scientific study of evaporation and rainfall measurements in upland catchment areas of the British Isles.

The Hydrology Division is devoting its main attention at present to surface waters. The water industry is immediately interested in calculating effective reservoir capacities, and in the effects of different types of land use on water yield. Several continental countries and the United States of America have made considerable progress in this respect and their results, although not directly applicable to the very different conditions in Britain, suggest a number of ways by which substantially increased yields might follow if the necessary data were determined and applied. The research aspects of the work of the Hydrology Division work are designed to assist in this.

In addition, since 30 per cent of the raw water taken by water undertakings in the British Isles comes from underground sources, these must be assessed as regards their long-term yield in terms of infiltrating rainfall. Natural replenishment by this means is a very slow process, but artificial replenishment by pumping from surface water sources offers storage at low capital cost. This method is already in use in Sweden, Germany, The Netherlands and the United States of America; the Association's programme provides for research to assist in collecting reliable data and overcoming technical difficulties.

Biology Division

The biological aspects of the water supply process are clearly of the utmost importance, not only because biological purity is required equally with chemical purity but also because biological as well as chemical processes are employed in water purification.

The Biology Division has only recently been established, and is still engaged on a preliminary examination of the problems. It is expected that its first programmes will be concerned with aspects of water sterilization, with the development of faster techniques for bacteriological examination and with the control of algae in stored waters.

Information Division

The objects of the information services are to see that new information from all sources is readily available to members, to provide assistance with day-to-day problems where the necessary information already exists, and to maintain communication with the water industry, other research establishments and other organizations with appropriate interests throughout the world.

In addition to the material supplied to staff and members by the library, numerous technical inquiries from members are answered. The staff of the Association is in a position to accumulate extensive experience of such problems, to maintain contact with specialists and to keep abreast of the published information.

The problems presented are normally within the experience of the technical staff of an undertaking but outside their special province. They cover a very wide range of topics; a typical selection might include complex cases of corrosion, attacks by insects (even on polythene water-supply pipe), the infestation of water supplies by various organisms, the chemical contamination of supplies, and such practical problems as the protection of reservoirs from birds.

In addition to its technical papers the Association publishes a periodical, *Water Research News*.

The Future

In its recent annual report, the Council of the Water Research Association comments: "It is now apparent that considerable changes will be required in the nation's water systems if the rapid increases in agricultural and industrial demands are to be met everywhere. The techniques of every stage of the water supply process are open to review, and a large part of the work must properly fall on the Water Research Association".

A visitor to the Water Research Association will realize that this consideration underlies all the planning at the new Research Station.

MUSCLE RECEPTORS

THIS year the University of Hong Kong, as part of its golden jubilee celebrations, held six symposia during September 11-16. One of these, under the chairmanship of Prof. Ragnar Granit (Stockholm) was on muscle receptors. It was organized by Prof. D. Barker, professor of zoology. There were about thirty participants, who represented both the physiological and histological aspects of work on receptors in mammalian muscle. The muscle spindle was considered from many angles and the papers, which ranged from accounts of the exacting work of electrical recording and single nerve fibre stimulation to details of the intricate structure of spindle innervation were given to full audiences and provoked lively discussions.

Prof. Granit opened the proceedings with a summary of much of the earlier work and a statement of some of the outstanding problems. A special lecture by Sir John Eccles (Canberra), who was unable to be present, on the "Central Connections of Muscle Afferent Fibres", was read by Prof. A. K. McIntyre (Otago, New Zealand). In the papers and demonstra-

tions that followed, evidence was given of new advances which we may expect to see developed further in the future. H. Shimazu and T. Hongo (Tokyo) directed attention to brain-stem influences on the motor supply to muscle spindles, while E. Eldred (California) spoke of cerebral influences. McIntyre considered that any discharges passing up muscle nerves and reaching the cerebrum probably came from Pacinian corpuscles and joint receptors and not from spindle primary endings. Y. Laporte (Toulouse) described elegant work in which both the primary and secondary afferent endings in a single spindle could be subjected to controlled stimulation of the spindle motor nerves and the responses compared. C. Eyzaguirre (Salt Lake City) spoke of spindle motor innervation and described how some of the intrafusal muscle fibres were actually seen to contract slowly. I. A. Boyd (Glasgow) gave a graphic account, with many beautiful colour slides, of the whole structure of muscle spindles in the cat, based on de-afferented and de-efferented material and much work on nerve fibre spectra. He directed particular

attention to the possibility of a double motor innervation. D. Barker (Hong Kong) and his co-workers, N. K. Chin, M. N. Adal, M. C. Ip and M. Cope, also described much detailed work on the structure, nerve spectra and distribution of spindles in cat muscles. It became obvious that there are points of great interest to both physiologists and histologists still needing to be settled about the complexity of the motor innervation of spindles.

The mechanisms by which sensory endings initiate electrical discharges were considered by C. C. Hunt (Salt Lake City), using the simpler Pacinian corpuscle. The electron micrographs shown by M. C. R. Merrillees (Melbourne) gave an insight into the ultrastructure of both spindle and tendon organ endings and their relation to underlying tissues. A. S. Paintal (New Delhi) directed attention to the less well-known muscle receptors, with small nerve fibres, which probably subserve pressure and pain. K. S. Lim

(Indiana) also spoke of the responses of these endings. Other papers dealt with pharmacological studies of spindles (J. E. Pascoe, London, and H.-D. Henatsch, Göttingen); spindle numbers and distribution (Eldred); differentiation of primary and secondary ending discharges (S. Cooper, Oxford); the potentiation of motoneurons by spindle discharges and also human experiments on reflexes involving muscle receptors (S. Homma, M. Kano and K. Takano, Chiba, Japan).

The ideal conditions under which the symposium was held both in the Department of Zoology and in the beautiful surroundings of Hong Kong gave many opportunities for discussions in small groups which did much to bring to light problems of structure and function that may be solved by mutual efforts of the workers in the two fields.

The Hong Kong University Press plans to publish the Proceedings early in 1962. SYBIL COOPER

CHEMOTHERAPY OF VIRUS DISEASES

At a meeting of the Fine Chemicals Group of the Society of Chemical Industry held in the Wellcome Foundation on October 6, the subject under discussion was research on the chemotherapy of virus diseases. There are two ways in which this subject can be approached. What might be called the rational approach requires an investigation of the essential components of virus multiplication with special emphasis on those steps which could be readily inhibited. Thus, many substances are known that will inhibit the synthesis of viral nucleic acid or viral protein or that will block the supply of energy required for virus multiplication. The problem is not how to inhibit virus growth but how to inhibit it selectively, without at the same time damaging the host cells. The second approach, the empirical one, seems to have been the favoured approach, and one which has had more success so far.

Dr. A. Isaacs (National Institute for Medical Research) presented the first paper, on interferon. Interferon was first found during an investigation of the phenomenon of viral interference, in which it seems to play an important mediating part. Further investigations suggest that it may also play a part in the immune processes that lead to recovery from virus infections.

Interferon is a protein of molecular weight 63,000 which is produced by cells of a number of different vertebrates in response to infection with a large number of different viruses. Its antiviral activity is usually more apparent in cells of the animal species in which it was made. However, it is active against a wide range of animal viruses although there are differences among viruses in their sensitivity to interferon. It does not prevent adsorption or penetration of virus but it inhibits the replication of viral ribonucleic acid. This probably results from inhibition of an oxidative process of the cell which supplies the energy for viral synthesis. The inhibition seems to affect viral synthesis much more than normal cellular syntheses, however, since human thyroid cells can divide at a rate not grossly different from that of normal cells in the presence of a large amount of interferon.

There is growing evidence that antibody may play a less important part in the processes of recovery from virus infections than has been thought hitherto, and that interferon may play a more important part. This was shown first by experiments in chick embryos of different ages, in which recovery from virus infections is found to be closely related to development of sensitivity to interferon. Secondly, persistence of virus in the lungs of mice of different ages was found to be inversely related to the production of interferon in these animals. Thirdly, two ways of inhibiting the interferon mechanism *in vitro*, namely, increased oxygenation and treatment with cortisone, both have a detrimental effect on the course of virus infections *in vivo*. These findings point to the conclusion that interferon may play an important part in our ability to recover from virus infections and they suggest that it might be possible to assist natural recovery from virus infections by giving interferon therapeutically. This has been carried out successfully in some virus infections of animals and it is hoped that preliminary trials of its action in man will begin shortly.

The second paper was given by Drs. R. Hull and E. W. Hurst (Imperial Chemical Industries, Ltd.) on structure activity in various heterocyclic compounds.

Material tested for possible antiviral activity was obtained from products synthesized for other biological assays, from the synthesis of analogues obtained in the course of following up an antiviral lead already found in the department or elsewhere, and from the synthesis of possible antimetabolites to viral nucleic acid. Heterocyclic compounds constituted the largest section of organic compounds tested and a review was given of structure-activity relationships that had been found in the acridines. 'Mepacrine' was the most active and showed antiviral activity against equine encephalomyelitis, Rift Valley fever and louping ill viruses.

In evaluating experimental work it was important to take into consideration the complex of cell and virus that was studied. Examples were given of compounds which reduced the growth of viruses in the chick embryo but which were not appreciably