in young physicists, involving major laboratories, particularly CERN and American and British labs.

CERN now employs well over 2500 people, but only about a third of these are professional scientists and engineers. The rest are divided about equally into two groups, administrative workers on the one hand and technicians and support workers on the other. There are more than 200 professionals on the permanent staff, but a relatively small number of these are scientists engaged in research. About 330 scientists are on the books as "visitors." They are paid by CERN but work at the laboratory for a stipulated period. Many of them are postdoctoral-level researchers who work on CERN teams.

As a pioneering international laboratory, CERN faced special problems in establishing a permanent staff structure. CERN could not make appointments in the way that a national civil service could, but the prospect of a career had to be offered if capable administrators, engineers, and technicians were to be attracted and kept. A new employee is given a 3-year contract. Generally, after two 3-year contracts, if a person's service has been satisfactory and his services are required he may be offered a permanent appointment.

The policy has been to limit the number of permanent appointments of scientists. There is a firm intention not to make CERN a refuge and haven for expatriate physicists, but, more important, the laboratory is intended essentially as a facility to be used by working physicists based in the member countries.

CERN has made it a point not to distribute jobs and contracts on a pro rata basis according to the size of national contributions. The aim is to hire the best man for the job and award the contract to the lowest bidder who can satisfy requirements. Circumstances naturally affect the balances. CERN is in a French-speaking area, so many of the employees in lower grades are French-speaking. France produces a lot of engineers. Many CERN engineers are French. Britain probably leads Europe in training people in data-processing work, and in the CERN computer center—which now has the biggest capacity of any computer center in Europe—the British are much in evidence. This is not to say that the national origin is ignored. If two candidates for a post are equally well qualified, the nod may well go to the one from the country which might be underrepresented. Sometimes nothing more than tact is involved, as in seeing that a CERN delegation to an international meeting includes a range of nationalities. Salary and allowance policies worked out in the early years seem to have made CERN an attractive place to work.

The success of the laboratory in organizing itself for productive research, however, would obviously have been irrelevant if things had not gone well at the interface between the laboratory and the member governments. The vital group here is the policy-making council, which had its origins in the provisional committee set up in 1952. Under the CERN convention each member state is entitled to two representatives on the council. In practice, these posts have been filled by one scientist of high reputation and a senior official of whatever government department administers the national grant to CERN. The result has been that CERN has maintained well-mended fences with both scientists and governments. All members have equal votes, whatever the size of their contribution, and CERN's history has been something of a testimonial to skill and good will in maintaining a consensus.

CERN, however, has not found a magic formula which banishes all difficulties. Links between CERN and the universities in the member states are still far from perfect. Big Science can hold expensive frustrations for small countries. As costs rise, the major European countries face increasingly difficult decisions in allocating funds among national and regional projects in high-energy physics and other research. These present and future problems will be the subject of another article in this space.—JOHN WALSH

Test Detection: Decoupling Theory Verified, but Does It Matter?

Although extension of the 1963 test-ban treaty to underground detonations continues to be an objective of U.S. arms control policy, the Russians are showing little interest at the moment in negotiating such an agreement. One recalls, however, that the successful negotiations which led to the 1963 treaty had been preceded by years of discouragingly slow progress. Thus, there is always the possibility that U.S. research on test detection problems will take on a real immediacy and political significance. "Project Sterling," a recent experiment which tends to verify the theory that an underground nuclear explosion can be "decoupled" or muffled to avoid detection, is a case in point.

Should prospects improve for a ban on underground tests, the results of Sterling will be cited by those who oppose such a ban. Already Representative Craig Hosmer, a California Republican and member of the Joint Committee on Atomic Energy, is saying, "now that undetectable cheating has been proved even more possible than before believed, there is more reason than ever to stay away from this kind of national security trap." The U.S. insists that a comprehensive test ban treaty must provide for a limited number of inspections for the verification of suspicious events. But Hosmer argues that if, through decoupling, the Soviet Union can prevent detection of their tests, the right to make inspections would constitute no real safeguard.

Government arms control experts strongly dispute the contention that agreeing to a comprehensive test ban treaty need entail high risk. In their view, Sterling merely supports a theory already widely accepted. The decoupling theory, first advanced in 1959 by a group of scientists at the Rand Corporation, holds that the seismic signals

from an underground blast can be reduced by a factor of as much as 200 or more if the nuclear device is suspended in the center of a sufficiently large cavity.

In Project Sterling, a small nuclear device, equivalent in explosive power to 350 tons of TNT, was exploded in a cavity of 110-foot diameter at a depth of 2700 feet. Detection stations less than 150 miles from the explosion did not record the event. Sponsored by the Advanced Research Projects Agency (ARPA), Sterling was conducted by the Atomic Energy Commission in the Tatum Salt Dome near Hattiesburg, Mississippi, on 3 December.

The problems associated with forming and using the cavity required for decoupling are difficult—so difficult, in fact, that it remains very much a matter of dispute whether decoupling is a practical possibility for a nation wishing to cheat on a test-ban commitment. The 5-kiloton nuclear explosion by which the Sterling cavity was formed in October 1964 was detectible at distances of thousands of miles. Morever, so much heat was left by the explosion that the Sterling experiment was delayed by more than 2 years. Even with the delay, the temperature in the cavity was 200°F when Sterling was conducted.

Despite the heat problem, there is at least a small chance that a hostile nation might resort to nuclear blasts to form and "stockpile" some cavities before agreeing to a comprehensive test ban treaty. However, none of the Soviet Union's underground tests are believed to have been conducted in areas where salt domes occur. Salt domes are large solid masses of salt, regarded as an especially favorable medium for the formation of cavities.

Although nuclear blasting is but one of several ways by which cavities might be formed, the alternative methods involve major problems, too. The Advanced Research Projects Agency has asked AEC to study the feasibility of forming a cavity by mining, or by leaching with large quantities of hot water. The cavity would be 290 feet in diameter; this, ARPA believes, is large enough for decoupling a 5-kiloton explosion. While there is little doubt that a cavity of this size can be mined or leached, ARPA does not know whether it will stand. The wall of a cavity for decoupling cannot be shored up, for the shoring material would transmit shock waves.

Some if not most of the scientists interested in weapons development and

NEWS IN BRIEF

● **NEW SYSTEM LINKS NEW YORK LIBRARIES**: A system designed to make available to researchers material in the main research libraries in New York State is being set up on an experimental basis by the New York State Library. The network will enable the libraries to transmit facsimiles of material throughout the state. Twelve libraries covering most of the state will be linked up by 15 February, and the system eventually will be extended to about 25 research libraries, according to Lynn R. Hard, a consultant for the Academic and Research Library of the New York State Library. Under the system, requests submitted to local libraries will be transmitted to one of the larger research libraries. Once the material has been located, it will be transmitted to the local library. The service would take some 24 hours, compared with the 10 days that are usually required to carry out an interlibrary loan.

● **DOCTORAL STATISTICS**: The physical sciences and education have been the most attractive fields for doctoral candidates in the past 10 years, according to Office of Education surveys. Engineering is expected to be the most popular by 1976. The number of doctorates awarded per academic year in the U.S. has nearly doubled in the past decade and is expected to more than double—to 36,900—in the next 10 years. In 1964–65, the schools granting the most doctorates were: University of California, Columbia University, University of Wisconsin, University of Illinois, Harvard-Radcliffe. All statistics appear in the surveys "Earned Degrees Conferred" and "Doctor's Degrees Conferred by U.S. Institutions" or will appear in the 1966 edition of "Projection of Educational Statistics," published by the U.S. Office of Education. Single copies available from Publications Distribution Section, U.S. Office of Education, Washington, D.C. 20202.

● **SCIENTISTS' SALARIES**: A National Science Foundation survey of 243,000 scientists finds that self-employed scientists earned the highest median salaries ($17,000) in 1966. Next highest earners were scientists employed by business and industry ($13,000), followed by those employed by the Federal government ($12,100), and finally those employed for the calendar year at educational institutions ($12,000). Among the self-employed, mathematicians earn the highest median salary ($20,500); in business, economists are on top ($15,300); and in industry, psychologists and sociologists (around $15,000) have the highest median. The median for all scientists responding to the survey was $12,000, an increase of $1,000 since 1964. Further details of the survey are reported in "Reviews of Data on Science Resources, No. 11 —Salaries and Selected Characteristics of American Scientists, 1966" available from the U.S. Government Printing Office, Washington, D.C.

● **PHS POLLUTION LABORATORY**: The first field laboratory for general research on solid-waste pollution abatement will be established by the U.S. Public Health Service under a 5-year land-use permit of PHS and the University of Cincinnati. The facility will be designed for research on methods for improving the management of municipal, industrial, and agricultural solid wastes under conditions reflecting common U.S. disposal practices. The laboratory will be built on a 15-acre tract in the northwestern part of Cincinnati which is owned by the University. Activities of the laboratory will become part of a national Public Health Service program for solid waste pollution abatement authorized by Congress in the Solid Waste Disposal Act.

● **HOPKINS-NIH GRADUATE PLAN**: Students in biochemistry at Johns Hopkins University may soon have an opportunity to conduct their doctoral research at the National Institutes of Health, Bethesda, Maryland. Under a recently developed cooperative arrangement, about ten Hopkins students will take initial courses at the university, then move to NIH for further courses, research, and work on their dissertations. The program is scheduled to get underway next year for a 3-year trial period, pending a final go-ahead from the Department of Health, Education, and Welfare. Students will be chosen by a joint Hopkins-NIH admissions committee and will work under NIH scientists appointed to the university's faculty. The Foundation for the Advanced Education of the Sciences, a private organization set up by NIH scientists, will oversee the operation.

arms control believe that tests in the low-kiloton range are not likely to produce results significantly affecting the military balance. This is so, even though these scientists are aware that small tests can contribute to technological advances for all classes of nuclear weapons. The larger the nuclear test, the more formidable the problem of decoupling. According to ARPA, decoupling a 100-kiloton test would require a cavity of 770-foot diameter at a depth of 3300 feet. Even if the cavity should stand, the work of building it might be detected by satellite reconnaissance. Detected or not, the work would cost many millions of dollars, and, if leaching were the method employed, serious water pollution could result.

Thus, advocates of a comprehensive test ban treaty are able to cite a variety of reasons why Project Sterling has produced no arguments to shake their convictions. Nevertheless, Sterling's apparent confirmation of the decoupling theory will be cited by Congressman Hosmer and others as evidence that the U.S. goal of obtaining a ban on underground tests, subject to effective verification procedures, is illusory.

—LUTHER J. CARTER

Announcements

The National Institute of General Medical Sciences is now accepting applications for its pharmacology research associate training program. The program was established in 1965 to encourage participation of pharmacologists in industry, government, and universities, specifically in the study of drug toxicity. Those selected will receive 2 to 3 years of postdoctoral training in National Institutes of Health laboratories. Applications and information may be obtained from Program Coordinator, Pharmacology Research Associate Training Program, National Institute of General Medical Sciences, National Institutes of Health, Bethesda, Maryland 20014. Deadline for applications is 21 April.

New Journals

Bulletin of Thermodynamics and Thermochemistry, No. 9, May 1966. E. F. Westrum, Jr., Editor. Prepared since 1955 under the auspices of the Commission on Thermochemistry, International Union of Pure and Applied Chemistry and distributed free of charge on a limited scale; opened to subscriptions this year. Information on research in progress or completed but not yet published; includes abstracts and author index but no actual data; in separate sections, glossary of symbols, meeting list, and bibliographies of papers published in the last year and of recent books. (Publications Distribution Service, Univ. of Michigan, Ann Arbor 48104. Annual, $6)

Health Services Research, vol. 1, No. 1, Summer 1966. W. S. Spector, Editor. Results of research in any discipline pertaining to health services. (Hospital Research and Educational Trust, 840 N. Lake Shore Drive, Chicago, Illinois 60611. Quarterly, $12 a year; $6 for the remaining two issues of vol. 1)

Molecular Crystals, vol. 1, No. 2, April 1966. G. J. Dienes and M. M. Labes, Editors. International journal of experimental and theoretical papers; deals primarily with processes in simple molecular crystals. (Gordon and Breach, 150 Fifth Avenue, New York 10011 or 9 Kingsway, London, W.C.2. Quarterly; $20 a year institutions; $9.50 individuals)

Scandinavian Journal of Gastroenterology, vol. 1, No. 1, September 1966. J. Myren, Managing Editor. Papers in English on clinical and experimental gastroenterology and pertinent fields of nutrition. (Universitetsforlaget, Publishers to the Norwegian Universities, P.O. Box 307, Oslo 3, Norway; U.S.: P.O. Box 142, Boston 13, Mass. Quarterly; $14.75 U.S.; Norwegian Kr. 88)

Scandinavian Research Information Notes, vol. 1, No. 2, September 1966. E. Törnudd, Editor. Major developments in scientific and industrial research in the Scandinavian countries; includes decisions on science policy, changes in institutions and programs, inquiries by government and research organizations; and reports in English of ad hoc committees; does not include research results. (Scandinavian Documentation Center, 2136 P Street NW, Washington, D.C. 20037; twice a year, free of charge)

Materials Research Bulletin, vol. 1, No. 1, September 1966. H. K. Henisch and R. Roy, Eds. Research on crystal growth and materials preparation and characterization. (Pergamon Press, 44–01 21st Street, Long Island City, N.Y. 11101. Quarterly; $50 a year for institutions, $15 for individuals)

Recent Deaths

James T. Barrett, 90; professor emeritus of plant pathology at the University of California, Berkeley; 1 January.

Gian Alberto Blanc, 87; professor emeritus of chemistry and physics at the University of Rome and president of the Italian Chemical and the Italian Geological Society; 31 December.

Lord Walter Russell Brain, 71; neurologist; former president of the Royal College of Physicians, fellow of the Royal Society, past president of the British Association for the Advancement of Science, chairman of the Interdepartmental Committee on Drug Addiction, and former president of Family Planning Association; 29 December.

Ernst Watson Burgess, 80; professor emeritus of sociology at the University of Chicago and past president of the American Sociological Society; 27 December.

Joseph C. Gilman, 76; professor of botany of Iowa State University; 24 December.

Boris A. Jacobsohn, 48; physics professor at the University of Washington and internationally known authority on theoretical physics; 28 December.

Edward G. Locke, 62; research administrator and director of the United States Forest Products Laboratory; 19 December.

Reginald J. S. Pigott, 80; retired director of the engineering division of Gulf Research and Development Company; 23 December.

Isaak Y. Pomeranchuk, 53; Soviet theoretical physicist, recipient of the Stalin Prize; 14 December.

Percy H. Royster, 78; retired head technical adviser to the Metallurgical Division of the Bureau of Mines; 25 December.

Robert Spencer Stone, 71; pioneer in nuclear medicine, former director of the radiological laboratory at University of California Medical School, San Francisco; 18 December.

Grantley W. Taylor, 69; leading American surgeon and heart specialist and retired clinical professor of surgery at Harvard Medical School; 24 December.

Andrew H. Wright, 79; retired University of Wisconsin agronomist and developer of the first seed corn drier; 25 December.

Ernst Zerner, 82; consultant to Argus Chemical Corporation and researcher in synthetic organic chemistry; 25 December.