SCIENCE

4 August 1972

Vol. 177, No. 4047

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

CUT IT OUT !

FOR ANY TYPE OF GRADIENT — that is all you have to do when you program the LKB ULTROGRAD® gradient mixer. A pair of scissors is all you need to cut the gradient profile for exactly the type of gradient you require. Our technician has just cut three, and he now indicates that he will use the one in the scanning window. When he has set the scanning rate and the duration of the run, he will switch on and the ULTROGRAD will take over— automatically producing the gradient. He can program any type of gradient you like to name, from as many as three liquids at once.

With an optional level sensor, you can also monitor absorbance levels in an eluate and automatically vary the gradient, to provide greater separation of eluted components.

LKB IN THE SERVICE OF SCIENCE

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6600 West Irving Park Road, Chicago Ill. 60634
260 North Broadway, Hicksville N.Y. 11800

We want to be useful ...and even interesting

Illegitimacy kept him from a notary's career

For two years in Italy, a film about Leonardo da Vinci has been in production. A substantial work, it explores in great depth a life, relentlessly objective of mind and inner-directed at the same time, lived at a point in cultural history before the walls grew up that separate art, science, and engineering. It goes on CBS at 9 p.m. on August 13. Whether you consider photography an art, or part and parcel of science, or a branch of engineering technique, Kodak hopes Leonardo will make five Sunday nights exciting for you.

The woods are full of what? Trees.

These men of the Forest Service are going out in their vehicle "XR-2" to x-ray the trees.

They are of the opinion that x-raying the trees in the woods makes sense. Also city shade trees.

Forty-two years ago the Rochester city forester and a man at the Kodak Research Laboratories brought up the idea in *American Forests*. It did not catch on.

Now there is a different feeling about trees. Cutting trees down just to make sure they are sound no longer seems more sensible than spending money to x-ray them.

Furthermore, it costs less than back in 1930. We now offer sensitized paper for x-rays and a little machine for processing it. No plumbing required. Also, 100-kV x-ray sources have become compact enough to shove easily up a tree.

The men in the picture have taken our course in Rochester on non-destructive testing by x-ray. They have also done a lot to correlate the appearance of the radiographs with forest pests and pathogens. The project is being carried out by the USDA Forest Service Laboratory, P.O. Box 365, Delaware, Ohio 43015.

Non-sentimental note: a big tree can have its dollar value increased by x-ray proof of its internal structure and of freedom from treacherous metal that somebody might have buried in it about the time that Roentgen discovered x-rays.

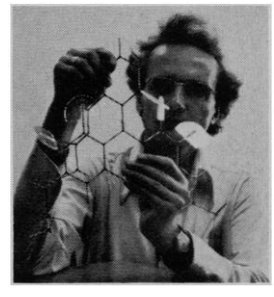
Designs by Drexhage

At Kodak we are no longer discovering laser dyes. Now we design them. Some people design hooked rugs. Karl Drexhage designs laser dyes.

A dye laser is a beautiful light source because not only is it strong and coherent but also tunable. A good dye laser needs a good laser dye. Many kinds of dyes have been tried. We even tried quinine water. One brand sort of worked, and another sort of didn't.

A good laser dye does not lose excitation by electron transfer to or from the molecule. Even that favorite, rhodamine 6G, gets quenched in nonpolar solvents, where the dye salt is poorly dissociated. ClO_4^- and BF_4^- are better than halides as anions. Rhodamine 6G perchlorate keeps its 95% fluorescence quantum yield in 20 very different solvents, reports our Drexhage.

A good laser dye does not lose excitation by conversion to internal vibrations, which is why he makes himself wire models to suggest where steric hindrances could be designed in. They cut down mobility within the chromophore. The electron cloud of a single hydrogen atom can freeze a chemically convenient but physically objectionable substituent rigidly perpendicular to the plane of the actual chromophore. Against losses due to mobility of dialkylamino end-groups, solvents of high dipole moment give localized microrigidity. Another solvent strategem is the use of deuterated alcohol. As the deuterons change places with certain hydrogen atoms on the dye molecule, quantum yield gets better.



A good laser dye molecule resists flipping an electron to enter the condition known as triplet state, where it drops out of laser action. Drexhage has found a rule that predicts how circulating electrons in the molecular structure affect the probability of loss to the triplet state. One of his current favorites for low triplet yield is the phenoxazine class of dyes. With that fundamental advantage, he feels phenoxazines are well worth design efforts to suppress the mechanisms of internal conversion. He is rather pleased with 2,7-bis-(diethylamino) phenoxazine perchlorate in o-dichlorobenzene. Flashlamp-pumped, it lases at 740 nm with a threshold energy comparable to the visible-range performance of rhodamine 6G in ethanol.

Drexhage is not optimistic about efficient dye lasing outside the 0.3–1.5μm range. The limits seem to be set by molecular vibration at the long end and absorption by the excited singlet states at the other end.

Drexhage looks to the future. He would be making a mistake to get tied down by little things like synthesis yield and shelf life that concern the people who make and market EASTMAN *Organic Chemicals and put out "Dyes for Liquid Lasers," which consists of a few sheets packed with data and references for readers who are judged by what they accomplish with laser dyes in the present. Request Kodak Publication JJ-169 from Dept. 412-L, Kodak, Rochester, N.Y. 14650, an equal-opportunity employer.*

Kodak

Patient and optimistic

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SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Wildcat Mountain Research Natural Area, Oregon. A variety of habitats in this area feature Noble fir (*Abies procera*) as the forest dominant. Research here includes long-term studies under the auspices of the International Biological Program (IBP) Coniferous Forest Biome program. See page 396 [U.S. Forest Service]

Once you've seen the PDP-11/45, you'll scale computers

Take a good close look at the new 11/45 and you'll start expecting medium scale computers to have features like 64-bit multi-accumulator floating point hardware. Memory expansion to 248K bytes. Complete memory management hardware for dynamic relocation and protection. Dual ported memories. Three protected processor environments for multi-programming. 16 general-purpose registers. Stack and double-address operations.

And you'll be looking for speeds like 300 nanosecond instruction execution.

never be able to look at medium the same way.

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And you'll expect to get it all for around $19,500. Complete with 8K core and console terminal. Before quantity discounts.

That's what you'll go looking for. But you won't find it.

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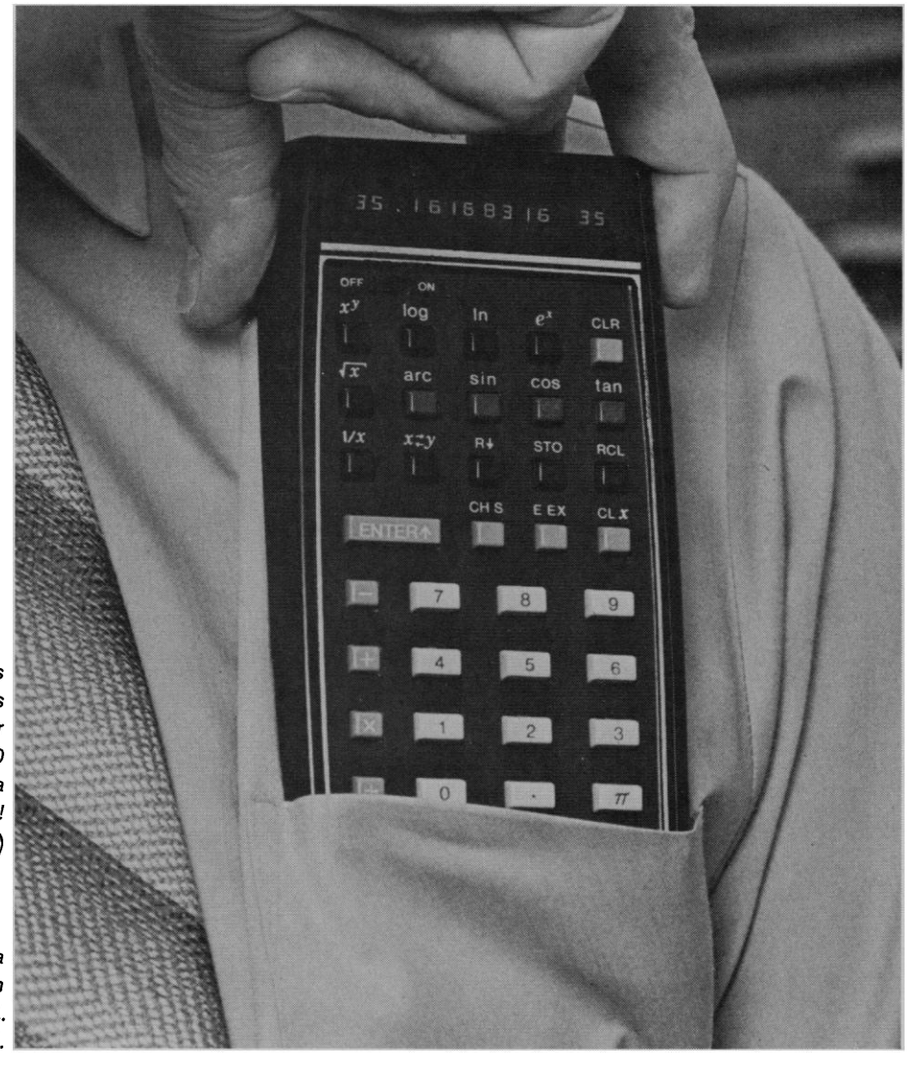
digital

Some things are changing for the better.

Many people know us as an instrument manufacturer: we make more than 2,000 products for measurement, test and analysis. Others know us as a computer company: more than 10,000 own our programmable calculators and computers. We prefer to think that our business is to serve measurement, analysis and computation needs . . . in science, industry, medicine and education. That is the rationale behind every new instrument, computer or system that we tell you about in these ads. This month:



The HP-35 Shirt Pocket Calculator lets you make complex calculations like this one approximately five times faster than with your slide rule . . . with 10 place accuracy . . . and without a single scratch note!

$$\alpha_H = 1 + [3\times10^{-2}](10^{7.21}) + [8.7\times10^{-3}](10^{2.16})$$

$$pH = -LOG\sqrt{\frac{1}{\alpha_H}\left(\frac{3\times10^{-2}}{10^{11.7}} + \frac{8.7\times10^{-3}}{10^{7.21}}\right)}$$

**Chemists will recognize this as a calculation of the pH of a buffer solution for the mixture of Na_2HPO_4 @0.03 M/ℓ. and NaH_2PO_4 @8.7×10^{-3} M/ℓ.*

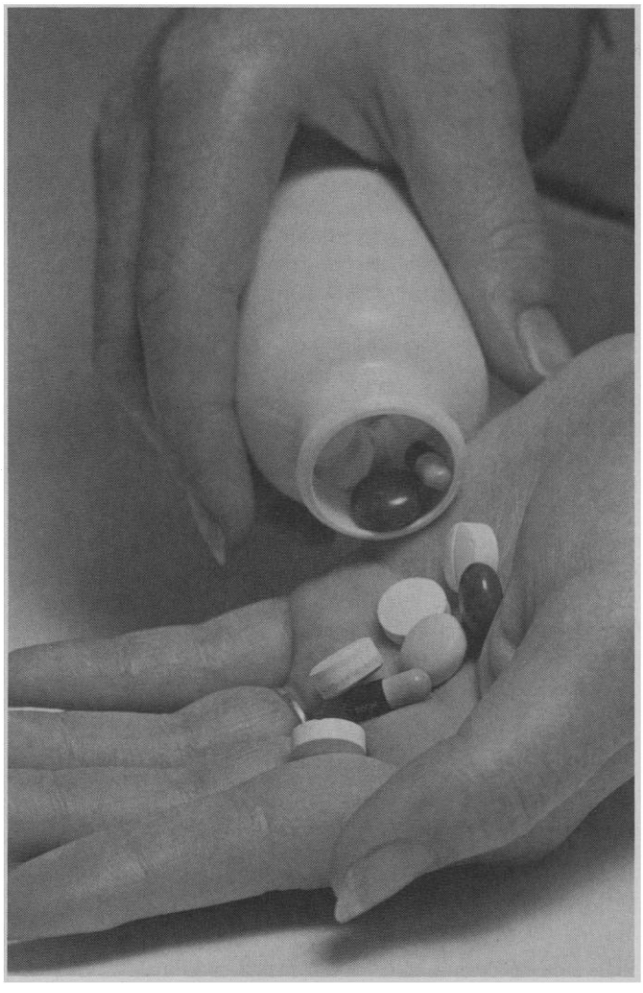
The new HP-35 Pocket Computer: a boon for scientists, engineers, or almost anyone.

When you first hear about it, it sounds like an electronic slide rule, the kind that's been available only in science fiction. Although it's only 3 by 6 inches and weighs 9 ounces, with rechargeable battery, it computes transcendental functions with a single keystroke, in less than a second. It calculates positive and negative numbers in floating point or scientific notation, automatically keeps track of the decimal throughout its 200-decade range, and displays answers that are accurate to the 10th significant digit.

And when you use it, you soon realize that it is more like a computer than a super slide rule. The secret is its 4-register operational stack. Solidly based on computer theory, it holds intermediate answers in a higher register and *automatically* brings them back when they are required for further calculations. The calculator also has a fifth register that lets you store any number and recall it to the working register at the touch of a key.

The power of our little wonder is illustrated in the calculation shown above. The HP-35 solves this problem in about 60 seconds and displays the answer to 10 significant digits, without a single scratch note.

The new HP-35 Pocket Calculator contains the equivalent of 30,000 transistors in specially designed MOS/LSI circuits. Yet it costs just $395 (domestic US price only). You may have to wait a while because demand has been so great. But if your people need this kind of computation power, it's worth the wait. Just use the coupon and we'll send full information to you.

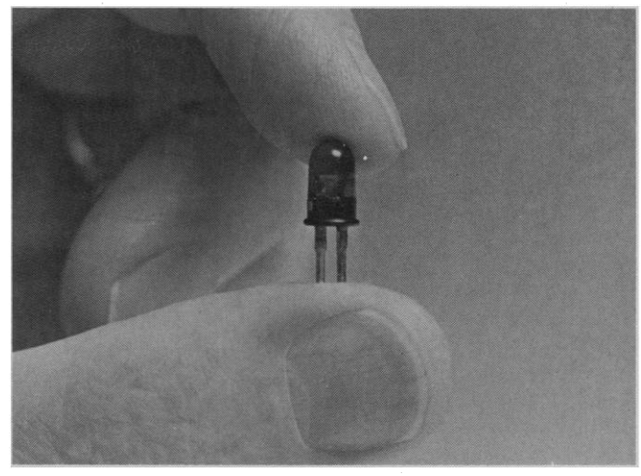


A faster, more efficient way to analyze drugs.

Not much can happen – neither emergency treatment for a drug overdose victim, nor prosecution of the pusher – until the drug has been positively identified. In large cities, where drug emergencies often reach into the hundreds daily, the chemist faces an enormously difficult problem, especially with traditional methods of chemical analysis. But there is a better way.

A laboratory in Charlotte (N.C.) recently sent us some powder from a confiscated pill for analysis on the new HP Gas Chromatograph/Mass Spectrometer/Computer System. Twenty minutes later, the analysis was complete: the pill contained heroin, morphine, and barbituric acid.

Fast, complete and positive, the analysis satisfied all medical and legal requirements. The HP system also takes a load off the lab's scientific staff because it can be successfully operated by technicians who have no special knowledge of mass spectroscopy or computers. The computer itself controls the operation of the spectrometer and records the mass spectrum while it makes all the necessary calculations, automatically. It can also compare the results of the analysis against a taped library of suspected components (in this case, a library of the mass spectra of 100 dangerous drugs) and automatically identify each of the sample constituents by name, positively. Where drugs are involved, that's an essential requirement. Just check the coupon for full information.



Try our solid-state lamp, free.

When Thomas Edison invented it, the incandescent lamp was one of the brightest ideas ever. It still is, if your object is illumination. But for display or indication, the new solid-state lamps (LED's) win hands down: they last at least 10 years and use only a few milliamps of current.

Because we are convinced that hands-on experience with an LED surpasses any description, we'd like to send you one of our 5082-4400 Series free. Use it even once, and we'll wager you'll never use any other kind of display lamp again.

Our LED is a gallium arsenide phosphide diode that's hard to ignore. You can see its red glow several yards away at any angle to 180°. It lights up when you connect a mere 1.6 volts to its rugged leads, draws only 2 to 10 milliamps, and includes a clip for easy panel-mounting.

Use the coupon to send for your free LED.* If it turns you on, we're ready to ship quantity orders immediately.

For more information on the calculator, our systems or a free LED fill out the coupon and send to: Hewlett-Packard, 1507 Page Mill Road, Palo Alto, California 94304; Europe: P.O. Box 85, CH-1217 Meyrin 2, Geneva, Switzerland; Japan: YHP, 1-59-1, Yoyogi, Shibuya-Ku, Tokyo, 151.

*OFFER EXPIRES OCTOBER 31, 1972 00213

safely exposed to any levels of DDT and that "DDT has been shown to be carcinogenic."

Epstein has ignored the fact that not a single case of human cancer due to DDT has been proved anywhere in the world in the quarter of a century in which hundreds of millions of humans have been exposed to DDT. Even among employees of a DDT plant, 11 to 19 years of heavy exposure to DDT has caused no demonstrable illness, and definitely no cancers. Let some qualified statistician, balancing this record against a few "crude" and "grossly insensitive" animal experiments, determine the odds that someone, somewhere, sometime, may have a cancer due to DDT.

"Science" is defined as "Knowledge; especially knowledge gained through experience" (*1*). I am forced to conclude that Epstein's "point of view" is not science. Rather, it is anxiety-produced and -producing propaganda for the Washington lobby of the Environmental Defense Fund. The use of DDT has its problems. The World Health Organization and many governmental and private agencies throughout the world are conducting research to find a substitute that will be more actively biodegradable, but equally effective, cheap, and safe.

PAUL F. RUSSELL

Westover,
North Edgecomb, Maine 04556

Reference

1. W. Morris, Ed., *The American Heritage Dictionary of the English Language* (American Heritage and Houghton Mifflin, New York, 1969), p. 1162.

The insensitivity of current toxicological practice stems largely from statistical considerations that reflect the very restricted number of animals conventionally tested for adverse effects induced by a chemical, including carcinogenicity, mutagenicity, and teratogenicity, when millions of humans are at presumptive risk (*1*). In spite of such insensitivity, DDT has been shown to be carcinogenic in various tests and in various species, and its continued use clearly poses potential carcinogenic hazards to man. It must be stressed that the experimental determination of carcinogenicity is a relatively uncommon occurrence; in the Bionetics carcinogenicity study of over 140 pesticides and other industrial chemicals, less than 10 percent were shown to be carcinogenic in mice, even when tested at the largest tolerated doses, with exposure commencing in infancy (*2*).

It is very difficult to demonstrate carcinogenic and other adverse effects of chemicals which are widely disseminated in the environment and for which sharp differentials in exposure cannot be established between large populations followed up for long periods of time. It is largely because of these difficulties that no valid epidemiological data on the carcinogenicity of DDT are available.

I freely admit to anxiety about the widespread dissemination of carcinogenic chemicals, especially when there is no evidence that they are more effective or more critically needed than other, noncarcinogenic agents. This has not been established for DDT as it is used in the United States.

SAMUEL S. EPSTEIN

Department of Pharmacology,
School of Medicine,
Case Western Reserve University,
Cleveland, Ohio 44106

References

1. S. S. Epstein, *Nature* **228**, 816 (1970).
2. J. R. M. Innes *et al.*, *J. Nat. Cancer Inst.* **42**, 1101 (1969).

Organic Chemists and Odors

In most theories of olfaction, it is assumed that "acceptor sites" exist on the excitable portion of receptor cell membranes, where odorous molecules bind during excitation. Such theories usually state that the mechanism of odorant-acceptor attachment does not depend on simple chemical attributes of the odorant, but that it involves more subtle chemical parameters, such as molecular vibrational frequency or stereochemistry. However, experienced organic chemists often seem to be able to name unknowns by chemical class, functional groups, or certain heteroatoms. We would like to attempt to quantify this supposed ability by testing a large number of organic chemists with a series of selected odorants. Organic chemists who think they have a good nose for unknowns and who have an hour of their time to spare can write to us to receive a free, disposable testing kit. Each participant will receive a full report of the study after its completion.

ROLLIE SCHAFER
K. R. BROWER

Departments of Biology and
Chemistry, New Mexico Institute of Mining and Technology,
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L-METHIONINE [^{35}S]

Specific activity 40-100Ci/mmole

Routinely available from stock at New England Nuclear with a radiochemical purity greater than 90%.

L-Methionine [^{35}S] NEG-009
40-100Ci/mmole $95/mCi $250/5mCi
Aqueous solution, containing 10 micromoles of 2-mercaptoethanol per ml, in leakproof combi-vial shipped in dry ice.

Related compounds

L-Methionine [methyl-^{14}C] NEC-165H
40-55mCi/mmole $20/50$\mu$Ci $75/250$\mu$Ci $275/1mCi
Ethanol:water 7:3 in combi-vial.

L-Methionine [methyl-^{3}H] NET-061H
3-5Ci/mmole $22/250$\mu$Ci $45/1mCi $115/5mCi
Ethanol:water 7:3 in combi-vial.

L-Methionine [^{14}C(U)] NEC-425
>200mCi/mmole $105/50$\mu$Ci $490/250$\mu$Ci
Ethanol:water 1:1 in combi-vial.

DL-Methionine [carboxyl-^{14}C] NEC-466
2-10mCi/mmole $23/50$\mu$Ci $90/250$\mu$Ci $335/1mCi
Crystalline solid in screw-cap bottle.

DL-Methionine [2-^{14}C] NEC-426
2-10mCi/mmole $50/50$\mu$Ci $230/250$\mu$Ci
Crystalline solid in screw-cap bottle.

S-Adenosyl-L-methionine [methyl-^{14}C] NEC-363
40-60mCi/mmole $40/10$\mu$Ci $150/50$\mu$Ci
Sulfuric acid (pH~2-3):ethanol 9:1 in combi-vial in dry ice.

S-Adenosyl-L-methionine [methyl-^{3}H] NET-155
2-5Ci/mmole $38/50$\mu$Ci $78/250$\mu$Ci $195/1mCi
Sulfuric acid (pH~2-3):ethanol 9:1 in combi-vial in dry ice.

S-Adenosyl-L-methionine [carboxyl-^{14}C] NEC-604
5-10mCi/mmole $45/10$\mu$Ci $175/50$\mu$Ci
Sulfuric acid (pH~2-3):ethanol 9:1 in combi-vial in dry ice.

3'-Phosphoadenosine-5'-phosphosulfate, tetrasodium salt [^{35}S] NEG-010
0.5-4.0Ci/mmole $100/100$\mu$Ci $180/250$\mu$Ci $500/1mCi
Ethanol:water 1:1 in combi-vial in dry ice.

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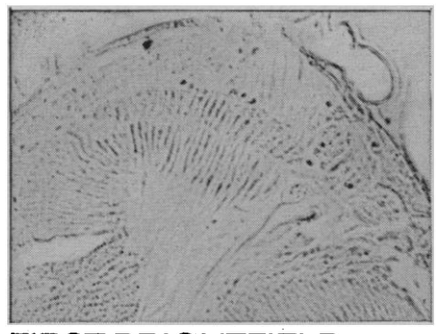
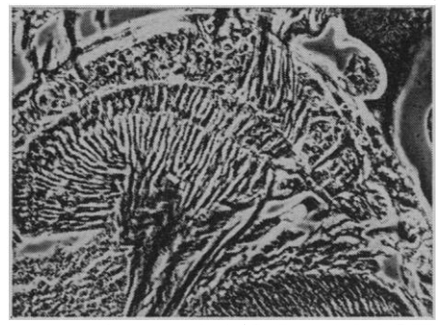
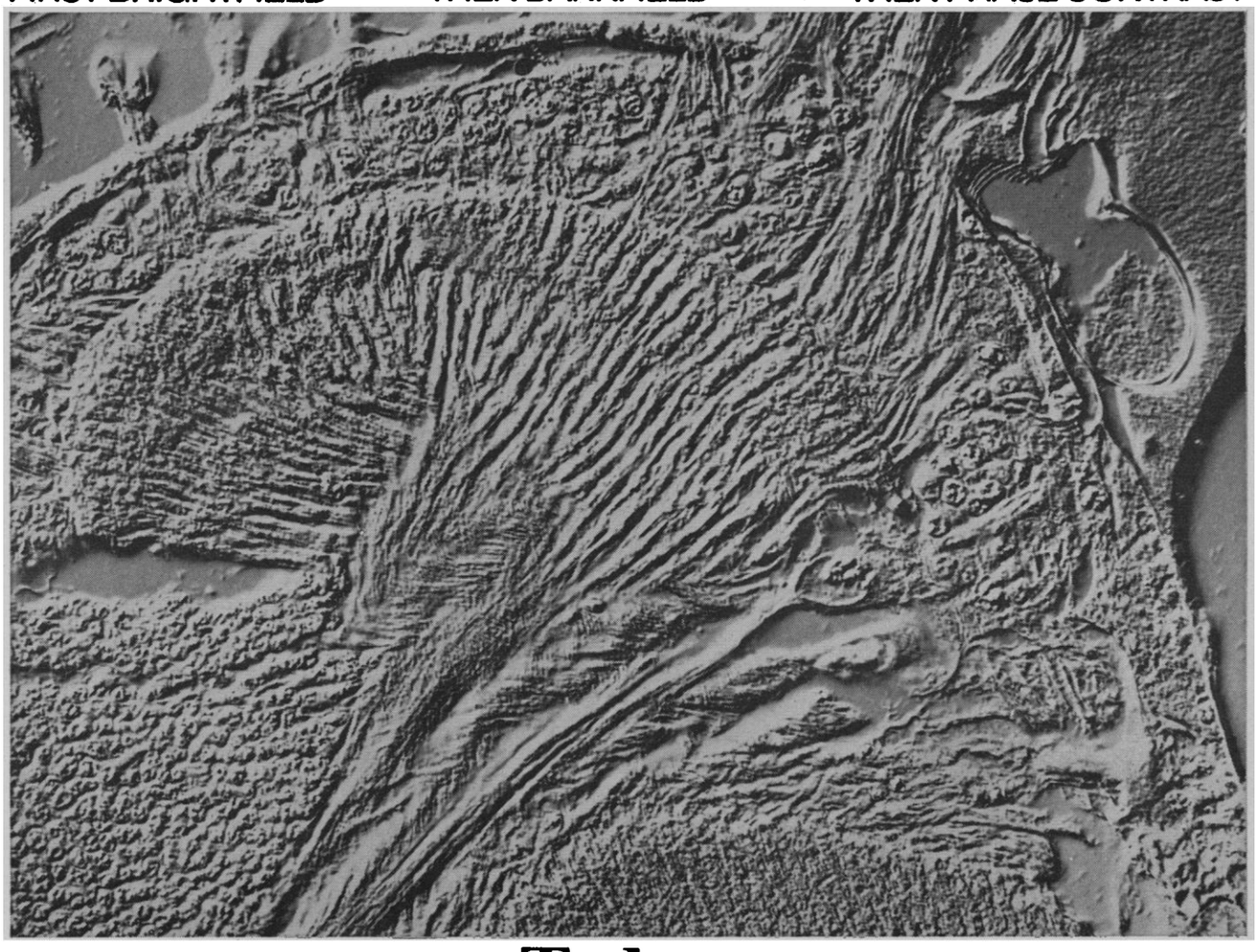


FIRST BRIGHTFIELD

THEN DARKFIELD



THEN PHASE CONTRAST



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4 August 1972, Volume 177, Number 4047 **SCIENCE**

Understanding of Science

The AAAS is about to intensify its efforts to enhance the public's understanding of the scientific enterprise. With the help of a grant from the National Science Foundation, the AAAS is beginning a broad new program to include seminars for those who manage the mass media and for government officials, a new approach to science on television, a critical journal to examine science and the mass media, an experimental project to involve AAAS members in more collegial activities, and a modest research program on the sources and cures of public misunderstanding of science.

Vital to the success of the program is a recognition of the distinction between scientific *information* and an *understanding* of science. The temptation is to treat science as a cornucopia of facts and to seek to share this bounty with all who are not yet so blessed. The urge is to try to publicize the findings of every discipline by making scientists available to the public via the lecture circuit, television, radio, pulpits, and every other medium known to man.

Unfortunately, there are sharp limits to the amount of information average citizens, even educated or professional persons, can absorb. And, even if each of them could somehow miraculously memorize all of the facts that science established, it would not necessarily increase their understanding of the scientific enterprise.

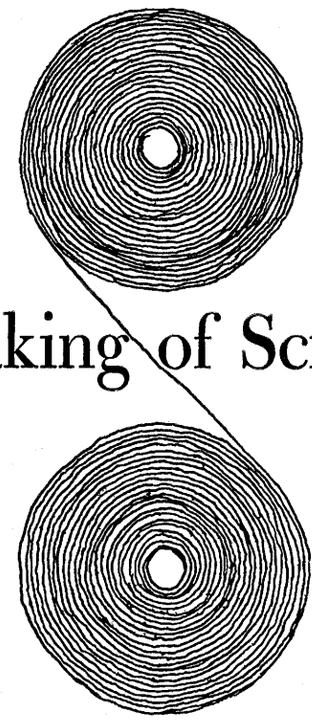
To understand science, one must learn to appreciate the value, validity, and vitality of an empirical-logical approach to the world. One must be willing to limit ideological, religious, and political considerations to questions of "ought to?" excluding "what is?" and to allow the inner logic of the scientific procedure to unfold. These normative considerations must be applied to questions of how the fruits of science are to be shared and the areas science ought to focus on, but not to how it is to be conducted.

To understand science, one must acquire a taste, or at least a tolerance, for the beauty of mathematical models, of the structure of galaxies or crystals, of DNA. One must appreciate the process itself—data that fall into place after years of analysis, finding the missing element that completes a table, predicting an event on the basis of careful calculations and a flash of insight—as an end in itself.

One must understand that the scientist, while not a rainmaker who can deliver solutions to specific problems on short order, nevertheless addresses himself to relevant problems of the day—that, in ways difficult to specifically foresee and almost impossible to control, scientific efforts do "pay off" and are not just idle games. The public must learn that scientific findings are always tentative and may prove erroneous or obsolescent, but that their tentative guide is more valid and safe than any other approach to the world.

To advance this understanding, especially in the face of renewed hostility and suspicion of science—some of it limited to small counterculture groups, some widely shared by middle America—will require all the ingenuity that the AAAS board, staff, and Committee on the Public Understanding of Science can muster. Misconceptions, anxiety, and paranoia rarely retreat when merely bombarded with facts, and new appreciation is rarely cultivated by mere sharing of information. This is the task the AAAS has now undertaken and one in which all its members may wish to share, seeking effective means to broaden and deepen this appreciation of science and becoming involved in activities aimed at advancing public education. The future of science in America may well depend on this effort.—AMITAI ETZIONAL, *member, Committee on the Public Understanding of Science, and Director, Center for Policy Research, 475 Riverside Drive, New York 10027*

Conversations With Outstanding Scientists



Speaking of Science

The American Association for the Advancement of Science is pleased to announce a new educational resource for libraries and teachers of science. This provocative audiotape series should also be of interest to the general public and to scientists who want to remain up-to-date on advances being made in other fields of science.

The first offering in this continuing series features 12 informal conversations with more than 20 of America's leading scientists. These well-known men and women of science discuss The Mars Probe, Evolution and the Descent of Man, Advances in the Physical Sciences, Advances in Astronomy, Peace, and seven other timely and important subjects.

The 12 recordings are on six cassettes (one complete 30-minute conversation on each side) for playback on standard machines. They are packaged in a compact binder that will fit easily into a bookshelf.

The conversations are narrated by Mr. Edward Edelson, science writer for the *New York Daily News,* and Mr. Mitchell Krauss of *WNET-TV* in New York.

You are invited to purchase this new AAAS educational service at the low price of **$39.95**—AAAS member's price **$34.95.**

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Dr. Herbert Gursky
(with Mitchell Krauss and Edward Edelson)

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(with Edward Edelson)

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