

SCIENCE

1 September 1967

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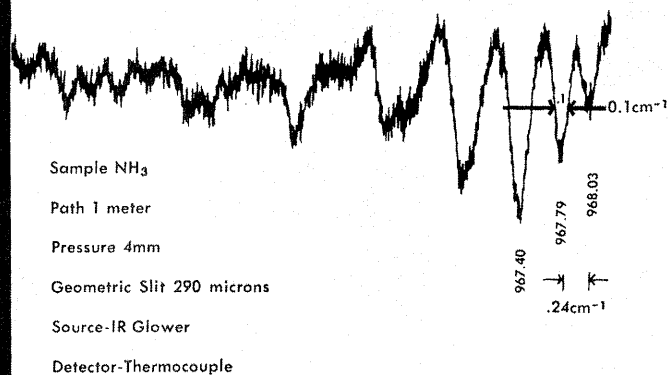
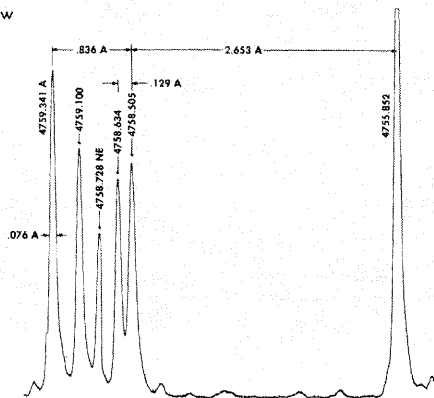
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Resolution of the Model E-1 monochromator in the double-pass mode is demonstrated in the two spectra shown here. At left, in the visible region, the half-band width of neodymium at 4759.341 Å is observed as .076 Å. At right, an infrared scan of NH_3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

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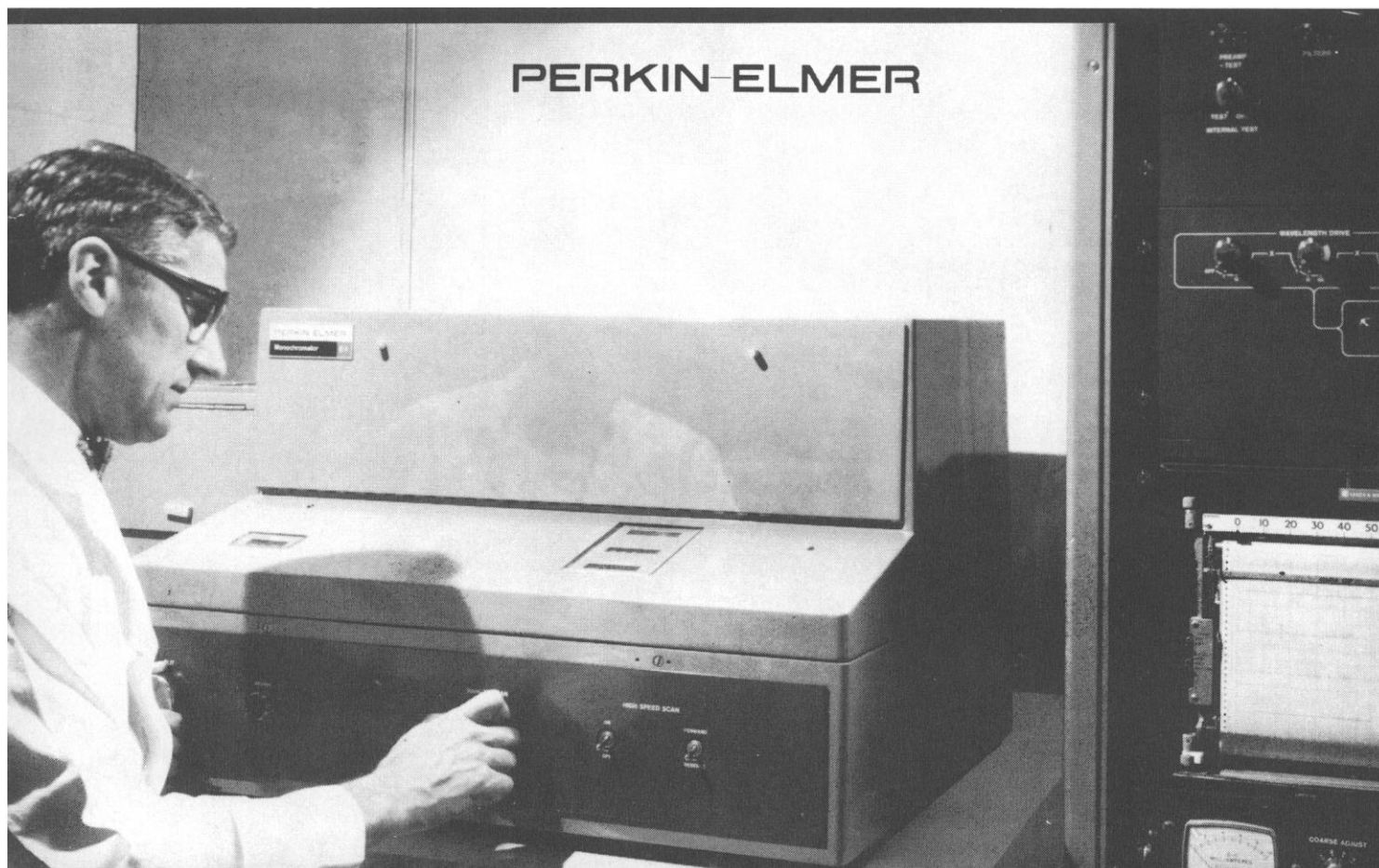
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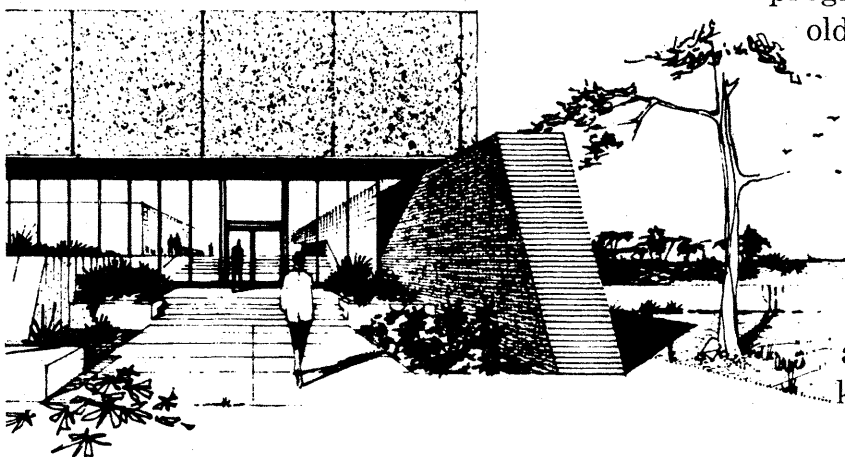


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SCIENCE

LETTERS	Distribution of the NSF Dollar: <i>H. J. Jerison</i> ; Amazonian Wildlife and Forests: <i>A. M. Fletcher</i> ; Groping through Spoken English; <i>G. C. McVittie</i> ; Painfully Slow Medical Progress: <i>L. C. Edie</i>	991
EDITORIAL	Forecasting Future Developments	995
ARTICLES	Chlorination of Unsaturated Compounds in Nonpolar Media: <i>M. L. Poutsma</i>	997
	Dietary Intake of Pesticide Chemicals: <i>R. E. Duggan</i> and <i>J. R. Weatherwax</i>	1006
	Scientific Communication as a Social System: <i>W. D. Garvey</i> and <i>B. C. Griffith</i>	1011
NEWS AND COMMENT	Civilian Technology: NASA Study Finds Little "Spin-off"	1016
	Air Pollution: The "Feds" Move To Abate Idaho Pulp Mill Stench	1018
	Copper Controversy: Conservationists Dig in for Kennecott Battle	1021
	Whales: Decline Continues Despite Limitations on Catch	1024
BOOK REVIEWS	<i>Reflections on Big Science</i> , reviewed by <i>R. E. Lapp</i> ; other reviews by <i>A. H. Dupree</i> ; <i>C. R. Noback</i> ; <i>D. Gottlieb</i> ; <i>E. P. Dozier</i> ; <i>W. J. Pierson, Jr.</i> ; <i>K. J. Ott</i> ; <i>K. L. Loening</i> ; <i>L. P. Williams</i> ; <i>A. V. Oppenheim</i> ; <i>M. K. Hubbert</i> ; <i>E. A. Ackerman</i>	1026
REPORTS	Paleozoic Sedimentary Rocks in Oaxaca, Mexico: <i>J. Pantoja-Alor</i> and <i>R. A. Robison</i>	1033
	Fossiliferous Bauxite in Glacial Drift, Martha's Vineyard, Massachusetts: <i>C. A. Kaye</i>	1035
	The First Mesozoic Ants: <i>E. O. Wilson</i> , <i>F. M. Carpenter</i> , <i>W. L. Brown, Jr.</i>	1038
	Perhydro- β -Carotene in the Green River Shale: <i>Sister M. T. J. Murphy</i> , <i>A. McCormick</i> , <i>G. Eglinton</i>	1040
	Algal Stromatolites: Use in Stratigraphic Correlation and Paleocurrent Determination: <i>P. Hoffman</i>	1043
	Sinkhole Formation by Groundwater Withdrawal: Far West Rand, South Africa: <i>R. M. Foose</i>	1045
	Echinoderm Calcite: Single Crystal or Polycrystalline Aggregate: <i>K. M. Towe</i>	1048

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Immunoglobulin Structure: Variation in Amino Acid Sequence and Length of Human Lambda Light Chains: <i>F. W. Putnam et al.</i>	1050
Eosinophilic Response in Glioblastoma Tissue Culture after Addition of Autologous Lymphocytes: <i>J. Cierniewicz and O. Kolar</i>	1054
Zeatin and Zeatin Riboside from a Mycorrhizal Fungus: <i>C. O. Miller</i>	1055
Induction of Drug-Metabolizing Enzymes in Liver Microsomes of Mice and Rats by Softwood Bedding: <i>E. S. Vesell</i>	1057
Bromophenols from Red Algae: <i>J. S. Craigie and D. E. Gruenig</i>	1058
Cytotoxic Effect of Lymphocyte-Antigen Interaction in Delayed Hypersensitivity: <i>N. H. Ruddie and B. H. Waksman</i>	1060
Inhibition of Lipolytic Action of Growth Hormone and Glucocorticoid by Ultraviolet and X-Radiation: <i>J. N. Fain</i>	1062
Herpes-Type Virus and Chromosome Marker in Normal Leukocytes after Growth with Irradiated Burkitt Cells: <i>W. Henle et al.</i>	1064
Virus-Induced Hydrocephalus: Development of Aqueductal Stenosis in Hamsters after Mumps Infection: <i>R. T. Johnson, K. P. Johnson, C. J. Edmonds</i>	1066
Enclosed Bark as a Pollen Trap: <i>D. P. Adam, C. W. Ferguson, V. C. LaMarch, Jr.</i> ...	1067
Viral Inhibition of Lymphocyte Response to Phytohemagglutinin: <i>J. R. Montgomery et al.</i>	1068
Gene Activation without Histone Acetylation in <i>Drosophila melanogaster</i> : <i>E. G. Ellgaard</i>	1070
Intracellular Olfactory Response of Hippocampal Neurons in Awake, Sitting Squirrel Monkeys: <i>T. Yokota, A. G. Reeves, P. D. MacLean</i>	1072
Somatosensory Thalamic Neurons: Effects of Cortical Depression: <i>H. J. Waller and S. M. Feldman</i>	1074
Lateral Hypothalamic Stimulation in Satiated Rats: The Rewarding Effects of Self-Induced Drinking: <i>J. Mendelson</i>	1077
Technical Comments: Hemoglobin F and Beta Thalassemia: <i>T. G. Gabuzda, D. G. Nathan, F. H. Gardner; M. Kreimer-Birnbaum and R. M. Bannerman</i> ; The Supernova of 1572: <i>C. M. Botley</i>	1079
MEETINGS INTERMAG: <i>R. F. Elfant</i> ; Thermal Addition to the Marine Environment: <i>J. B. Pearce</i>	1080

LINA S. REES THELSTAN F. SPILHAUS	H. BURR STEINBACH JOHN A. WHEELER	PAUL E. KLOPSTEG Treasurer	DAEL WOLFLE Executive Officer
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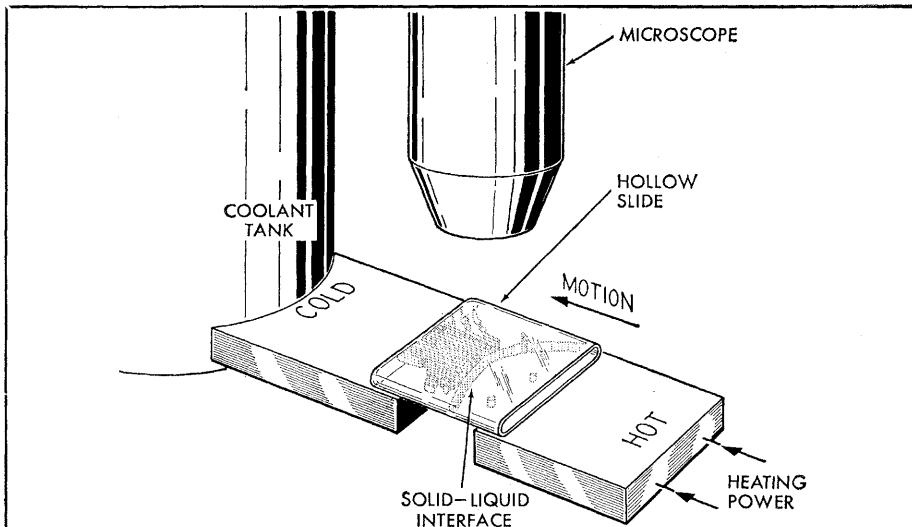
COVER

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 $\times 33$). See page 1038 [Frank M. Carpenter, Museum of Comparative Zoology, Harvard University]

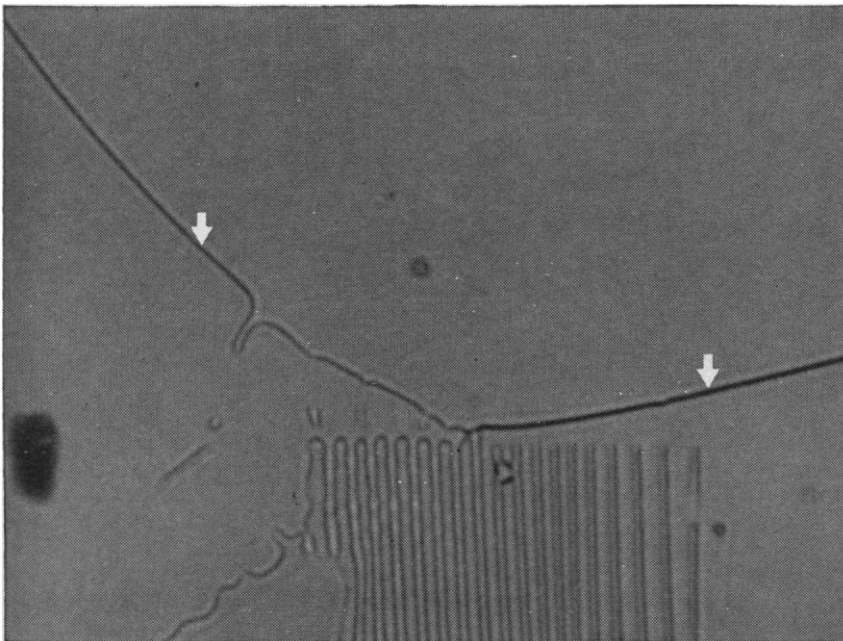
Report from

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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.



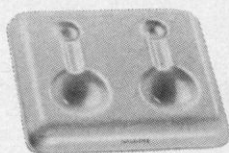
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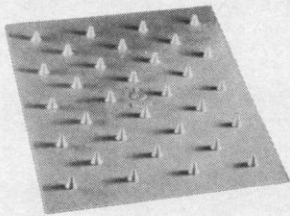
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be why Heltne didn't see any.) Nature-conscious visitors to Amazonia have always noticed the relative paucity of mammal life. It is inaccurate to blame this on exploitation by humans.

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.

ALAN MARK FLETCHER
*J. B. Lippincott Company,
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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 con-

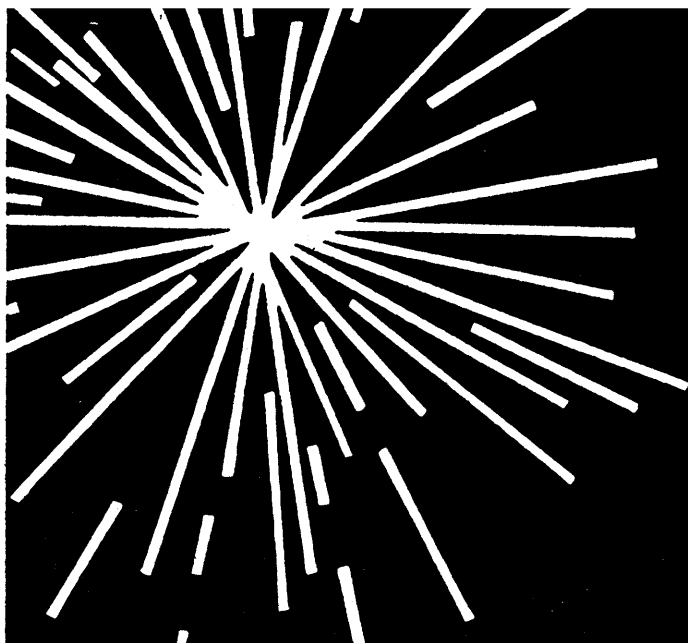
trast with scientific meetings in this country! I await the day when an unusually honest speaker of Ah-ah-ese will begin his talk with: "A-a-a-UMM! The ah insignificance of my ah remarks will-uh be-ah minimized, or er-er concealed, by the ahah braying noises I am ahahah emitting." The speakers in Paris 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.

G. C. McVITTIE
*University of Illinois Observatory,
Urbana 61801*

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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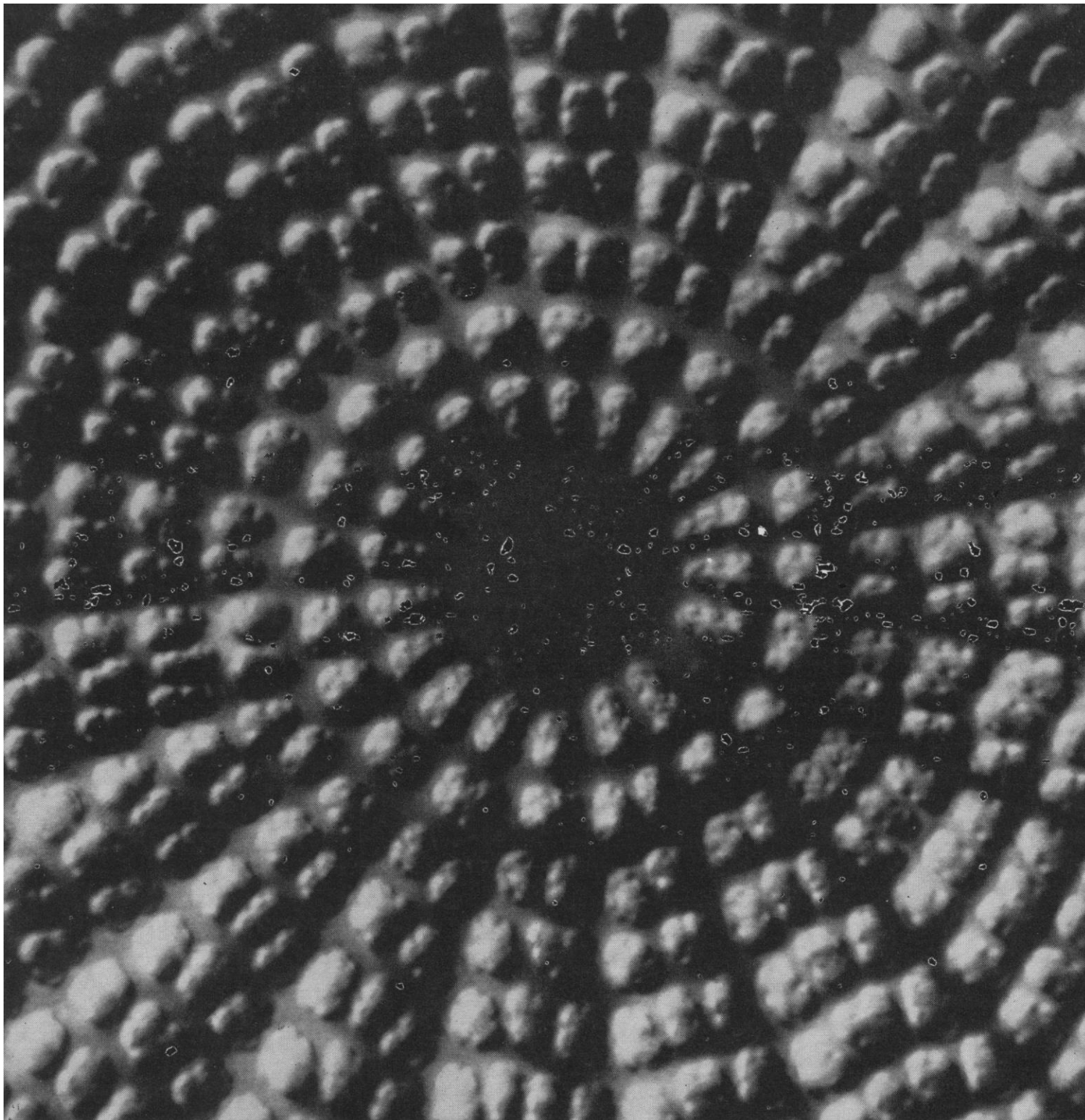
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Forecasting Future Developments

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).

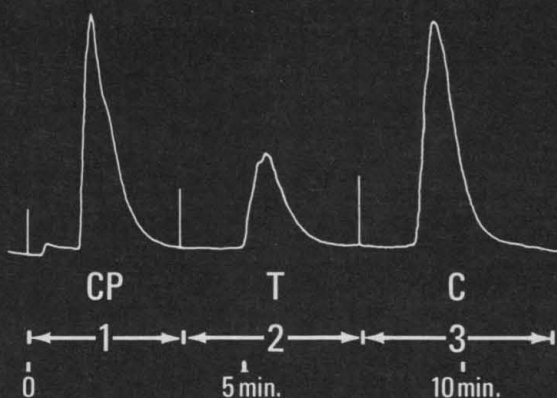
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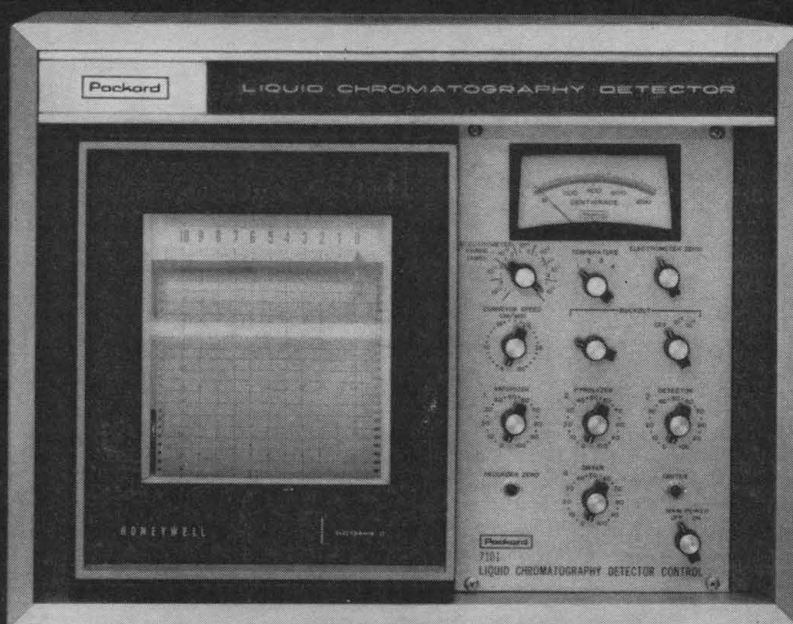
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