system of the country and its government. So they went to the university to acquire some general culture. There was a risk that the new enthusiasm for deeper study and research "would be elbowed out of existence by endeavours to gratify the wish for a higher education which would suit a young gentleman desirous of making his mark in some recognized public or professional capacity and which should not take up too much of his time". This risk was materially increased by the introduction of a system by which school and college elections were influenced in favour of the well-to-do against the poor; more especially the best prizes—fellowships—were awarded in obedience to mandates obtained in devious ways from the Court. For the first time a university education had a social value, which led to a different type of student and a more riotous way of living. So much so that Caius, who had done his best to promote the new learning, began to wonder whether his benefactions had been wisely bestowed. It is, by the way, curious that though Caius and Gilbert were contemporaries at Cambridge, separated only by the length of Trinity Street, there is no record of any association between them. It strengthens my expressed belief that Caius was more interested in institutions than in individuals. We can set against this an undoubted spread of a genuine love of learning, while the following century was the most active in the intellectual life of Cambridge until the latter half of the nineteenth. Still, one must admit that in the Elizabethan period there was a change from a home for poor scholars to a more mundane life—a change which has in varying degrees persisted and which this century has been trying to overcome. There is indeed a danger of the pendulum swinging too far the other way.

As to the position of the medical world at that time, A. W. Ward says, "The physician's profession . . . was being disentangled on the one hand from that of the clergyman . . . and on the other hand from the trade of the apothecary . . . and from that of the barber, who united to his main function those of the dentist, and yet others. . . . The pretensions of both physicians and surgeons to a knowledge of which they fell far short were still a subject of severe censure; but little or nothing was said in or outside the profession against what was still the chief impediment to the progress of medical science—its intimate association with astrology".

On these dangers, both at the university and in the medical profession, Gilbert's influence was salutary. His insistence on observation and experiment, his scorn for reliance on mere authority, his hatred for shams and quackery, were not without their effect. In the conditions laid down for the teacher of medicine in the Academy he visualized, but which never came to fruition, it was stated, "He was never to allege any medicine of any kind, but that he was to declare the reason philosophical of every particular, and he was to show how the medicine was made and all the instruments used in making it. . . . The physician was continually to practise with the Natural Philosopher to try and search out the riddles of Nature." Note here an anticipation of Harvey's injunction. Gilbert has been called the first English Copernican, and without transgressing beyond my particular thesis of Gilbert as a physician, I would urge that this made him particularly suited to combat the pestilential influence of astrology on medicine, from which Jean Fernel of Paris was just emancipating himself.

"Q." has spoken of "men, who with the splendour of the Renaissance in their eyes, supposed themselves to be working all the while upon pale and borrowed shadows". Thus Linacre looked to the past for the revival of learning; Caius faced both ways; but Gilbert steadfastly looked forward, and thus he may be acclaimed the first of English modern men of science, and was so recognized by the succeeding generation. For Sir Thomas Browne described him as the Father Philosopher who discovered more in terrestrial magnetism than Columbus or Amerigo ever did by it, while Dryden said of him, "Gilbert shall live till Loadstones cease to draw".

REFERENCES

- Hale-White, Sir Wm., "Bacon, Gilbert and Harvey" (London, 1927).
 Moore, Sir Norman, Wm. Gilbert, "Dictionary of National Biography".
 Munk, Wm., "The Roll of the Royal College of Physicians", Vol. 1 (London, 1878).
 Thompson, Silvanus P., "Gilbert: Physician" (Chiswick Press, 1903).

CEREAL DISEASES

By W. C. MOORE

THE important place of cereals in the war-time food production programme, and the urgency of increasing both acreages and yields, have inevitably thrown into prominence the problems of failure and loss through disease. A good deal of attention has been given to these problems during the war years, and the time is appropriate to take stock of the position. For this purpose the Association of Applied Biologists recently devoted one of its general meetings to a symposium on cereal diseases, which was held at the Imperial College of Science and Technology, with the president, Prof. W. Brown, in the chair.

In his introductory remarks Mr. W. C. Moore referred to the surveys of plant diseases organized by the Ministry of Agriculture and Fisheries since 1917. These enable one to form a fairly clear picture of the relative importance of different cereal diseases; but the time is now ripe for concerted efforts to determine the significance of disease more precisely and in terms of loss of yield or in cash value. More than fifty diseases have been listed on cereals in England and Wales, and of these at least seven are of some economic importance—wheat bunt (*Tilletia caries*), take-all (*Ophiobolus graminis* and its var. *Avenae*), eyespot (*Cercospora herpotrichoides*), yellow rust (*Puccinia glumarum*), mildew (*Erysiphe graminis*), leaf spot of oats (*Helminthosporium Avenae*) and leaf stripe of barley (*Helminthosporium gramineum*). To these must probably be added the various deficiency diseases about which little is yet known. Yellow rust is the most injurious of cereal rusts, but only about once in ten years is it sufficiently bad (as in 1943) to reduce yields by more than an estimated 5–10 per cent. Black rust is usually late and local; but occasionally, probably when large numbers of uredospores are blown over from the Continent in June or July, an epidemic such as occurred in 1940 develops. Bunt bids fair to repeat its behaviour after the War of 1914–18 unless care is taken. In the early '20's about a third of the seed wheat samples were bunted. A steady improvement followed, and in 1940 the figure was as low as 1.2 per cent; but the number of badly bunted crops reported in the last three years strongly suggests that the disease may again be on the increase, in spite of the great advances made in seed dressing. Fortunately, ergot

need give rise to no alarm in Britain. It becomes prominent only when cool, wet weather prolongs the normally short flowering period, and these conditions have been fulfilled very few times in the last twenty-five years.

Those who have not personally studied biologic specialization in fungi are often bewildered by, or even sceptical of, the multiplicity of physiologic races found among rust fungi. All modern British work on biologic specialization in cereal rusts has been carried out under the supervision of Prof. F. T. Brooks, and the authoritative survey he made of the subject was both illuminating and stimulating. The races of each rust are determined by their behaviour on a limited number of differential host varieties in the seedling stage when grown under constant environmental conditions. The complexity of the problem is exemplified by the fact that nearly two hundred physiologic races of *Puccinia graminis tritici* and more than a hundred of *P. triticea* have been defined abroad, chiefly in the United States. Nothing is known about the particular races of *P. graminis tritici* that occur in Britain, but a number have been distinguished in *P. triticea*, *P. anomala* and *P. coronata*. At least two races of yellow rust are found here, and a comprehensive survey for further races is needed after the War in order that the relative susceptibility of common wheat varieties to them can be determined. Certain difficulties are inherent in the work. Genetic purity of the differential races and of the rust cultures is essential, the cultures must be kept in isolation and free from contamination, and constant environmental conditions must be maintained. In view of the extreme biologic specialization in cereal rusts and the possibilities of further changes by hybridization and gene mutation, Prof. Brooks doubts whether further study along the usual lines will be really profitable except in relation to plant-breeding programmes. To the plant breeder the discovery of physiologic specialization is of paramount importance. He need not concern himself with all the races described, for many of them behave as single groups in the field; moreover, the discovery of mature plant resistance has greatly eased matters. None the less, new virulent races may develop at any time, and the position can be safeguarded only by continued close co-operation between pathologists and plant breeders.

Dr. W. A. R. Dillon Weston reviewed the history of cereal diseases in East Anglia during the past twenty-one years and explained how their prevalence and intensity have been influenced by improvements in seed treatment. In 1923 copper sulphate was the chief material used for disinfecting seed wheat against bunt. A few farmers used formalin, and afterwards copper carbonate came into prominence for a time, but in the early '30's these were gradually displaced by the organo-mercury seed dressings. This was an event of outstanding importance. The new compounds provided an effective means of controlling the stripe diseases of barley and oats, which had up to then been responsible for much pre-emergence blight and thin stands. As a result the balance has gradually shifted; leaf blotch of barley (*Rhynchosporium secalis*), for example, which is not seed-borne and therefore not prevented by seed treatment, has become more noticeable as the prevalence and intensity of leaf stripe has declined. Oat smut, at one time prevalent and intense in most crops, is now less evident. On the other hand, the most recent trials with various organo-mercury dusts have shown that

they are not all equally effective, and this aspect of things was considered in its relation to the voluntary scheme, recently inaugurated by the Ministry of Agriculture and the Department of Agriculture for Scotland, for the official approval of insecticides and fungicides marketed under brand names for the control of plant pests and diseases. Particular emphasis was laid on the need to assess the efficiency of the products by field tests. Cereal rusts are not normally serious in East Anglia, and take-all, at one time rampant on many farms, cannot now be considered a major problem.

Dr. R. W. G. Dennis discussed the occurrence of cereal diseases in Scotland, where the position is somewhat different from that in England and Wales. Oats are the most important cereal crop, and the seedling blight phase of leaf spot is still the most important disease—in 1942 more than half of 260 samples of seed taken at random showed from 5–42 per cent infection with *Helminthosporium*. Tribute was paid to the pioneer work of D. G. O'Brien, whose efforts to put dry seed dressing on its feet in west Scotland had resulted in the sale in 1932 of sufficient organo-mercury dust to dress two million bushels of grain or about half the oats sown in Scotland that year. The use of seed dressings is now general in the west and to some extent in the north, but on the best Lothian soils and elsewhere in the east little benefit is derived from their use, even with heavily infected grain. Species of *Fusarium*, especially *F. nivale*, and pre-emergence rotting due to soil fungi are also responsible for thin stands of oats sown under poor moist conditions or in wet soils. The virtual disappearance of oat smuts in Scotland occurred before seed dressings came into use and has been attributed to the introduction of 'regenerated strains' of oat varieties and to increased care and selection of seed crops. In the wetter districts of the west and north take-all is prevalent in oats following old pasture and is common elsewhere if oats are taken more than two years in succession. Crown rust is usually scarce, though extensive outbreaks occur at long intervals. Wheat diseases are of little importance apart from eyespot, which is widespread in the Lothians, Fife and Morayshire; bunt is scarcely ever seen and brown rust (*Puccinia triticea*) is unknown in Scotland.

Take-all of wheat is widely distributed in England, but becomes troublesome only in wet seasons and on light soils overlying chalk or limestone, where the rotation is too short. The form on oats is restricted to those areas—Wales, the north-west and north of England, and Scotland—where oats is the chief cereal crop. Mr. S. D. Garrett, whose work on this disease has thrown so much light on the wider and more fundamental problems of root rot caused by fungi, discussed the factors affecting the behaviour of take-all in different soils and seasons. Growth of the runner hyphae of *Ophiobolus* along the host roots is favoured by good soil aeration and by an alkaline reaction of the soil. In poorly aerated or acid soils the growth of the hyphae may be controlled by accumulation of respiratory carbon dioxide at the root surface, with which is associated a reduction in the partial pressure of oxygen. In well-aerated soils carbon dioxide must diffuse rapidly away from the root zone, and in alkaline soils a high proportion of the carbon dioxide is transformed into bicarbonate. Light-textured soils also favour take-all inasmuch as they are usually poor in nitrogen and often other plant nutrients, and deficiency in the

main nutrients hinders recovery from attack by curtailing the production of new secondary roots to replace those destroyed by the fungus. In Australia phosphate is usually the missing nutrient, in England nitrogen. The exceptional severity of the disease in certain southern counties of England in 1942 may have been due in part to leaching-out of nitrates by abnormally heavy rainfall in January. Survival of *Ophiobolus* in infected root and stubble residues is mainly dependent on an adequate supply of nitrogen from the soil, which encourages fresh hyphal growth.

For some years Miss M. D. Glynne has made a special study of eyespot in wheat and barley, and the account she gave of this disease revealed how closely it is bound up with lodging in these crops. Less eyespot occurs on light, well-drained soils than on heavy, wet ones, and the climate of the west and north of Britain favours attack by it more than conditions in the south and east. Yet, because oats are highly resistant and the disease increases with the frequency of wheat and barley in the rotation, eyespot is more prevalent in the eastern than the western half of southern England. In a thin crop the individual affected straws begin to fall over among the upright ones from the end of June, giving the condition known

as 'straggling'. If the affected crop is a heavy one general lodging is likely to take place sooner or later in long-strawed varieties. In a survey carried out in 1941, lodging caused by eyespot was about as common as lodging due to non-parasitic causes. In addition to direct loss from the disease there may be indirect loss as a result of lodging. Experimental work has shown that in a field with about 60 per cent severe infection, yield is reduced by 30 per cent and there is a marked increase in the amount of tail corn; if lodging occurs the loss is much greater or even complete. Such losses can be minimized by sound rotation or by using short-strawed varieties and feeding them well.

Dr. F. R. Immer, professor of genetics in the University of Minnesota, was warmly welcomed as a visitor at the meeting, and in the general discussion that followed he referred briefly to the programme for plant breeding in relation to disease that is now under way in Minnesota. He expressed surprise at the wide differences in cereal disease problems in Britain and the United States; but entered a word of warning against underestimating the real effect and the potentialities of common but apparently harmless diseases.

NEWS and VIEWS

Research Fellowships at British Universities

THE directors of Imperial Chemical Industries, Ltd., have offered to provide eighty fellowships at nine universities in Great Britain, to be held by senior workers in certain sciences. The scheme is announced to operate for an initial period of seven years, and the fellowships will be of the average value of £600 a year, though the universities will have power to determine the emolument for each particular appointment. The subjects to which the fellowships are to be devoted are laid down as physics, chemistry and the sciences dependent thereon, including chemotherapy. The administration of the scheme rests wholly with the universities, which will select and appoint the fellows, subject only to such conditions as to duties and tenure as the universities themselves impose. No conditions whatever are attached by I.C.I. to the tenure of these fellowships. The fellows will be members of the university staffs, and will be concerned only with the duties laid upon them by the universities. Their primary work will lie in research; but they must also take some part in university teaching. It is intended not to relieve the universities from the cost of maintaining any part of their normal work, but to enable them to add to what they already do. The universities to which this offer has been made comprise the larger metropolitan universities and those which have a close geographical relation to the main centres of the Company's production. Twelve fellowships have been offered to the Universities of Oxford, Cambridge and London, eight to the Universities of Glasgow, Edinburgh, Manchester, Birmingham and Liverpool and four to the University of Durham.

The purpose of the directors of Imperial Chemical Industries, Ltd., in instituting this scheme is to strengthen the general provision in British universities for scientific teaching and research. It is in-

tended to implement the Company's view that academic and industrial research are interdependent and complementary, and that substantial advances in industry cannot be looked for without corresponding advances in academic science; and the main purpose is the strengthening of university scientific departments in whatever way each university thinks to be best. A rational policy of this character, together with a wise selection of men both as regards capabilities and tenure of office, will lead, it is thought, to the emergence of a body of men capable of taking high academic or industrial positions, thereby advancing academic and industrial research. This it should certainly accomplish, for the scheme is so wide in its scope, and the universities are given so free a hand in its working, that most of the limitations usually inherent in trusts and endowments are avoided. The task is now before the selected universities, while preserving scrupulously their independence, so to select recipients of these fellowships as to justify the belief in the importance of university research which has led to their establishment.

The Society for Cultural Relations

THE Society for Cultural Relations between the Peoples of the British Commonwealth and the U.S.S.R., known more widely by its briefer title S.C.R., has just completed its first twenty years of activity and has issued a concise and very interesting report on its work during the period. It is difficult now to recapture the atmosphere of 1924, when the sufferings caused by the Revolution and the Civil War were still fresh in people's minds, and only relatively few recognized the importance of trying to understand what was going on in Russia and of breaking down the barriers that threatened to isolate that country from the Western world. A small but distinguished group of people founded the Society and organized an exhibition of Soviet art, books and