vol. 69.

Imms' General Textbook of Entomology. Vol. 2, Classification and Biology. O. W. Richards and R. G. Davies. Chapman and Hall, London, and Halsted (Wiley), New York, ed. 10, 1978. viii + pp. 419–1354, illus. $60.

Immunity to Blood Parasites of Animals and Man. Papers from a conference, Bellagio, Italy, Sept. 1975. Louis H. Miller, John A. Pino, and John J. McKelvey, Jr., Eds. Plenum, New York, 1977. x, 322 pp., illus. $29.50. Advances in Experimental Medicine and Biology, vol. 93.

Journey through the Universe. An introduction to Astronomy. Thomas L. Swihart. Houghton Mifflin, Boston, 1978. xvi, 366 pp., illus. + plates. $15.95.

Kidney Hormones. Vol. 2, Erythropoietin. J. W. Fisher, Ed. Academic Press, New York, 1977. xvi, 602 pp., illus. $46.90.

Landscape Construction. M. E. Downing.

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BSA	—	6.45

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