Irrigation is possible over an area of about 1,200,000 acres in the Columbia Basin, of which 980,000 acres will be by gravity and the remainder by supplemental pumping. The district lies on the east side of the Columbia River, between Soap Lake on the north and Pasco at the extreme southern end, with a maximum width of 60 miles. The land has been declared to be "the best undeveloped irrigation area on the continent".

The estimated ultimate cost of the entire undertaking is 377,000,000 dollars (£75,400,000) of which 179 million dollars is assignable to the dam and power plant and the balance to the irrigation system. The initial development at the Grand Coulee Dam is estimated to cost 60 million dollars.

II

Bonneville Dam

The Columbia River furnishes other sites than the foregoing for the economical exploitation of water-power, including Rock Island and Bonneville. The former of these has already been developed by private enterprise ; the development of the latter, Bonneville, is now in hand by the U. S. War Department Corps of Engineers under an authorization of Congress on August 30, 1935. The main features of the Bonneville undertaking are a dam, a power house, a ship lock and fishways. The total cost, inclusive of an initial installation of two (out of ten) power units of 60,000 horse-power each, will amount to 45 million dollars (£9,000,000).

The Bonneville site (Fig. 2) is about 143 miles from the coast of the Pacific and the river is tidal for that distance. At this point, the river flows in a westerly direction in two channels, separated by Bradford Island. The dam is being constructed in the north or main, channel, while the power house and navigation lock are located on the south channel. The bedrock under the principal structures is a sedimentary deposit of volcanic ash, largely intermixed with pebbles and rock fragments of all sizes, and is locally known as Eagle Creek formation. There is a mushroom-shaped intrusion of andesitic lava of high quality which forms the foundation for the lock and the power house.

The dam is a concrete gravity structure at the base, supporting reinforced concrete piers for eighteen vertical lift steel gates. The gate openings are each 50 ft. wide and the piers 10 ft. thick, making the length of the dam proper, 1,090 ft. The width at the base is 200 ft. and the height above lowest foundation, about 170 ft. A service roadway is to be carried across the piers, so that the completed dam will have the appearance of a concrete multiple-arch bridge. The dam is designed to pass a flood of 1,600,000 cusecs—37 per cent in excess of the volume of the flood of 1894.

The ultimate capacity of the power installation will be ten 43,200 kw. units, 3 phase, 60 cycles, and one 4,000 kw. station service unit. Each of the main turbines will be of 60,000 horse-power, with a head of 45 ft. and a flow of about 2,200 cusecs.

The ship lock is designed to receive ocean-going vessels, so that by deepening the channel below Bonneville (the natural depth of which at low water ranges from 7 ft. to 50 ft.) such vessels may ascend from Vancouver to The Dalles, about 50 miles above Bonneville. The lock will have clear dimensions of 76 ft. in width by 500 ft. in length, and a depth of 24 ft. over the lower sills at low water.

The information on which the foregoing article is based has been supplied by the Bureau of Reclamation, Department of the Interior, Washington, so far as the Grand Coulee installation is concerned, and by the Corps of Engineers, U. S. Army, Washington, in relation to the Bonneville project, to both of which bodies, acknowledgments are also made for the photographic illustrations.

Medical Research in 1936

IN addition to the usual summary of the present position of many aspects of medical research, the report of the Medical Research Council* discloses that steps have been taken during the past year to develop the Council's policy of establishing senior clinical posts for whole-time work in research and higher teaching, such as will give a satisfactory career in later life to young men who devote themselves to the scientific study of clinical problems. The Council already supports, in whole or in part, three clinical research units in London, at University College Hospital, Guy's Hospital and the National Hospital for Diseases of the Nervous System. Reference is made to the establishment of a department of clinical research at Cambridge, under the regius professor of physic, in which research students are supported by the Elmore Fund, and to Lord Nuffield's gift to the University

* Committee of the Privy Council for Medical Research. Report of the Medical Research Council for the Year 1935–1936. (Cmd. 5378.) Pp. 172. (London : H.M. Stationery Office, 1937.) 3s. net.

of Oxford for the development of research and post-graduate teaching in medical science.

The Council has given special attention to another aspect of the problem, namely, the training of young clinicians with academic and research appointments in view: for this purpose it has instituted six post-graduate studentships and four research fellowships in clinical science and experimental pathology. The students receive a grant for personal maintenance while undertaking approved courses of study in Great Britain, which may include modern languages as well as advanced physiological, pathological and special clinical work under recognized teachers. The fellowships are for candidates who have already had some experience in the use of research methods, and are intended as probationary appointments for research in clinical science and experimental pathology under suitable direction in Great Britain.

The Council has also always considered problems of health and disease in relation to tropical conditions within its sphere: in fact, one of the chief reasons why it was originally placed under the direction of the Privy Council was that it should be free from territorial limitations. With the prospects becoming more favourable of being able to institute a wider programme of work in the tropics, the Council has appointed a Tropical Medical Research Committee, which contains representatives of the Colonial Office and of the Liverpool and London Schools of Tropical Medicine. The Committee having advised that the most effective means open to the Council of promoting investigations in this subject is the establishment of a small staff of highly qualified workers giving their whole time to research under the best possible conditions, the Council has awarded two junior and two senior fellowships with the view of training suitable candidates in research in tropical medicine. The Council's further intention is to establish, as suitable investigators become available under this scheme, permanent and pensionable appointments for research work in tropical medicine including senior posts: members of this staff will work partly in the tropics and partly in institutions at home. The terms of service will be as favourable as those applying to other Government appointments for men of similar professional standing.

There have been three changes in the constitution of the Council during the year: the Marquess of Linlithgow, Prof. E. D. Adrian and Mr. W. S. Morrison have retired and been succeeded by Lord Balfour of Burleigh, who becomes the new chairman of the Council, Prof. J. Mellanby and Mr. R. K. Law. Reference is made in the report to the award of the Nobel Prize in Medicine for 1936 to Sir Henry Dale, conjointly with Prof. O. Loewi of Graz, in recognition of their work on the nature of the chemical mechanism involved in the transmission of nerve impulses, and to the loss suffered by the National Institute for Medical Research by the death of Captain S. R. Douglas: Sir Patrick Laidlaw has been appointed to succeed Captain Douglas as deputy director of the Institute and head of the Department of Experimental Pathology and Bacteriology.

The scientific researches carried out by members of the scientific staff of the Council and by other workers supported by grants-in-aid cover the whole field of medical research: it is possible to refer to only a few of the more outstanding advances during the past year in this review.

Investigations have been continued on the properties of different viruses: in the case of influenza, it has been shown that the virus obtained in various outbreaks of the disease in widely distant parts of the world is identical with that originally isolated in Great Britain. Conclusive proof has also been obtained of the identity of the experimental disease in ferrets with influenza in man; an infection originally obtained from human sources and since passed repeatedly from ferret to ferret, has been retransmitted by accident to a human being. Progress has been made in the study of methods for the immunization of man against this disease by use of vaccines; but nothing suitable for application in more than an experimental way has yet been achieved.

A new method of determining the size of the particles of different viruses has been used to check results obtained by differential filtration. The rotor of a Sharples centrifuge, closed at the lower end, is lined with a thin layer of a weak agar gel, which is allowed to set during rotation: the suspension to be separated forms a layer only a small fraction of a millimetre in depth on the surface of the agar when the rotor is spinning, so that the particles become entangled in the gel and are protected from re-suspension when the rotor is decelerated. The correspondence between the figures given by filtration and centrifugation has been found in all cases to be a good one.

A characteristic of the known pathogenic viruses has been the failure, hitherto, to grow them in artificial culture media free from organized cellular material which they can infect. A group of free-living non-pathogenic organisms, of about the size of vaccinia virus, has now been discovered living in London sewage; they grow readily on ordinary bacteriological media, in which they can be maintained indefinitely in pure culture. The suggestion that propagation of viruses is possible only under conditions of intra-cellular parasitism, since the system of enzymes and surfaces necessary for self-reproductive life could not exist within a

sphere of such small diameter as that of a virus, is therefore inapplicable to viruses of the size of the vaccinia group—about 150 millimicrons. The existence of these free-living organisms raises the hope that means may yet be found for growing some of the pathogenic viruses in artificial culture.

Analysis of some recent studies of nutrition in Great Britain has shown the relative constancy in the distribution of calories between protein, fat and carbohydrate eaten by people in different towns : in particular, the percentage of protein eaten is constant, at 10–11 per cent in St. Andrews, Cardiff and Reading. In spite of this, the types of foodstuffs eaten are widely different : in fact, the constant percentage intake of protein and the similar calorie intake of people living far apart, are obtained independently of the type of foodstuff eaten and seem to represent the result of some kind of instinct. As regards the daily calorie intake, a recent investigation of the diet of more than a hundred women students showed the daily intake to be 2,035 calories per person. This intake is considerably less than the usual standard of 3,000 calories, which has itself been considered by some workers to be too low. The analysis of these diets led to the conclusion that few can be considered really poor : on the other hand, many of them, particularly with reference to their content of 'protective' foodstuffs such as milk, green vegetables and fruit, leave much to be desired. The remedy is the education of the average housewife in the relative nutritive value of different foodstuffs.

Epidemic diseases still remain one of the greatest enemies of mankind, although some have been partially or even completely conquered. Problems relating to the spread of epidemics have been studied by field investigations of epidemics naturally occurring among human beings ; but there are still many problems which have resisted field investigation because the difficulties of collecting statistical evidence prevent the assessment of the importance of inter-related factors. The experimental study of the spread of epidemics in a population of mice, as carried out for many years at the London School of Hygiene and Tropical Medicine, has provided answers to certain of these problems. Thus it appears that in large herds living under conditions favourable to the spread of epidemic disease, and receiving regular additions of healthy animals, the disease will persist indefinitely. The form of the mortality curve and the size of the herd are determined mainly by the rate of immigration. In epidemics initiated by virulent organisms, the rate of mortality during the early days of herd life is high, reaching a low level between the fortieth and sixtieth days of cage life. The expectation of life from the twentieth to the thirtieth day rises continuously but never reaches that of normal healthy mice. It is considered that both selection and natural immunization play a part in the increased average resistance displayed by surviving animals, the latter being the more important.

Another important subject which is discussed in the report is the problem of the prevention and treatment of puerperal (or childbed) fever. Summing up the present position, the report states that modern investigation suggests two lines of prevention, with a reserve line of treatment if the first two lines of defence are broken down. First, childbirth should be so conducted that access of pathogenic organisms to the birth-canal is rigorously excluded, especially streptococci from the throats of medical attendants, friends or the patient herself. Secondly, the diet should be of such a nature as to raise the resistance to infection to the highest possible level ; this means an ample consumption of milk, green vegetables and other protective foods. Finally, if infection does occur, there is evidence that the new chemotherapeutic compounds, 4-sulphonamido-2-4 diaminoazobenzol and *p*-aminobenzene sulphonamide, will reduce both the mortality and the incidence of complications.

Obituary Notices

Prof. W. M. Wheeler

IN the death of Prof. William Morton Wheeler, the United States loses an outstanding personality in the biological world and a man whose reputation spread far beyond the confines of his native country. The first intimation of his death received in England was a telegram from Dr. T. Barbour of Harvard University to Prof. J. Stanley Gardiner, on April 21. He died suddenly in Harvard Square, Cambridge, Mass., on the evening of April 19, after having only very recently returned from a journey in Mexico.

Born at Milwaukee (Wisconsin) on March 19, 1865, Wheeler graduated from the German-American Normal College in that city in 1884. In June 1885, he became a teacher of German and philosophy in the High School, Milwaukee, under George W. Peckham, a well-known student of spiders and social insects. In 1887 Wheeler became custodian of the public museum in his native city, and gave up this post in 1890 on being made a fellow of Clark University, under C. O. Whitman. He graduated Ph.D. there in 1892 and, in the same year, became instructor