

until he had first worked with home-made apparatus; his father built the Kenwood Observatory, but not until his son had matured his plans by work at Harvard and elsewhere. "His policy always was," writes the son in one of his letters, "to induce me to construct my first apparatus, and then to give me a good instrument if my early experiments were successful." On the death of this wise and kind father, his children established, in pious and affectionate memory of him, the "William E. Hale Fund" for the encouragement of research, which has already aided, in an unobtrusive but none the less efficient manner, several scientific projects of different kinds. His lessons are so deeply impressed on the mind of his son that in the address above referred to he said, "with all seriousness, that it is a fair question whether large observatories, with powerful instrumental equipment, should be established, if they tend to keep back the man who is pursuing the subject with less expensive appliances, and is introducing, through his careful consideration of the possibilities of research, the new methods which in the process of time will take the place of the old ones."

A few facts and dates may be given here. George Ellery Hale was born in Chicago on June 29, 1868 (a few months before the classical observations of prominences without an eclipse, on which he was to build his main work), the son of William E. and Mary S. Hale; he married in 1890 Miss Evelina S. Conklin, of Brooklyn, N.Y., and has a daughter and a son. He entered the Massachusetts Institute of Technology (Boston) in 1886, taking the course in pure science, and graduating S.B. in 1890. He spent some time at the University of Berlin in 1893-4. While in Boston he was enabled, by the kindness of Prof. E. C. Pickering, to spend his spare time at the Harvard Observatory, doing any work assigned to him. The principle of the spectroheliograph occurred to him in the summer of 1899, but experiments were not then successful. He first photographed the prominences in the spring of 1891, within a week or two of similar successes by C. A. Young and Deslandres; but this achievement must be carefully distinguished¹ from the construction of the first successful spectroheliograph, in which Hale had a clear lead of all other workers. It was completed in January, 1892, and from that time regularly recorded, at the Kenwood Observatory, prominences and faculæ. Before the end of 1892 the project for the great Yerkes Observatory was already on foot, and was completed in the autumn of 1897. We may note in passing two incidents of that early history; first, that the project originated in a chance conversation with Alvan G. Clark at the Rochester meeting of the American Association for the Advancement of Science. Hale then learnt of the existence of two discs of glass available for a large telescope, and immediately began the search for a Mæcenæ. Such incidental results of scientific gatherings are sometimes forgotten in estimating their value. Secondly, after several applications had failed, when ultimately the matter was laid before the late Mr. C. T. Yerkes, he replied at once, inviting President Harper and Mr. Hale to call upon him, and telegraphed for Mr. Clark as a result of the interview. His rapidity in decision seems to have been noteworthy, even in Chicago.

It would unduly extend this brief notice to follow the history of the Yerkes Observatory during the years from its completion in 1897 until Hale handed over the directorship in 1904 to Prof. E. B. Frost,

¹ It does not seem to the present writer that the late Miss A. M. Clerke has been sufficiently careful to distinguish these two distinct steps in her otherwise admirable writings (see, e.g., "Problems in Astrophysics," pp. 18 and 98.

in order to devote himself to the Mount Wilson Observatory. One is sometimes tempted to peer into the future; from Kenwood to Yerkes, from Yerkes to Mount Wilson, from Mount Wilson to ———? Does a fourth term of the series ever occur to Prof. Hale in his dreams? Series are treacherous to deal with; "it is most unpleasant," once remarked an eminent mathematician who has devoted part of his life to them, "to dream that you are expanded in an infinite series, and that it will not converge." There is a notable divergence in the series of observatories with which Prof. Hale might identify himself; but then it may not be infinite. Indeed, we expect to find—recurring to the attitude of anticipation with which this notice began—we confidently expect to find in August next excellent reasons why the series should stop short at its third term. It is difficult to imagine how conditions for work could be bettered. Mount Wilson has great instruments and a fine climate; it has the financial backing of the wealthy Carnegie Institution; it is within easy reach of Pasadena, and in telegraphic communication with the whole world; and last, but by no means least, it has already an able staff of workers, including men like Adams, Ellerman, and Ritchey, whose names are famous wherever there is an astronomer. Those who have visited the mountain are enthusiastic in praise of the conditions for work. A notable visit was paid by Prof. Barnard, who found the times of exposure required for his photographs considerably less than at the Yerkes Observatory.

The main purpose of the Mount Wilson Observatory is solar research, but a wide interpretation must be given to the term. Prof. Hale has often emphasised the representative character of the sun—it is the one star near enough to be examined in detail; but it is nevertheless a star, and to understand it we must study it alongside other stars; we cannot do justice to the sun by working at the sun alone. Hence he has insisted on an adequate equipment for stellar work at Mount Wilson. The method of attacking scientific problems along more than one line is a characteristic feature of Hale's work generally, and has been an important factor in his success. To give a recent and striking instance. Along one line he was developing the spectroheliograph to the point where good photographs could be obtained in red light ($H\alpha$), and this led to the discovery of the solar vortices; along another line, which might have seemed irrelevant to the former, he was working at the photography of sun-spot spectra, and at last succeeded in getting good images of double and triple lines. Forthwith the two researches met and flowed in the same stream; to test the magnetic hypothesis of the vortices he could examine the spot spectra polariscopically. Had either of these two lines of work been neglected, the other would have remained unfruitful. No doubt there was an element of luck in the simultaneity with which the two became available; but luck proverbially attends on energy and enterprise.

H. H. TURNER.

THE BRITISH SCIENCE GUILD.

THE fourth annual meeting of the British Science Guild was held at the Mansion House on March 18, when the fourth annual report upon the work of the past year was presented. The Lord Mayor occupied the chair, and an address was delivered by Mr. Haldane, president of the Guild. Sir John Cockburn, K.C.M.G., gave a summary of the report, the adoption of which was moved by Lord Strathcona, and seconded by Sir Alfred Keogh, K.C.B. Sir George Darwin, K.C.B., and Sir Ernest

Shackleton also spoke. We propose to print the main parts of these speeches later, and here limit ourselves to the mention of a few points of wide interest included in the report.

The following gentlemen were elected as new vice-presidents:—Sir William White, K.C.B., F.R.S., Sir Clifford Allbutt, K.C.B., F.R.S., Sir George Darwin, K.C.B., F.R.S., Surgeon-General Sir A. Keogh, K.C.B., Right Hon. Sir George Reid, K.C.M.G. The following new members of the executive committee were also elected:—Sir David Gill, K.C.B., F.R.S., Sir William White, K.C.B., F.R.S., the Rt. Hon. the Earl of Chichester, Sir A. Keogh, K.C.B., Mr. A. Mosely, C.M.G., Sir Boverton Redwood, Colonel Sir John Young, C.V.O.

The executive committee proposes to offer two prizes for an essay on "The best way of carrying on the struggle for existence and securing the survival of the fittest in national affairs." The essay should state the main points to which attention must be directed; the following, in which the practice of modern nations differs, may be touched upon:—

- (1) The training of the citizen to secure national efficiency in peace, and national defence in war.
- (2) State organisations for securing the same objects.
- (3) The State endowment of the higher teaching and research in universities and elsewhere.
- (4) Whether a system of party government alone is sufficient to secure all the best interests of the State in those directions in which brain-power and special knowledge are needed, or whether a body free from the influence of party politics and on which the most important national activities are represented by the most distinguished persons is desirable.
- (5) Whether it is of advantage that the nation's greatest men in science, learning and industry on whom, in peace, the prestige and progress of the nation chiefly depend should be in touch with the head of the State.
- (6) How discoveries and applications of science can be best and soonest utilised for State purposes both in peace and war.

Formation of Colonial Branches.

In the last annual report reference was made to the proposed formation of branches of the Guild in Australia and Canada. During the year further progress has been made, and inaugural meetings have been held in Winnipeg (Canada) and Sydney (New South Wales). A branch is also being formed in South Australia.

In Canada an organising committee has been formed, consisting of the leading educational, scientific, and business men. By forming such a committee, it was considered that not the least of the advantages would be the keeping in touch with the scientific methods throughout the Empire, and it was hoped that the Canadian committee might thus be the means of obtaining accurately for the British Guild information on Canadian matters.

The inaugural meeting of the New South Wales branch was held on October 13, 1909, at the Royal Society's House, Sydney, the Governor of New South Wales, Lord Chelmsford, occupying the chair. In the course of an address Lord Chelmsford said that what is wanted to-day, and what he thought the Guild intends to try to do, is to get a scientific spirit to permeate the public at large. Science is an end in itself; but the general public should be convinced that in giving money for scientific purposes they are giving it for a good cause, and also that scientific knowledge is worth something in pounds, shillings, and pence. He hoped in that way to get the public alive to the importance of scientific knowledge in everyday life. Departments of public instruction may bring forward schemes of coordination and the like, but until the parents have been convinced that education is of value to them, all the schemes in the world are not going to make them

alive to education. In Germany and in America parents in the homes are alive to the importance of education, and they are determined to undergo any personal sacrifices if they can only give their sons and daughters the best possible education.

In the case of agriculture, we have to convince the farming community as a whole that there is something in scientific knowledge that is going to be of value to them. This is very hard to do. It is to be hoped that by its methods the Guild will be able to press home, not only upon men in authority—he believed men in authority are fully alive to the value of scientific knowledge—but also upon the men in the street, that scientific knowledge is not a mere abstraction, and that if devoted to commerce, trade, and everyday life, it will sweeten and enrich the lives of all and help the well-being of the community at large.

Speaking of the objects of the Guild, Dr. F. A. Bennet said that Germany spends more money on the University of Berlin alone than does England upon the whole of her universities put together. "It is not the German Dreadnoughts we have to be afraid of, but the German schoolmaster," observed Sir James Graham. "He is the man who is doing the damage."

In South Australia, the Governor, Sir Day Hort Bosanquet, is acting as patron of the branch. In a circular, issued by the secretary, the ideals of the Guild are stated as:—

"To give one kind of education only to the people of the Empire—the best (both practical and theoretical)—and to secure its economic application to the wants of mankind.

"To help us to keep our Empire the greatest factor in the world and retain our immense commerce. To do this we must teach the people the necessity of applying the methods of science to all branches of human effort. It must be observed that practical and scientific knowledge combined, and its application to useful purposes, is the secret of all human mental influence and power. It reduces labour, increases pleasure, and gives health and contentment.

"Scientific straight-thinking is just as good for us as a navy is for Germany. *Brains lie at the root of all things.*"

The Want of National Organisation.

The president of the Guild in his address last year remarked:—"The exertions of our people as a united people are necessary if we are to hold our own in the stress of the competition of nations." These remarks have led the executive committee to consider how best the suggested changes can be brought about. The committee points out that in the case of the armed forces of the country, following the example of Germany, a general staff for army purposes is already in being, and the Government has announced that a similar organisation is being established for naval purposes. The view that the peace purposes of the nation could be well served by an organisation dealing similarly with peace requirements, and indeed that they cannot be best served without it, is rapidly gaining ground, all the more because it is becoming fully recognised that party politics deal more with the temporary success of a party than with the permanent welfare of the State. A body composed of men selected from among the most eminent representatives of science, education, industry, commerce, and finance, associated with the technical heads of the Government institutions dealing specially with such matters, would provide such a general staff fully competent to deal with questions in which united action would be conducive to the nation's welfare and progress.

In university organisation there has been steady growth of opinion in two directions. First, the necessity for the fullest consideration of research in connection with all the higher teaching; and, secondly, the national loss which results from the exclusion of the universities from the Government view of education as represented by its Board.

In giving a statement of some scientific researches which have recently been aided by the State, the executive committee remarks that the present Government has shown itself more anxious to promote scientific inquiry than any of its predecessors.

Work of Committees.

New committees have been formed for dealing with the conservation of natural sources of energy, and to consider the question of technical education and its position in regard to universities. In addition to these, there are committees dealing with education, inexpensive instruments in science teaching, agriculture, synchronisation of clocks, naming and numbering of streets (executive committee), and the coordination of charitable effort.

The medical committee has been increased in numbers in order to take up specially the consideration of medical research. In its report this committee emphasises the very great importance of post-graduate medical study, and points out the very wide field and the great materials for such work which exist in London, and that owing to the absence of organised effort relatively little use is being made of this immense field. It is further considered that the ideal to be worked for is the establishment of a central medical school in connection with the London University, which should be devoted to post-graduate teaching and research. Such central school might be associated with all the London hospitals in connection with the London University for the purpose of post-graduate medical study, and should have affiliated to it other medical institutions and hospitals for the treatment of special types of disease (such as hospitals for epilepsy and diseases of the nervous systems, the Royal Ophthalmic Hospital at Moorfields, Brompton Hospital for Consumptives, &c.). Professors appointed by the Central London University School would be deputed to work at any of the appointed institutions, where special facilities might exist for research and post-graduate teaching in the subject dealt with by each professor. The committee is strongly of the opinion that much greater facilities should be given for medical research than exist at the present time, and that large funds should be furnished from public and private sources for such purposes. One of the objects on which expenditure is urgently required is in the endowment by the Central London University School of arrangements for pathological research at the medical schools.

The committee on the conservation of natural sources of energy, of which Sir William Ramsay is chairman, has decided to draw up reports on (1) coal, particularly in connection with its employment for smelting and other industrial purposes; (2) internal-combustion engines and oil engines; (3) atomic and interatomic energy; (4) the availability and quantity of natural oil and natural gas; (5) the heat of the earth; (6) availability of water-power; (7) forestry; (8) carburisation of coal at high and low temperatures; (9) solar power.

THE PROPOSED SCOTTISH NATIONAL ANTARCTIC EXPEDITION OF 1911.

A LARGE and enthusiastic meeting, organised by the Royal Scottish Geographical Society, was held in the Synod Hall, Edinburgh, on Thursday evening, March 17, to hear the plans of Dr. Bruce for his second Antarctic expedition. Prof. J. Geikie, F.R.S., president of the society, was in the chair, and was supported by a number of representatives of Scottish scientific bodies and others. The keynote of the meeting was that the aim of the expedition was to be throughout scientific. This was emphasised first of all by the chairman, who on that ground disclaimed the idea against which a needless protest had been put forth by the president of the Geographical Society of Berlin, that Antarctic exploration should be in any way reserved for any particular nation, and, in view of the immense field for scientific investigation in Antarctica, welcomed the friendly rivalry of all nations in carrying out that work.

Dr. Bruce then addressed the meeting, and before giving an account of his present plans, gave a brief sketch of the history of Antarctic exploration, laying special stress on the part that Scotsmen had borne in that work since Weddell set sail from Leith in 1823. It is hoped that the expedition now planned will leave Scotland about May 1, 1911, and reach

Buenos Aires about June 20 of that year. About ten days later it will sail for Cape Town, pursuing a zigzag course, for the most part, between the parallels of 40° and 50° S., but including a visit to the Sandwich group in about 57° S., as well as to Gough Island. The purpose of this navigation will be to supplement the bathymetrical survey of the South Atlantic Ocean begun by the *Scotia* in 1902-4, and it is not expected that Cape Town will be reached before September 1. After refitting and coaling, the ship will sail once more for the Sandwich group, and thence to Coats Land, and seek for a place on or near that coast where it may be possible to land and erect a house, although from the experience of the previous expedition it is thought possible that it may be necessary to go so far east as Cape Ann in Enderby Land for that purpose. At some point in Coats Land, however, it is intended that a sledge-party of three, under the leadership of Dr. Bruce, shall land with the view of crossing to the Ross Sea by way of the South Pole. The ship, after landing a party of ten or twelve persons at whatever point they find suitable for the erection of a house, will proceed, by a route in as high a latitude as possible, to winter at Melbourne, taking soundings and carrying on deep-sea research all the way.

In the following spring the ship will leave Melbourne and push southward to McMurdo Strait, Victoria Land, in order to send a sledge party to meet, and furnish with fresh supplies, the previously landed sledge-party under Dr. Bruce. It is expected that the two parties will meet near the Beardmore Glacier, and, after meeting, the combined party will proceed to the ship and sail for New Zealand. Further oceanographical work will afterwards be carried on between New Zealand and the Falkland Islands in as high a latitude as the winter season will permit, and in the following spring the ship will sail southwards to relieve the wintering party, which by that time will have been engaged for two years in surveying the coast-line of Antarctica east and west of the station, and in taking meteorological, magnetic, and other observations. The total cost of the expedition is estimated at about 50,000l. Dr. Bruce, it may be mentioned, is in cordial correspondence, not merely with Captain Scott, but also with the promoters of the German expedition, and there is good reason to hope that if funds are raised both for his and the German expedition, there will be no useless overlapping of work. As regards the McMurdo Strait, which Captain Scott has chosen for his special sphere of work, Dr. Bruce expressly announces that the Scottish expedition will make no special investigations in that region.

The meeting was then addressed by Dr. John Horne, F.R.S., director of the Geological Survey of Scotland, who, as representing the Royal Society of Edinburgh, first referred to the high value of the publications already issued giving the scientific results of Dr. Bruce's previous Antarctic expedition, including upwards of twenty papers published by the society he represented, and expressed the hope that the Government would see its way to furnish the necessary funds for the publication of the remaining results, which were eagerly looked for by all interested in Antarctic exploration in every part of the world. He stated that he was commissioned by the council of the society to give to Dr. Bruce's new scheme the most cordial recommendation to the Scottish public for financial assistance.

Prof. J. Graham Kerr, F.R.S., professor of zoology in the University of Glasgow, then spoke as representative of the Royal Philosophical Society of Glasgow, expressing that society's cordial sympathy with Dr. Bruce's project, and especially because they felt that they had in him a splendid example of the type of explorer who, while ready to take any adventures that came his way, recognised that his real object was to do honest scientific work. The Earl of Cassilis, representing the St. Andrew Society, dwelt