infection by the intracerebral or intranasal routes. After intramuscular or intraperitoneal inoculation, however, 15-day-old mice are all susceptible while at one month of age 40 to 50 per cent. are already resistant, and beyond the age of three months this resistance rises to 95 per cent. After intramuscular injection in young mice this virus was found to invade the central nervous system along the local peripheral nerves in only about 5 per cent. of the animals, while in most of the others it appears to be eliminated from the blood onto the olfactory mucosa from where it invades the brain along the olfactory pathways. Studies on the nature of the resistance in older mice revealed that it is bound up with a failure of the virus to traverse the blood vessels, for the systemic phase of the disease, with virus circulating in the blood, occurs in both young and old animals. In guinea-pigs there is an indication that virus in the blood may pass or grow across the vessels directly into the brain and it is interesting that here too old animals were found to be resistant except when overwhelming doses were injected. That similar factors may play a role in human beings is suggested by the fact that in the first epidemic of this disease in man the majority of cases occurred in children, and also by the observation that adult laboratory workers may develop antibodies against the virus without having exhibited any signs of disease of the nervous system.

With the western strain of the mouse-passage virus, the first evidence that age has produced some change in the animal is found in the fact that after injection into the muscles of a hind leg, 80 to 90 per cent. of 15-day-old mice develop signs of encephalitis and the rest, signs of flaccid paralysis, while at 21 days the ratio is reversed, the majority developing flaccid paralysis, and about 20 per cent. resisting altogether. At one month of age and beyond, 90 per cent. or more are resistant to intramuscular inoculation, although injection directly into the sciatic nerve results in the paralytic disease in a large proportion of the animals. There are thus at least three phases during the maturation of the mouse, at which the neuroinvasiveness of the western virus is differently affected: first, at 15 days of age when certain vessels still permit the virus to traverse and spread in the central nervous system by some definite pathway; second, at the age of 21 days when the virus can no longer do this in the majority of mice, but now progresses along the nerves supplying the inoculated muscle; and third, between the 21st and 30th days of life when the appearance of some change in the muscles or specialized nerve endings in the great majority of mice now prevents invasion of the nervous system altogether.

Finally it should be noted that practically all the animals in whom constitutional resistance operated in one form or another to arrest and render inapparent, infection with the vesicular stomatitis or equine encephalomyelitis viruses ultimately developed specific immunity of the entire body, including humoral antibodies. This, at least as regards these neurotropic viruses, is an excellent illustration for the hypothesis that specific immunity without apparent disease is the result of preexisting resistance rather than the reverse.

In summary, it may be said, therefore, that as a result of the special mode of spread of certain viruses from the periphery into the central nervous system and also within it, the insusceptibility or inavailability of certain isolated tissues or structures, rather than resistance or immunity of the whole animal can act as a barrier to virus progression and prevent the development of apparent disease of the nervous system. While this mechanism may be only one among a number of others which operate in protecting the major portion of the animal and human population from disabling or fatal disease of the nervous system, it is especially interesting because it lends itself to the kind of experimental manipulation by which one may attempt to change susceptible individuals into resistant ones.

OBITUARY

ROY GRAHAM

DR. ROY GRAHAM, geologist at the Britannia Mines, British Columbia, was fatally crushed by a fall of rock in the mines on August 10, 1939. Thus tragically a life of unusual promise was brought to a close. Graham received his undergraduate education at the University of British Columbia, graduating in 1930 and receiving the master's degree in 1931. From 1931 to 1933 he held a fellowship in geology at the University of Chicago, where, under Dr. A. C. Noé, he became interested in the field of paleobotany, writing his doctor's dissertation (1933) on the Pennsylvania flora of Illinois as revealed in coal balls.

His excellent record at Chicago brought him the award of a National Research Fellowship in the fall of 1933 and enabled him to spend a year at Cambridge, England, studying under the distinguished English paleobotanist, Professor A. C. Seward. Returning to America in the fall of 1934, Graham soon thereafter was appointed to an assistantship at the University of British Columbia, serving in that capacity until May, 1937, and spending his summers in field work in Saskatchewan under the auspices of the Geological Survey of Canada.

His greatest talents and keenest desires lay in the field of paleobotanical research, but while awaiting

an adequate opportunity in that restricted field he turned his energies to applied geology, in which he was also much interested, serving in the summer of 1937 as geologist with the Consolidated Gold Alluvials Company of Wingdam, British Columbia, and later serving for nearly two years as geologist with the Britannia Mining and Smelting Company, Britannia, British Columbia.

Graham described nine, or about half, of the new species thus far identified from American coal balls, and there is little doubt that his species are based on substantial distinctions. It is chiefly to Graham's work that we must turn to learn of the paleontological distinctions between the flora of higher McLeansboro of Illinois and the well-known Lower Coal Measures flora of England. Other contributions have generally lacked the essential paleontological outlook which he possessed, so that generalized identifications which tended to obscure the age relations were elsewhere carried into our literature. There can be no question that Graham's work was of high caliber and, in comparison with the rest of our fragmentary knowledge, exceedingly valuable. Consequently, his loss was a serious one to this rather neglected field of science in America.

He will be greatly missed by his former teachers and associates, who were not slow to discover the earnest, lofty but friendly spirit beneath a somewhat shy exterior.

EDSON S. BASTIN

RECENT DEATHS

DR. HENRY L. SWAIN, professor of diseases of the ear, throat and nose of the Medical School of Yale University, died on January 11 at the age of seventy-five years.

DR. CHARLES E. COATES, dean emeritus of the College of Pure and Applied Science at the Louisiana State University, known for his work as sugar technologist, died on December 27 in his seventy-fourth year.

ALBERT H. BUMSTEAD, for twenty-five years chief cartographer of the National Geographical Society, died on January 9 at the age of sixty-four years.

EDMUND NEVILLE NEVILL, late director of the Government Observatory at Natal, died on January 17 at the age of ninety-three years.

Nature reports the death of Dr. Eduard Fischer, professor of botany at the University of Bern from 1897 until 1933, and of Prince Ginori Conti, the Italian industrial chemist.

SCIENTIFIC EVENTS

SCIENTIFIC RESEARCH AND TECHNICAL DEVELOPMENT IN GREAT BRITAIN

IT is announced in *Nature* that an Advisory Council on Scientific Research and Technical Development has been set up by the British Minister of Supply to advise him on scientific and technical problems. The main functions of the council will be to ensure that the work of the Directorate of Scientific Research is carried out with due regard to recent advances in scientific knowledge, to introduce new fields of research and development and to make recommendations regarding the most effective use of scientific personnel. The chairman of the council is Lord Cadman, emeritus professor of mining and petroleum technology in the University of Birmingham, chairman of the Anglo-Iranian Oil Company, Ltd., and of the Iraq Petroleum Company, Ltd. The Admiralty, Air Ministry and Ministry of Home Security are also represented on the council, of which the joint secretaries are E. T. Paris and F. Roffey, of the Ministry of Supply, Adelphi, W.C.2.

The council is constituted as follows:

Professor E. N. da C. Andrade, professor of physics, University College, London; Dr. E. V. Appleton, secretary, Department of Scientific and Industrial Research; Sir Joseph Barcroft, formerly professor of physiology, University of Cambridge; Professor W. L. Bragg, Cavendish professor of physics, University of Cambridge; Major-General E. M. C. Clarke, director of artillery (military adviser), Ministry of Supply; Professor J. D. Cockcroft, professor of natural philosophy, University of Cambridge; Major-General A. E. Davidson, controller of mechanization development (military adviser), Ministry of Supply; Dr. H. J. Gough, director of scientific research, Ministry of Supply; Dr. H. L. Guy, chief engineer, Mechanical Engineering Department, Metropolitan-Vickers Electrical Co., Ltd.; Sir Harold Hartley, vice-president and director of research, L.M.S. Railway, and chairman of the Fuel Research Board; Professor I. M. Heilbron, professor of organic chemistry, University of London; Professor A. V. Hill, secretary, Royal Society, and Foulerton research professor (physiology); Professor R. S. Hutton, professor of metallurgy, University of Cambridge; Sir Robert Robertson, director of the Salters' Institute of Industrial Chemistry, formerly government chemist; Sir Robert Robinson, professor of chemistry, University of Oxford; J. Rogers, deputy director-general of explosives, Ministry of Supply; Sir Frank Smith, director of instrument production, Ministry of Supply, director of research, Anglo-Iranian Oil Co.; Professor R. V. Southwell, professor of engineering, University of Oxford; Professor G. I. Taylor, Yarrow research professor of the Royal Society (engineering); Sir Maurice Taylor, senior military adviser, Ministry of Supply; Sir Henry Tizard, rector of Imperial College of Science, chairman, Aeronautical Research Committee.