SCIENCE NEWS

Science Service, Washington, D. C.

THE EFFECTS OF FEDERAL ECONOMY ON THE GEOLOGICAL SURVEY

SCIENTIFIC research work in the U. S. Geological Survey of the Interior Department will suffer a 29 per cent. cut for the year beginning July 1 next, as compared with the fiscal year now in progress, and in the whole operation of the survey about 250 employees, many of them specialized scientific workers, will be cast adrift to look for whatever work they may be able to find.

This is the net result of the Senate's recent 10 per cent. slashing of the already reduced Geological Survey budget. It is understood that House conferees are ready to accept these cuts. For geological surveys and research, there will be spent $440,000 in 1933 compared with $619,500 in 1932.

The reduction in funds "will inevitably mean a reduction of at least one third in effective work and accomplishment," Dr. W. C. Mendenhall, director of the U. S. Geological Survey, declared in response to an inquiry by *Science Service*.

"With less money for salaries and expenses," Dr. Mendenhall continued, "the staff must be sharply reduced and field work correspondingly curtailed. Not only must many problems, long awaiting attention but as yet untouched, be indefinitely postponed, but still worse, some of the projects that are already under way must be postponed or abandoned, even though nearing successful completion. This is a real loss to the nation, for when the scientists are discharged before their investigations are complete and their reports prepared for publication, the public loses the benefits that it would gain from the information and derives no value from the money already spent on the investigations thus abandoned.

"In another way, also, a large decrease in the scientific staff will mean serious loss to the public service. Reduction in personnel is far less simple in a scientific bureau than in a manufacturing industry, for the work of many of the scientists is so specialized that the men in general can not be interchanged between types of work. Any one project, whether it be investigation of the extent and value of the mineral resources of a certain area or a less specific research problem, may and usually does require contributions from a number of specialists in mineralogy, petrology, chemistry, physics, paleontology, stratigraphy, physiography and allied subjects.

"These highly trained specialists have been carefully selected for their qualifications as research workers in subjects that are essential elements in a properly organized geological survey. Some of them have had many years of service and experience in the survey. Others are younger assistants in training to fill vacancies caused by death, retirement or voluntary separation, for these special lines of work must be continued effectively without a break as long as the survey is called upon to function successfully and efficiently. The dropping of a quarter or a third of the scientists will leave gaps that can only in minor part be bridged, with inevitable loss in effectiveness and accomplishment."

A reduction of $75,000, or 18.7 per cent., in the appropriation for geologic surveys valuable to the mineral industry, is proposed. Fundamental research is cut $60,000, or 60 per cent. Between 35 and 40 employees will be forced out in these cuts. Volcanologic surveys lose $20,000, or 57 per cent., and the Alaskan mineral resources work is cut $24,500, or 29 per cent. Cuts for these research activities as proposed by the Senate total $179,500.

In addition to these research work curtailments, the Geological Survey funds for topographic surveys, necessary to the nation's mapping, are cut $100,000, meaning the loss of 94 employees. A salaries fund cut will mean the loss of 17. The appropriation for gaging streams is reduced $120,000 to the sum of $600,000, but as $450,000 of this is available only in cooperation with states and municipalities which are cramped themselves for funds, 40 to 50 persons in this work will probably lose their jobs.

THE COST OF PLANT DISEASES

TAXES on farm products, heavier than any legislative body would ever dare to levy, are assessed every year by plant diseases caused by fungi, bacteria and other parasitic microbes. This is made evident by a summary just issued by the U. S. Department of Agriculture, covering plant disease damage to the principal agricultural and horticultural crops for the years 1928, 1929 and 1930, the latest dates for which approximately complete figures are available.

Corn, the most important single crop in America, in 1928 had to give up 10.3 per cent, of its 2,839,959,000-bushel crop to its principal diseases. In 1929, the crop and the "tax" were both smaller: 2,622,189,000 bushels, with an 8.5 per cent. loss. Another drop occurred in 1930: crop 2,081,048,000 bushels; plant disease loss 7.6 per cent.

Cotton stands next to corn in economic importance in this country. The 1928 crop of 14,373,000 bales was cut 2,432,000 bales, or 17.2 per cent., by the worst of the cotton diseases. In 1929 a crop of nearly 15,000,000 bales suffered a 14 per cent. loss. In 1930 the crop was only a little smaller than that of 1928, but its damage was considerably less—just short of 10 per cent.

Wheat, the third big-money crop when prices are normal, was taxed by its main fungus enemies to the extent of 7.8, 8.2 and 5.7 per cent., respectively, of its total yields during the period, which ran between eight and nine hundred millions of bushels.

Some regional losses, of course, naturally ran higher than the average for the country at large. This was not of country-wide importance in some instances; but when the great wheat state of Kansas lost by disease 9.75 per cent. of its 1930 wheat crop, while the national average was only 5.7 per cent., it was a matter of more than local concern.

The general average disease loss for the country as a whole, in the crops reported, ranged around the five to ten per cent. bracket. Thus, the 1930 loss in barley was 4.2 per cent.; in oats, 3.7 per cent.; in pears, 13.9 per cent.; in apples, 11.5 per cent.; in peaches, 4.5 per cent. Potatoes, however, seem to have more virulent enemies; their nation-wide loss in 1930 was 22.4 per cent.

The figures, as given in this report, are for plant diseases only; losses due to the inroads of insect enemies are not considered, since they are the concern of a different bureau of the Department of Agriculture. There are literally thousands of plant diseases, since every cultivated and wild plant has plant parasitic enemies ranging in numbers from single species to scores. Some of them are so subtle and stubborn in their attacks that whole groups of scientists have to specialize in dealing with one disease, just as doctors of human ailments do.

THE NATURE OF LUMINESCENCE

ORGANISMS that shine in the dark, like fireflies, and the bacteria that cause the light of "punkwood" or "fox-fire," have evolved this special ability from one of the biochemical reactions that underlie ordinary respiration. Reasons in support of this view were presented before the opening session of the American Philosophical Society's annual meeting at Philadelphia on April 21, by Professor E. Newton Harvey, of Princeton University.

Professor Harvey, who has been working on the problems of "living light" for many years, traced a close parallelism between the reaction of the glowing substance "luciferin" and oxygen, brought about by the enzym "luciferase," and the "hydrogen acceptor" mechanism involved in the oxidation of food substances to set free energy in common non-luminous forms. The outstanding difference between the two processes is that in ordinary oxidation the end-product is carbon dioxide, whereas in the light-producing reaction this substance is not set free. Instead, the oxygen involved seems to be tied to hydrogen atoms to form water, and the oxidized luciferin is later caused to lose its oxygen and thus to be ready for use all over again.

Luminescence is a capacity possessed by many organisms scattered all over the evolutionary family tree; which leads Professor Harvey to believe that the shift-over from ordinary respiration to the special case of luminescence has occurred many times, and is not confined to any one line of descent.

There are two main modes of luminescence: continuous glow, exhibited by bacteria, and intermittent glow, exhibited by practically all other organisms. The intermittent type is the one most familiar to the majority of people; it is well exhibited by the common firefly. Intermittent luminescence ordinarily takes place only in response to a stimulus. It may serve an evolutionary end, such as scaring off enemies or attracting prospective mates. The anatomical mechanisms for its production are often quite complex.

The continuous glow of bacteria is emitted without stimulus and apparently serves no useful purpose to the organisms that display it. It seems to be produced simply by the secretion of luciferin within the bacterium's body, and the oxidation of this luciferin when it makes contact with the air.

THE EFFECTS OF VOLCANIC ERUPTIONS ON THE WEATHER

SOUTHERN South America may get a cold, wet summer as a result of the volcanic eruptions now in progress in the Chilean Andes, if the experience of North America twenty years ago is any criterion.

In 1912, one of the greatest of the Alaskan volcanoes, Katmai, literally blew its top off, hurling vast quantities of fine volcanic ash high into the air. This drifted in the upper atmosphere, the particles serving as nuclei for cloud particles. The result was that over huge stretches of territory in the United States proper the sun was hardly seen at all that summer.

A few days after the eruption, showers of the ash itself fell at Victoria and Vancouver, in British Columbia, 1,300 miles away, just as ash showers from the Andean volcanoes have been falling in cities on the Atlantic side of South America.

The after-effects of the Katmai eruption were confined to the Northern Hemisphere, and disappeared within a year or so. But a generation earlier, in 1883, there was an eruption whose effects were noticed all over the world, and lasted for several years. This was the explosion of the East Indian volcano Krakatau, which destroyed over 36,000 lives. This eruption threw so much ash—estimated at 4.25 cubic miles—so high into the air that it drifted entirely round the earth, and is credited with causing the unusual red sunsets that were observed for several years after the eruption.

Whether the present South American outbreak will have any such effects as these will depend largely on how high the volcanoes are casting their ash vomitings. If they get any large quantity of ash above the level of the highest clouds, about ten miles up, it may drift indefinitely, cross the equator and make its effects felt in the Northern Hemisphere, said Professor W. J. Humphreys, of the U. S. Weather Bureau, in response to a *Science Service* inquiry. At a somewhat lower elevation, the ash will still drift, but, caught in the Southern Hemisphere air circulation, it will not invade the supra-equatorial lands. And if the ejecta are not cast above cloud level, Professor Humphreys continued, they will be caught by condensing water and soon be washed entirely out of the air.

Although volcanologists themselves freely use the term "volcanic ash," they are careful to point out that it is not an accurate usage, if by "ash" one understands material that has been exposed to fire. For there is no fire in a volcano, except such small incidental flames as are caused by the ignition of minor amounts of inflammable matter such as hydrogen and sulphur. The appearance of great flames above the volcano is caused by the reflection of the glowing lava on the clouds above; and the "ash" is simply lava that has been blown into fine froth and finally shattered into particles by the explosive action of the eruption.

ROTENONE

ROTENONE, most effective insect killer yet discovered, has yielded the secret of its chemical make-up to three chemists of the U. S. Department of Agriculture, Dr. F. B. LaForge, Dr. H. L. Haller and Mr. L. E. Smith.

Rotenone is a white crystalline substance, obtained from the roots of tropical plants belonging to the pea family. Its principal commercial source at present is the East Indian vine, derris; but a South American shrub, cubé, has also been shown to contain it in paying quantities.

Rotenone contains only three chemical elements, carbon, hydrogen and oxygen, in the ratios of 23, 22 and 6. This is expressed by the "linear" formula $C_{23}H_{22}O_6$. The "structural" formula, which shows organic chemists just where each atom of the molecule is located, is reported to be quite complex.

The three chemists who conquered rotenone's secret are referred to by Dr. C. A. Browne, assistant chief of the Bureau of Chemistry and Soils, as winners over keen competition by German and Japanese chemists, who also were hard on the trail of its formula, and had been working for some time before the Americans started.

Chemists always want to know the exact formula of a compound that has been found valuable, because then they may be able to learn how to put it together more cheaply out of coal tar or some other low-priced material, instead of extracting it from expensive imported plant sources. The three chemists are now at work on this problem, and have already succeeded in assembling several compounds that might be said to represent halfway steps in the reconstruction. There is, of course, always the possibility that some entirely new synthetic product may be put together that will be even better than the natural prototype. This has happened frequently in the history of organic chemistry. The three Department of Agriculture chemists naturally hope that they may have a similar success.

Rotenone, for all its present highly scientific exploitation, was originally a gift to white men by naked savages. In both the East Indies and in South America the plants containing it were used as fish poisons, to kill fish wholesale in dammed-up little rivers. Though poisoned, the fish were still good to eat.

White man tried the poison on himself and on warm-blooded animals and found it harmless. He tried it on insects, and found it killed them with amazing quickness and economy. Now rotenone is used on a large scale in many widely-advertised insecticides. It is in the hope of making cheaper and better insect-killers that the Department of Agriculture chemists are carrying on their research.

ITEMS

BOTH neutrons and gamma-rays are given off when the metal beryllium is bombarded with the hearts of helium atoms, Dr. F. Rasetti, of the Kaiser Wilhelm-Institute for Chemistry, Berlin, has concluded after repeating the experiments of Drs. W. Bothe and H. Becker, German physicists, Mme. I. Curie-Joliot and Professor F. Joliot, French experimenters, and Dr. J. Chadwick, of Cambridge, England, which had been interpreted both as artificial radioactivity and as demonstrating the existence of the neutron, close combination of electron and proton. The neutrons are detected most readily in an ionization chamber and the gamma-rays, like those from radium, are detected by a counting tube.

CHEER for persons suffering from high blood-pressure was given by Dr. Carl J. Wiggers, professor of physiology of Western Reserve University School of Medicine, in an address before the American College of Physicians. High blood-pressure, he said, must be looked upon as a compensatory reaction designed to restore a normal blood supply to the tissues of the body. According to Dr. Wiggers, "If the physiological conception that hypertension is nature's agent, assuring an adequate blood supply to the tissues, could gain firmer root in the doctor's mind and through him be relayed to his patient, it would do much to remove the feeling of despair and impending doom so common in the layman who learns that his blood-pressure is 'high.'"

NEARLY sixteen years before the ninth planet, Pluto, was discovered, it was photographed at Harvard College Observatory. Its image has just been found on a photographic plate by Miss Arville D. Walker after Dr. E. C. Bower, of the University of California, had computed where the planet should have been on the night of November 11, 1914, when the plate was exposed through the 16-inch Metcalf telescope at Cambridge, Massachusetts. Pluto was discovered at Lowell Observatory, Arizona, early in 1930.

THE heavenly object discovered in March by Professor E. Delporte, Belgian astronomer, may be the return to the solar system of the Tuttle-Giacobini comet seen in 1858 and 1907. This is suggested by Dr. A. C. D. Crommelin, now that the orbit of the Delporte object has been computed. Comets known as 1858 III and 1907 III were not immediately recognized as identical. If the Delporte object proves to be the same comet, it must have lost most of its gaseous envelope since 1907, because it looked more like a star than a comet when first found, although it moved rapidly as comets do. It was bright when first found but faded shortly thereafter although it was approaching the earth and sun. It is suggested that there must have been some kind of outburst to explain its temporary brightness.

DISCOVERY of two substances that affect profoundly the growth and activity of female sex organs has been reported to the French Academy of Sciences by Drs. André Girard and Georges Sandulesco, of the Roussel Research Laboratories, Paris. These substances are described as new sex hormones in addition to the remarkably active substance known as theelin, the female sex hormone which was discovered by an American, Professor Edward A. Doisy, of St. Louis University School of Medicine. The two hormones belong to the same chemical group, the oxy-ketones, which means that they are related to acetone and alcohol, or, rather, phenol. They differ only slightly in composition. They all contain the same quantity of carbon and oxygen in their molecule, namely, eighteen carbon and two oxygen atoms, and differ only in the number of hydrogen atoms in the molecule.