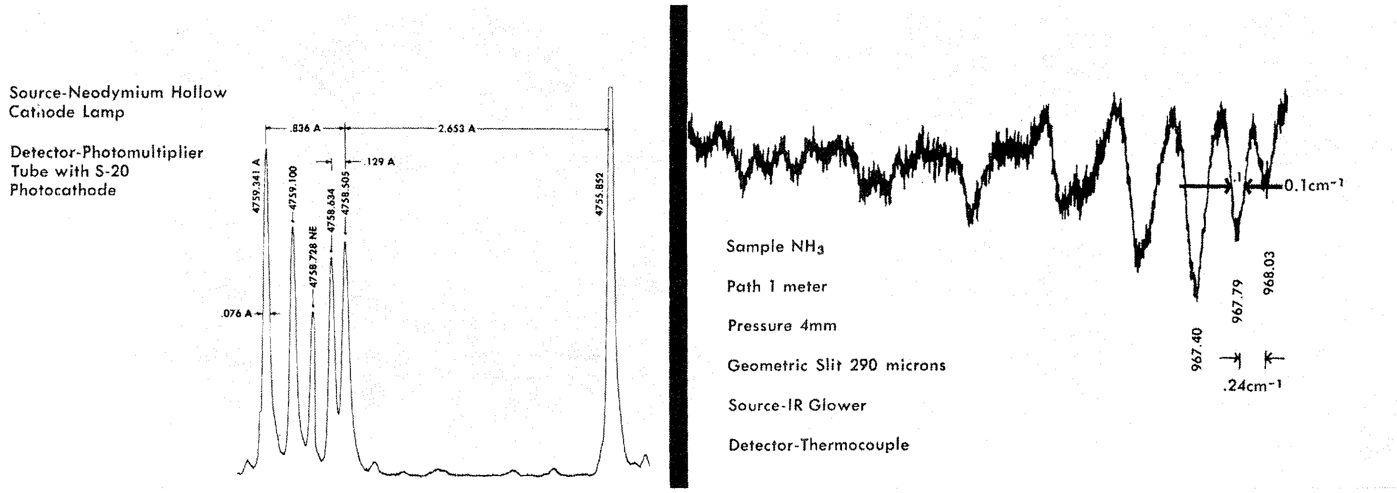
SCIENCE

1 September 1967

Vol. 157, No. 3792

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Resolution of the Model E-1 monochromator in the double-pass mode is demonstrated in the two spectra shown here. At left, in the visible region, the half-band width of neodymium at 4759.341A is observed as .076A. At right, an infrared scan of NH_3 demonstrates a half-band width of 0.1 cm^{-1}.

THE E-1 MONOCHROMATOR

HEART OF A NEW SPECTROMETER SERIES FROM PERKIN-ELMER

The E-1 is the nucleus of a whole new series of building-block spectrometers. It covers the UV to mid-IR range from 200 mμ to 40 μ using 7 interchangeable gratings. No effort was spared to make it the most advanced monochromator/spectrometer you can buy.

The Ebert system of mounting was selected to give maximum resolution and light-gathering power, and yet maintain a compact size. Resolution at 5000 A is at least 0.1 A. Each grating is used only in the first order, eliminating the possibility of double diffraction and simplifying filtering. Gratings are so precisely mounted that there is no need for indexing or alignment upon interchange.

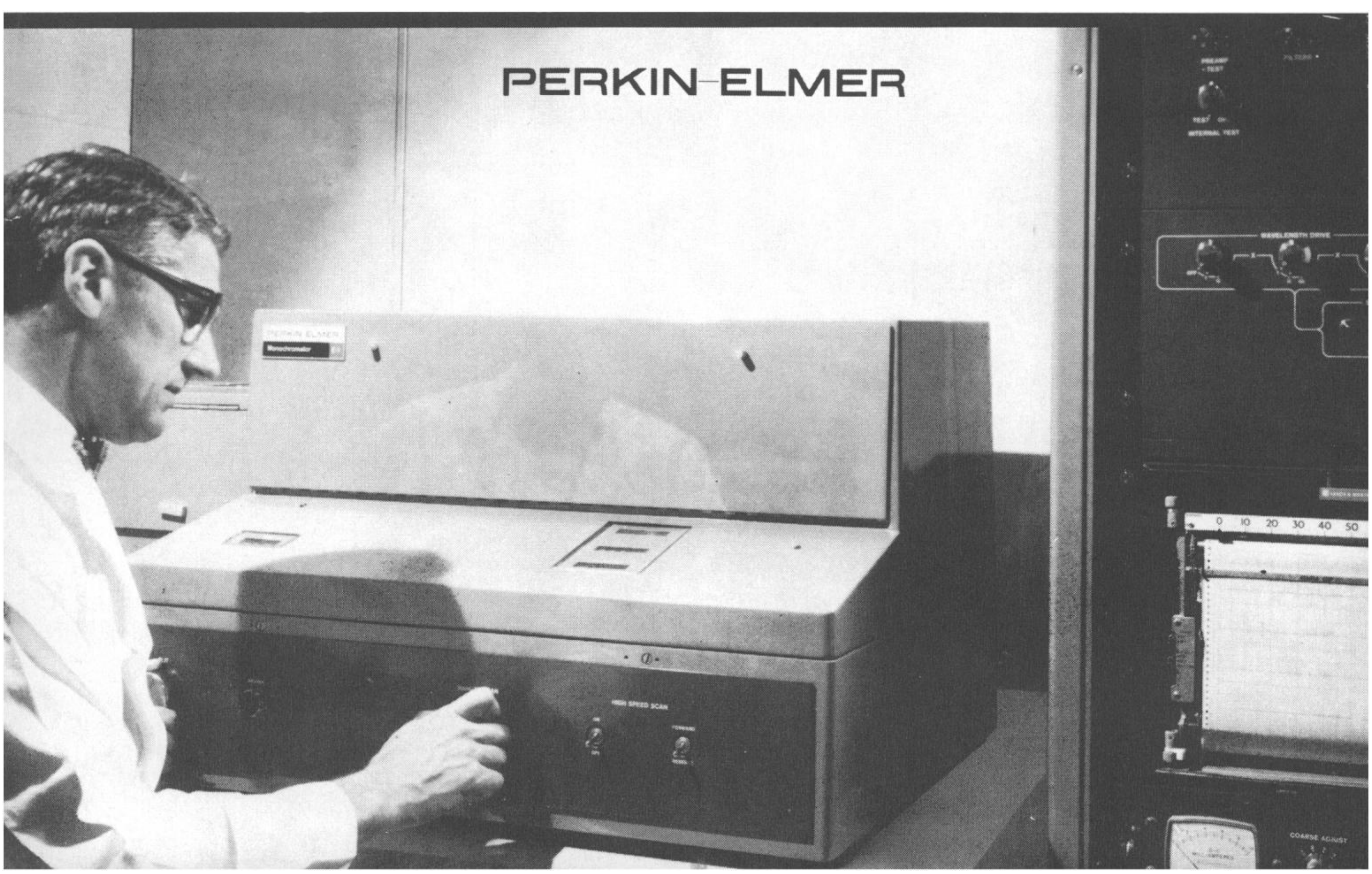
Abscissa presentation is linear in wavelength and is extremely precise. To achieve this, we developed a barrel cam to form a spiraling sine function. Wavelength accuracy is one part in 10,000 absolute: you can read wavelength to five significant figures.

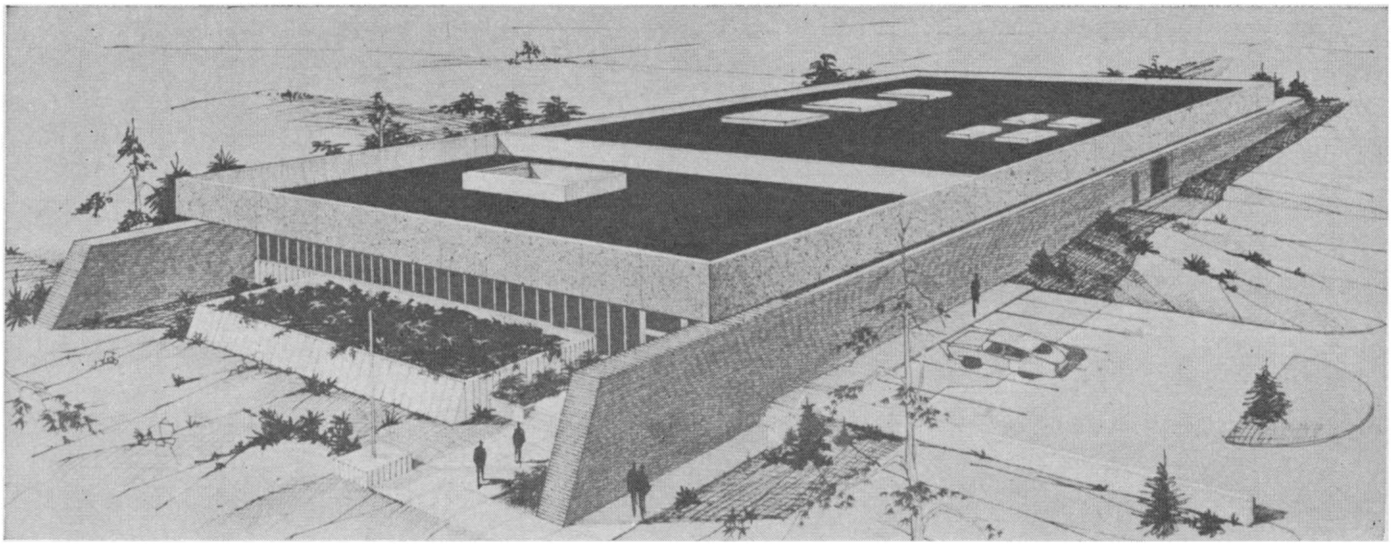
You can select either single or double-pass optical path, the latter doubling dispersion. In double-pass operation, the stray light is reduced to a minimum. You can also elect to chop internally or externally at various chopping frequencies.

The automatic wavelength drive accessory is designed to give a wide dynamic range of scanning speeds, so that you can take full advantage of its inherent high resolution and still survey at high speeds. Electronics are solid-state. All power supplies, amplifier, wavelength drive control and recorder are rack mounted. The optical bench accepts standard triangular rail components.

You can buy the Model E-1 as a simple, manually operated monochromator or as part of a complete high-performance spectrometer. We supply four standard integrated systems: E-11. UV-VIS from 2000A to 1μ. E-12. NIR from 1 to 2.5μ. E-13. Mid-IR from 2 to 40μ. E-14. The entire range from 2000A to 40 μ.

For details, contact your local Perkin-Elmer representative or write to Instrument Division, Perkin-Elmer Corporation, 723 Main Avenue, Norwalk, Connecticut 06852.





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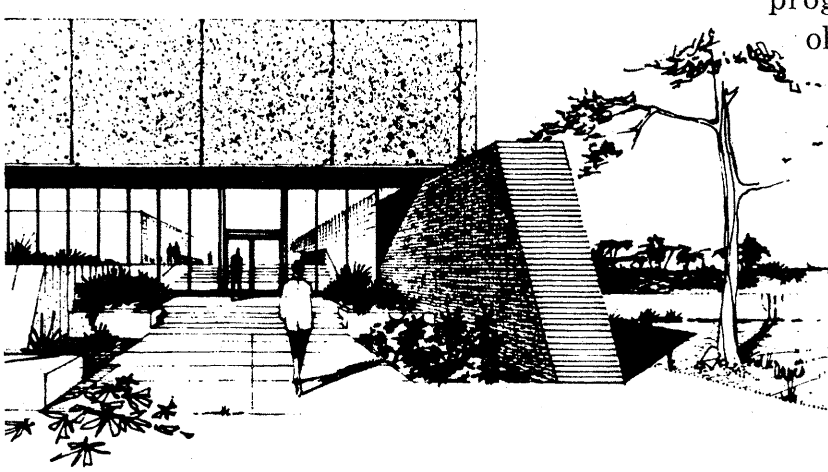

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1 September 1967
Vol. 157, No. 3792

SCIENCE

SCIENCE is published weekly on Friday and on the fourth Tuesday in November by the American Association for the Advancement of Science, 1515 Massachusetts Ave., Washington, D.C. 20005. Now combined with **The Scientific Monthly**®. Second-class postage paid at Washington, D.C. Annual subscriptions $8.50; foreign postage, $1.50; Canadian **postage**, 75¢; single copies, **50¢** (back issues, $1), except **Guide to Scientific In ments**, which is $2. School year **subscriptions: 9 months**, $7, 10 months, $7.50. Provide 4 weeks' notice for change of address, giving new and old address and zip cc Send a recent address label. **SCIENCE is indexed in the Reader's Guide to Periodical Literature.**

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

he American Association for the Advancement of Science was founded in 1848 and incorporated in 874. Its objects are to further the work of scientists, to facilitate cooperation among them, to nprove the effectiveness of science in the promotion of human welfare, and to increase public undertanding and appreciation of the importance and promise of the methods of science in human progress.

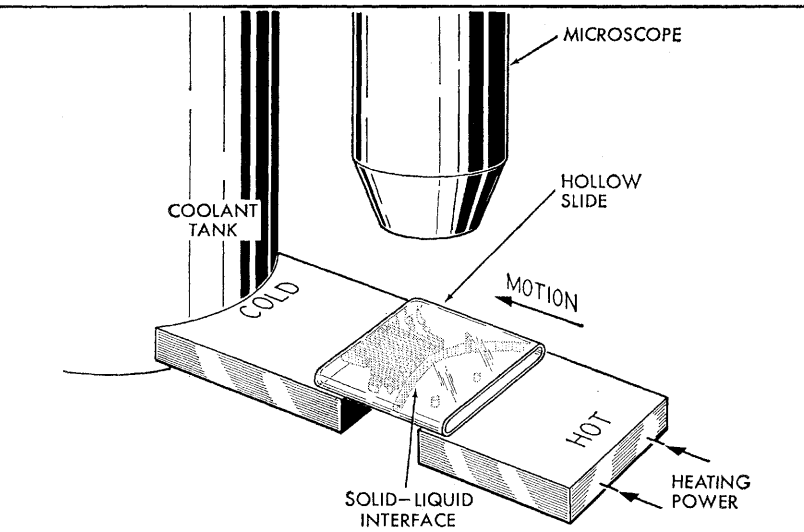
COVER

One of the first two fossil worker ants known to be of Mesozoic age. The two specimens, preserved in amber originating from the Magotthy formation of New Jersey, have been dated to the lower part of the Upper Cretaceous, approximately 100 million years old. This species has been given the name *Sphecomyrma freyi*; it constitutes a new subfamily linking the ants with the nonsocial wasps of the family Tiphiidae (about × 33). See page 1038 [Frank M. Carpenter, Museum of Comparative Zoology, Harvard University]

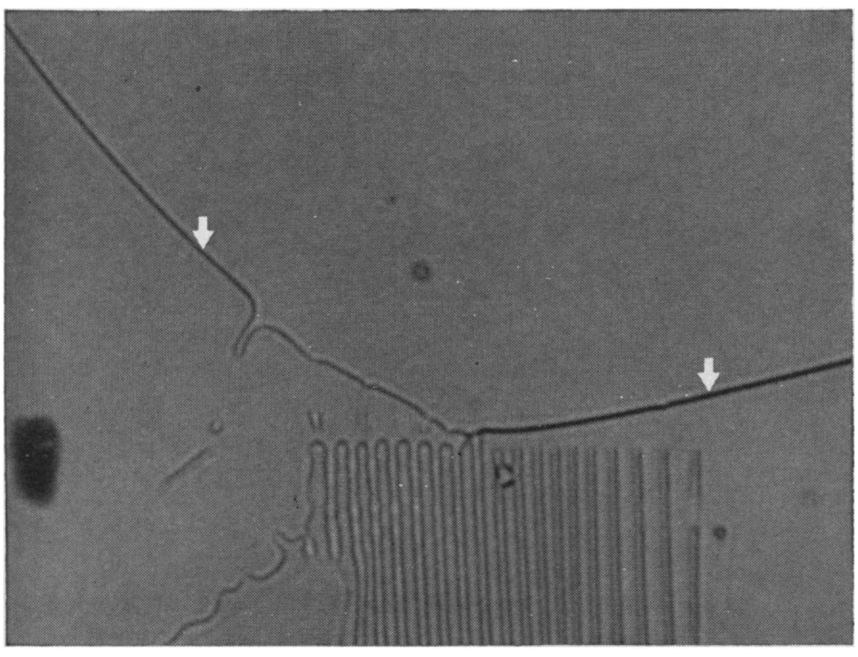
Report from

BELL LABORATORIES

Inside Solidifying Metals



Experimental setup in which photographs such as that below were taken. The glass slide or cell—containing a liquid which freezes like a metal—is placed between hot and cold blocks of brass. This produces a temperature difference along the slide. A solid-liquid interface then forms between the two blocks. By moving the slide toward the cold block at a constant rate, one can observe the steady growth of the crystal under the microscope.



Bell Laboratories' model (200x) permits physical simulation of a eutectic phase diagram for an alloy such as lead-tin. Diagram relates liquid proportions (horizontal scale) to temperature (vertical).

Two different liquids were put into a single slide . . . hexachloroethane on the left and carbon tetrabromide on the right. After a brief period, the liquids formed a graded mixture, from 100% of one at the left to 100% of the other at the right. The mixture was partially frozen, then photographed with the slide stationary. The solid-liquid interface (arrows) then showed the freezing point for every possible composition.

The "grid" under the solid-liquid interface is made up of alternate solid layers of the two chemicals (the eutectic region).

At Bell Telephone Laboratories, metallurgist Kenneth A. Jackson has devised transparent models of solidifying molten metals. With these models, we can now study what happens inside a metal as it freezes. This gives us a tool which promises to improve existing alloys and will perhaps help us find new and better ones.

The models are hollow microscope slides (diagram) containing such organic liquids as camphor or carbon tetrabromide. These compounds are among the few transparent substances whose molecules freeze without having to rotate into a specific orientation. Metal atoms act the same way, hence the similarity in freezing behavior.

Various modes of metal-crystal growth—planar, dendritic (tree-like branching) and cellular—have been studied in detail with this technique. Also, the solidification of alloys has been simulated (photo). To do this, liquids with freezing characteristics corresponding to those of two metals are mixed and cooled. With this procedure, Jackson and J. D. Hunt (now at the University of Oxford) observed, for the first time, the process by which the "equiaxed" zone forms in alloy castings. This is a zone of relatively small crystals, usually found in the center of an alloy casting. The new technique shows that the equiaxed zone results from "branches" melted from dendritic crystals. As the alloy cools, freezing begins at the outer surface, producing dendrites which project inward toward the hotter, liquid center. Branches, melted from these growing dendrites, are carried to the center of the casting to form the crystals of the equiaxed zone.

Until now, the only methods for studying metal freezing were laborious... cutting, polishing and etching, for instance. The new technique is not only simpler but also reveals hitherto unknown details of crystal growth.

be why Heltne didn't see any.) Nature-conscious visitors to Amazonia have always noticed the relative paucity of mammal life. It is inaccurate to blame this on exploitation by humans.

Also, I find it difficult to believe that human exploitation has had any appreciable effect on the great Amazon rain forest. First, native agricultural deforestation always covers such small areas that the natives are able to extract only marginal existence from them. Second, only a fraction of the rain forest has commercial value. With few exceptions, lumbermen cut a tree here and another there, and always near a waterway. Third, even during a brief visit to Amazonia, Heltne must have developed an awareness of the extent of the virgin forest. Hour after hour the airborne traveler observes towering green forest as far as the eye can see in every direction with no visible signs of human exploitation—or even habitation. It's an awesome spectacle.

It will be a long, long time before man destroys the Amazon rain forest, but it *is* conceivable that species of animals might be eliminated from substantial portions of this earth's largest remaining untouched area.

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Groping through Spoken English

The columns of *Science* often contain expressions of concern about the inadequacy of the writing found in scientific papers. In this country, however, scientific communication is largely made through the spoken word in lectures and talks at meetings and symposia. The language employed for these presentations is almost invariably Ah-ah-ese. I propose a return to the use of English. This radical suggestion is prompted by my recent experience at a symposium in Paris where many papers were delivered in French. Through a fortunate circumstance in my childhood, I understand French as well as I do English. The speakers varied in eloquence, clarity, and audibility, but every talk possessed a quality of smoothness and directness whose origin I was unable at first to identify. Eventually it became trivially simple: every sound uttered by a speaker was part of a French word. What a contrast with scientific meetings in this country! I await the day when an unusually honest speaker of Ah-ah-ese will begin his talk with: "A-a-a-UMM! The ah insignificance of my ah remarks will-uh be-ah minimized, or er-er concealed, by the ahah braying noises I am ahahah emitting." The speakers in Paris convinced me that we too could speak our native tongue without groping around for every other word and moaning dismally as we search. Some of us may be too old to alter our ways. But at least we can persuade our students to cut out the noise, pronounce nothing but English words, and remain silent during the birth pangs of the next inspired phrase.

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Painfully Slow Medical Progress

Sabin's article, "Collaboration for accelerating progress in medical research" (23 June, p. 1568), appeals strongly to this layman who has been observing painfully slow progress in one area where collaboration and coordination could yield a quick, important payoff—the area of artificial internal organs in general, and artificial kidneys in particular. Though originally a temporary expedient, the kidney machine is now the only practical means of treating chronic uremia. Its cost of $10,000 per year has been prohibitive and, despite available technology, 15 years elapsed before these costs were reduced. Now a unit designed for periodic home hemodialyses has been made available to 25 patients under an experimental program. It is expected to reduce costs by a factor of five—a result of collaboration by physicians, chemists, engineers, and others. This is a major step forward, but its use still requires extensive training of patients and family physicians. The next obvious objective is continuous dialysis with simple equipment portable on the patient, thus obviating problems of intermittent, high-volume flow adopted for emergency use. But without coordinated collaboration, guided by NIH or others, another 15 years can pass before this is achieved even though it may today be within the "state of the art."

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1 September 1967, Volume 157, Number 3792

SCIENCE

Forecasting Future Developments

Many of the nation's current domestic problems were visible a decade or more ago, and their gradual growth was obvious years before they were accorded serious political status. For instance, there were warning signals of the increasing menace of air pollution. There was the tragic incident at Donora and the annoying smog in Los Angeles. Consumption of fuel in electric plants, process industries, and automobiles was expanding so steadily as to guarantee the emergence of a nationwide problem. Yet little was done to encourage development of better automobile engines or sulfur-free fuels. Even so fundamental a matter as the toxicity of pollutant gases was not thoroughly investigated. The American style seems to be to allow problems to grow to menacing proportions before tackling them. Then the action takes the form of an ill-considered "crash" program. While it is undesirable to make inflexible plans concerning most aspects of the future, some problems involving long lead times cannot be dealt with effectively on a crash basis. Thus, there is a need for a clearer view of the future. In some respects the crystal ball is opaque. However, in other areas there are trends that are likely to persist.

The challenge of seeking to foresee long-term major developments has not been neglected. There have been major studies in France, Britain, and the United States. A recent issue of *Dædalus,** the publication of the American Academy of Arts and Sciences, records initial efforts of the Academy's Commission on the Year 2000. Daniel Bell, chairman of the group, describes the work of the Commission as "an effort to indicate now the future consequences of present-day public-policy decisions, to anticipate future problems, and to begin the design of alternative solutions so that our society has more options and can make a moral choice, rather than be constrained, as is so often the case when problems descend upon us unnoticed and demand an immediate response."

In discussing the future, even so distant a future as the Year 2000, Bell makes the point that our present-day decisions are already shaping it. He suggests that there are four sources of change in society that can be charted with differential ease. The first is technological change; an example is the increasing extent of applications of computers. The second is a continuing tendency toward "the diffusion of existing goods and privileges in society, whether they be tangible goods or social claims on the community." The third involves structural developments in society. In the past 30 years, the American political system has become more centralized. At the same time, the weight of the economy has shifted from the product sector to services. The fourth—important, but difficult to foresee—is the relationship of the United States to the rest of the world. During the past decades our lives have been greatly influenced by external forces, and this is likely to be true in the future.

Obviously we cannot solve today all the problems of the Year 2000, or even those of 1968. However, groups such as the Commission on the Year 2000 can serve important functions. They can provide early warning of problems, identify alternative solutions, and suggest goals for society. They remind us that "the future is what we make it."

—PHILIP H. ABELSON

* *Dædalus* **96**, No. 3 (1967).