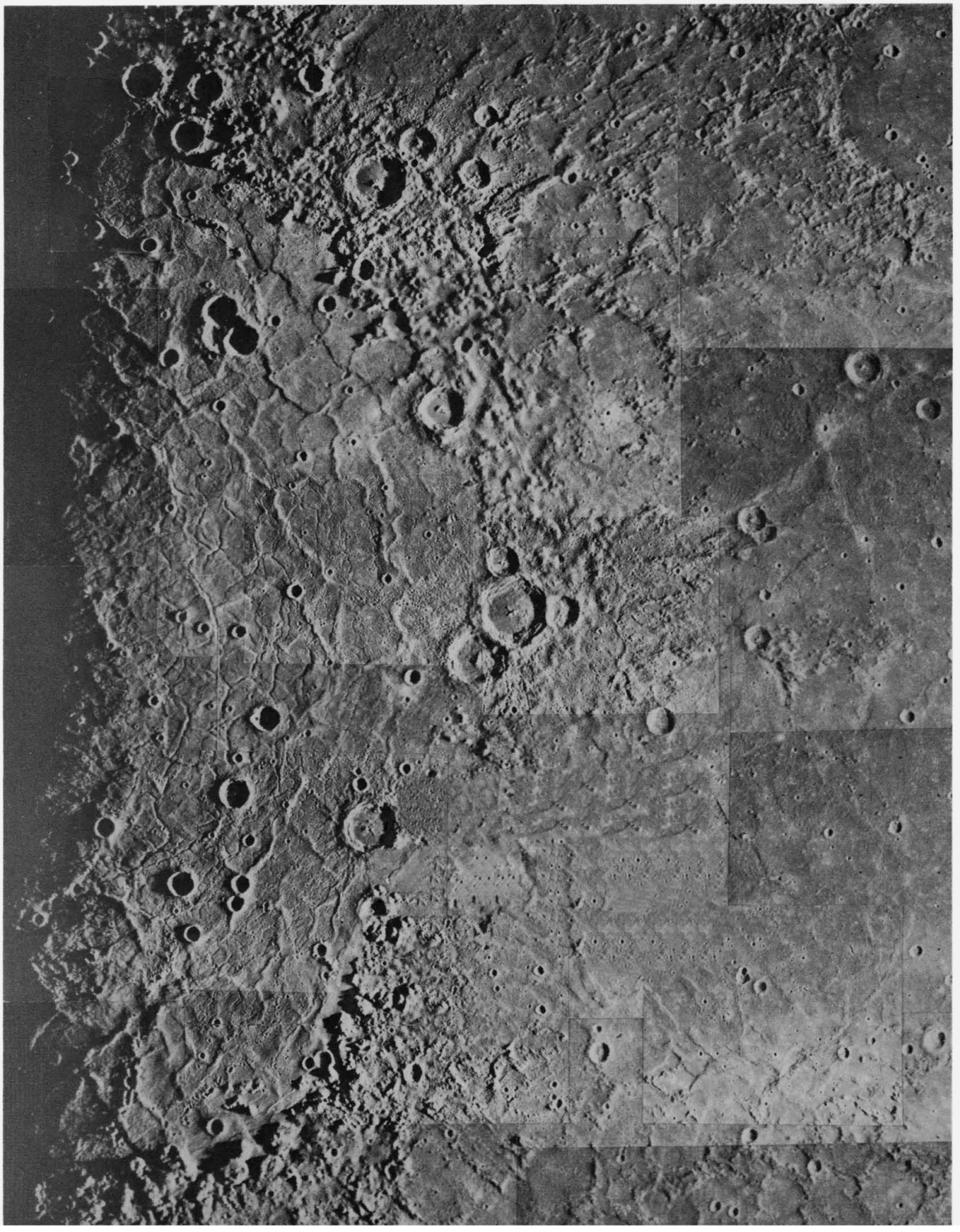
SCIENCE

12 July 1974

Vol. 185, No. 4146

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Start a quiet revolution

Turn on a Beckman J-21B Centrifuge

The new Beckman J-21B refrigerated centrifuge is quieting down a lot of labs. We've thoroughly sound-dampened it and vibration-isolated the drive so there's no whine and very little noise.

But quiet is only one advantage of the J-21B. It has an automatic vacuum system that reduces wind friction and a high-torque dc drive that gets rotors to speed fast. The advantage: you save considerable time and often can complete several more runs per day.

And J-21B rotors do more. For example, the JCF-Z rotor permits separations by continuous flow, zonal and reorienting gradient techniques—all in one rotor body with interchangeable cores.

You can start a quiet (and more efficient) revolution in your lab by buying a J-21B. Send for Brochure SB-366 to Beckman Instruments, Inc., Spinco Division, 1117 California Avenue, Palo Alto, California 94304.

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HOW WE'VE MADE SOMETHING VERY GOOD EVEN BETTER!

Packard introduced the world's first Tri-Carb Spectrometer System over twenty years ago. And ever since, we've been continually refining such systems to better meet the continually expanding needs of liquid scintillation counting.

Take our 2425 and 2450 Tri-Carbs for example. When they were introduced, both systems represented a major advance in liquid scintillation counting by offering unequaled total-system precision and performance... along with the unique, unmatched operating simplicity and convenience of SERVO-TRAY® sample handling (each individual 50-vial tray can be used and programmed for a separate assay by as many as 9 individual users).

Now, we've done it again. The current versions of the 2425 and 2450 may look unchanged on the outside, but they incorporate a series of development advances on the inside which give these second generation systems even better performance characteristics than their "state of the art" predecessors. Again, Packard leads the way in liquid scintillation counting.

Unchanged on the outside, updated on the inside: The 150-sample capacity Model 2425 Tri-Carb/**Request Bulletin 1117.**

Unchanged on the outside, updated on the inside: The 450-sample capacity Model 2450 Tri-Carb/ **Request Bulletin 1177.**

Please send information on:

- ☐ Model 2425 Tri-Carb (150 sample)
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SCIENCE

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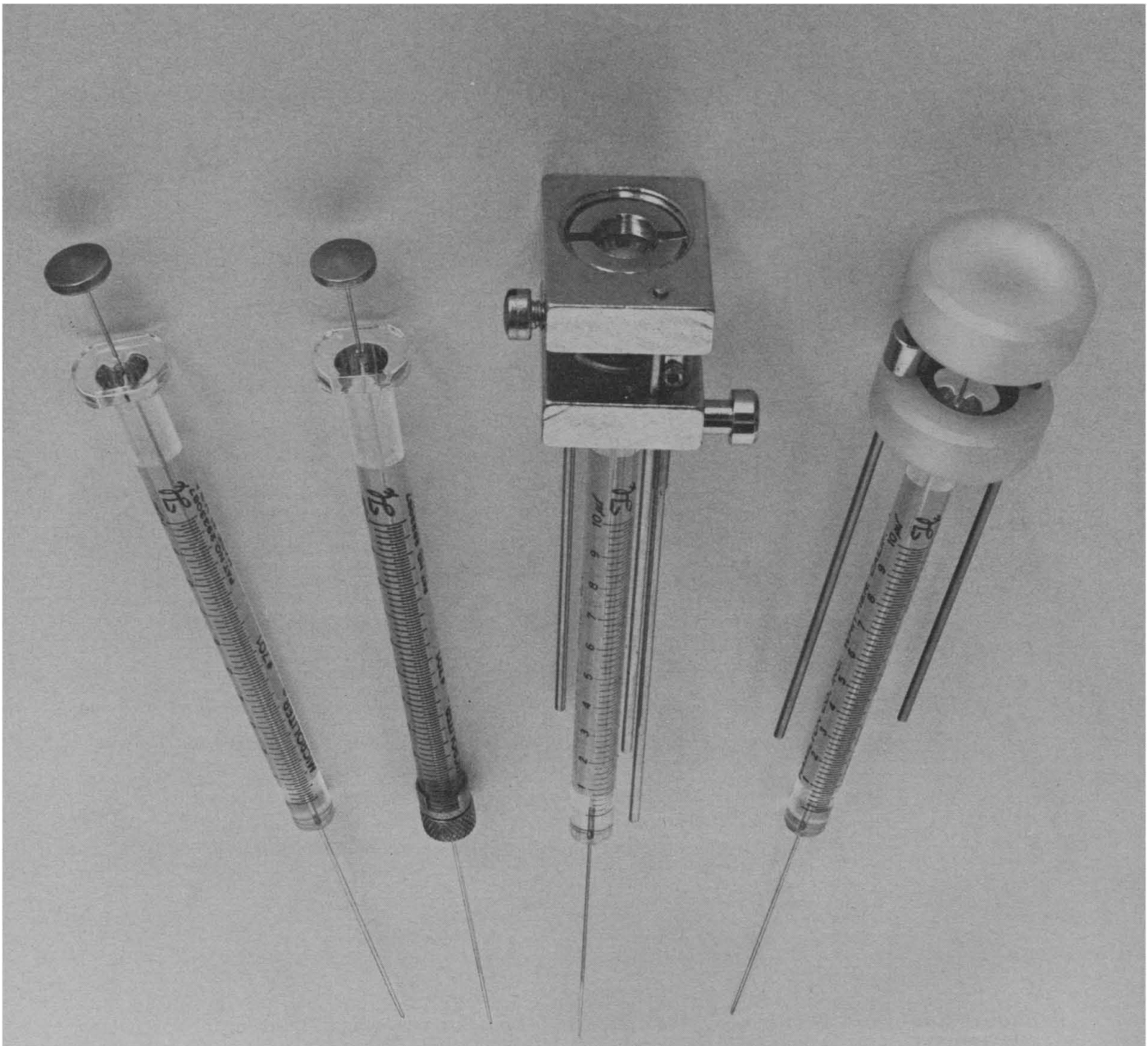
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

The semicircle of cratered mountains in the left half of this processed photomosaic form the boundary for the largest basin on Mercury seen by Mariner 10. The basin is provisionally named "Caloris" or "hot" basin for its position near one of the subsolar points when Mercury is at perihelion. The ring of mountains is 1300 kilometers in diameter and up to 2 kilometers high; the basin floor consists of intensely fractured and ridged plains. The photomosaic was compiled by personnel at the Jet Propulsion Laboratory and the U.S. Geological Survey in Flagstaff. See page 169.



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Do you know how to make a Hamilton 701N Microliter Syringe four times as versatile? You simply add attachments . . . such as a guide to inhibit bending of small diameter plungers . . . or a Chaney Adaptor that makes the 701N into a repeating dispenser. Or, you can get any one of several special needles. Or, you can get a 701 with a removable needle, designed to make it possible to replace bent or plugged needles. But no matter how versatile you make your 701N, there's no way to improve upon its quality (we guarantee that) or its repeatable delivery and accuracy. ▫ The 701N . . . versatility is only one of its virtues. Write for literature to Hamilton Company, Post Office Box 17500, Reno, Nevada 89510.

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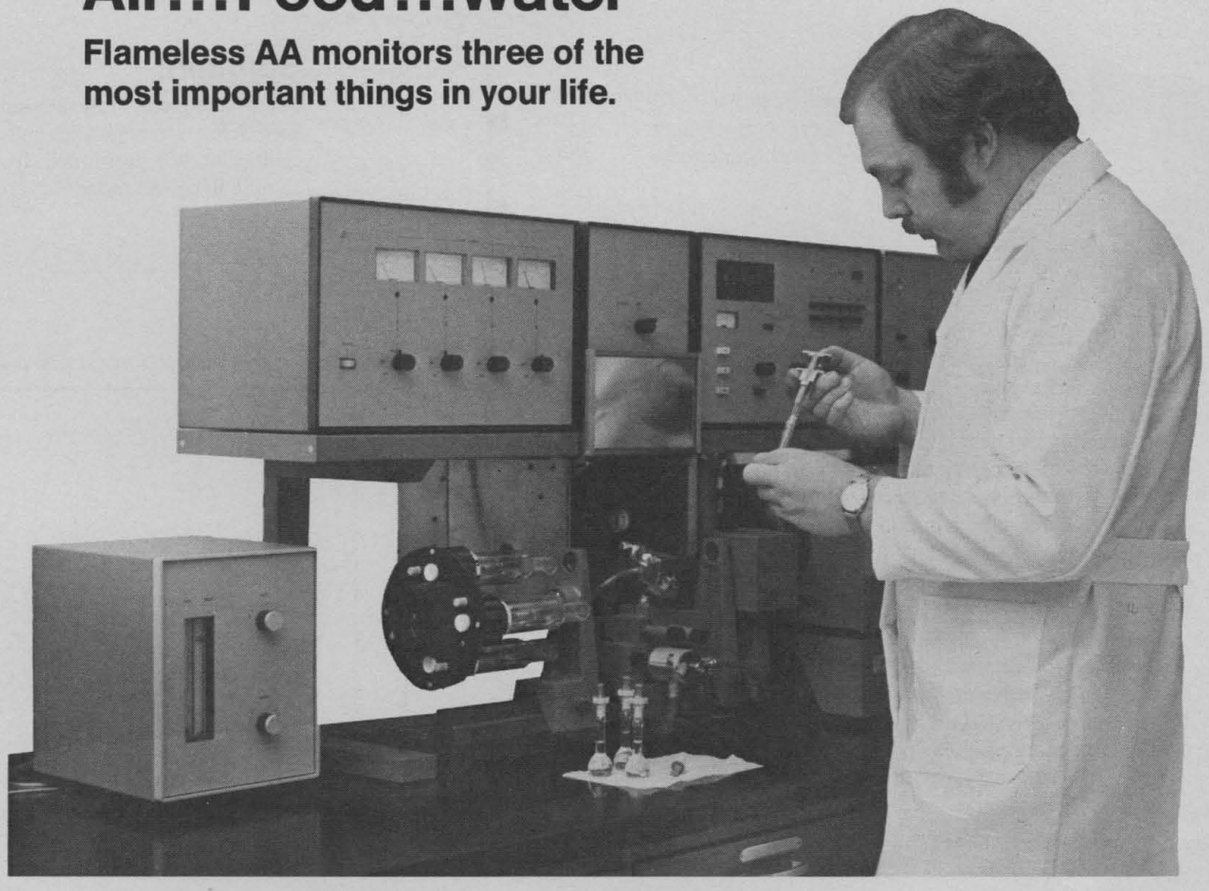
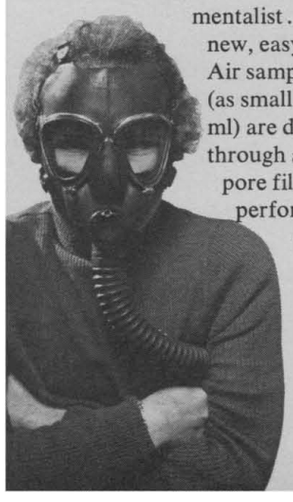
Flameless AA monitors three of the most important things in your life.



This new AA-6CS, *dedicated* to flameless atomic absorption, is *also dedicated* to scientists concerned with traces of toxic metals throughout the environment...

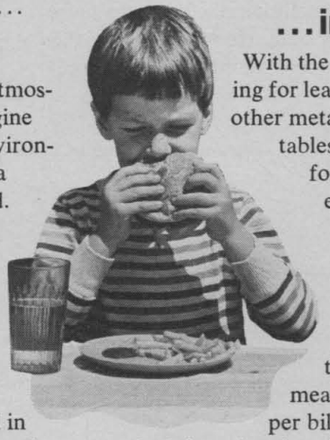
...in air

Monitoring toxic metals in the atmosphere from industrial plants and engine exhausts is vital to the environmentalist... and here's a new, easy, fast method. Air sample volumes (as small as 250 ml) are drawn through a Millipore filter in a perforated carbon cup, which is then placed in the AA-6CS and atomized. Within a minute, you know the concentration of lead, cadmium, or other toxic elements, in parts per billion!



...in food

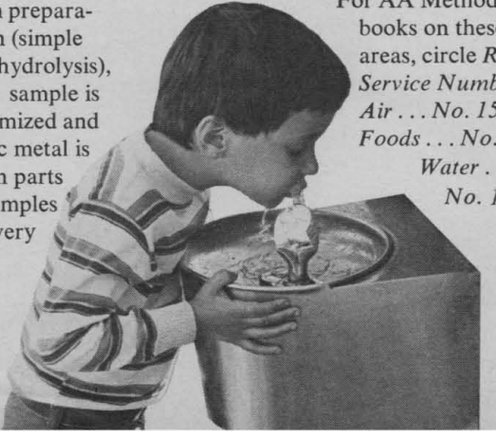
With the AA-6CS, analyzing for lead, cadmium, and other metals in fruits, vegetables and canned baby foods could be no easier! After minimum preparation (simple hydrolysis), sample is atomized and the toxic metal is measured in parts per billion; samples can be injected and analyzed every 90 seconds!



...in water

Direct determinations of toxic metals in water and effluents are simply and rapidly carried out on the standard AA-6CS. Little or no sample preparation is needed... and the analysis requires only microliter samples. Sensitivity is unmatched! To monitor water pollutants, select the leader in flameless AA... the AA-6CS from Varian Techtron!

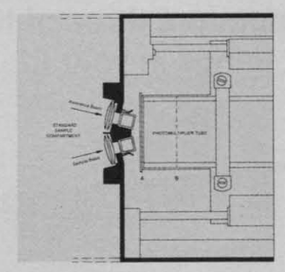
For AA Methodology books on these areas, circle *Reader Service Numbers: Air... No. 153, Foods... No. 154, Water... No. 155.*



Are turbid sample spectra your problem?

Problem:

Murky suspensions or cellular materials that scatter too much light to allow standard absorptiometric measurements.

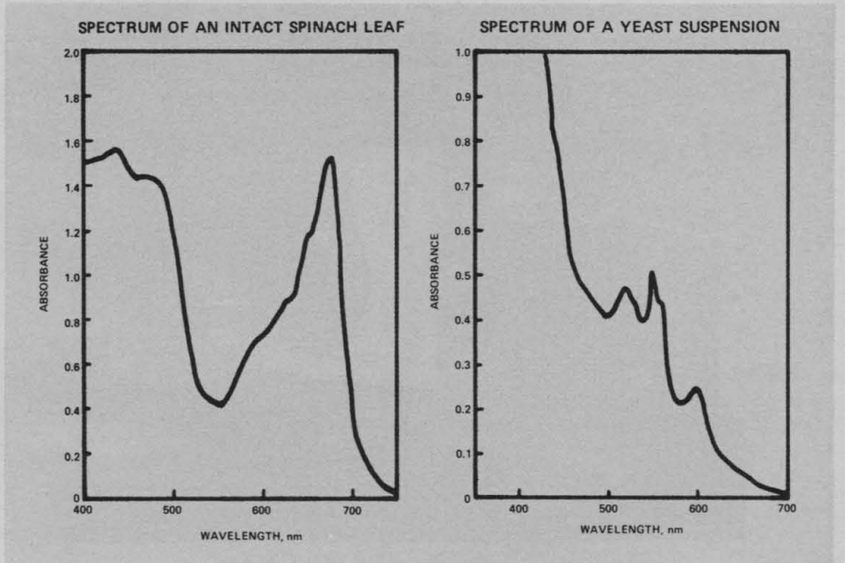


Solution:

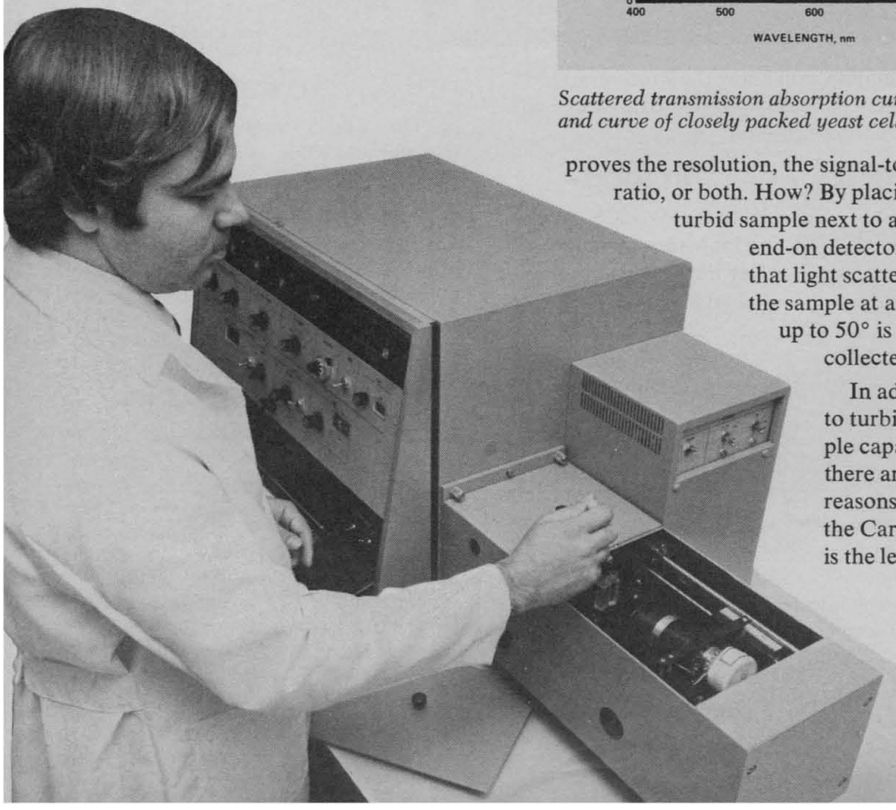
A new Scattered Transmission Accessory detector system with end-on photomultiplier tube positioned close to the sample to collect more scattered light.

Measuring absorbance of such turbid biological systems as cytochromes, flavoproteins and hemoglobins in their native state has been difficult at best. But now, with our new Scattered Transmission Accessory, meaningful spectra can be routine. This accessory replaces the detector compartment of the Cary 118, retaining the standard cell compartment for non-scattering samples.

The Scattered Transmission Accessory increases light-gathering power up to 100-fold over the standard absorption method. This greater intensity vastly improves the resolution, the signal-to-noise ratio, or both. How? By placing the turbid sample next to a large end-on detector so that light scattered by the sample at angles up to 50° is collected.



Scattered transmission absorption curve of an intact spinach leaf, showing chlorophyl peak, and curve of closely packed yeast cells in suspension, resolving the cytochrome bands.



In addition to turbid sample capability, there are other reasons why the Cary 118 is the leading UV-Visible Spectrophotometer today:

Highest photometric precision of any instrument in its range.

Measures micro samples down to 20 microliters.

Performs derivative recording and difference measurements.

Far UV capability (down to 170 nm with optional accessory).

If your studies involve complex biological compounds in micro *or* macro quantities, the Cary 118 is the logical, and often the only, choice.

For more information, circle *Reader Service Number 156.*

Varian Instruments for Life Science Research & Analysis

Varian GC Autosampler

With this new automatic sampler you can run your gas chromatograph overnight, unattended, and have chromatograms from 60 samples (contained in four 15-vial quadrant holders which fit into a carrousel unit) by morning. Or, if you'd like to run it continuously for longer periods, each 15-vial holder can be easily removed after its samples are analyzed and replaced with new samples — all while the unit is operating! And reproducibility is 0.5% σ rel on an absolute basis, something no human operator can come close to.

For details, circle *Reader Service Number 158.*

Model 2100... first choice 'U' column GC

Model 2100 is the finest "U" column gas chromatograph ever built. Chemists choose it because its large, accessible oven and its multi-glass-column, multi-detector operation (up to four simultaneously) make it ideal to handle a large throughput of difficult samples such as steroids, triglycerides, amino acids, pesticides and other labile compounds.

For specifications, circle *Reader Service Number 159.*

New 8500 LC makes it easy to use the full power of liquid chromatography

The all-new Varian 8500 Liquid Chromatograph is the first push-button LC system. All the knobs and levers have been replaced by a simple, solid-state control panel. No other LC system is so easy to operate and control.

But more important, no other LC system gives you so much capability to use the full analytical power of liquid chromatography. Here are just a few of the full-performance features available only on the 8500:

Pulseless flow at rates up to 990 ml/hr at 8500 psi — full flow at full pressure and a wider selectable range of flow rates/pressures to improve your separation. Further, the 8500's pulseless, precisely-controlled flow ensures lowest detector noise, lowest minimum detectable quantities, and greater accuracy and reproducibility of peak areas and retention times.

8500 psi pumping — a significant margin of extra pressure for high speed LC and to take advantage of the new high performance columns that often require high solvent flow rates and corresponding pressures for fast analysis.

8500 psi injector — new easy-to-use design for highly reproducible injections.

8500 psi columns — columns that operate over the entire pressure range from 0 to 8500 psi, for greater efficiency, speed and capacity in all LC modes.

Multilinear Solvent Programmer controls the dual-pump gradient system. Provides capability to form gradients of virtually any useful shape to improve your analysis.

Choice of detectors — UV, Refractive Index and Variscan. Variscan is the detector that makes it possible to detect and analyze any compound that absorbs in the UV-Vis range from 200 to 800 nm.

Every component in the 8500 extends the range of liquid chromatography — makes it possible to do almost everything in LC either better or faster.

For full information, circle *Reader Service Number 157.*

Now the XL-100A NMR Spectrometer lets you think small

Thanks to another Varian first, a 1-mm Insert Accessory for the XL-100A Pulsed-Fourier Transform NMR Spectrometer, scientists such as biochemists and pharmaceutical chemists who have to work with limited sample quantities can obtain rapid proton NMR analysis of microgram samples.

Using the insert, it's possible to run proton spectra of 50 μg or less of sample. Spectra run thusly are obtained in less than 17 minutes, yet are superior to 8-hour runs in a 5-mm tube. Sensitivity for a fixed amount of sample can improve from 4- to 6-fold when the 1-mm Insert Accessory is used.

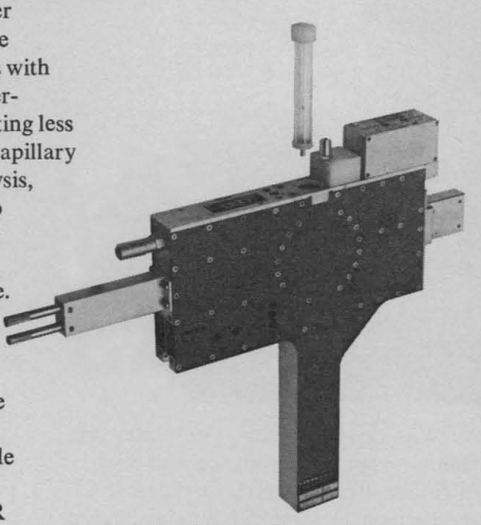
The two spectra of Δ^9-tetrahydrocannabinol (THC) shown here demonstrate the dramatic results possible using the 1-mm Insert. Spectrum A, of a concentrated sample in a 5-mm tube, serves as a comparison for the other spectra. Spectrum B (20 μg of sample in a 1-mm tube) and Spectrum C (20 μg of sample in a 5-mm tube) were run under identical conditions. Note the well-defined peaks in the spectrum run using the 1-mm Insert.

This innovative approach is successful since reducing the sizes of both the sample tube and the receiver coil ensures maximum coupling of the available nuclear magnetic moments with the coil. It permits the use of commercially available capillary tubes costing less than one cent each. Hence, the capillary can be thrown away after analysis, eliminating the messy clean-up required with special tubes, or the sample can be easily stored for future reference.

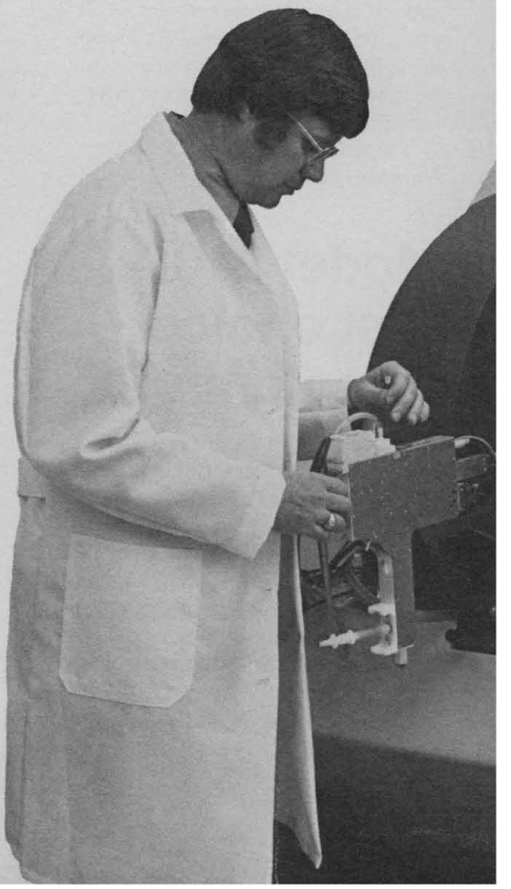
Interchanging the 1-mm Insert with standard XL-100A inserts is extremely easy. Merely take out one, put in the other, retune and balance. Sample preparation is easy, too. The sample is dissolved in 5 μl of an NMR solvent containing TMS for a reference. It is then transferred into a 1-mm sample tube by using a drawn out glass pipette or a hypodermic syringe. This eliminates the bubble problems which sometimes arise with the use of microcells in larger tubes. The resulting column length is about 10 mm, assuring freedom from line shape distortion. Since spinning produces no vortex, spinning speed is not a critical factor. The sample volume in the 1-mm Insert is so much less than the 400 μl required for 5-mm tubes that use of deuterated species becomes more economical.

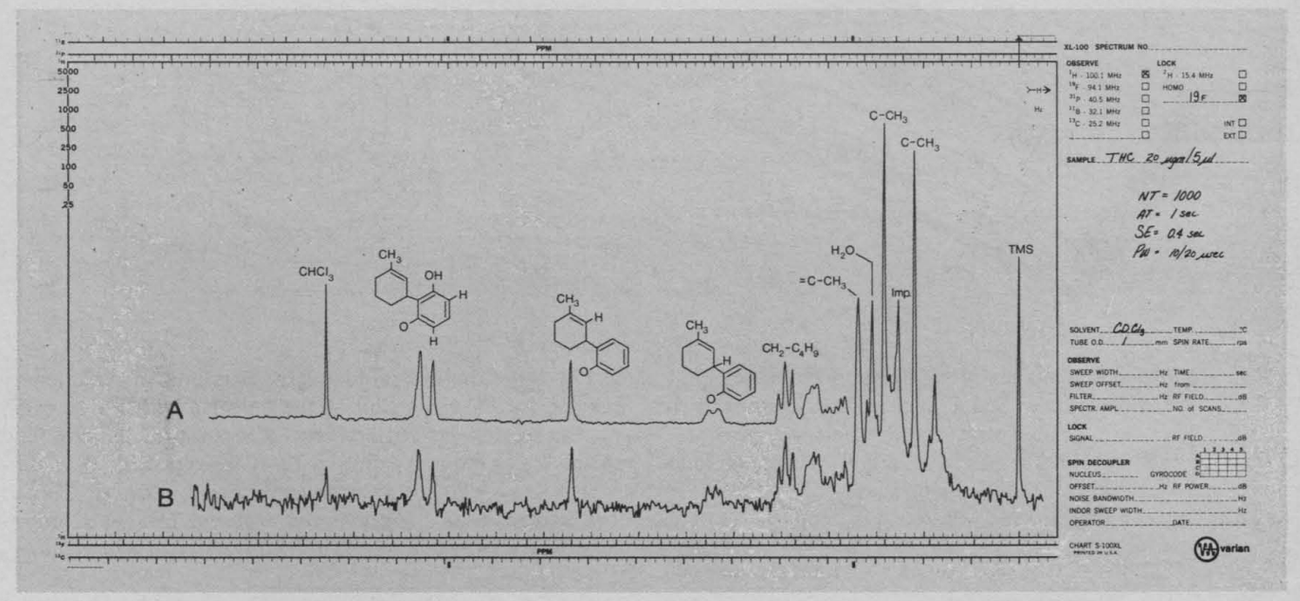
The 1-mm capillary has its own spinner turbine attached. Unlike other existing techniques designed to accommodate small quantities of samples, there are no plugs to adjust and no sample positioning necessary. Proper positioning is automatic thereby assuring reproducible homogeneity.

So, if your research would benefit from rapid proton NMR analysis of microgram samples, write for a copy of Varian's Application Report NMR-2, which describes the XL-100A Insert Accessory in more detail.

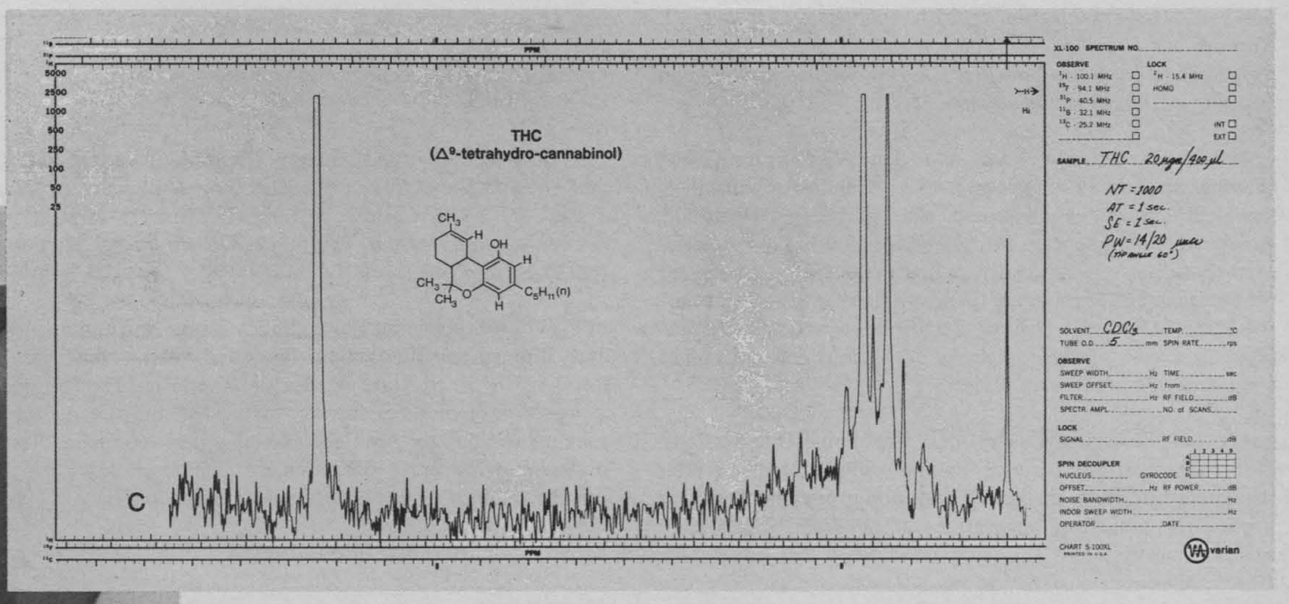


Circle *Reader Service Number 160.*





The spectrum of 20 μg of Δ⁹-THC (tetrahydro-cannabinol) in a 1-mm capillary with 5 μl $CDCl_3$. Total time was 16⅔ minutes (1000 pulses at 1-second intervals). The spectrum of a concentrated sample is partially reproduced above for comparison. Assignments are written over peaks.



The spectrum of 20 μg of Δ⁹-THC in a 5-mm tube with 400 μl $CDCl_3$. Total time was 16⅔ minutes (1000 pulses at 1-sec intervals). Note the huge background peaks from the residual $CHCl_3$, the H_2O in the solvent and adsorbed on the glassware, and solvent impurity.

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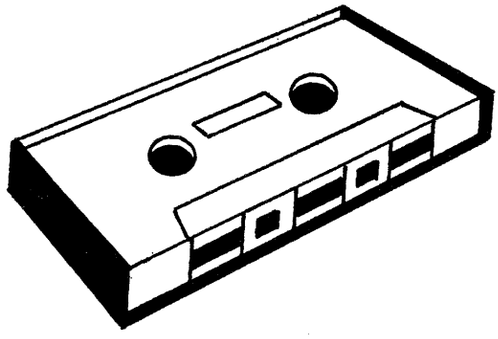
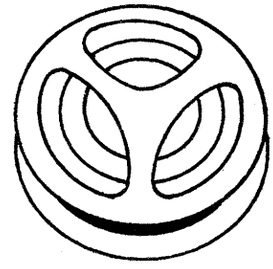
1974 AAAS Audiotapes





The following audiotapes were made during the 1974 AAAS Annual Meeting in San Francisco, 24 February to 1 March. They are available in 5-inch reels or cassettes. The price is $19.95 for the first session and $16.95 for each additional session of the same symposium. Each session is about 3 hours in length.

168-74—The Development of American Science in the 19th and 20th Centuries (Sessions I–II). Recent research on the history of American science with special emphasis upon the contributions of past presidents of the AAAS in connection with the organization's 125th anniversary. *Robert H. Kargon and Harry Woolf, Johns Hopkins University; Sally Kohlstedt, Simmons College; Charles Weiner, American Institute of Physics; and others.*

169-74—Architecture and the American Future: The Coming Showdown (Sessions I–IV). Architects, with their technical knowledge combined with a designer's attitude, can usefully comment on future environments perhaps better than those persons especially skilled in "social planning" or the "science and technology of physical resource allocation." *Nathaniel Alexander Owings, San Francisco; Glenn T. Seaborg, Lawrence Berkeley Laboratory; Paolo Soleri, Cosanti Foundation; and others.*

170-74—Biological Control of Populations (One Session). Not only must the size of human populations be better regulated but new methods, preferably nonchemical, are needed for control of populations of pests and parasites of man's domestic plants and animals. *R. W. Allard and M. M. Green, University of California (Davis); Robert van den Bosch, University of California (Berkeley); Timothy Prout, University of California (Riverside); and Kingsley Davis, University of California (Berkeley).*

171-74—Biomedical Aspects of Aging (Sessions I–IV). In general, there is a decline in physiological function with age. The loss of vigor and declining mental function are two changes familiar to all. A review of classical issues and problems on aging is presented. *Lester Smith, National Institutes of Health; F. Douglas Lawrason, Schering-Plough Corp.; Robert D. Terry, Albert Einstein College of Medicine; and others.*

172-74—Cosmic Evolution (One Session). An evolutionary scheme for the formation of the universe with a discussion of the possibility of intelligent life in the universe and methods for comunicating with it. *George Field, Smithsonian Astrophisical Observatory; Frank Drake, Cornell University; A. G. W. Cameron, Harvard College Observatory; and Cyril Ponnamperuma, University of Maryland.*

174-74—The "Dismal Science" Comes of Age: Economics in America's Third Century (One Session). Marina Whitman, University of Pittsburgh. As man gains control over his environment, and more and more things once regarded as free (e.g., air and water) become visibly scarce, the "trade-offs" or choices among scarce resources which are the central concern of economists will move more and more to the forefront.

175-74—Energy and Society (Session II only). Energy and social policy. *Robert Engler, City University of New York; W. Fred Cottrell, Miami University; Arnold H. Packer, Committee for Economic Development, Washington, D.C.; and others.*

176-74—Ethical and Public Policy Issues in Amniocentesis and Biomedical Innovation (Sessions I–II). New breakthroughs in genetics are increasingly making heredity, once a mystery of nature, into a matter of human decision-making and design. Amniocentesis is a new biomedical technique allowing early diagnosis of genetic diseases of the unborn. *Amitai Etzioni, Columbia University; Lloyd Smith, University of California (San Francisco); Leon E. Rosenberg, Yale University; and others.*

177-74—Search for Extraterrestrial Life (One Session). *Harold P. Klein and Keith A. Kvenvolden, NASA-Ames Research Center; Carl Sagan, Cornell University; and others.*

178-74—Food Additives: Beneficial or Deleterious? (One Session). Nutritive value of food additives in child and adult diets are considered. Possible deleterious effects of additives are discussed. Numerous benefits and potential risks of additives are weighed against each other. *W. Ann Reynolds, University of Illinois at the Medical Center; L. J. Filer, Jr., Iowa College of Medicine; Leon Goldberg, Albany Medical College of Union University; and others.*

179-74—Fusion Power (One Session). Power from controlled thermonuclear fusion of the light elements promises to be a viable and unique solution to the energy crisis facing our technological society. *Rolf M. Sinclair, National Science Foundation; Robert L. Hirsch, U.S. Atomic Energy Commission; and others.*

180-74—Implied New Directions for Science and Technology (One Session). A large part of the national effort in R & D is heavily influenced by new and dimly perceived federal policies in allocating resources; much can be gained from a firsthand observation of the system by which the allocations are made and carried out. *Howard J. Lewis,* Public Science; *Hugh Loweth, Office of Management and Budget, Washington, D.C.; Eugene B. Skolnikoff, Massachusetts Institute of Technology; and others.*

181-74—Neurobiological Mechanisms of Adaptation and Behavior (Sessions I-IV). *Arnold J. Mandell, University of California (San Diego); Walter Lovenberg, National Heart and Lung Institute; Joseph J. Schildkraut, Massachusetts Mental Health Center; and others.*

182-74—New Developments in Brain Function for Speech Perception and Production (One Session). Psychophysical and physiologic data on general models and data on asymmetry of the human brain for speech perception and production. *C. I. Berlin, Louisiana State University Medical Center; Ruth S. Day, Yale University; and others.*

183-74—The Emerging Portrait of the Planets (Sessions I-II). The Moon, Mars, Venus, and Jupiter. *Carl Sagan, Cornell University; S. I. Rasool, NASA; Bruce Murray, California Institute of Technology; and others.*

184-74—Science and the People's Republic of China (Sessions I-II). Reports from American scientists who have visited China. *Anne Keatley, National Academy of Sciences; John W. Lewis, Stanford University; Edward Chao, U.S. Geological Survey; and others.*

185-74—Science for the Naked Eye: Or the Physics of Everyday Experience (Sessions I-II). The fundamental concepts of science that can be derived from our everyday experiences. *Rolf M. Sinclair, National Science Foundation; James E. Gunn and Eugene Shoemaker, California Institute of Technology; and others.*

186-74—Velikovsky's Challenge to Science (Sessions I-II). Immanuel Velikovsky has concluded that close encounters between the earth and the planets Mars and Venus occurred at about 1500 B.C. and 775 B.C. Arguments for and against his theory are discussed. *Immanuel Velikovsky; Carl Sagan, Cornell University; J. Derral Mulholland, University of Texas; and others.*

187-74—Skylab Science Experiments: A First Report (Sessions I-IV). Scientific information gathered from the Skylab flights. *George W. Morgenthaler, Martin Marietta Corp.; William C. Schneider, National Aeronautics and Space Administration; Philip O'B. Montgomery, Southwestern Medical School; and others.*

188-74—Nutrition and Numbers in the Third World. J. George Harrar, president emeritus, The Rockefeller Foundation. The progress of civilization is squarely dependent on the provision of an adequate diet, health protection, education, and productive opportunity for all of the world's citizens.

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Sometimes a digital computer can keep up with the real world only by calling an analog into play

Current theory holds that the tennis champion's efficiency—and yours—results from hybrid computation. Half your brain, it seems, does simultaneous parallel processing (which is what our analog computers do). The other half does sequential processing (like a digital). It's the interaction between the two that lets you plan tactics logically while you follow the ball and position your racquet.

Similarly, it is the interaction between the digital and analog portions of EAI's computer systems that allows them to cope with immensely complex scientific and engineering problems at real-time speeds—or even faster.

These hybrid systems, called PACER™, solve the most intricate of mathematical models in a hundredth of the time and at a quarter of the cost of a digital alone.

That's why our hybrids are hard at work for cost-conscious scientific and engineering labs involved in almost every area of manufacturing and research.

Producing speedy solutions to complex problems has made us the world's largest maker of analog/hybrid computers. Probably we can solve a problem or two for you. Write Electronic Associates, Inc., West Long Branch, N.J. 07764. Or call (201) 229-1100.

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Solar Energy Absorption

In the excellent article "Atmospheric effects of pollutants" by Hobbs *et al.* (8 Mar., p. 909), there is a misstatement concerning the absorption of solar energy in the atmosphere. In the section "Radiation balance" the authors state: "The infrared radiation is a minor part of the incoming solar power . . . ," and then go on to discuss atmospheric heating by absorption of solar radiation without considering absorption by H_2O, CO_2 or other species with infrared absorption bands. In fact, the infrared radiation is not a minor part of the incoming solar power. Above the atmosphere, only 50 percent of the solar energy is at wavelengths less than 0.71 micrometer, which is approximately where the infrared begins. The wavelengths below which 60, 70, 80, 90, and 98 percent of the solar energy is found are 0.84, 1.0, 1.2, 1.6, and 3.0 μm, respectively. There are important absorption bands for H_2O at 0.72, 0.81, 0.94, 1.1, 1.38, 1.87, 2.7, and 3.2 μm; for CO_2 at 1.6, 2.0, and 2.7 μm; and for O_2 at 0.78 and 1.27 μm. The water bands are the most important by far. The literature has been well summarized by Robinson (*1*).

The atmospheric absorption of H_2O, CO_2, and O_2 is almost entirely responsible for the reduction of solar energy flux from 2.00 calories per square centimeter per second at the top of the atmosphere to 1.40 at sea level. The direct heating of the atmosphere from this absorption can hardly be neglected.

MARSHAL F. MERRIAM
Department of Materials Science and Engineering, University of California, Berkeley 94720

References

1. N. Robinson, *Solar Radiation* (Elsevier, New York, 1966), pp. 47–110.

Merriam correctly points out that we excessively deprecated the influence of solar infrared radiation on the heat budget of the atmosphere. To complement his values for the integrated solar radiance as a function of wavelength, we add an approximate budget for the interaction of solar radiation with the earth (*1*): for every 100 watts of incoming power, 24 are reflected by clouds, 7 are scattered back to space by the earth's atmosphere, and 4 are reflected back to space by the planet's surface (subtotal 35); 22.5 watts reach the surface directly, 14.5 more after diffuse scattering from clouds, and 10.5 more after diffuse molecular scattering (subtotal 47.5); of the residue (subtotal 17.5), about 6 are absorbed by the atmosphere in the ultraviolet and 11.5 in the infrared. In our article, we carelessly "misspoke" our intention of stating that this last number is a minor part of the total power incident on the planet. It is, of course, a larger part of the nonreflected solar power, about 18 percent.

The main purpose of our article was to estimate the influences of potential pollutants upon the atmosphere. For a hypothetical pollutant that is very active in the infrared to absorb 10^{-3} of that 18 percent, its global concentration would have to exceed about 10 parts per million. The arguments in our article suggest that other deleterious effects would likely be observed at lesser concentrations.

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References

1. M. Neilburger, J. G. Edinger, W. D. Bonner, *Understanding Our Atmospheric Environment* (Freeman, San Francisco, 1973), p. 65.

Osmotic Power Plant

I have for years used the osmotic pump fallacy to illustrate the workings of the second law of thermodynamics, and hope that none of my students see the article "The osmotic pump" by Levenspiel and de Nevers (18 Jan., p. 157) and have dust thrown into their intellectual gears. Those familiar with oceanography know that the nonequilibrium states which do obtain over short distances do not admit of practical energy-producing processes.

If one wants to engage in speculation and still be quite consistent with the laws of thermodynamics, one should calculate the amount of energy produced by having the mixing of the Hudson River with the Atlantic Ocean in New York Harbor take place under those conditions which approach reversibility and which are attainable by the use of modern ion-exchange membrane technology. A simple calculation will show that such a membrane plant would make electricity sufficient to supply all of the needs of New York City and much of the hinterland. It would

require, incidentally, membrane stacks that would cover all of Central Park to a height of some 3 miles, for such is the slow rate of diffusive processes.

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We share Gregor's respect for the laws of thermodynamics; we believe our article shows that respect. As we point out in the article, the concentration-depth relationship in the oceans is far from the equilibrium one; the second law of thermodynamics makes it amply clear that one can, in principle, extract power from any such nonequilibrium situation.

We hope that in addition to teaching his students thermodynamics, Gregor teaches them to read articles all the way through, and not take parts out of context. If his students do, they will read the last two paragraphs of our article, which we hereby quote.

> In principle, at locations where the oceans are deepest the osmotic pump should be able to bring fresh water to the surface of the real ocean and the osmotic power plant should be able to generate significant electric power. However, these devices are not likely to be economically feasible at the present time. . . .
>
> One may think of this as a way of harvesting some of the sun's free energy which is stored in the nonequilibrium state of the ocean. So far, mankind has harvested such solar energy where it is more concentrated—through photosynthesis, fossil fuels, hydroelectric power, winds, and tides. There are other untapped sources of solar energy and possibilities which may be more economically attractive than this one, such as the steep temperature gradients in the tropical oceans and photovoltaic conversion. For the near future this osmotic approach seems less likely to be commercialized than others, although as we have shown here it is thermodynamically feasible.

We do not believe that anyone who reads those paragraphs will be misled about the practical prospects of the osmotic pump or power plant.

We have accepted Gregor's suggestion to calculate the power obtainable from the reversible salination of the Hudson River at New York. The reversible power would be the volumetric flow rate times the osmotic pressure. The former averages about 610 m^3 sec^{-1} (*1*), while the latter is about 25.6 atm. Multiplying these together, we have (610 m^3 sec^{-1}) × (25.6 atm) × (1.013 × 10^5 watt m^{-3} atm^{-1} sec^{-1}) = 1.58 × 10^9 watts. The installed electric capacity of the United States is about 1500 watts per person, so this is approximately enough power for a population of 1 million people. The statement about "New York City and much of the hinterland" seems exaggerated.

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References

1. *U.S. Geol. Surv. Circ. 44* (1949).

Wind, Waves, and Women

In his review of *Exercise and Sport Sciences Reviews* (*1*) (31 May, p. 977) Steven M. Horvath mentions that the best time for a marathon run of 50 miles was made by a woman. The best time for a 50-mile swim is also held by a woman. The indomitable Greta Andersen beat the only other swimmer (a male) and won the race by 5 hours. The question of noblesse oblige was not involved since it was a professional race in which a $10,000 purse was involved. In my book *Wind, Waves, and Sunburn* (*2*), which is a history of marathon swimming, I called Greta the greatest female marathon swimmer in the history of the sport. Twice she won the English Channel race (21 miles), beating all the men in doing so. She is also the only person to make a round-trip swim (44 miles) of the Catalina Channel. Greta at some time in her career has beaten every man she has ever swum against. And it should be mentioned that Greta is no androgyne. She has all the right padding in the right places that characterizes the feminine woman. There are many other examples of women surpassing men in this sport.

In more than 20 years of training marathon swimmers, I have observed the following. Whenever a race is more than 4 miles long (about 1½ to 2 hours), the women begin to recoup the lead the men have taken. From that time on it becomes a toss-up as to whether the winner will be a man or a woman.

Over the years, many a University of Chicago student and professor has been humbled by one of my female students in training in Lake Michigan.

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In fact, in many cases, the men have spent a whole summer whipping themselves into shape only to find that their chances of beating a woman were no more than 50-50 over the greater distances.

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References

1. J. H. Wilmore, Ed., *Exercise and Sports Sciences Reviews* (Academic Press, New York, 1973), vol. 1.
2. C. Wennerberg, *Wind, Waves, and Sunburn* (Barnes, Cranbury, N.J., 1973).

Interaction of Sperm with Somatic Cells

In their report (1 Mar., p. 857) on the novelty and potential value of the uptake of spermatozoa by somatic cells, Bendich, Borenfreund, and Sternberg fail to mention that the subject is at least as old as the observations of Kohlbrugge (*1*) and that almost all their methods were put to the same use and achieved the same results in Sydney, Australia, a decade ago (*2*). We were similarly attracted to the idea of the male gamete's being a vector of nucleic acid, particularly as a potential carcinogen in human cervical cancer (*3*). The epidemiological literature is replete with suggestions that the disease is truly venereal, and demonstrable intimacy of the two nucleic acids—those of sperm head and cervical epithelial cell—following coitus was the subject of much thought and model building by our group (*4*). Like our colleagues in the field of viral oncogenesis, we seized industriously upon the concept of an admixture of the two nucleic acids being potentially somehow carcinogenic. The concept, however, has not been as productive as we hoped. We now see the importance of the sperm head as a vector of arginine-rich histones acting not so much deep within the target cell, as the authors' electron micrographs and autoradiographs so dramatically show, but quite superficially at its surface and quite early during the first moments of contact (*5*).

The Sydney studies have been the subject of three books, review articles, and numerous papers published in many countries, including the United States and the United Kingdom. Is it possible, in an age of some of the most sophisticated communications mechanisms in the history of mankind, from satellites to computer-aided bibliographies, that the noise level generated by an avalanche of publications sets the chances of contact between scientists in related fields at a level less effective than that which obtained in Medieval times?

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References

1. J. H. E. Kohlbrugge, *Arch. Entwicklungsmech. Org.* **35**, 165 (1912).
2. B. L. Reid, *Lancet* **1964-I**, 21 (1964).
3. M. Coppleson and B. L. Reid, *Preclinical Carcinoma of the Cervix Uteri* (Pergamon, Oxford, England, 1967).
4. ———, *Obstet. Gynecol.* **32**, 432 (1968); B. L. Reid and M. Coppleson, in *Scientific Basis of Obstetrics and Gynaecology*, R. Maconald, Ed. (Churchill, Oxford, England, 1971).
5. B. L. Reid, *Biosystems*, in press.

We regret we did not cite the earlier work of our colleagues in the field of gynecology mentioned above; we disagree with their contention that the methods were put to the same use and achieved the same results. Our study dealt with nonphagocytic spermatozoal transfer of genetic information to cultured somatic cells. Coppleson and Reid regarded sperm as potential mutagens and presented experimental data which bear on this. They have speculated that phagocytic uptake of sperm or sperm components by immature squamous metaplastic cells in the human cervix might lead to carcinoma after a long latent period. Although they do not now regard their concept as productive as they had hoped, we believe this latter possibility to have great merit. The astonishingly high incidence of prostatic carcinoma (*1*), the anatomical possibility that sperm can play a role in this disease also, and the current difficulty obtaining direct experimental evidence on various stages of this lengthy process make it important to pursue and support systematic fundamental investigations which can be rigorously evaluated at each step.

AARON BENDICH
ELLEN BORENFREUND
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References

1. F. K. Mostofi and J. E. Leestma, in *Pathology*, W. A. D. Anderson, Ed. (Mosby, St. Louis, 1971), p. 828. Carcinoma of the prostate is seen in 26 to 37 percent of men at autopsy performed for other reasons and this rises to 40 to 80 percent by the ninth decade.

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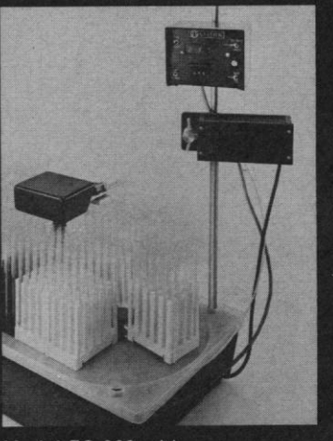

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12 July 1974, Volume 185, Number 4146 **SCIENCE**

AAAS: Retrospect and Prospect

When I was approached by the search committee of the Board of Directors early in the spring of 1970 about the possibility of joining AAAS, I was infected by their enthusiasm for the roles AAAS could play in increasing the public understanding of science and in educating scientists to their responsibilities as citizens.

Shortly after I came to AAAS, I expressed my conviction that the Association must seek to reach out to five populations: the scientific community, youth, teachers and education administrators, leaders in government, and science journalists.

Scientists have become increasingly conscious of parochialism within the scientific enterprise. *Science* has evolved as a counterforce for the broader education of scientists. I take pride in having served as its publisher and in having shared the responsibility for answering the irate letters that are an indicator of a lively journal.

In the field of science education, *Science—A Process Approach* has had a major impact upon instruction at the elementary school level. Similarly, the AAAS-developed curriculum guidelines have been models for education and planning at both the elementary and secondary levels.

The Congressional Seminars conducted for many years jointly with the Brookings Institution and expanded 2 years ago are an effective educational instrument for decision-makers. The program of Congressional Science Fellowships, inaugurated last fall, is among the three or four most important things that the Association has engaged in during its recent history. These fellowships offer scientists and engineers—particularly young scientists and engineers—exciting new career opportunities.

Communications with the public through science journalists have been rather limited. But with our recent participation with the Corporation for Public Broadcasting in science television, our audiotape program, and our community seminars on energy held this year in six cities around the country, there is a glimpse of what is possible.

A sixth audience that I should have included in my earlier list are the artists and writers of our country. The two cultures gap is as broad now as it was when C. P. Snow wrote about it in the late 1950's. Everyone will agree that science profoundly affects our life and times, but we scientists have failed to have a significant impact upon the general scheme of American values.

The artist, in contrast to the scientist, immerses himself in the everyday experiences of people, reflects what society is, and ultimately has a powerful role in shaping what it will become. If we are truly to achieve Bacon's vision of science as the enlightened servant of man, we must take science and, as one great humanist of an earlier day urged upon the artist, "assimilate it to human needs, color it with human passion, transform it into the blood and bone of human nature." Sir William Osler is reported to have said not too many years ago that we are in "yet the childhood of the world, and a supine credulity is still the most charming characteristic of man." If such is the case, it is high time that we got on with the job of teaching society at large that science and technology—as the companion approaches to solving problems that combine logic with observation—are, in the general case, simple, straightforward, and even beautiful in their conceptualization.

My life and times at AAAS have been exhilarating. I've formed many friendships. I've had a great learning experience. As I leave my present post, I look forward to participation in Association affairs as a life member. My enthusiasm and affection for AAAS will long continue.—WILLIAM BEVAN

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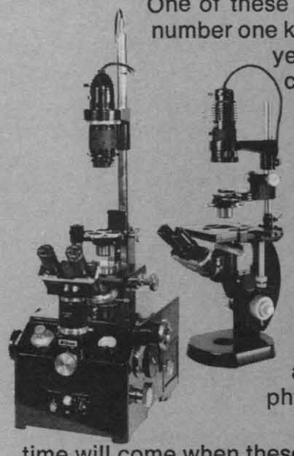

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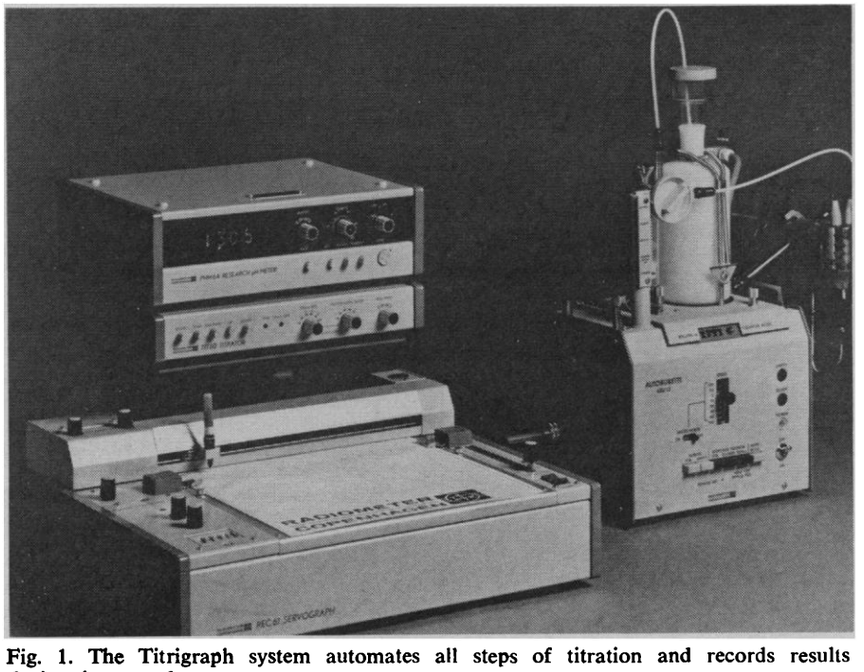

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Mössbauer Effect Methodology. Vol. 8. Proceedings of a symposium, New York, N.Y., Jan. 1973. Irwin J. Gruverman and Carl W. Seidel, Eds. Plenum, New York, 1973. xii, 282 pp., illus. $22.50.

Mycoplasma and Mycoplasma-Like Agents of Human, Animal, and Plant Diseases. Papers from a conference, New York, Jan. 1973. New York Academy of Sciences, New York, 1973. 532 pp., illus. Paper, $44. *Annals of the New York Academy of Sciences*, vol. 225.

Natural Chelating Polymers. Alginic Acid, Chitin and Chitosan. R. A. A. Muzzarelli. Pergamon Press, New York, 1974. xii, 254 pp., illus. $15. International Series of Monographs in Analytical Chemistry, vol. 55.

New Concepts III. P. Carsky, R. Zahradnik, H. Hartmann, K.-H. Lebert, and K.-P. Wanczek. Springer-Verlag, New York, 1973. iv, 116 pp., illus. $19.70. Topics in Current Chemistry, vol. 43.

Organic Syntheses. An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. Vol. 53. Arnold Brossi, Ed. Wiley, New York, 1974. xiv, 194 pp., illus. $10.50.

Orientation and Form. Irvin Rock. Academic Press, New York, 1973. x, 166 pp., illus. $11.95.

The Packed Column in Gas Chromatography. Walter R. Supina. Supelco, Bellefonte, Pa., 1974. vi, 166 pp., illus. Paper, $12.

Pétrole et Protéines. Alfred Champagnat and Jean Adrian. Doin, Paris, 1974. 196 pp., illus. Paper, 76 F.

Physical Science. George A. Williams, Max C. Bolen, and Ray D. Doerhoff. Webster Division (McGraw-Hill), New York, 1973. xii, 420 pp., illus. $7.96. Challenges to Science.

Physics and Geology. J. A. Jacobs, R. D. Russell, and J. Tuzo Wilson. McGraw-Hill, New York, ed. 2, 1974. xviii, 622 pp., illus. $17.95. McGraw-Hill International Series in the Earth and Planetary Sciences.

Phytochemical Methods. A Guide to Modern Techniques of Plant Analysis. J. B. Harborne. Chapman and Hall, London, 1974 (U.S. distributor, Halsted [Wiley], New York). x, 278 pp., illus. $15.50.

The Pituitary Gland. A Comparative Account. R. L. Holmes and J. N. Ball. Cambridge University Press, New York, 1974. x, 398 pp., illus. $28.50. Biological Structure and Function, vol. 4.

Policy Analysis in the Federal Aviation Administration. Steven E. Rhoads. Lexington (Heath), Lexington, Mass., 1974. xii, 160 pp. $11.50.

The Population Problem. Stanley Johnson, Ed. Halsted (Wiley), New York, 1974. 232 pp., illus. $9.95. David and Charles Sources for Contemporary Issues Series.

Practical Histochemistry. J. Chayen,

L. Bitensky, and R. G. Butcher. Wiley-Interscience, New York, 1973. xiv, 272 pp., illus. $11.50.

Prices, Profit, and Production. How Much Is Enough? J. William Leasure and Marjorie Shepherd Turner. University of New Mexico Press, Albuquerque, 1974. xvi, 144 pp., illus. Paper, $3.50.

Principles of Dairy Science. G. H. Schmidt and L. D. van Vleck. Freeman, San Francisco, 1974. xii, 558 pp., illus. $15. A Series of Books in Agricultural Science.

Principles of Modern Immunobiology. Basic and Chemical. Byung H. Park and Robert A. Good. Lea and Febiger, Philadelphia, 1974. x, 618 pp., illus. $20.

Proceedings of the First Philip Morris Science Symposium. Proceedings of a symposium, Richmond, Va., Apr. 1973. Nicholas J. Fina, Ed. Philip Morris, New York, 1973. 134 pp., illus.

The Processing of Information and Structure. Wendell R. Garner. Lawrence Erlbaum Assoc., Potomac, Md., 1974 (distributor, Halsted [Wiley], New York). xiv, 204 pp., illus. $10.95. Experimental Psychology Series.

Psychoanalysis and Psychotherapy. 36 Systems. Robert A. Harper. Aronson, New York, 1974. x, 182 pp. $7.50. Reprint of the 1959 edition.

A Psychology of Picture Perception. John M. Kennedy. Jossey-Bass, San Francisco, 1974. xvi, 174 pp., illus. $10.75. The Jossey-Bass Behavioral Science Series.

Psychopathological Disorders in Childhood. Theoretical Considerations and a Proposed Classification. Group for the Advancement of Psychiatry. Aronson, New York, 1974. x, 176 pp. $10.

Radio Frequency Heating in the Timber Industry. J. Pound. Spon, London, 1973 (U.S. distributor, Halsted [Wiley], New York). viii, 192 pp., illus. $11.50. Second edition of *Practical RF Heating in the Timber Industry*.

Remote Sensing. Techniques for Environmental Analysis. John E. Estes and Leslie W. Senger, Eds. Hamilton (Wiley, New York), Santa Barbara, Calif., 1974. x, 340 pp., illus. $11.50.

Research Techniques in Nondestructive Testing. Vol. 2. R. S. Sharpe, Ed. Academic Press, New York, 1973. xii, 454 pp., illus. $25.75.

Review of Child Development Research. Vol. 3, Child Development and Social Policy. Bettye M. Caldwell and Henry N. Ricciuti. University of Chicago Press, Chicago, 1974. xiv, 582 pp. $15.

Road Salt, Drinking Water, and Safety. Improving Public Policy and Practice. Robert C. Terry, Jr. Ballinger, Cambridge, Mass., 1973. xxviii, 164 pp., illus. $8.50.

The Science of Life. The Living System —A System for Living. Paul A. Weiss. Futura, Mt. Kisco, N.Y., 1973. xx, 138 pp., illus. $7.95.

The Science and Technology of Aerosol Packaging. John J. Sciarra and Leonard Stoller, Eds. Wiley-Interscience, New York, 1974. xvi, 710 pp., illus. $35.

The Scientific Achievement of the Middle Ages. Richard C. Dales. University of Pennsylvania Press, Philadelphia, 1973. x, 182 pp., illus. Paper, $3.45.

Sea Turtles and the Turtle Industry of

the West Indies, Florida, and the Gulf of Mexico. Thomas P. Rebel. University of Miami Press, Coral Gables, Fla., ed. 2. 1974. 250 pp., illus. $10.

Second Order Equations with Nonnegative Characteristic Form. O. A. Oleinik and E. V. Radkevic. Translated from the Russian edition (Moscow, 1971) by Paul C. Fife. American Mathematical Society (Plenum), Providence, R.I., 1973. viii, 260 pp. $20.

La Séparation des Isotopes. Marius Chemla and Jacques Périé. Presses Universitaires de France, Paris, 1974. 246 pp., illus. Paper, 26 F.

Sexual Deviation. Psychoanalytic Insights. Mortimer Ostow, Ed., with the assistance of Martha H. Gillmor. Quadrangle (New York Times Book Co.), New York, 1974. xviii, 188 pp. $7.95.

Social Indicators 1973. Selected Statistics on Social Conditions and Trends in the United States. Statistical Policy Division, Office of Management and Budget, Washington, D.C., 1973 (available from the Superintendent of Documents, Washington, D.C.). xiv, 258 pp., illus. Paper, $7.80.

Social Problems and Public Policy. Deviance and Liberty. Lee Rainwater, Ed. Aldine, Chicago, 1974. viii, 438 pp. Cloth. $15; paper, $5.75.

Sociocultural Origins of Achievement. Martin L. Maehr. Brooks/Cole, Monterey, Calif., 1974. xii, 100 pp., illus. Paper. $2.95. Basic Concepts in Educational Psychology Series.

Southwestern Groundwater Law. A Textual and Bibliographic Interpretation. John R. Chalmers. Office of Arid Lands Studies, University of Arizona, Tucson, 1974. xii, 228 pp., illus. Spiral bound, $5. Arid Lands Resource Information Paper No. 4.

Statistical Thermodynamics. B. J. McClelland. Chapman and Hall London, 1973 (U.S. distributor, Halsted [Wiley], New York). xvi, 334 pp., illus. Cloth, $23; paper, $12.75. Studies in Chemical Physics.

Statistics. The Essentials for Research. Henry E. Klugh. Wiley, New York, ed. 2, 1974. xvi, 426 pp., illus. $11.95.

Structural Geology. An Introduction to Geometrical Techniques. Donal M. Ragan. Wiley, New York, ed. 2, 1973. x, 236 pp., illus. Paper, $7.95.

Subcellular Particles, Structures, and Organelles. Allen I. Laskin and Jerold A. Last, Eds. Dekker, New York, 1974. xiv, 312 pp., illus. $24.75. Methods in Molecular Biology, vol. 5.

Superconducting Materials. E. M. Savitskii, V. V. Baron, Yu. V. Efimov, M. I. Kychkova, and L. F. Myzenkova. Translated from the Russian edition (Moscow, 1969) by G. D. Archard. K. D. Timmerhaus, Transl. Ed. Plenum, New York, 1973. xiv, 460 pp., illus. $27.50. International Cryogenics Monograph Series.

Surface Carbohydrates of the Eukaryotic Cell. G. M. W. Cook and R. W. Stoddart. Academic Press, New York, 1973. xiv, 346 pp., illus. $19.50.

System Analysis Techniques. J. Daniel Couger and Robert W. Knapp, Eds. Wiley, New York, 1974. xiv, 510 pp., illus. $14.95.

The Technique of Psychoanalytic Psy-