We can give an example in which the notion of isomeric nuclei may be of great use. In the region of the heavy elements there exist the stable isotope of lead $_{82}Pb^{210}$ found by Aston* which is isomeric with β-decaying RaD, and the isomeric nuclei UX_2 and UZ resulting by β-forking from UX_1 and both giving after the emission of a second β-particle the nucleus of U_{II}. In the last case, two different β-branches leading from UX_1 to U_{II} : $UX_1 \xrightarrow{\beta} UX_2 \xrightarrow{\beta} U_{II}$ and $UX_1 \xrightarrow{\beta} UZ \xrightarrow{\beta} U_{II}$ may be considered as due to the above mentioned two possibilities for β-emission : $n\bar{p} \xrightarrow{\beta^+} pp \xrightarrow{\beta^-} pn$ and $np \xrightarrow{\beta^-} nn \xrightarrow{\beta^+} pn$ giving rise to isomeric nuclei at the half-way stage.

* The existence of this isotope is unfortunately not quite definitely proved.

It is interesting to notice here that the negative protons are the only particles, apart from neutrons, for which there are no potential barriers around the nuclei, and therefore one would expect that substitutional reactions of the type

$$_nX^m + {}_0n^1 \rightarrow {}_{n+1}Y^m + {}_{-1}p^1$$

would be probable even for the heaviest elements. It is not impossible that some of the Fermi reactions for heavy elements may be explained on this basis.

In conclusion, we may say that there are so many indications of the existence of negative protons that the hope is justified that these as yet hypothetical particles, completing the symmetry of the physical world, will be found sooner or later.

Progress in Medical Research*

THE report of the Medical Research Council for 1933–34 reveals the wide boundaries within which investigations relating to health and disease are being initiated and supported throughout Great Britain, and reflects the rapid development of medical science as well as the need for scientific knowledge as a guide in practical affairs. Parliament provided a grant-in-aid of £139,000 for the Council's expenditure during the present financial year, the provisional allocation of which is, for administration £9,000, for the expenses of the National Institute for Medical Research including the farm laboratories £54,000 and for research grants to scientific workers and for the investigations of the Industrial Health Research Board £76,000. The funds available have, as usual, been augmented from other sources for the promotion of particular schemes of research.

Lord D'Abernon resigned his membership of the Council ; the vacancy was filled by the appointment of the Marquess of Linlithgow, who was also elected chairman of the Council in succession to Lord D'Abernon. Prof. E. Mellanby also resigned his membership on being appointed secretary of the Council ; Prof. H. S. Raper was appointed to succeed him. Sir Charles Sherrington and Dr. J. A. Arkwright retired and Prof. A. J. Clark and Prof. J. C. G. Ledingham were appointed members. It was decided that the tribute to the late Sir Walter Morley Fletcher, for which funds had been collected during the year, should consist in the first place of a personal memorial, in the form of a portrait bust to be placed in a suitable setting in the National Institute for Medical Research, and secondly of the inception of some scheme for the advancement of knowledge for the relief of human suffering, which, it is proposed, should be the foundation of a Walter Fletcher Laboratory at Mill Hill, to be devoted particularly to nutritional studies.

The Department of Biological Standards at the National Institute now holds twenty-three different standards. Thirty-three different countries, including British Dominions, have been supplied with samples of some of them during the year. The standards for gas gangrene antitoxin, staphylococcus antitoxin and two anti-pneumococcus sera, prepared at the Institute, have now been adopted by the Permanent Commission on Biological Standardisation of the League of Nations, and units defined in terms of them. They will be preserved at the State Serum Institute, Copenhagen, for international distribution. The work carried out on vitamin standards by and for the Accessory Food Factors Committee was reported to the second International Conference on Vitamin Standards held in London last June: the National Institute continues to hold the four standards for vitamins A, B_1, C and D and is responsible for their international distribution.

In the field of clinical research the Council has applied the funds released by the permanent endowment by the Rockefeller Foundation of the post held by Sir Thomas Lewis at University College Hospital, to the establishment of a new Clinical Research Unit at Guy's Hospital ; Dr. R. T. Grant has been appointed director. The opportunities for clinical research are steadily widening. The report refers to the departments established during the past few years, including

* Committee of the Privy Council for Medical Research: Report of the Medical Research Council for the Year 1933–34. (Cmd. 4796.) Pp. 172. (London : H.M. Stationery Office, 1935.) 3s. net.

those at the National Hospital for Nervous Diseases, Queen Square, at King's College Hospital, at the Middlesex Hospital and finally at the new British Postgraduate Medical School, for which funds have been supplied by various benefactors or responsible authorities.

The work on viruses at the National Institute has been actively continued. The important discovery by Laidlaw, Andrewes and Wilson Smith that the virus of human influenza can be transferred to ferrets, mentioned in last year's report, has opened up a new line of attack on the problems of this disease. It has now been found that mice can be infected from ferrets by suitable methods, for example, intranasal inoculation under light ether anæsthesia. The animals show signs of illness of a pneumonic type, which is usually fatal. The disease can be transmitted from mouse to mouse and from mouse back again to ferret: the direct infection of mouse from man has not yet been attempted, in the absence of an epidemic of influenza. The virus has been detected in the throat washings of only one case of illness, clinically diagnosed as 'influenza', out of a number examined. The method of transmission to the mice is of crucial importance, and there is no evidence of a natural spread of the disease from infected animals to others living with them. Neutralising sera can be obtained from the ferret, horse and pig after infection with the virus, and the blood serum of practically all human subjects recently examined contains such a neutralising antibody. The infection for the mouse can be neutralised by ferret serum and the animal afterwards rendered hyper-immune by repeated administration of the virus. The influenza virus is very similar to that found by American workers in 'hog influenza', which causes a severe illness in the ferret or mouse: the original disease in swine, however, is caused only by the joint action of the virus and a visible bacterium.

Sir Henry Dale, working with Drs. Gaddum, Feldberg and Vartiainen, has continued his experiments on the nature of the process by which nervous impulses are transmitted from the nerve endings to the cells under their control. It is highly probable that the effectiveness of practically all messages passing from the central nervous system to voluntary muscles and other organs of the body depends upon the liberation, at particular points of their course, of acetylcholine. In the case of the sympathetic nervous system, however, the substance liberated at most nerve endings is related to adrenaline. An exception is the nerve-supply to the sweat glands, which, although belonging to the sympathetic system, yet, in the cat at any rate, acts by the liberation of acetylcholine. Sir Henry Dale has used the words 'cholinergic' and 'adrenergic' for nerve fibres the effects of which are transmitted by acetylcholine and a substance related to adrenaline respectively. It now appears that the preganglionic fibres of the whole autonomic system and the motor fibres to striated skeletal muscle are cholinergic, together with the postganglionic fibres of the parasympathetic division of the autonomic system; the postganglionic fibres of the sympathetic system are predominantly, but not exclusively, adrenergic. These observations throw light on the experiments of Langley and Anderson thirty years ago on the replacement of the fibres of one nerve by those of another in regeneration. They showed that voluntary motor fibres and preganglionic fibres of any part of the autonomic system could functionally replace one another, or postganglionic fibres of the parasympathetic system, but not postganglionic fibres of the sympathetic system. These observations can now be summarised by saying that cholinergic fibres are interchangeable with other cholinergic fibres, and adrenergic with other adrenergic fibres, but that fibres employing different methods of chemical transmission cannot replace one another.

Another type of evidence showing the importance of specific chemical substances in the working of the nervous system has been brought to light by nutritional experiments, for example, the work of Peters on the rôle of vitamin B_1 in the oxidation of carbohydrate in the brain and of Mellanby on the degenerative changes occurring in nerve cells and their conducting fibres when the supply of vitamin A or carotene in the diet is insufficient. The fibres and cells chiefly affected are the afferent, and their degeneration is followed, or accompanied by, changes in the epithelial surfaces connected with them, resulting in microbial infection. It appears that nerve cells may play a much larger part in aiding the defence of certain tissues against infection than had previously been suspected.

Among the many other investigations carried out by, and for, the Council, that on 'accident proneness' has a special interest at the present time. Recent work has widened the field of inquiry from that of ordinary industrial risks, to include the study of road accidents. With regard to the former, it is now well established that certain persons have a special liability to be the subjects of accidents; for example, 10 per cent of a group may be responsible for 75 per cent of the accidents occurring amongst them. The phenomenon is independent of any question of responsibility or blameworthiness. It has been found that those who sustain an undue number of one kind of accident also sustain an undue number of other kinds, and that accident proneness is a relatively

stable quality, so that if those who have an undue number of accidents in their first year of exposure are eliminated, the subsequent accident ratio of the group is diminished. A similar relationship has been found to hold for motor accidents. The elimination (on paper) of those who sustain an undue number of accidents in an initial period of exposure reduces the accident rate shown by the remainder of the group in the subsequent period. The report suggests that data are already available, in the records of the insurance companies, for giving a trial to this method of accident prevention on a large scale. The novelty of the method, as compared with judicial disqualification, lies in the facts that it makes use of information provided by minor accidents and that it is dissociated from any question of blame, since a man cannot be blamed because his reactions are slower than those of others. Yet it appears reasonable that he should be removed from a position in which he is a danger to himself and others, or by appropriate tests be prevented from reaching this position.

Obituary

SIR JAMES WALKER, F.R.S.

THE death of Sir James Walker at Edinburgh on May 6, in his seventy-third year, severs one of the last links between classical and modern physical chemistry. Closely connected in work and friendship with the three great founders of the science on the Continent—van't Hoff, Ostwald and Arrhenius—Walker may be justly regarded, indeed, as the protagonist of physical chemistry in Great Britain during the last forty years. His text-book, "Introduction to Physical Chemistry", has passed through ten editions since its first appearance in 1899, and has probably assisted more students towards an easy, yet serious, appreciation of the science than any other single volume. Several of the more significant chapters of the subject—for example, those on hydrolysis and amphoteric electrolytes—were largely his own original work. Walker was also, however, a skilled organic chemist, and his success in attacking purely technical problems was exceptional. In an age of increasing specialisation, he retained to the last an unusually wide range of interests, and kept himself up to date in a great many diverse fields. Remembering the bitter controversies in which he participated as a young man, while the revolutionary ideas regarding the nature of solutions were being forced upon his reluctant seniors, he was always particularly open-minded in his attitude towards the work of the second generation of physical chemists which has recently effected another revolution in this same field. He recognised quite complacently that, if they could see farther than Arrhenius, it was, after all, only because they were standing on Arrhenius's shoulders.

Born in Dundee in 1863, and educated at Dundee High School, Walker entered the University of Edinburgh in 1882 and was inspired by Crum Brown to seek an academic career in chemistry. After obtaining the degree of D.Sc. for his thesis on "The Dehydration of the Metallic Hydroxides by Heat", in 1886 he proceeded to Baeyer's laboratory in Munich to engage in organic research, but at the end of six months, learning that Ostwald had been appointed professor of physical chemistry at Leipzig, he hastened to become the first British pupil of that new school, and graduated therefrom as Ph.D. in 1889 with a thesis on "The Affinity Constants of Organic Bases".

For the next three years, Walker served as research assistant to Crum Brown at Edinburgh, his most outstanding contribution being on the electrolytic synthesis of organic acids. In this period falls also the inauguration of the Alembic Club, an association of assistants in the chemistry department which afterwards undertook the publication of fundamental papers of historical interest—the Alembic Club Reprints—with gratifying success.

An introduction to Ramsay at the memorable Leeds meeting of the British Association in 1890, where van't Hoff and Ostwald triumphantly vindicated their views against a mass attack of their opponents, led Walker in 1892 to enter Ramsay's laboratory in University College, London, first as a research worker and later as an assistant. In 1894 he was selected to succeed Percy Frankland in the chair of chemistry at University College, Dundee, and for fourteen years he occupied that post in his native town, adding steadily to his reputation for research, teaching and administrative ability. He was elected a fellow of the Royal Society in 1900, and when his old teacher, Crum Brown, resigned in 1908, Walker was appointed to fill the vacancy at Edinburgh.

Here Walker found that his first and most urgent duty was the reorganisation of the laboratories, which had become entirely inadequate. The solution of this problem was delayed until after the War, but the new Department of Chemistry at King's Buildings, completed in 1924 and still unrivalled in Great Britain, constitutes a fitting memorial to his twenty years occupancy of the Edinburgh chair. During the War he rendered valuable services to the country by erecting and equipping, in conjunction with some of his colleagues in the Department, a factory for the manufacture of T.N.T. which produced as much as fifty tons of the explosive weekly. The efficiency of the plant may be illustrated by the statement of the Department of Explosives Supply that its figures for nitrogen economy during the months of September and October, 1918, constituted a record for the country.

In 1921 Walker received a knighthood and was also elected to the presidency of the Chemical Society.