comparison, simple pulse-counting systems that measure peaks containing less than 1 ion per spectrum which allow one to utilize the full sensitivity range of the instrument, and simple gating systems which allow conventional recording of mass spectra.

An experiment recently performed concerning the detection of metallic ions may suggest other applications for the instrument. It was desired to check the dependence of resolution on initial energies considerably higher than those usually encountered, and for this purpose a beam of metallic molecules, thermally emitted from a hot source, was allowed to pass through the ionizing region at right angles to the electron beam and parallel to the source electrodes. As was expected, the resolution was unaffected by this transverse velocity. In general the resolution and intensity obtained with metallic vapors have proved to be very similar to those that would be obtained with gases at the same molecular density. It was possible, however, to detect a shift in the direction of travel of the metallic ion beam as compared with the background ions, the metallic ions being displaced at the collector in the direction of their high initial velocities. This fact can be turned to advantage by aiming the metallic ions directly at the collector, causing the majority of the background ions to be lost to one side. With aluminum vapor, an improvement of a factor of 10 for the sensitivity of the metallic vapor as compared with the background gas was obtained in this way.

Another application in the experimental field is to measure the lifetime of different types of ions by varying the time between the shutoff of the ionizing electron beam and the beginning of the ion-acceleration pulse. With most source geometries it is possible to have a lag between ion formation and ejection from the source of about 5 to 10 microseconds.

Conclusions

Many of the applications of the Bendix Time-of-Flight Mass Spectrometer make use of the instrument's high resolution, speed of response, and simplicity. Among these are studies of fast reactions, the monitoring of chromatography columns, fast, moderately accurate chemical analyses, the optimizing of pilot-plant operations, the detection of metallic vapors, and studies of ion lifetimes.

Further experience is expected to uncover other applications to the problems of science and industry where the unique characteristics of this instrument can be of service.

References and Notes

1. U.S. patent 2,685,035.
2. W. C. Wiley and I. H. McLaren, *Rev. Sci. Instr.* 26, 1150 (1955).
3. L. P. Lessing, *Sci. Am.* 188, No. 5, 29 (May 1953).

News of Science

Phosphagen of Tunicates

It has been established that invertebrates and vertebrates differ with respect to their phosphagens. Thus, phosphoarginine is characteristic of invertebrates and phosphocreatine of vertebrates.

The invertebrates, however, exhibit some variability [Baldwin, *Dynamic Aspects of Biochemistry* (Cambridge Univ. Press, ed. 2, 1952)]. Although most of the five extant classes of Echinodermata possess nonprotein arginine and so follow the general invertebrate pattern, the Ophiuroidea contain creatine and the Echinoidea both arginine and creatine. A few invertebrates are devoid of both phosphoarginine and phosphocreatine but possess one or the other (gephyreans, some polychaete annelids) or both (some polychaetes) of two recently discovered phosphagens that contain neither arginine nor creatine. On the other hand, phosphocreatine is the only phosphagen present in vertebrates.

The protochordates (Hemichordata, Urochordata, Cephalochordata), although they are grouped together with the vertebrates to form a single phylum, the Chordata, are recognized as being morphologically intermediate between invertebrates and vertebrates. Their biochemical affinities, and hence their phosphagens, are therefore of considerable interest (see Baldwin, 1952). Only phosphocreatine is present in Cephalochordata (lancelets), which thus most closely resemble vertebrates, as they do in their morphology. On the other hand, the Hemichordata (sea acorns), which exhibit the greatest structural affinities with invertebrates, appropriately possess both the arginine and creatine compounds. Since 1932, the Urochordata (tunicates or sea squirts) have been regarded as quite anomalous among chordates in this respect, for the studies of both Flössner and Needham *et al.* have indicated the presence of phosphoarginine, but not of phosphocreatine, in these animals. Hence, in this respect, the tunicates have been thought to resemble the invertebrates.

Morrison, Griffiths, and Ennor have recently reported a study of two species of tunicates, *Pyura stolonifera* and *P.* sp. [*Nature*, **178**, 359 (18 Aug. 1956)] in which they found no traces of arginine, phosphoarginine, or arginine phosphokinase. However, the presence of creatine, phosphocreatine, and an enzyme possessing creatine phosphokinase activity was established. The authors note that, although it may not be permissible to conclude that tunicates as a class possess phosphocreatine, their findings on *Pyura* do relieve these animals of their anomalous position and provide biochemical support for their accepted classification among the chordates.

It would seem of interest to investigate the phosphagens of other species of tunicates, including those already studied by earlier workers. It may well be that Flössner, Needham *et al.*, and Morrison *et al.* are all correct; if so, the tunicates possess more than one type of phosphagen, which varies with the species, sometimes being phosphoarginine, as in invertebrates, sometimes phosphocreatine, as in vertebrates and lancelets, and sometimes, perhaps, both of these compounds, as in hemichordates. This would befit the accepted phylogenetic position of the Urochordata.—W. L. S., JR.

French Atomic Power

France became the first country on the West European continent to produce electricity by atomic means on 28 Sept. On that date the atomic center at Marcoule, on the Rhone River north of Avignon, began to produce sufficient heat to make vapor, which in turn started the operation of specially constructed turbines.

The pile, the first of three that will be built at Marcoule, began operating in

January, and its power has been progressively increased since then. It is now producing 30,000 kilowatts of heat energy, three-fourths of the total capacity that is expected to be reached in a few weeks. When the maximum power of 40,000 kilowatts of heat energy is reached, approximately 5000 kilowatts of electricity will be produced. However, between 7000 and 8000 kilowatts are needed to run the blowers that cool the pile.

The Marcoule center is primarily a producer of plutonium. Electricity on a commercial basis will not be produced in France before 1959, when a plant in the Loire Valley is constructed. It will have a capacity of 300,000 kilowatts.

Hyksos Tomb

Hebrew University archeologists working in the area of the biblical town of Tel Hazor, in northern Galilee, have reported the discovery of what seems to be an unopened royal tomb of the Hyksos period. Yigal Yadin, former chief of staff of the Israeli Army, and Jean Perrot have found a circular staircase leading into a rock tunnel that is behind an arch such as is found only in royal tombs. The tunnel is still blocked by tons of debris.

The Hyksos were the earliest invaders of Egypt, conquering it about 1685 B.C., according to Josephus, Jewish historian at the start of the Christian Era. He also identified them as Israelites. Historical records of the Hyksos period are rare, and few archeological traces of it have been found.

Salk and Sabin Vaccines

The National Foundation for Infantile Paralysis has announced that recent work reported by Albert B. Sabin of the University of Cincinnati in the development of a live-virus vaccine against paralytic poliomyelitis does not affect the current use of the Salk vaccine. The foundation has supported the work of both Sabin and Salk. Sabin's experimental oral vaccine contains attenuated strains of live virus, while the Salk killed-virus vaccine is injected in a series of three shots spaced over a period of 8 months.

In a statement to the press, Thomas M. Rivers, medical director of the foundation, said: "The Salk vaccine is safe, effective and available today. The Sabin vaccine still is in an experimental stage. As Dr. Sabin himself has pointed out, it is impossible to estimate how long it might take to test and prove the effectiveness of the new vaccine in human beings. But we know that the Salk vaccine has been 75 to 80 per cent effective. It would be tragic if parents, misled by the report of a possible future vaccine, delayed the use of the vaccine which now is available for protection against paralytic polio." Rivers also commented that the foundation has received no request from Sabin for mass testing of his new product.

Engineering Graduates Here and Abroad

Comparative data for the graduating classes of engineers for 1954 in Great Britain, the United States, and the U.S.S.R. are as follows: Great Britain graduated 57 engineers per million of population; the United States graduated 136 engineers per million of population; and the U.S.S.R. graduated 280 engineers per million of population.

The available data for the U.S.S.R. show that the Soviet Union is graduating an additional 326 lower-grade engineers per million of population. Although the population of the U.S.S.R. is about one-third greater than that of the United States, she is graduating more than twice as many engineers as the United States.

Doctor Draft

The special draft law passed in 1950 that permitted the induction of physicians and dentists up to the age of 50 will expire next June, and the Department of Defense has let it be known that next year the military will rely instead on the regular draft to get its medical staff. More than 30,000 physicians, dentists, and veterinarians have been called to duty under the provisions of the law, which was extended in 1951 and 1953 and again in 1955.

The American Medical Association and the American Dental Association have long protested that the law was discriminatory. Under the regular draft, men under 35 may be inducted. Only about 200 more doctors are expected to be called before the law expires.

Erythromycin Molecule

The complete molecular structure of erythromycin has been determined after 4 years of research at Eli Lilly and Company, Indianapolis, Ind. The team of organic chemists who participated in the work included Edwin H. Flynn, Koert Gerzon, Max V. Sigal, Jr., Paul F. Wiley, Ollidene Weaver, Rosemarie Monahan, and U. Carol Quarck (who is now at the Organic Chemistry Institute, Technical University, Berlin-Charlottenburg).

Erythromycin, which is produced by the soil mold *Streptomyces erythreus,* is widely used by the medical profession, particularly against common bacterial infections. It was discovered in the Lilly laboratories in 1951 and given the trade mark Ilotycin (Erythromycin, Lilly). The determination of the molecular formula will aid research to develop new forms of the antibiotic and to study its metabolism and physiological action.

The formula is $C_{37}H_{67}NO_{13}$. The molecule consists of a large lactone ring, called erythronolide, to which are attached two unusual sugars, desosamine and cladinose. The desosamine structure was worked out by chemists of another laboratory after the Lilly group had isolated, characterized, and named it.

Part of the structure work on erythromycin has been detailed in the *Journal of the American Chemical Society* [**78,** 388, 808 (1956)], and the final reports are to appear in that publication in the near future.

Report of the Pentagon's New Industrial Security System

The Department of Defense has issued an unusual 200-page report on the functioning of its arms plant security system. This *First Annual Report* of the Pentagon's Industrial Personnel Security Review Program, subtitled "Security at work" has an illustrated cover, charts, and a clearly written text.

Breaking precedent, the report cites 30 case-histories to illustrate how the security system works. Although most of the cases seem to be clear-cut ones in which security clearance should have been withheld, one case-history disclosed that a "research scientist of national stature" had been finally granted clearance in the face of charges that his mother was a known Communist and his father a supporter of Communist-front organizations, and that he himself had gone to Russia to do research work in the 1930's, had read the *Daily Worker,* and had shown a "sympathetic interest" in Communism.

The report stresses that the Government has a duty to release as much information as possible regarding security cases, to avoid the "confusion and misunderstanding" that has resulted in the past because of partial disclosures. It also defends the limited use of "faceless informers." In general, the report presented the following information.

Under the new centralized control system and improved local screening procedures, the number of disputed security cases arising among the some 2 million employees of defense plants has been sharply reduced since April 1955 when the clearance system was revised.

For fewer clearance denials are forwarded by local agencies to the Pentagon, and of these, clearance is being granted in a higher percentage of cases. During the first 14 months of the present system,