to Changing Conditions," under the auspices of the Society for the Promotion of Agricultural Science; and "The Effects of the War upon Experimental Medicine and Physiology," under the auspices of Section K.

It was an important meeting from the point of view of association business, since the revised constitution was adopted, a copy of which has been published in the journal *Science*. The principal changes in the constitution which will be of interest to members of the British Association are the raising of the annual dues from three dollars to five dollars and of the life-membership fee from fifty dollars to a hundred dollars, the re-lettering of some of the old sections and the adding of new sections. The old Section A, *Mathematics and Astronomy*, has been divided, and A is now *Mathematics* and D *Astronomy*. The old Section H, *Anthropology and Psychology*, has been divided into two sections: H, *Anthropology*, and I, *Psychology*. *Social and Economic Science* becomes Section K; the Section of *Engineering* becomes Section M, and that of *Medical Science* Section N; *Agriculture* becomes Section O, and *Education* Section Q. The titles of the old Sections F and G, namely, *Zoology* and *Botany*, have been changed to *Zoological Sciences* and *Botanical Sciences*. Two new Sections—I, *Historical and Philological Science*, and P, *Manufactures*—have been established, although they will not be organised at present.

The work of the old office of the permanent secretary has been divided, and it has been arranged that a general secretary shall take charge of all features of organisation, while the permanent secretary shall be simply an executive officer to have charge of meetings and of the current finances of the association.

Chicago was chosen for the place of the next annual meeting during holiday week 1920–21, and a schedule of future meetings was tentatively drafted as a guide for affiliated societies in forming their plans for future meetings. This tentative programme includes Toronto or Buffalo for 1921–22, Boston for 1922–23, Cincinnati for 1923–24, and Washington for 1924–25. The Chicago meeting next year will be one of the large fourth-year meetings, that in Washington in 1924–25 being another of these specially large meetings. It is hoped that all the affiliated societies, and, in fact, all scientific men in America who can do so, will make a special effort to attend these fourth-year meetings, and that men of science from other countries also will be able to attend.

Arrangements were made for the establishment of geographical branches of the association and for the affiliation of State and city academies of science.

The newly established American Meteorological Society and the Southern Educational Society were admitted to affiliation.

A committee on international auxiliary languages was authorised to co-operate with a corresponding committee of the British Association and with the International Research Council.

The following affiliated societies met with the association:—American Mathematical Society, Mathematical Association of America, American Physical Society, American Meteorological Society, Society for Promotion of Engineering Education, Association of American Geographers, National Council of Geography Teachers, American Society of Zoologists, Entomological Society of America, American Association of Economic Entomologists, American Nature-Study Society, Botanical Society of America, American Phytopathological Society, American Pomological Society, Ecological Society of America, American Society for Horticultural Science, Association of Official Seed Analysts, Society for Promotion of Agricultural Science, American Metric Association, and Wilson Ornithological Club.

The election of officers by the general committee resulted in the selection of Dr. L. O. Howard, of Washington, as president for the coming year. The following vice-presidents (chairmen of sections) were elected: Section A—D. R. Curtis, Northwestern University; Section B—J. C. McLennan, Toronto University; Section C—S. W. Parr, University of Illinois; Section D—Joel Stebbins, University of Illinois; Section E—Charles Schuchert, Yale University; Section F—J. S. Kingsley, University of Illinois; Section G—R. H. True, Bureau of Plant Industry, Washington, D.C.; Section H—G. B. Gordon, American Museum of Natural History, New York; Section I—E. K. Strong, jun., Carnegie Institute of Technology, Pittsburgh; Section M—C. L. Mees, Rose Polytechnic Institute, Terre Haute; Section N—J. Erlanger, Washington University, St. Louis; and Section Q—C. H. Judd, University of Chicago.

The election of the chairmen of Sections K, L, O, and P was deferred for the present. Prof. E. L. Nichols, of Cornell University, was elected general secretary, and the selection of a permanent secretary to succeed Dr. Howard, who has held office for twenty-two years, was referred to the council, with power to act.

PIONEERS IN THE SCIENCE OF THE WEATHER.[1]

THE year 1919 will be memorable in the annals of meteorology. It witnessed the completion of the process of co-ordination of the national meteorological work in the operations of a single institution by the incorporation of the work of the British Rainfall Organization with the Meteorological Office. Beginning with the meteorology of the sea alone in 1854, when it was a department of the Board of Trade, in 1867, after FitzRoy's death, the Office undertook the mapping and the study of the daily sequence of weather, and on that account was placed in charge of a director with a "grant in aid" from Parliament under the control of a committee appointed by the Royal Society. In 1879, under a directive council, also appointed by the Royal Society, it became generally responsible for the publication of the national contribution of climatological data in accordance with an international scheme laid down by the Meteorological Congresses of Vienna in 1874 and Rome in 1879. In discharge of this duty it was authorised to obtain the aid of the Royal and Scottish Meteorological Societies and of the British Rainfall Organization; it was also empowered to recognise the duty of development of meteorological science by experiments and special investigations.

From the early years of the twentieth century the collection of the climatological data of private observers became more and more associated with the Office, until now, by the transfer of the British Rainfall Organization, the co-ordination is completed, and the compilation of information of all kinds about weather is recognised as a common public duty centred in the Meteorological Office.

At the same time, in the course of the year, by a decision of the War Cabinet on May 8, 1919, the Office itself has been "attached" to the Air Ministry; and, instead of deriving the public funds for its maintenance directly from Parliament through the Treasury, it will receive them through the Air Council, and the Air Minister will be responsible to Parliament for them. What modifications of procedure are involved in the change are not yet known.

Since the year marks so important an epoch in meteorological history, the anniversary meeting of the

[1] Abstract of the presidential address delivered to the Royal Meteorological Society on January 21 by Sir Napier Shaw, F.R.S.

society is an occasion on which we may commemorate those of our countrymen who have contributed to the organisation and development of meteorological science. From the time of the invention of the barometer by Torricelli in 1643, proceeding in chronological order, we find examples of the experimental investigation of the properties of air in the work of the Hon. Robert Boyle (1627), natural philosopher and philanthropist; of the design of meteorological instruments in Robert Hooke (1635), the first demonstrator of the Royal Society; of the compilation of observations at sea in the remarkable discourse on winds by William Dampier (1652), sailor and buccaneer; of meteorological theory in Edmund Halley (1656), natural philosopher and Astronomer Royal; in George Hadley (1686), a lawyer who explained the trade winds; and James Hutton (1726), a physician who developed a theory of rain.

Next come Richard Kirwan (1733), a weatherwise Irish gentleman, "consulted about the weather by half the farmers of Ireland," with ideas about the meteorology of the globe on the basis of the distribution of temperature; Charles Wells (1757), physician of St. Thomas's Hospital, who elaborated the theory of dew; John Dalton (1766), famous for his atomic theory, teacher of mathematics and natural philosopher of Manchester, who put the theory of water-vapour in the atmosphere upon a physical basis, a lifelong meteorological observer, and a student of the aurora, the height of which he measured successfully; Luke Howard (1772), a successful manufacturing chemist, an assiduous meteorologist who classified clouds, introduced automatic records of the barometer, discoursed on the climate of London, and studied the influence of the phases of the moon; Admiral Sir Francis Beaufort (1774), Hydrographer of the Navy, who devised the Beaufort scale of wind-force and the Beaufort alphabetical notation for weather at sea; Sir Edward Sabine (1788), Royal Engineer, secretary and, later, president of the Royal Society, and also general secretary of the British Association, who obtained the co-operation of those three great agencies in the magnetic survey of the British Isles, the trigonometrical survey of India, and the establishment of magnetic observatories in Toronto, St. Helena, the Cape, India, and elsewhere in the British Dominions, and of meteorological observations at all the foreign and Colonial stations of the Royal Engineers and Army Medical Department, and who lived long enough to become the first chairman of committee of the Meteorological Office; John Frederic Daniell (1790), professor of chemistry, the inventor of the Daniell cell and the Daniell dew-point hygrometer, a meteorological essayist, and a writer on artificial climates for horticulture; and, finally, William Reid (1791), major-general of the Royal Engineers, and Henry Piddington (1797), merchant seaman, author of "The Sailor's Horn Book," who made most notable contributions to the analysis of the phenomena of what the latter first called "cyclones," and are now in their various forms the familiar elements of interest in the daily charts of weather prepared by meteorological offices all over the world. William Whewell (1796), the omniscient Master of Trinity, may perhaps be added as representing anemometry, thus carrying on the story of weather science as developed by those born before the end of the eighteenth century, and so bringing the history to the middle of the nineteenth, when the society was founded.

These names and histories show from what various sources meteorology has derived its ideas, its initiative, and its support. In the future, as in the past, the science must preserve its wide outlook.

THE REDUCTION OF WAVE ACTION IN HARBOURS.

THE important question of the best means of effecting the maximum reduction of wave action in harbour areas formed the subject of four papers read before the Institution of Civil Engineers on January 13. Next to affording the readiest and safest accessibility under extremely adverse conditions of weather and tide, the exclusion of storm waves, or rather their reduction within limits of harmlessness, is the most pressing concern of the harbour engineer. Unfortunately, the conditions essential to the attainment of the former desideratum are not often conducive to the realisation of the latter. The criticism has been passed on at least one modern harbour of importance that in tempestuous weather the sea is as rough inside as outside. Where large areas have to be enclosed in order to afford the necessary accommodation for shipping, it is a matter of considerable difficulty to provide simultaneously the equally necessary degree of shelter.

Four river harbours—those at the mouths of the Tyne, the Wear, the Esk, and the Blyth, all on the north-east coast of England—were under consideration. In the first two the principle of wide encircling piers had been adopted, with an entrance width on the Tyne of 1200 ft. and on the Wear of 700 ft.; in the second two there is the contrast of a comparatively narrow way or passage from 200 ft. to 400 ft. in width between fairly, or roughly, parallel piers, with intercepting jetties, or wave-traps, at intervals in their lengths. The semicircular arms afford expanding areas of large proportions, wherein the entering waves are diffused and a large amount of their energy dissipates itself harmlessly on spending beaches flanking the entrance to the inner harbour. On the other hand, the openings provided in the overlapping sides of parallel piers deflect a certain portion of the wave from its course and pass it out again to sea. Both systems have their merits, and all the authors claimed that the desired results had been obtained by the method adopted in the particular cases. At Blyth sea-waves of 10 ft. to 12 ft. in height at the pierheads are reduced to 6 in. to 24 in. in mid-harbour, while at Sunderland the factor of wave-reduction is 65 per cent.

In forming a judgment on the respective claims, it must be borne in mind that much depends on the character of the port. Obviously, an internal wave action which might be without prejudicial effect on a large mercantile liner might be fatal to small fishing craft. It is difficult also to detach the problem from the particular conditions of site and coastal configuration. Spending beaches are no doubt admirable adjuncts to a harbour, but they are not always available, nor are the financial resources of ports always commensurate with bold and ample schemes of accommodation. With the means at his disposal, the task of the engineer is to secure the best compromise possible: an adequate degree of tranquillity combined with a serviceable entrance width. Circumstances may favour one method or the other. Even after general lines have been laid down, it will certainly be found wise to proceed tentatively and cautiously in the execution of the design. Much useful information can be gained during the progress of the work, and the exact position and width of the entrance may often be left to a late stage of the operations.

BRYSSON CUNNINGHAM.