by volcanic action or by differential diffusion in the earth or in unorganized matter. The slime of some snails carries as much as three per cent. of free sulphuric acid. Temperature, light, water and CO_2 are potent factors.

While the actual experimental work is largely the province of biologists, they will gain much both in direction and interpretation by close consultation with the chemists and physicists.

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SCIENTIFIC EVENTS

ANIMAL EXPERIMENTS IN GREAT BRITAIN[1]

THE annual return showing the number and nature of experiments on living animals during the year 1921 gives a list of all "registered places" where such experiments may be performed, the names of all persons who hold licenses during 1921, together with the registered place for which the license was in force and the number and nature of experiments performed. In the year 1921 twenty new places were registered for the performance of experiments and thirteen places were removed from the register. The total number of licensees was 812, of whom 219 performed no experiments. The experiments may be divided into two main groups, according to whether or not an anesthetic was used. It should be noted that the granting of a license only permits the licensee to perform experiments under an anesthetic, for the law declares "the animal must, during the whole of the experiment, be under the influence of some anesthetic of sufficient power to prevent the animal feeling pain; and the animal must, if the pain is likely to continue after the effect of the anesthetic has ceased, or if any serious injury has been inflicted on the animal, be killed before it recovers from the influence of the anesthetic which has been administered." To perform other experiments or even to observe the subsequent course of experiments undertaken with an anesthetic the licensee must be possessed of special certificates. Special certificates are also necessary for experiments on dogs, cats, horses, asses, mules and other large animals. The total number of experiments with anesthetics was 8,165, and of these 2,053 were simple inoculations into the skin of guinea-pigs, which were anesthetized in order to keep the animals motionless during the introduction of a minute quantity of the fluid to be tested for the purpose of standardization. Of the remaining 6,112 experiments, comprising all the cases in which any serious operation was involved, 2,751 were performed under the license alone, and were subject therefore to the restrictions above mentioned. In all operations, with the exception of a few special cases dealing with the efficiency of antiseptics, the law demands that the operation shall be performed antiseptically so that the healing of wounds shall, as far as possible, take place without pain. If the antiseptic precautions fail, and suppuration occurs, the animal must be killed. The following "pain condition" is attached to the license under special certificates: "If an animal, after and by reason of the said experiments, is found to be suffering pain which is either severe or is likely to endure, and if the main result of the experiment has been attained, the animal shall forthwith be painlessly killed. If an animal, after and by reason of the said experiments, is found to be suffering severe pain which is likely to endure, such animal shall forthwith be painlessly killed, whether the main result of the experiment has been attained or not. If any animal appears to an inspector to be suffering considerable pain, and if the inspector directs such animal to be destroyed, it shall forthwith be painlessly killed." The total number of experiments without anesthetics was 67,097. These were mostly simple inoculations and hypodermic injections, but included also some feeding experiments and administration of various substances by the mouth or by inhalation or by external application, and the abstraction of blood by puncture or simple venesection. In no instance was a certificate dispensing with the use of anesthetics allowed for an experiment involving a serious operation. The total number of experiments was 75,262, being 4,895 more than in 1920. The objects for which these experiments were performed were very diverse. A large number, almost wholly simple inoculations, were performed either on behalf of official bodies, with a view to the preservation of the public health or directly for

[1] *The British Medical Journal.*

the diagnosis and treatment of disease. Experiments conducted at a sewage farm to test the character of the effluent by its effect on the health of fish is an example of work carried out for the preservation of public health. Nearly 20,000 experiments were performed for the preparation and testing of antitoxin serums and vaccines and for the testing and standardizing of drugs. The several registered places were visited frequently by the inspectors, usually without previous notice, and they report that the animals were suitably lodged and well cared for, and the licensees generally attentive to the requirements of the act and the conditions attached to their licenses.

THE REPORT OF THE ENGINEERING COUNCIL ON WORK PERIODS

"THE tendency throughout the world is toward the abolition of the twelve-hour shift," it is held by the report of the Committee on Work-Periods of the American Engineering Council of the Federated American Engineering Societies, which has been adopted after a long discussion by the executive board of the council in Boston. The report, in effect, finds that the two-shift day of twelve hours each is not an economic necessity in American industry.

"In almost every continuous industry," according to the report, "there are plants which are operating on an eight-hour shift basis in competition with twelve-hour shift plants." It is also shown that in practically all major continuous industry plants which have changed from twelve hours to eight hours have increased the quantity of production per man up to as much as twenty-five per cent. In a few cases, the report states, the increase has been much higher. In the steel and iron industry, which is made the subject of a special report, it was found that "the change from the twelve to the eight-hour day has secured results sufficient to compensate in whole or in part for the extra cost."

Other advantages of the eight-hour day in the steel and iron industry are described as increased efficiency, better morale, elimination of the "floating gang," which is maintained to give twelve-hour men a day off a week, and greater prestige of the industry with the public.

Professor Samuel McCune Lindsay, of Columbia University, representing the Cabot Fund of Boston, officialy styled the report as embodying the results of "the most important investigation of any industrial situation ever undertaken in this country." The Cabot Fund cooperated in the engineering investigation, which occupied nearly two years and covered practically every continuous industry in the United States. Professor Lindsay, who is president of the Academy of Political Science, authorized the statement that Professor Henry R. Seager, of Columbia, president of the American Economic Association, shared his general view.

The results of the industrial investigation, which will exercise a great influence on the general labor situation, were obtained through two lines of inquiry. One enquiry, embracing the steel and iron industry of the country, was directed by Bradley Stoughton, of New York, former secretary of the American Institute of Mining and Metallurgical Engineers and former adjunct professor of metallurgy in Columbia University.

The second enquiry was directed by Horace B. Drury, industrial investigator and former member of the faculty of Ohio State University. Each enquiry was made the subject of a separate report, the whole investigation being in charge of the council's Committee on Work-Periods, of which Dr. H. E. Howe, of Washington, is chairman. Dr. Howe presented the report to the board. His associates on the committee are J. Parke Channing, L. P. Alford, Fred J. Miller and Dwight T. Farnham, of New York; Morris L. Cooke, of Philadelphia, and L. W. Wallace, of Washington.

Presentation of the report by Dr. Howe caused a spirited discussion of two hours, during which President Cooley, urging adoption, asserted that the report was a remarkable contribution of the engineering profession toward the advancement of mankind. Others participating in the debate were Philip N. Moore, of St. Louis; Professor Joseph W. Roe, of New York University; Irving E. Moulthrop, of Boston; W. W. Varney, of Cleveland; Calvert Townley, of New York; E. S. Carman, of Cleveland; John A. Stevens, of Lowell; Wil-