News of Science

Storing Molecular Fragments

The National Bureau of Standards has developed a technique for capturing and storing large numbers of highly reactive molecular fragments at temperatures near absolute zero. In this method, unstable atoms and free radicals, known to exist but momentarily in flames and hot gases, are produced in an electric discharge, frozen into immobility, and trapped in solid form. Because these atoms are frozen in the excited state, they can be conveniently studied by optical spectroscopy.

In experiments to date, the bureau has produced solids containing atomic nitrogen and oxygen, and possibly atomic hydrogen and an unstable hydroxy (OH) molecule. These solids have very unusual properties, emitting bright glows, blue "flames," and colored flashes of light. When warmed 20 or 30 degrees, they combine very actively, releasing large quantities of stored energy, principally as heat. Possible fields of application for this new method include studies in solid state physics and basic chemistry, in which the trapped atoms could be used as powerful probes into the solids containing them. From a study of their properties, information could be obtained about the arrangement of the atoms and molecules in the solid and about the forces acting on them. The mechanism of atomic diffusion and of reactions between atoms and molecules also could be studied.

The technique has the advantage that the free radicals are stored in highly excited states as a result of the electric discharge, making it possible to study and analyze them by spectroscopic techniques. Also, because the radicals are collected at much lower temperatures than in previous methods, they can be stored longer in the uncombined form.

In this method, gases containing molecules of nitrogen, hydrogen, oxygen, or water are first passed through a high-frequency electric discharge, then frozen very suddenly at 4.2°K, just a few degrees above absolute zero.

The discharge is maintained in a waveguide resonator by a 2,450-Mc power supply. From the resonator, a glass tube leads the resulting molecular fragments into an evacuated metal vessel containing a cold surface in contact with a liquid helium bath. To prevent solidification of the discharge products at temperatures above 4.2°K, the gases are carried to the cold surface through a passageway that is kept near room temperature by contact with warm helium gas. When the gases reach the cold surface, they freeze into solid form there.

Because the free radicals produced by this method can be kept unchanged for many hours, a more detailed study of their properties has been possible than in previous work. For example, during the discharge through nitrogen the condensed solid emits a bright green glow, which tends to become yellow at high flow rates. The spectra obtained from this glow show that the structure of the solid condensed from the discharge differs from that of ordinary solid nitrogen. In fact, each atom of the condensed nitrogen forms a very loosely bound complex with some neighboring molecule, and this complex has properties that differ from those of the separate atom and molecule. The evidence shows that the complex is a definite unit. By analyzing its spectra, the forces holding it together can be studied.

Public School Growth

The Department of Health, Education, and Welfare has recently completed a study of the growth of the public school system in the continental United States (48 states and the District of Columbia) in the bienniums from 1951–52 to 1953–54. The total school population was at an all-time high, but secondary school enrollments were below the peaks reached in the 1930's. During the biennium from 1 July 1951 to 1 July 1953 the school-age population (ages 5 to 17 years inclusive) increased by 3.2 million (an increase of 10.1 percent) to reach 34.5 million. At the same time enrollments in the public schools increased from 26.6 million in 1951 to 28.8 million in 1953, an increase of 8.6 percent.

The total instructional staff increased by 86,000 to reach 1.098 million. Expenditures for public elementary and secondary schools amounted to $6.833 million in 1953–54, a rise of 19.7 percent over the $5.753 million spent in 1951–52. The total educational cost for 1953–54, when expenses for summer schools, community colleges, adult education, and so on are included, amounted to $9.092 million. Of this total $2.055 million went for capital outlay, a record high.

The report analysed salaries as follows:

"The average annual salary of the total instructional staff (supervisors, principals, teachers, etc.) was $3,825 in 1953–54 as compared with $3,450 in 1951–52, a rise of 10.9 percent; however, when adjusted to reflect the decrease in the purchasing power of the dollar, the average salary increased by 8.4 percent during the 2-year period. During the same period, the personal income (in 1953–54 dollars) per member of the labor force rose from $4,073 to $4,245, an increase of 4.2 percent. That instructional staff salaries still lag behind the gains made by the total labor force is indicated by the fact that during the period 1940–1954, the personal income of the labor force increased 62.3 percent compared with an increase of 37.8 percent in instructional staff salaries. A State-by-State analysis of instructional staff salaries in 1953–54 reveals that in 1 State the average salary was less than $2,000, in 12 States between $2,000 and $3,000, in 20 States between $3,000 and $4,000, and in 15 States the average was over $4,000."

International Cancer Statistics

Facts concerning cancer of the digestive organs and peritoneum are to be found in a statistical publication issued by the World Health Organization on the mortality from such malignant neoplasms in 26 countries since the beginning of the century. Mortality from cancer of the digestive organs is higher in men than in women.

Stomach cancer is responsible for the majority of cancer deaths in both sexes, immediately followed by cancer of the large intestine and the rectum. In England in 1953, 44.5 percent of all cancer deaths were caused by cancer of the digestive organs; in Spain, 48.9 percent; in France, 50.1 percent; in Italy, 54.6 percent; in Sweden, 52.7 percent; in Switzerland, 50.6 percent; in Canada, 46.7 percent; in Chile, 62.6 percent; in the United States, 39 percent; in Uruguay, 54.6 percent; and in Japan, 73.3 percent.

A remarkable increase in cancer deaths since the beginning of the 20th century is clearly shown in the statistical tables of the WHO report. Among the many possible causes of this rise is the aging of the population. Because cancer starts mainly around middle age, the fact that people live longer means that more of them may be struck by this disease. Fur-

thermore, in the past 50 years other causes of death such as the infectious diseases have lost much of their importance, thus increasing the proportion of deaths caused by cancer.

Michigan Reactor Controversy

The Atomic Energy Commission has granted a conditional construction permit to the Power Reactor Development Company of Detroit for the building of a nuclear power plant near Monroe, Mich., with a capacity of 100,000 kilowatts of electric power. The plant, which will be known as the Enrico Fermi Atomic Power Plant, will have a reactor of the fast-neutron breeder type.

The Power Reactor Development Company is composed of 26 industrial concerns, more than half of which are utility companies. The power generated by the nuclear plant will be distributed by the Detroit Edison Company, one of the member industries.

The permit covers only construction of the nuclear plant and does not extend to its operation. However, issuance of the permit has evoked strong protests. The AEC's advisory committee says that not enough is known about fast nuclear power plants to rule out the possibility of a dangerous failure. On the strength of this opinion, Thomas Murray, a member of the commission, and Sen. Clinton P. Anderson and Rep. Chet Holifield of the Joint Congressional Committee on Atomic Energy, have objected to the commission's conditional approval of the new reactor. In a statement to the press Holifield said:

"A small experimental operation of a fast-breeder type reactor "melted down' in Arco, Idaho, last November. There was no serious reaction because the operation was only a tiny laboratory experimental type, but it was an 'accidental' melt-down from causes not foreseen. As far as we know the same thing could happen to the 100,000-kilowatt plant the AEC has approved for Michigan."

Belgian Reactor Ban

Public fears in Belgium have led to the banning of the reactor that was to have been exhibited at the International Exposition to be held in Brussels in 1958. However, a pilot model with a capacity of about 11,000 kilowatts may be built within easy distance of the city. Some of Belgium's leading industrialists in the power production field have been in the United States discussing this and related matters with the Atomic Energy Commission and private industry.

According to a report in the *New York Times,* the Belgians are no more concerned than others about radiation danger. However, on the basis of available information the citizenry feel that the operation of even a pilot model within the city limits seems to be a "needless, even a foolhardy risk." Belgium is by no means behind in matters of nuclear energy. Because she possesses one of the world's largest sources of uranium, Belgium has received special treatment with regard to the exchange of information and materials and therefore has a well-advanced atomic energy program.

South African Observatory

Six European nations are considering building a joint observatory in South Africa that will be second in size only to Mount Palomar in the United States. The South African observatory would have a 120-inch telescope compared with Mount Palomar's 200-inch unit. The nations involved are Britain, France, West Germany, Sweden, and the Netherlands.

Pieter T. Oosterhoff of Leiden Observatory, who is leading a joint European southern observatory expedition on a survey of possible sites in South Africa, says that all of these countries, except the United Kingdom, have approved the project in principle. Individual financial contributions are yet to be agreed upon, and the U.K. is expected to make known its decision at the next meeting of the group to be held at Stockholm in October.

U.K. University Population

Wallis Taylor has estimated the size of the university-age population (18, 19, and 20 years) to be expected in the United Kingdom for each year up to 1972 [*Nature* **178**, 135 (21 July 1956)]. The estimates are based on forecasts for the survival of children already born, with allowances for the decreasing mortality this population has shown.

The population in this age group was 1.64 million in 1955. According to the estimates, the population will increase by 42 percent to reach a maximum of 2.34 million in 1966, and will decline steadily to 1.95 million in 1972. Taylor's figures indicate that the peak number of students who will be seeking university education will be larger than had hitherto been expected.

University Research in the Soviet Union

The role of universities in research in the Soviet Union is undergoing a major change, according to the *New York* Times. The Soviet Government has ordered the transfer of a number of research institutions from the control of the Soviet Academy of Sciences to that of the universities. The Ministry of Higher Education, which controls the universities, will compile a plan that will stipulate the most important areas for research. It is expected that universities will work on automation of production, development of semiconductors, the application of oxygen to metallurgy, the chemistry of radioactive substances, nuclear physics, machine tool design, the increase of crop yields, and so on.

Officials of the Soviet Academy of Sciences will be put under increased pressure to produce research results by a competitive device. One-fifth of the senior scientific posts will be put up annually for open competition. Formerly, such posts were lifetime assignments.

Genetics Congress Resolution

At the final session of the International Congress of Human Genetics which met recently in Copenhagen, Denmark, Herman J. Muller of the University of Indiana proposed the following resolution on radiation danger. It was passed unanimously by the approximately 400 participants.

"The damage produced by radiation on the hereditary material [of man] is real and should be taken seriously into consideration in both the peaceful and military uses of nuclear energy as well as in all medical, commercial and industrial practices in which X-rays or other ionizing radiation is emitted.

"It is recommended that the investigation of the amount and type of damage and of related genetic questions be greatly extended and intensified with a view to safe-guarding the well-being of future generations."

National Bureau of Standards To Be Moved

A tract of approximately 550 acres of land near Gaithersburg, Md., has been selected for relocation of the Washington laboratories of the National Bureau of Standards. The move will permit the bureau to plan new buildings to replace present research facilities, which have become inadequate for current needs. The new site was selected as most suited to the special requirements of the bureau's scientific and engineering programs. The choice was based on a number of factors, including accessibility by railroad and highway as well as topography for certain technical projects.

Congress appropriated funds for site acquisition and preliminary planning early in June after details about the pro-