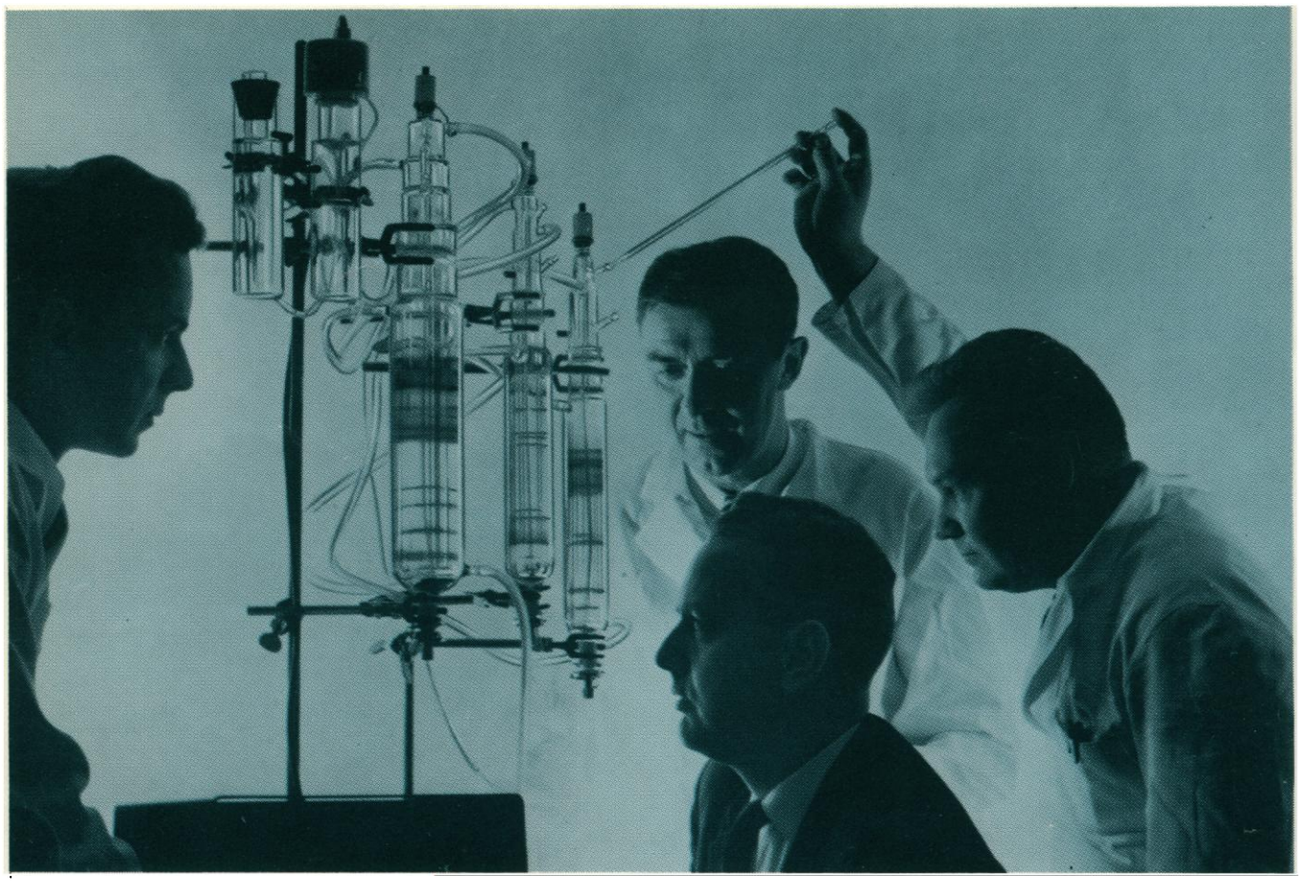
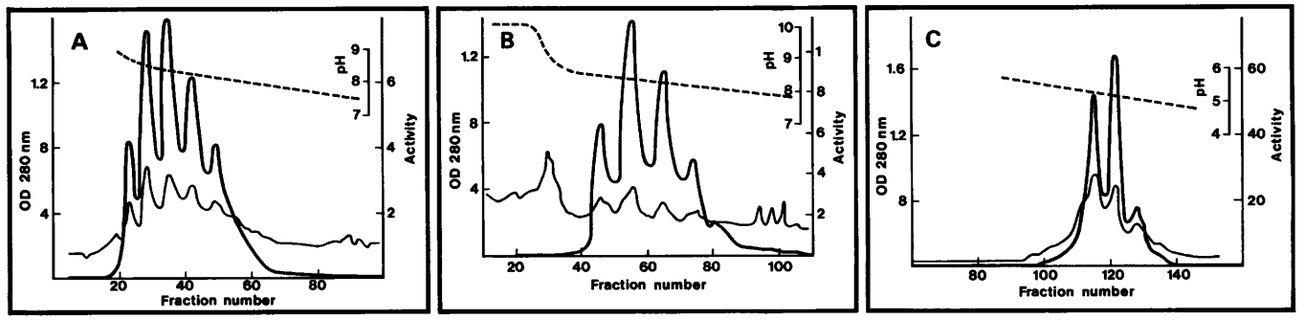
SCIENCE

28 May 1971

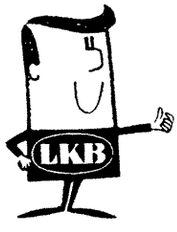
Vol. 172, No. 3986

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





* *(Walter A. Susor, Marion Kochman and William J. Rutter, SCIENCE, Vol 165, pp 1260—1262, 19 Sept. 1969. Copyright 1969 by American Assn. for the Advancement of Science.)*



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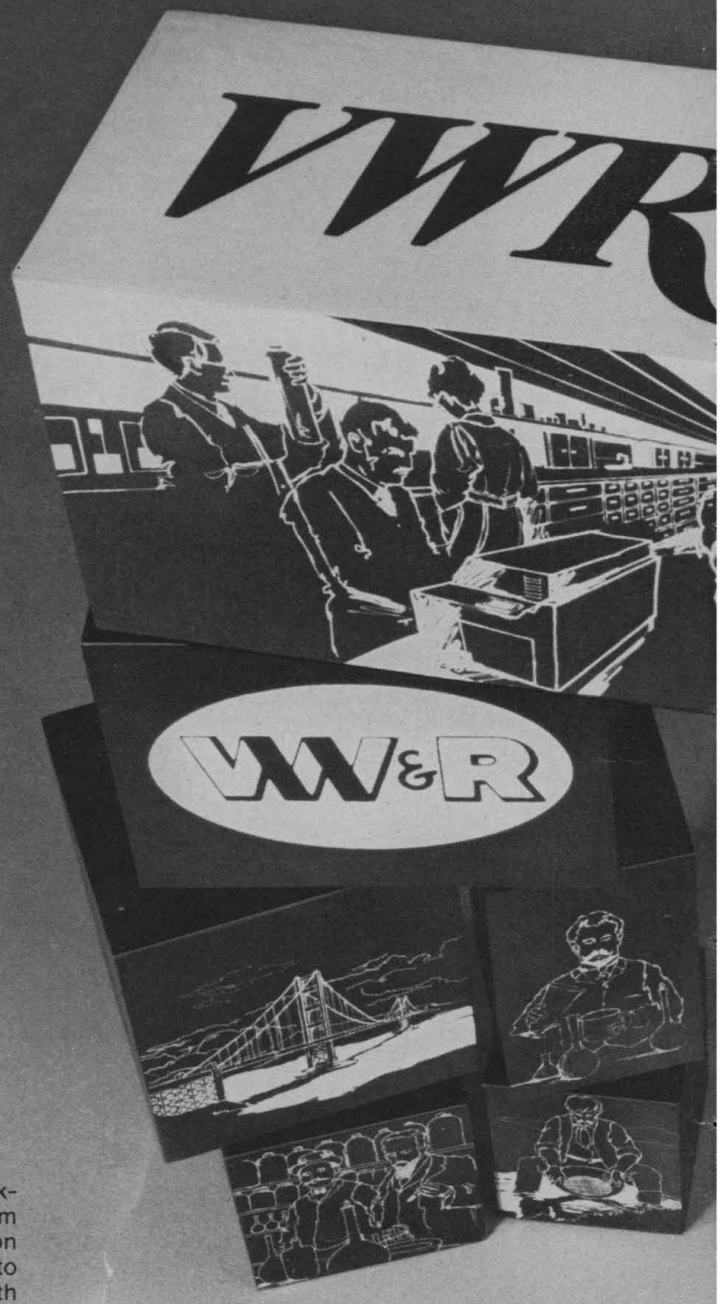
Measurements made at widely diverse locations show that there is a high degree of supersaturation of carbon monoxide in rainwater relative to the partial pressure of the gas in the atmosphere. These results indicate the possible existence of an additional natural source of carbon monoxide. See page 943. [U.S. Department of Agriculture]



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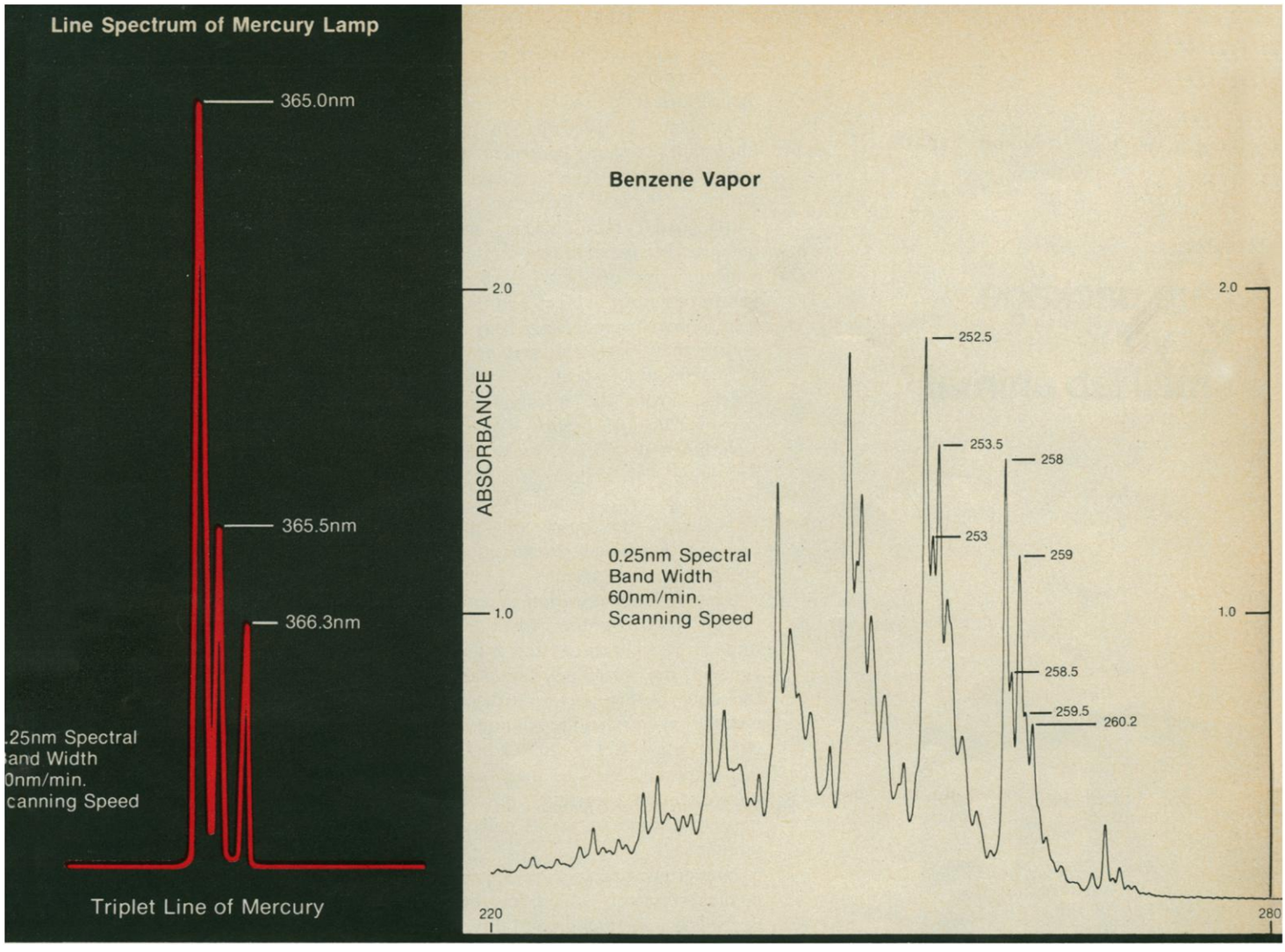

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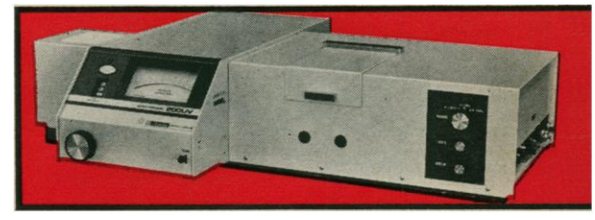

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must be replaced by active participation on a permanent basis by scientific organizations supported by their members.

This lack of participation by many important scientific organizations has arisen from the beliefs of many individual scientists that politics are "dirty," and "pure" science needs no defense. Many scientists also have no understanding of the vital role of organized groups ("lobbies") in the American political processes. They do not realize that special interest groups are a fundamental aspect of political decisions. From the information, often provided by such groups, Congress and governmental officials make the final decisions. The system fails when important groups do not present their viewpoints and point out fallacies, omissions, and consequences of proposals by other groups.

Some of the opposition to active participation by scientists arises from the implicit acceptance of the mouse trap concept: the world will find its way to the door of the person with the best mousetrap! In scientific relations this belief becomes, "If I do good work, it will be automatically accepted and supported." Unfortunately, this concept has no relation to sound and political realities.

Numerous attacks have appeared on medical research which has been described as a distraction and impediment for good medical teaching and health care. Yet, a very excellent basis exists to show that federal support for medical research has greatly improved teaching and medical care in the past two decades despite some minor abuses. Handler points out some of these benefits, but the scientific community must continually and extensively answer such criticisms on a regular basis. With only one side presented, how can congressmen make rational decisions?

The subject is too extensive to present adequately here, but one more example can be cited. The adviser to the President on scientific affairs, Edward David, Jr., in a letter to the *New York Times* (16 Dec. 1970) and in later news releases stated that the present administration has treated science better than previous ones. His facts may be basically correct, but they neglect the situation that the fields of support are being drastically shifted. Large bodies of scientists and engineers cannot be moved from one specialty to another except over long periods of time and with great losses of time and money. Highly trained molecular biologists, for

example, cannot be transferred to work on environmental control or improvements in mass transportation despite the ease with which an item in a budget can be transferred from one category to another. On these bases alone, I believe that it can be shown that through inflation and the transfer of funds from the established basic science fields, the future for science has even more dismal prospects.

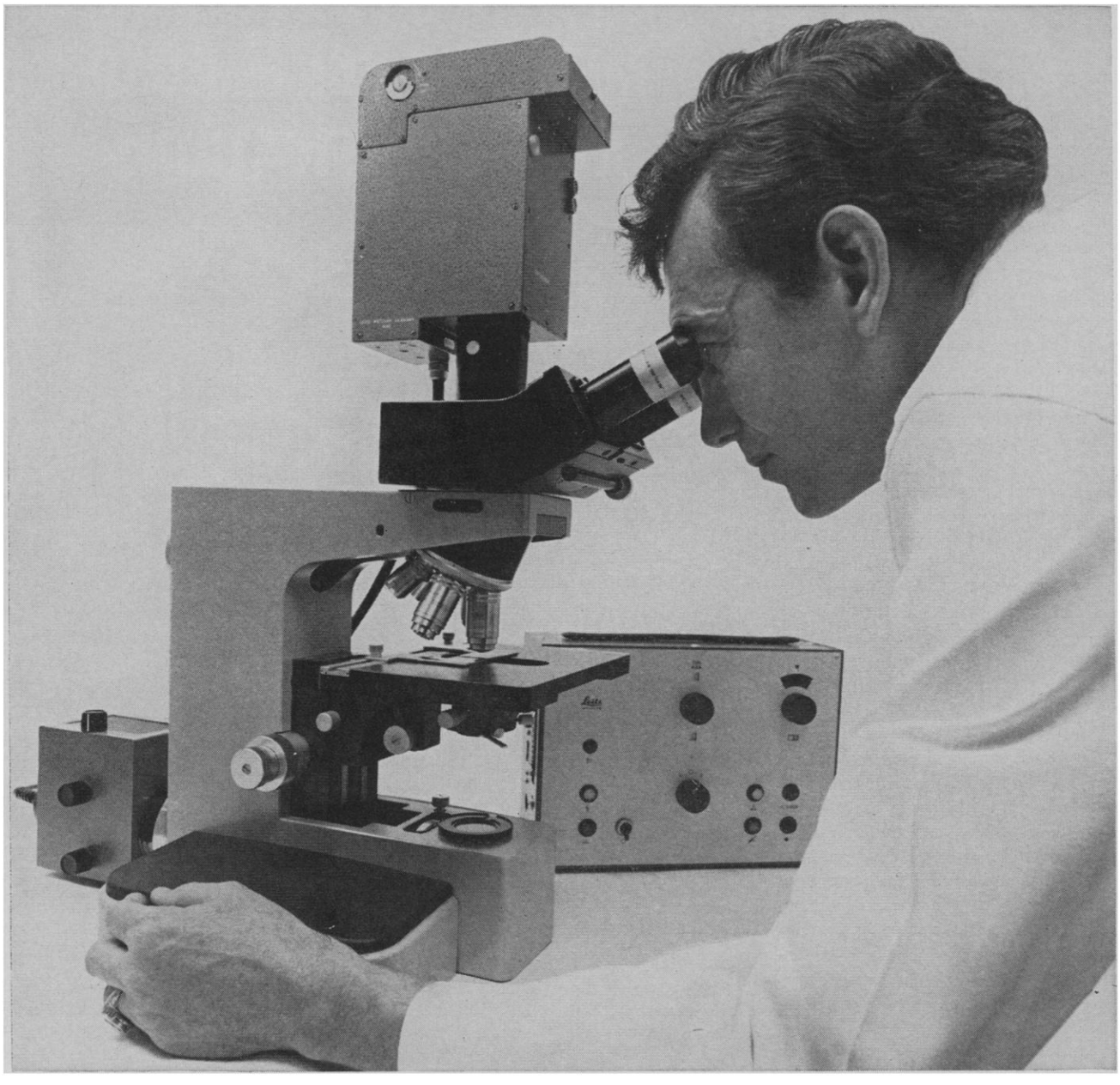
My suggestion, certainly not a new one, is that the major scientific societies be encouraged to establish committees on public relations. These committees should have as their functions: (i) close liaison with congressional committees and executive departments; (ii) establishment of arrangements for qualified persons to testify at hearings before congressional committees and the Office of the Science Adviser to the President; (iii) arrangements to answer unjustified attacks on science; (iv) the assembly and dissemination of information as to the current status of science in the various fields and the possibilities of immediate applications; and (v) the organization of many local subcommittees.

The last function is the most radical proposal but would greatly expand the effects of national committees. Such committees could provide the national committees with information about local effects of legislation and the executive measures. More importantly, as official bodies, their contacts with individual congressmen and local officials would be greatly more effective than action by individuals, and their press releases would be accepted much more readily.

A number of scientific societies are carrying out some of these functions, but their actions need active encouragement by their membership and expansion. The possibilities of science for the improvement of mankind, and the needs of a healthy scientific effort must be emphasized. No single "voice for science" can exist but a host of "voices" at national and local levels from all scientific organizations are needed to represent the diverse needs, opinions, and possibilities of the various branches of basic and applied science. Only through such efforts on a wide scale can the call for assistance by Philip Handler be answered adequately by the scientific community.

WARD PIGMAN

Department of Biochemistry,
New York Medical College,
New York 10029



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28 May 1971, Volume 172, Number 3986 **SCIENCE**

One Objective for Science Teaching

Since coming to Washington and seeing at firsthand some of the problems of matching science to society, I have become concerned that public expectations of spectacular achievements are far greater than science and technology can produce. I see in the newspapers and hear from many of my lay friends that, if we can accomplish successfully the Apollo missions, we should be able to clean up the environment, provide adequate mass transportation, increase the availability of health care, and so on. Logically, such statements are non sequiturs, and yet they do have a certain amount of popular appeal. As a result of the remarkable accomplishments of science and technology there has arisen a general feeling that scientists and engineers can accomplish anything when they put their minds to it. Going to the moon seems, superficially at least, far more difficult and certainly more exotic than maintaining the biological oxygen demand at a reasonable level in the Potomac River.

Science and engineering are not omnipotent. There are several reasons why this is so. First, technology cannot violate the laws of nature. For example, we cannot build a perpetual motion machine because the first law of thermodynamics would be violated.

Second, a different constraint on science and technology is the so-called state-of-the-art. Deriving electric power from nuclear fusion sources would violate no law of nature, but such an achievement is beyond the state-of-the-art at the present time. Man can tailor the world to his liking only to a partial degree. Only certain pathways are open. Man and his society can pick only the best of those available, and none may be entirely palatable to all segments of society.

A third limitation on science and technology arises from economic, political, and legal constraints. It is generally conceded that satellite systems on the domestic scene would be useful and might solve important problems in communications. However, the country does not have domestic communication satellites, principally because the associated sociopolitical problems have not been solved.

Thus, science is constrained by the laws of nature, by the state-of-the-art at any given time, and by the structures of our society and our legal system. This deceptively simple statement is too often ignored by the public. In my view, the most important objective of science education is to make future generations aware of the real nature of the scientific and technological enterprise in just this sense.

What principles do we have which can accomplish this educational objective for science education? I believe that these subtleties can only be communicated through an experience with reality. This is a familiar viewpoint in teaching physics and chemistry where experimentation has long been an essential part of courses. One possible approach is to make available to the general student firsthand experience with a digital computer. A general purpose computer can theoretically solve any problem that is, in the language of automata theory, computable. Thus, the ambitions that the student may develop, or indeed that society may develop, for computer applications are essentially unlimited. However, before any one application can be brought to fruition, it must be reduced to a sequence of explicit steps that form the computer program. It is the discipline of reducing desires and ambitions to explicit operations that is missing in the lay concept of science and technology. The digital computer could be used for communicating that idea to the general student. Few experiences are as educational as finding that one's ideas must be made concrete lest they become ephemeral.—EDWARD E. DAVID, JR.

Dr. David is science adviser to President Nixon. This editorial is adapted from a talk given on 27 March 1971 at the 19th annual convention of the National Science Teachers Association during a symposium on the national assessment of educational progress.

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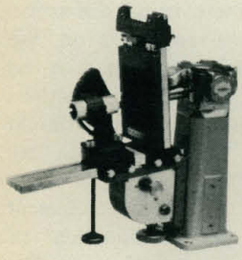
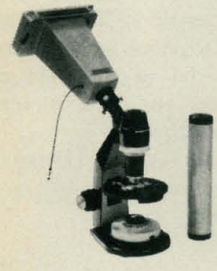
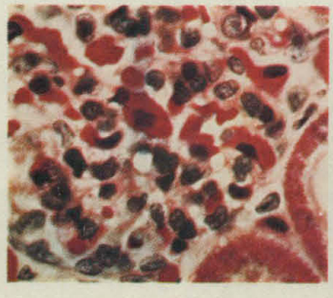


XR-7 FOR X-RAY CRYSTALLOGRAPHY

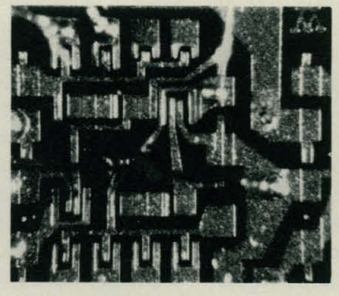
Diffraction pattern, sapphire



ED-10 FOR PHOTOMICROSCOPY

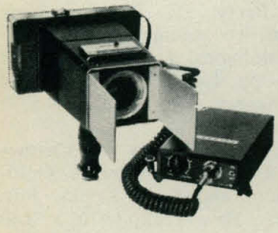


Section, mouse kidney, 1000x



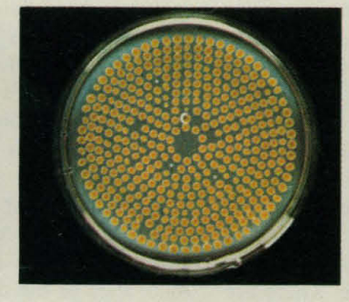
Integrated circuit, 80x

Pinus leaf section, 100x

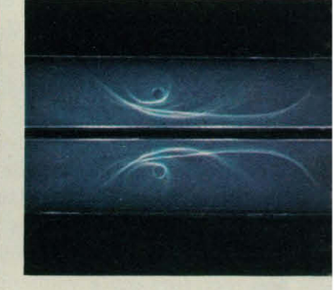


CU-5 FOR CLOSE-UPS

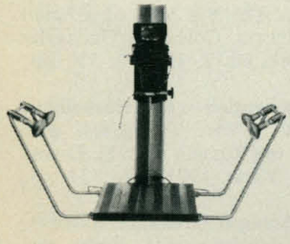
Clinical dental record



Macrophotograph, bacteria colonies



Immunoelectrophoresis



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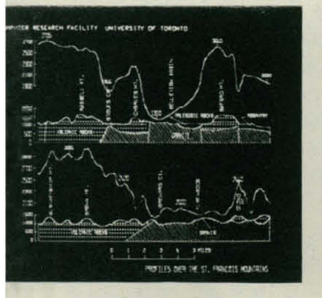
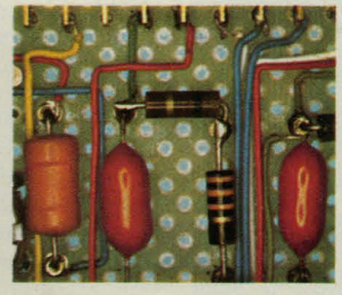
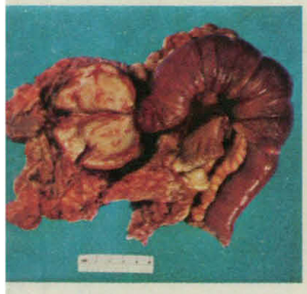


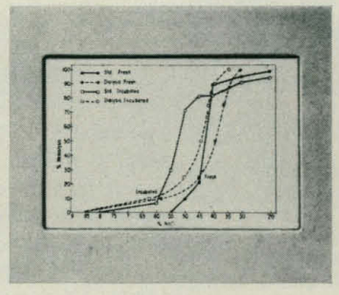
rd copy, computer terminal display



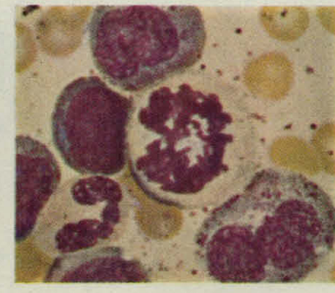
Electronic components



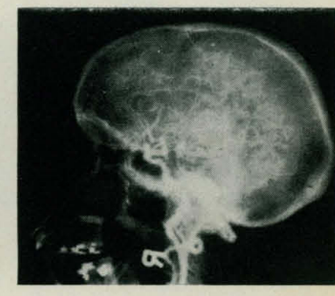
ss specimen, intestinal fibroma



Graph for presentation, 35mm



Human leukemia, 1600x



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BOOKS RECEIVED

(*Continued from page 933*)

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