# SCIENCE

24 December 1965

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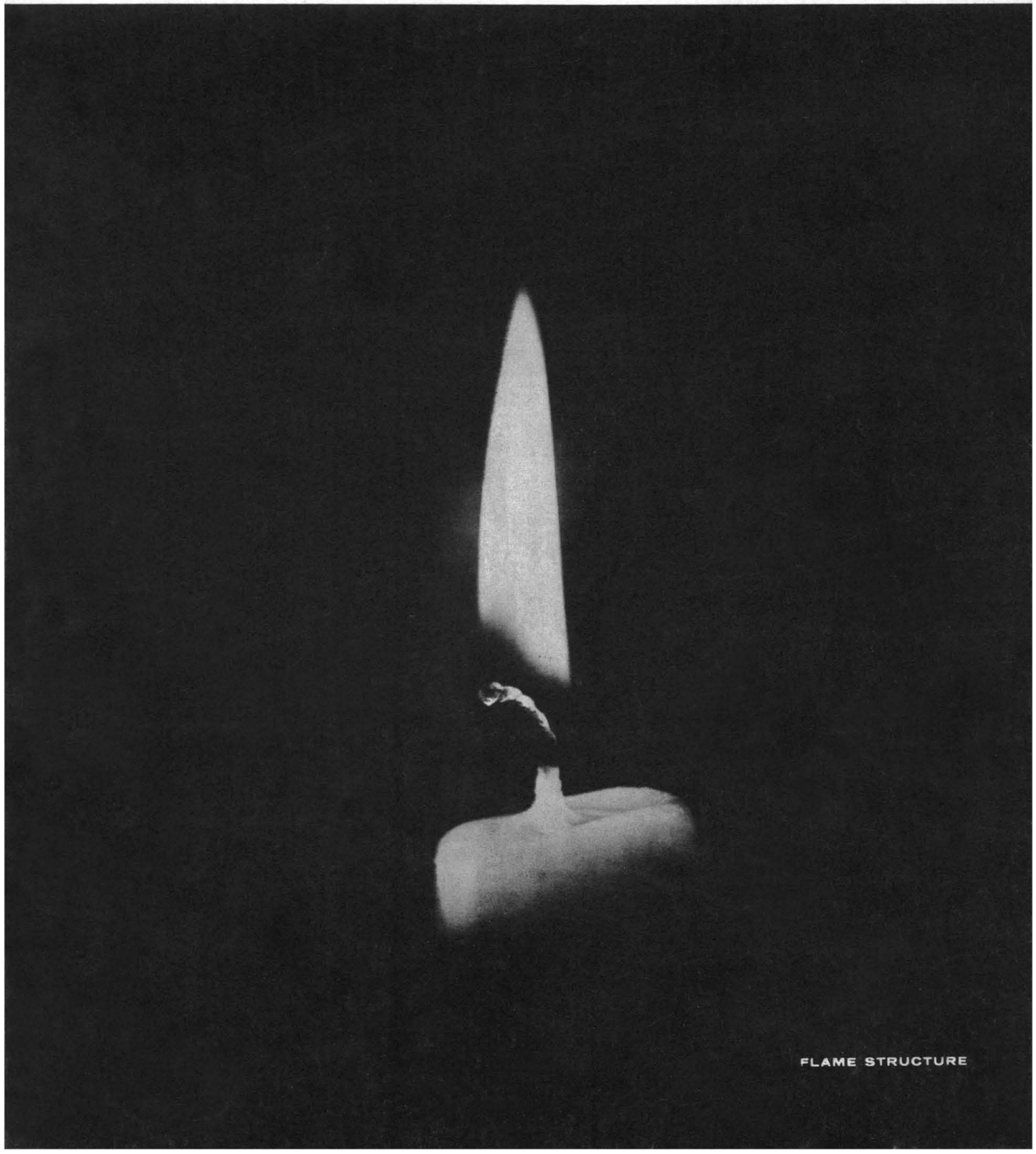
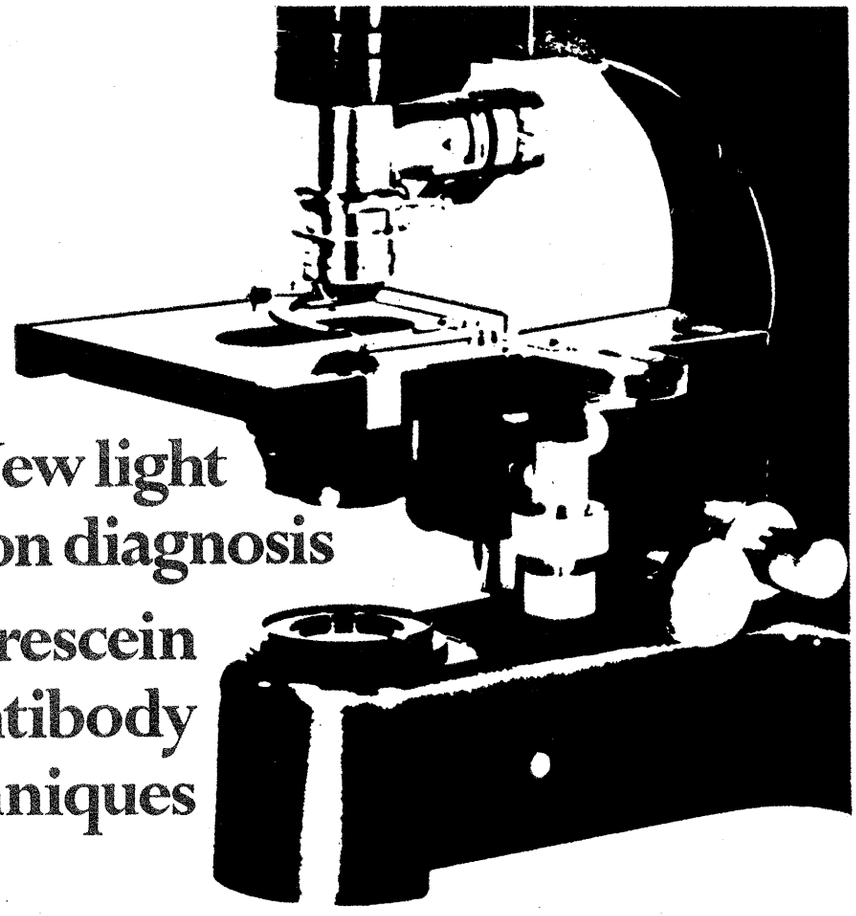
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

FLAME STRUCTURE



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(1) As reported in Chem. & Eng. News (Sept. 10, 1962). The literature references should not be interpreted as either an endorsement or disapproval of the biochemicals by the cited investigator.

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

**COVER**

The candle is a complex flame whose microstructure has been studied by recently developed experimental techniques. Detailed measurements of the aerodynamic, thermal, and compositional history of the gases passing through flame fronts have been made. These studies have provided quantitative understanding of the physical and chemical processes in simple flames. See review of *Flame Structure*, page 1703. [Applied Physics Laboratory, Johns Hopkins University]

control and communication theory, whether in the machine or in the animal, by the name *Cybernetics*, which we form from the Greek κυβερνητης or *steersman*. In choosing this term, we wish to recognize that the first significant paper on feed-back mechanisms is an article on governors, which was published by Clerk Maxwell in 1868 [*Proc. Roy. Soc.* (*London*) March 5, 1868], and that *governor* is derived from a Latin corruption of κυβερνητης. We also wish to refer to the fact that the steering engines of a ship are indeed one of the earliest and best developed forms of feed-back mechanisms.

Many writers, Greek as well as French, French as well as Italian, must have used the word, since it appears to be a common word meaning the "steersman's art," and that phrase, while quaint today, must have been as commonly used as *navigation* or *driver training*. Calling Duco *Duco* or Kodak *Kodak* called for more imagination and commercial savvy and were genuinely coined, not merely borrowed. But what difference does it make? Words after all are, as Henry Ward Beecher said, "pegs to hang ideas on." And Wiener and his circle certainly succeeded in doing that.

KENNETH J. WARD
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## Looking Ahead

In arguing for greater support of gerontology, Robert R. Kohn (Letters, 5 Nov., p. 685) says, "Aging processes are . . . of more personal concern to us than, for example, mantle-drilling or the space program. . . ." And rightly so.

According to a story popular in Germany (East and West) during the 1950's, Gottwald was checking the budget one day, and the dialog with his advisers went about as follows:

"What's this? An addition of 100,000 marks for the grade schools? No. Denied. An addition of 500,000 marks for the advanced schools? No, denied."

His advisers handed him the next batch, and he continued:

"An increase of 300,000 marks for playgrounds and parks? No. Denied.

"Another 50,000 marks for libraries? No. No. No.

"Add 150,000 marks for children's hospitals and lying-in homes? Denied."

So it went. He cut every departmental budget until he came to the one for prisons.

"What's this? No increase for prisons? The same budget as for last year? No. Double it! Allocate at least a million marks for prison hospitals, libraries, and recreation centers. And double the operating budget."

One of his advisers remonstrated, "But sir, you have cut all the other institutions, particularly the schools. Now why do you increase the budgets for the prisons?"

Gottwald stared at him meaningfully for a minute, then explained, "We've been to school."

As the man says, we can all expect to be aged. Shall we stint the plans for improving that condition?

F. C. DYER
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*Chevy Chase, Maryland*

## Messages from an Elder Scientist

. . . In his article on the development of the chemistry of solutions ("Order from chaos," 22 Oct., p. 441) . . . Joel Hildebrand delineates the difference between a true scientist and a mere practitioner. The one has schooled himself to understand; the other has devoted his academic life to learning all the recipes. Here is a message so vital to a beginning scientist that he hardly dare disregard it. . . .

The article carries also, by example rather than precept, a message about effective communication among scientists. It is replete with examples of communication at its best. Consider this statement from his discussion of scientific prediction: "The odds are extremely high for predicting an eclipse, . . . near zero for the time when John Doe will die." He might have written it this way: "Prediction of an eclipse can be accomplished with an extremely high degree of accuracy, but it should be noted that the probability factor changes considerably in the case of predicting the time at which life ceases for a human being." Naturally, the need for good communication becomes much more imperative when an elder scientist is trying to teach a younger one. The stuffed-shirt approach to science writing never inspired anyone. Yet how many elder scientists continue to expound their ideas in a writing style like that of a master's thesis. . . .

WARD W. KONKLE
Agricultural Science Review,
*U.S. Department of Agriculture,*
*Washington, D.C. 20250*

# CHARGED PARTICLES

## Extending the capabilities of research equipment

### Results from Tandem Research Program

The Tandem Research Group has made notable progress in the past year. Significant experimental results from the program are:

1. 250 mA high-brightness positive ion beam from an expanded-plasma source operating at 38 kv.
2. 270 $\mu$A analyzed beam of $H_1^+$ ions out of the Research Tandem with 320 $\mu$A $H^-$ injection and water-vapor stripping.
3. 2.0 $\mu$A analyzed dc beam of $He^-$ ions. The previous maximum current routinely available has been 0.1 $\mu$A with the EN source.

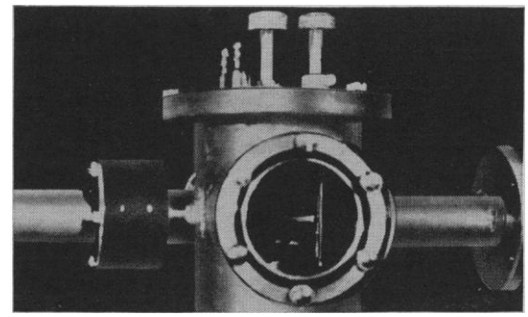
### Doubly Charged Helium Ions

Components are now available for converting 3, 4 and 5 MeV machines to produce $He^{++}$ ions at higher energies. Specifications: 30 $\mu$A at 5.0 MeV; 10 $\mu$A at 7.0 MeV; 5 $\mu$A at 10.3 MeV. More than double this current performance has been demonstrated but with some loss in stability and reliability. Multiple-charge states (2, 3 and 4) of neon, oxygen and nitrogen have also been produced with the new kit installed in a 3 MeV Van de Graaff. Beam energies from 5.04 MeV to 9.8 MeV and beam currents from 0.1 to 10 $\mu$A were observed. For details on the new $HE^{++}$ kit and experimental results, write for Technical Note #13.

### Optical Spectroscopy of Excited Atomic States

When an energetic beam of ions is passed through a thin foil, the charge state of the ion may change, either up or down. The emitted particles may be left in states of electronic excitation from which visible light is subsequently emitted during de-excitation. The emitted light spectrum is characteristic of the excited ion. When particle beams of approximately 0.4 $\mu$A or more are used, the light is sufficiently intense for spectroscopic analysis.

The refinement and application of this technique promises to be of major importance in the theory of atomic structure, in measuring hot plasma temperatures, and in acting for the means of energy loss in fast fission fragments in an absorber. Perhaps most importantly, it will help determine the relative abundance of the elements in the sun and other stars, which is the basis for theory of stellar evolution, the origin of the chemical elements, the age of astronomical objects and the nature of the stellar energy. For further details, ask for Technical Note #10.

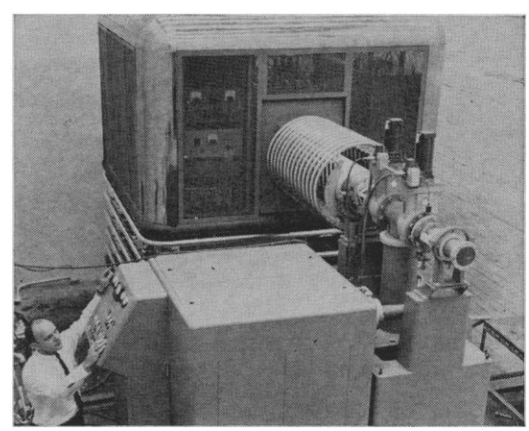


A nitrogen beam, 0.8 $\mu$A at 2 MeV, passes from right to left through a carbon foil approximately 9 $\mu$g/cm$^2$ thick.

### Intense Ion Beams at 500 kv

The ICT-500 keV positive ion accelerator now being built by High Voltage Engineering operates at energies from 100 to 500 keV dc and pulsed. In performance tests, the machine has produced analyzed ion beam currents from 4 mA at 100 keV to 10 mA from 300 to 500 keV. 10 mA dc positive ion beam currents of $H^1$, $H^2$, and $D^1$ have been produced at a target located 6 feet from the end of the acceleration tube. Beam diameter is 15 millimeters maximum for all particles over the entire energy range. Previous experience with a similar machine of 300 keV maximum energy showed 15 mA of $d_2^+$ and a 3 centimeter beam diameter. The ICT-500 positive ion accelerator is designed for dc and pulsed operation in the nanosecond and microsecond range with a minimum pulse length of 2 nsec. at a repetition rate of 2.5 Mc/s. Pulse content is 1 mA protons and 0.7 mA deutrons.

The particle source utilized with the ICT-500 positive ion accelerator is an expanded plasma type which has produced 70 mA total beam at 500 kv.



The high-brightness, intense ion beam produced by the ICT-500 accelerator is eminently suited for laboratory production of 14 MeV neutrons for cross-section measurements, dosimetry studies, weapons-effect simulation and special low-density target experiments.

**For detailed information,** write to Technical Sales, High Voltage Engineering Corp., Burlington, Mass. or HVE (Europa) N. V. Amersfoort, The Netherlands. Subsidiaries: Electronized Chemicals Corporation, Ion Physics Corporation. ARCO Division, Walnut Creek, California.

HIGH VOLTAGE ENGINEERING

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## President-Elect

In its 118-year history, the American Association for the Advancement of Science has been guided by men of the stature of Joseph Henry, Louis Agassiz, Ira Remsen, David Starr Jordan, A. A. Michelson, and Simon Flexner. Reflecting the composition of the Association, most of the presidents have been natural scientists. Only a few have been social scientists, the latest of these being the economist Wesley C. Mitchell, president in 1938.

The election of Don K. Price, a political scientist (page 1690, this issue), is thus a relatively rare event. The event takes on added significance when one considers the circumstances. The natural sciences do not lack for distinguished leaders of proven wisdom. The two candidates for the presidency were nominated by a committee well aware of the many other choices.

Responsibility for the affairs of the Association is vested in the Council, which elects the officers of the Association. The Council in turn is composed of about 470 members. Most of these are elected or appointed by the independent, affiliated societies; all major fields of science and a wide range of scientific interests are represented. The body that elected Mr. Price is a diverse and distinguished company. How could it happen that such a group could select a man of different background from its own? After all, there is a long tradition in human affairs that when the tribe selects a chief it chooses one of its members. I believe that part of the explanation lies in the special nature of AAAS and its membership. A selection process occurs at the time a person decides to become a member of AAAS. Those scientists whose interests are narrow see little reason for belonging to an organization of such diverse character. The act of joining is an act of tolerance and an expression of a wish to support efforts of broad significance. As set forth in its constitution, "The objects of AAAS are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare. . . ."

It is in the implementation of the third purpose that we can find a further explanation for Mr. Price's election. Science and technology have become crucial to our way of life. At the same time, there is increasing interaction between science and society at a multitude of interfaces. Of major importance now is the interface of science and government.

Dean Price has been the leading pioneer in the study of this interaction. He has wrestled with one of the central problems of our times: "How is science with all its new power to be related to our political purpose and values and to our economic and constitutional system?" Out of his labors have come books and articles, including several in *Science*. In his writing and in his conversations, Dean Price makes many perceptive comments. One of my favorites is found in his new book, *The Scientific Estate*. "The union of the political and scientific estates is not like a partnership, but a marriage; it will not be improved if the two become like each other, but only if they respect each other's quite different needs and purposes. No great harm is done if in the meantime they quarrel a bit."

In his articles in *Science* and in his 5 years of service on the board of directors of AAAS, Dean Price has made fine contributions toward bridging the gap between science and the humanities. It is good to know that the Council has seen fit to select him for even more demanding tasks.—P. H. ABELSON

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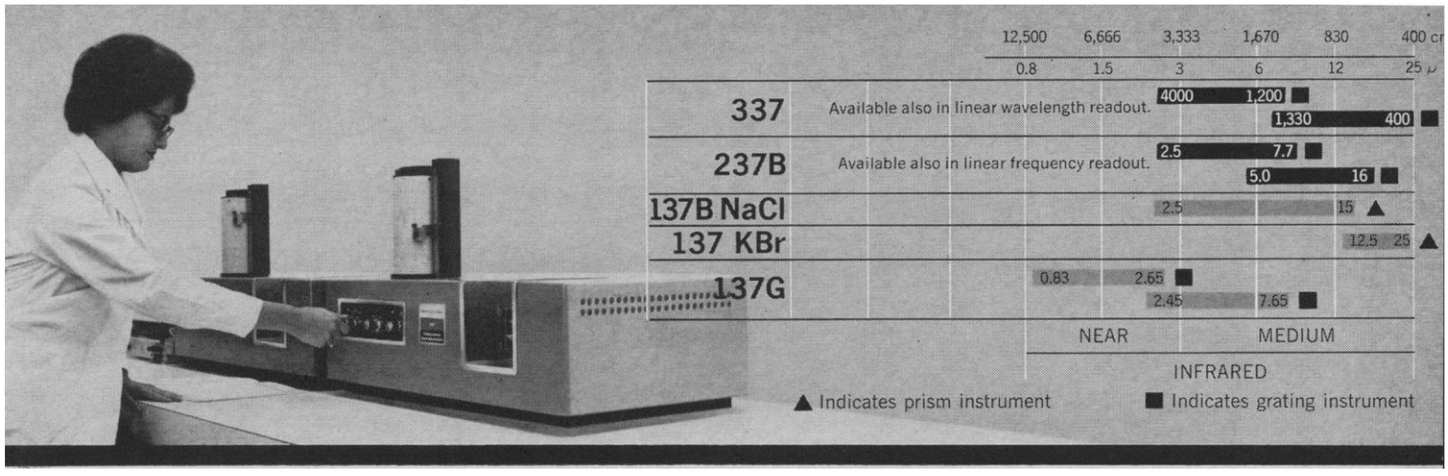


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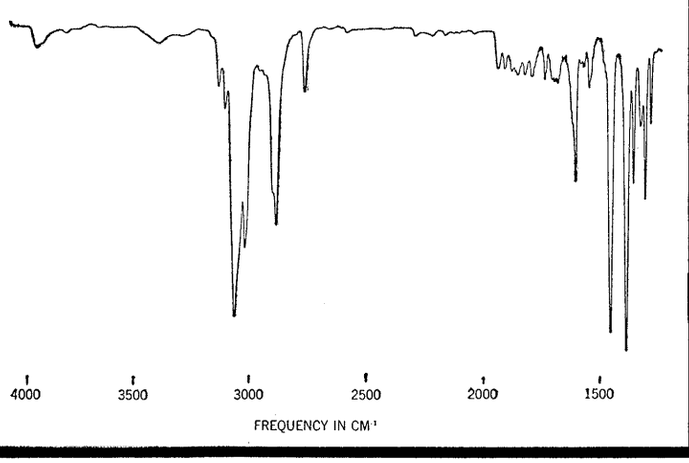
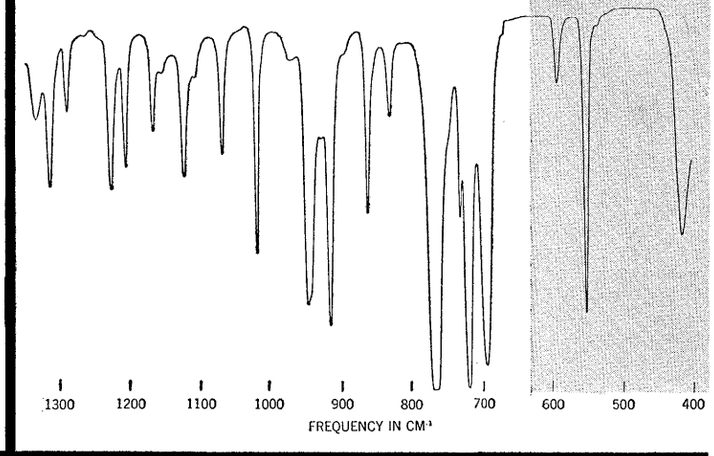
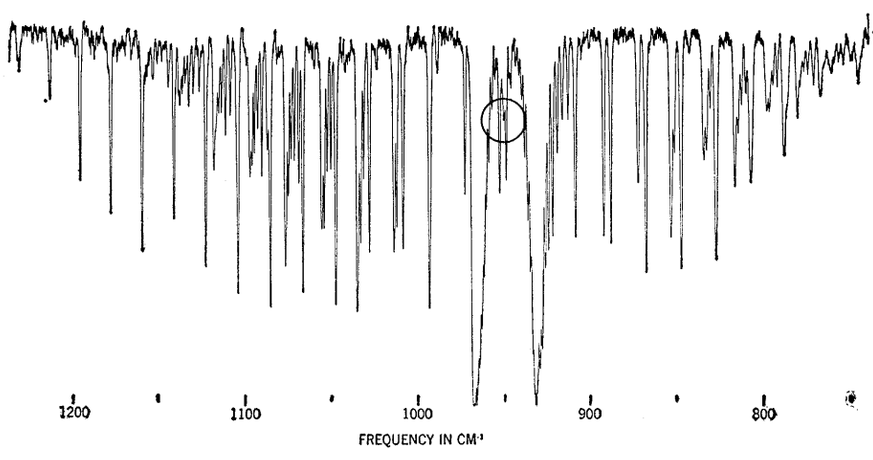
- external recorder attachment provisions, for abscissa expansion or compression, as required;
- dual-grating monochromator, for resolution better than that of many instruments costing twice as much.

The Model 237B covers the range from 4000 to 625 $cm^{-1}$, with a version available in linear wavelength. It is ideal if you normally operate in this fundamental region. The Model 337, also available in either linear frequency, or linear wavelength, scans from 4000 to 400 $cm^{-1}$. Both instruments cover their individual ranges in two serial scans, on convenient 8½" x 11" charts.

No matter what your choice, either the Model 237B or the Model 337 will provide all the performance you want at the lowest price available. For more information, write Instrument Marketing Division, Perkin-Elmer Corporation, 723 Main Avenue, Norwalk, Conn.




▲ Typical dual scan of indene, run in six minutes in the three-minute scan mode of the Model 337, demonstrates excellent definition possible even at this recording rate. Slit program was 6. Shaded area shows range added by the Model 337 to that of the Model 237B. In this region you gain access to carbon-bromine, carbon-iodine and carbon-chlorine vibrations, out-of-plane aromatic carbon-hydrogen bonds, and data on inorganic and metal-oxygen or metal-nitrogen bonds in complexes. Recent work also points to characteristic vibrations of ketones, aldehydes, acids and esters occurring in the 500 $cm^{-1}$ region.

◀ Ammonia scan from 1200 to 800 $cm^{-1}$ points out one wavenumber resolving power of Model 337, with abscissa expanded on auxiliary recorder.

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levels of preparation and ability of the body of students for whom the curricula are intended, and the compatriots of the speaker appear to sit at ease. How can our system (or chaos) be as fairly presented? A description of the curriculum possible for one of our most selective institutions is inspiring and for this reason valuable. However, it does not answer the question asked in corridors afterward, what is typical in the United States? A proper answer to this question is important too; it is difficult enough to bridge the gaps between the United States and other countries.

For the purposes of this summary, it is noted that even an international conference supposedly devoted to the techniques for producing specialists in physics cannot get off the ground without a characteristic digression. Lord Beeching, in the opening talk, made a plea that physics take care to retain its role as a liberalizing subject. This theme, recurring in all physics curriculum conferences in the United States, was taken up by many commentators. Perhaps it is inaccurate to term it, or to think of it as, a digression.

The conference approved a number of resolutions. Education ministries and universities were asked to encourage further the interchange of students and teachers and to liberalize the formal requirements governing appointment of professors. Universities and their physics departments were asked to insure that broad education in science and mathematics precede specialization, that the attitudes characterizing recent developments in physics teaching, and science teaching more generally, be considered in the modernization of curricula, and that measures be taken to increase the contact between university physics departments and industrial and government laboratories. Finally, the conference called for a meeting of physicists and mathematicians to examine ways of using recent mathematical developments in all levels of physics education.

The circumstances surrounding the conference were handled with thoroughness and grace. The Organizing Committee, with M. R. Gavin as chairman, and Miss P. N. Boston as secretary, deserves the thanks of all, as does the group of British scientific and industrial organizations that provided financial support. In view of the large representation from the United States, and the well-known interest of

our scientific and educational agencies in promoting gatherings of this kind, one could not help but note the absence of United States sponsors.

The full proceedings of the conference are being compiled and edited by S. C. Brown and N. Clarke, and publication has been promised for 1966.

RONALD GEBALLE
*Department of Physics, University of Washington, Seattle*

## Forthcoming Events

### January

*4–7.* **Solid State Physics**, conf., Manchester College of Science and Technology, Manchester, England. (S. F. Edwards, Dept. of Physics, Victoria Univ. of Manchester, Manchester 13)

*5–8.* National Soc. of **Professional Engineers**, winter mtg., Bal Harbour, Fla. (NSPE, 2029 K St., NW, Washington, D.C. 20006)

*6–7.* Society for **General Microbiology**, 45th general mtg., London, England. (P. H. Clarke, Biochemistry Dept., University College, Gower St., London, W.C.1)

*6–10.* International Council of **Scientific Unions**, 11th general assembly, Bombay, India. (Intern. Council of Scientific Unions, Via Sebenico 2, Rome, Italy)

*7–8.* **Surgical Research** Soc., winter mtg., London, England. (A. P. M. Forrest, Cardiff Royal Infirmary, Newport Rd., Cardiff, Wales)

*10–13.* **Radioactive Isotopes** in Clinical Medicine and Research, 7th intern. symp., Bad Gastein, Austria. (R. Hofer, Second Medical Univ. Clinic, Garnisongasse 13, Vienna 9)

*11–12.* Man's Extension into the **Sea**, symp. on SEALAB II, Washington, D.C. (T. Evans, Conference Management Organizer, Colonial Bldg., 105 N. Virginia Ave., Falls Church, Va. 22046)

*12–14.* **Medicinal and Aromatic Plants in India**, symp., Central Indian Medicinal Plants Organization, Lucknow, India. (S. C. Datta, CIMPO, 4 Sapru Marg, Lucknow)

*12–20.* International **Fertility** Assoc., Latin American mtg., Acapulco, Mexico. (M. Roland, 109-23 71st St., Forest Hills, N.Y. 11375)

*13–14.* **Body Fuel Utilization**, conf., Boston, Mass. (F. D. Moore, Dept. of Surgery, Harvard Medical School, 25 Shattuck St., Boston, Mass. 02115)

*13–14.* Institute of **Mathematical Sciences**, 4th Matscience anniversary symp., Madras, India. (C. P. Ramaswami Aiyer, Inst. of Mathematical Sciences, Madras)

*13–16.* Indian Institute of **Metals**, 19th annual mtg., Hyderabad. (The Institute, 31 Chowringhee Road, Calcutta 16)

*16–21.* American **Chemical** Soc., winter mtg., Phoenix, Ariz. (ACS, 1155 16th St., NW, Washington, D.C. 20036)

*17–19.* **Labelled Proteins in Tracer Studies**, conf., Pisa, Italy. (Euratom, La-