the housing of readers and the staff of the Library, the survey points out that these improvements led to a heavy increase in the use of the Library. At the conclusion of the War the number of readers wishing to consult the Library's international collections in history, politics, government, economics, law and international law will undoubtedly present the Library Committee with an anxious and difficult task. A little is being done to improve the lending library established for undergraduate students. The seminar collections, like the present lending library, are too small, and those systems should be developed into real ancillary libraries. The physical damage suffered by the Library and its collection through enemy action has so far been negligible, and despite many changes in the Library staff, which has now only six members who are fully conversant with its activities, work is being carried on in the same spirit as in 1940–41.

According to the annual report for the year ended July 31, 1944, 1,675 works, 1,000 pamphlets, 206 non-serial official reports, excluding British Parliamentary Papers and Public Documents of the United States, were added to the Library, which on July 31, 1944, was receiving currently 2,457 annuals and 1,340 periodicals. It is a subscribing member of twenty-six learned societies. All British Parliamentary Papers are received regularly by the Library, which is also a "library of deposit" for the Public Documents of the United States. The total number of bound volumes now in the Library is 258,360.

CHEMICAL EDUCATION

AT a joint meeting of the London Sections of the Royal Institute of Chemistry and the British Association of Chemists, and of the London Area Section of the Association of Scientific Workers, held in London on February 21, a spirited discussion on "Chemical Education" took place. The chair was taken by Dr. G. L. Riddell, chairman of the London and South-Eastern Counties Section of the Royal Institute of Chemistry.

Various aspects of the subject were introduced by different speakers. Dr. J. R. Nicholls gave his views on the knowledge and skill expected from an analytical chemist. He stressed the need for training in fundamental chemistry and in the principles underlying the various analytical procedures. Speed and accuracy are essential and keen powers of observation are required. He suggested that chemical education should include some account of the factors which determine whether a particular chemical reaction is suitable for use on a large scale, and concluded by regretting that there are no chairs of analytical chemistry at British universities and no academic schools of research in analysis.

Dr. F. W. Stoyle discussed the requirements of a work's chemist. He said that too high a degree of specialization in a degree course should be discouraged. At the same time, efforts should be made to give students an idea of the similarities and differences between laboratory and works practice by occasional visits to factories. After employment, the graduate chemist should supplement his academic training by courses in technology and ancillary subjects such as costing, factory legislation, etc. He should attempt to improve factory technique while making due allowance for the craft of the operative.

Mr. F. A. Robinson spoke on "What is Expected of the Research Chemist". He is of the opinion that the primary requirement is a sound grasp of the principles of scientific research and, secondly, an ability to apply these to whatever problems are encountered. He must also be gifted with a healthy scepticism, inventiveness, patience, the ability to read intelligently and an interest in the utilitarian aspect of his work. The latter quality is, perhaps, most neglected in a university training, and might be fostered by informing the student of technological as well as academic discoveries.

Dr. J. Kenyon, speaking on university training, pointed out that chemistry is a wonderful blend of craft and science, and that the training of the chemist is, therefore, twofold in character. In the laboratory the aim is to acquire manipulative skill and develop powers of observation and deduction, while in the lecture room the fundamental principles of the science are acquired. He stressed the importance of the latter, stating that he does not conceive it to be the function of university training to produce youthful specialists ready to fulfil the specific requirements of any particular industry. Its function is rather to supply young men and women capable of applying the results of their training—a skilled hand, an observing eye, a well-stored mind, a critical judgment and a logical intellect—to meet the varied demands of chemical industry.

Dr. A. J. Jinkings spoke on the technical training of the chemist. He affirmed that full-time day courses at a university or technical college are somewhat academic in character and that emphasis is rightly placed on principles rather than on applications. Greater co-operation is needed between the universities and technical colleges, and more technical college courses should be regarded as adequate qualifications for a degree. He suggested that a faculty of technology in the University of London and a national technological institute to grant degrees and to co-ordinate and supervise technical training generally would be of outstanding value.

Dr. E. A. Rudge paid high tribute to the sterling qualities of the part-time graduate, who, he said, stands high in industrial value. Against the advantages he shows in training and experience, however, are serious disadvantages of narrowness in outlook, since he lacks the experience of academic life. He suggested that this could be overcome by wider provision for part-time day classes which should be integrated, where possible, into the academic course.

The discussion which followed was summarized by Dr. C. G. Anderson. A number of contributors said that during university chemical courses a certain amount of technological training and some knowledge of standard forms of plant should be given, so that graduates should not be completely at a loss on entering industry. This training would be helped by interchange between industrial chemists and university teachers, by works visits and vacation employment in industry. Training should also be given in the use of literature. Students should be given some idea of the conditions, requirements and possibilities in industry in order that they may select, to some extent, the type of work for which they are fitted. More attention should be paid to inculcating the scientific outlook quite early in ordinary school training. Part-time evening study, while valuable, is too strenuous, and more day training and State bursaries for full-time study are desirable. The opinion was expressed that there should be refresher courses in a variety of subjects, and courses for the training of laboratory assistants and stewards; also that industry should provide special training, and apprenticeship schemes for juniors might prove of great advantage.

FLAGELLAR MOVEMENTS

THE mechanics of flagellar movements and the swimming of aquatic micro-organisms form a subject of great complexity, towards an understanding of which A. G. Lowndes (*Proc. Zool. Soc.*, **114** (111), 325; 1944) makes a critical contribution in respect of *Monas stigmatica* Pringsheim, *Peranema tricophorum* (Ehrbg.) Stein. and *Volvox* sp., and at the same time effectively refutes several statements about this process that have made their appearance in standard text-books of biology.

M. stigmatica is exceptionally sensitive to light, and although it swims actively and rapidly in subdued daylight, exposure to the light of an ordinary electric bulb induces a cessation of normal swimming. This, coupled with its high rate of movement, makes observation on, and photography of, flagellar movements and swimming difficult or impossible. Direct observation showed a maximum rate of swimming of 0·260 mm. per sec., that is, more than forty times its own length per sec.; but observations of flagellar movement at this rate of swimming were not possible. When the rate of swimming is reduced to about one twenty-sixth of normal, the long flagellum (about two and a half times the length of the cell) is held out in front of the organism, and waves which originate at its base pass regularly along it; at the same time a current is set up in the water, and this flows in the opposite direction (that is, tip to base) and past the anterior end of the organism. This is the condition of the long flagellum when the organism is moving slowly, and in the normally slow-moving *Peranema* the flagellum is also held extended in front of the cell with the anterior end of the flagellum vibrating. Stimulation causes the whole flagellum to beat violently, but this does not bring about an acceleration in the rate of movement of the cell. Instead the organism ceases swimming momentarily, and then changes its direction of movement. Hence statements that *Peranema* exhibits a slow forward movement during which undulations of the flagellum are confined to its anterior end, and a rapid movement accompanied by undulation along the whole length of the flagellum, appear to be incorrect.

Experiments with a physical model, for example, a leather thong rotated under water, show that it is possible to propel from base to apex (that is, from the attached to the free end) of the thong a series of waves of decreasing amplitude and wave-length. With the thong all the energy is applied at one end, but with a flagellum, while most of the energy may be applied to its base by the attached cell, the flagellum itself generates energy so that no decrease in the amplitude or length of waves passing along it need occur. Increasing the speed of rotation of the thong causes it to swing from side to side, and it may finally twist up, but shortening it increases its stability. When two thongs are attached to the arms of a Y-tube which is itself attached to a spindle and the whole rotated rapidly under water, the thongs bend outwards, and if the spindle moves forward the thongs bend backwards. If, however, the spindle is rotated relatively slowly, a current of water is caused to flow towards the base of the thongs and at this rate of movement the thongs do not bend outwards.

In *Monas*, when the swimming is slow, the flagellum is extended forward, but if the movement is rapid the long flagellum bends and trails behind the cell and causes the organism to gyrate and rotate. It is probable that in other fast-moving organisms the flagella trail behind and are not extended in front of the cell as they are in slow-swimming types. In *Volvox*, a slow-moving cœnobial alga, the pairs of cilia remain fully extended and each pair draws a current of water towards the surface of the cœnobium, but the precise contribution that these currents make towards the movement of the *Volvox* colony is not clear.

L. G. G. WARNE.

FOOD IN HOSPITALS

AN interesting article in the *Lancet* (61, Jan 13, 1945) discusses the monotonous, badly cooked and often scanty menus provided by hospitals. The fault lies, the writer concludes, not only with the hospitals, which fail to appreciate the importance of correct feeding and, in most instances, to employ a single experienced food officer with sufficient influence over the hospital's income, but also with the medical men, who do not insist that their patients' needs are properly met.

The quantity of food in hospitals is often insufficient and it has to be eaten in a hurry, for the nurses have to be getting on with the next job. The medical man could criticize the arrangements on all these grounds, and he should do so, paying special attention to the quality of 'light diet', when it is ordered. The blame has to be distributed between the hospital steward, the matron, the cooks, the out-of-date kitchen equipment, the methods of preparing, carving and serving the food, its transport along draughty corridors on unheated trolleys with delays, wilful or inevitable, on the way, and so on. The solution of this problem requires, the writer concludes, a more unified control. The prescription of diets is, and must remain, part of the treatment; the ward sister, who knows her individual patients' likes and dislikes, should interpret the prescriptions; but the buying, cooking and distribution of the food should not be done by three separate officers. Further, adequate meals should be provided throughout the day, inexpert buying and failure to use the open market should be eliminated, sufficient skilled kitchen staff should be provided, and the kitchen should have modern equipment and labour-saving devices.

A second article (*Lancet*, 94, Jan. 20, 1945) discusses the question: What is good feeding? The hospital should construe scientific knowledge of food values with the caterer's art of producing appetizing meals. Enough food of the right kind should be economically bought, properly stored and wisely cooked. Individual appetites vary, and those of sick people need special consideration. The lack of the important effects of the sights, smells and talk of the dining table can be counteracted by serving the food attractively. A third article (*Lancet*, 123, Jan. 27, 1945) suggests remedies for existing faults, with instances of improvements that have been made. The writer's evident understanding of the difficulties of all who are concerned with hospital food, his sympathy with them and with the patients, and his lively style, make these articles as attractive as they are valuable.