ing our knowledge of the direction and velocity of the currents of the upper air, to meet the demands of aviation, which will become greater in the near future, but with a very moderate increase in the resources of their existing institutions, and more active co-operation, they may powerfully aid in the solution of many meteorological problems of theoretical and practical importance.

But the organisation of the Empire's meteorology at the present time is very far from being adequate, for the provision of stations has grown out of local needs or individual initiative, not from a considered plan. When we examine the meteorological organisations of the Empire we may well be astonished at their extent and their development, but as we look further into the matter we shall see that we are still far from utilising them to the best advantage, for reasons which will appear.

In all countries where there is a meteorological service the network of climatological stations is controlled by one or more first-order stations, or meteorological observatories, at which continuous records or hourly readings of pressure, temperature, wind, sunshine, rain, etc., are taken, but none as yet exist in the great Colonial regions of East Africa, West Africa, or in the West Indian Islands, though there are eighteen institutions of this class in other parts of the Empire.

The work of the meteorologist does not end with recording the pressure, or the temperature, or the monthly amount of the rainfall, but meteorological observations, after being taken, must be worked up into the various forms in which they will be most useful for shipping, agriculture, water-supply, engineering, sanitation and health, and now, also, aerial transport. The same form will not suffice for all, and meteorology itself has its own especial needs, but the important thing is that this information, however accurate and detailed it may be, will not be available in exactly the forms that answer to different requirements unless there is a sufficient staff of trained meteorologists to handle it and to supervise its preparation.

Nor is the study of a single region sufficient in itself. India, in preparing the monsoon forecast, draws upon data from Egypt, St. Helena, Brazil, etc.; Egypt, in forming each year an estimate of the coming Nile flood, utilises information from India, Uganda, the South Atlantic, and so on. The East Indian Islands need warnings of their hurricanes from the more eastward islands of their archipelago, and must utilise all that Asia and Africa can tell them about the development and movement of tropical storms before their precautions can be considered to have exhausted all the means available. All lands which lie near the subtropical zones of scanty rainfall are vitally interested in the problems of forecasting the probable sufficiency or failure of their rainy season. The droughts of the pastoral regions of Australia and South Africa are well known, and the same occur in the Sudan, though from its retarded development less has been heard of them up to the present time, but in the future, as the population increases and becomes more settled, the same considerations will demand attention. Similarly, the countries in temperate zones find some of their most urgent problems in the adequacy or inadequacy of the summer heat for the ripening of cereal crops.

We are far from having solved these problems, but we know enough to say definitely that they cannot be solved from the study of a single region, but that they are world-problems in which the meteorological conditions of the whole world must be considered, and for studies of such vast importance the British Empire offers unequalled opportunities, which must be seized and fully utilised. It is in the development of our science within the Empire that there are opportunities by which we have hitherto profited inadequately.

In East and West Africa we have two large groups of Colonial possessions having closely related climates and being already in possession of a number of meteorological stations with records extending over a considerable number of years. It should not be beyond the wit of man to devise a workable system of co-operation for these stations so as to form for each a service which should have a meteorological observatory as its technical centre, with one or more trained meteorologists to direct its energies and to utilise the collected information for the use of the Colonies themselves and of the Empire as a whole.

Already a secular decrease in the annual rainfall of Nigeria has been not merely suggested as being indicated, but also announced by some as a fact, so that the confirmation or confutation of this contention is a matter of very urgent importance to the Colony. Such questions as these are best investigated on the spot by a trained meteorologist in the first instance, even though the final stages in the inquiry may require reference to the meteorological authorities of other regions for the results of their investigation into similar or related questions.

After considering in detail our meteorological organisation we find that within the Empire there are already upwards of 1000 climatological stations distributed all over the world, from lat. 60° N. to lat. 54° S., near the equator, within the tropics, and in the temperate zone. They are on coast-lines, in the heart of continents, and on oceanic islands. Some few, especially in India, are at high altitudes above sea-level. They therefore furnish us with opportunities for investigating almost any problem that may arise in meteorology if competent meteorologists make full and proper use of them.

We come, then, to the conclusion that, in order to provide trustworthy and adequate information regarding the climate of the Empire, and the meteorological phenomena which play so important a part in the lives of all the inhabitants of the earth, a more efficient organisation of our meteorological resources is necessary. In the first place, men will be required who have received a good training in modern meteorology, and have such a knowledge of physics and mathematics as will enable them to deal with the problems which they meet. Hitherto there have been very few of these men in this country, but the present needs have brought a number into direct contact with the subject, and if the meteorological services of the Empire are going to offer a career to an able meteorologist, some of them may elect to adopt it. Co-operation and intercommunication will be all the more essential and valuable when the meteorological work is entrusted to specially trained men who have seriously studied the subject, and this society should be able by means of its meetings, and especially by its Journal, to aid powerfully in the attainment of this desirable object.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LEEDS.—The Department of Physiology is about to undergo extension. The work of the teachers of physiology has been divided. Dr. H. S. Raper has been appointed professor of physiology and biochemistry, and Dr. C. L. Evans has been appointed to a new chair as professor of experimental physiology, or, as it will probably be called, "experimental physiology and experimental pharmacology." This change illus-

trates the trend of modern medicine and surgery. It is becoming evident that an increasing contribution to their progress is rendered possible by a detailed study of the chemical processes met with in health and disease, and the influence upon them of substances of known chemical composition. Recent investigations furnish an example. Antiseptic action of substances containing active chlorine was undertaken early in the war by the University in conjunction with Dr. H. D. Dakin. These researches led to the introduction of two antiseptics, chloramine-T and dichloramine-T, which have been widely used in the treatment of war wounds. To carry out efficiently the new schemes involved in the above changes, increased laboratory accommodation for research will be necessary, and additions to the apparatus in the Department of Physiology must also be provided. Prof. Raper was appointed, in 1910, lecturer in pathological chemistry at the University of Toronto, and held that post until his appointment in 1913 as lecturer in physiological chemistry at Leeds University. He is now on military service. Prof. Evans is also on military service. His published works comprise a number of valuable papers on subjects of physiology and chemical physiology. In the important branch of the medical school—that which relates to pathology and bacteriology—there are also likely to be interesting developments in the near future.

A COURSE of four advanced lectures on "The Electrical Examination and Treatment of Affections of the Nervous System" will be given by Dr. A. D. Waller and Miss M. D. Waller in the Physiological Laboratory of the University of London, South Kensington, on February 5, 12, 19, and 26, the admission to which will be free, without tickets.

A COURSE of nine public lectures on "Animal Life and Human Progress," arranged in conjunction with the Imperial Studies Committee of the University of London, to be given on Wednesdays at 5.30, will open at King's College on January 30 with a lecture on "Man's Account with the Lower Animals," by Prof. Arthur Dendy. The other lectures to the end of February will be:—Some educational and moral aspects of zoology, Prof. G. C. Bourne; Museums and research, C. Tate Regan; Man and the web of life, Prof. J. Arthur Thomson; The origin of man, Prof. F. Wood Jones. Admission to the lectures is free. Cards for the course may be obtained from the Publications Secretary, King's College, Strand, W.C.2.

IN connection with the work of the Imperial Studies Committee of the University of London, a course of public lectures on "Some Biological Problems of To-day" is being delivered at University College on Mondays at 4 p.m. The course began on January 21, and the first five lectures are:—(1) The problem of food, Prof. W. M. Bayliss; (2) War bread and its constituents, Prof. F. G. Hopkins; (3) Accessory food factors (vitamines) in war-time diets, Miss E. Margaret Hume; (4) Alcoholic and other beverages, Prof. A. R. Cushny; (5) The possibilities of increased crop production, Dr. E. J. Russell. The lectures are open to the public without fee or ticket.

THE early introduction by Mr. Fisher of an amended Education Bill, referred to last week, shorn of the more objectionable administrative features of the original Bill, has given general satisfaction. It says much for the credit and courage, no less than for the sincerity, of Mr. Fisher and his educational ideals that he has not failed to take note of the strong feeling evinced, throughout the country during his educational campaign, against any further increase of bureaucratic control with respect to the Board of Education. Parliament is justified in declaring a policy, but it must be left to the local authorities to give it full effect. The Act of 1902, whilst it made the county and borough councils responsible for all forms of education within their areas, failed to make the obligation mandatory. In the present Bill this is remedied, and now they must submit schemes for the approval of the Board to give effect to its requirements, and since the Board commands under the proposed system of consolidated grants large financial control up to 50 per cent. of the total local expenditure, it can readily call upon recalcitrant authorities to fulfil the conditions laid down. Probably the most difficult will be, having regard to industrial conditions, to the requirements of agriculture, and to the scattered and remote character of certain rural areas, to make satisfactory arrangements in respect of the clauses of the Bill which are designed to secure the continued education of young people between fourteen and eighteen. Many different solutions will be required according to the special circumstances of industries and localities. Wide and far-reaching as are the provisions of the Bill, it is, after all, a tentative measure, leading, it is to be hoped, to further developments, in the near future, alike in the provision of maintenance for children declared fit for fuller educational opportunities, in ensuring more complete measures for the care of child-life from the earliest age, and in the raising of the compulsory school age to fifteen, as in the Scottish Bill. The educational features of Mr. Fisher's Bill have met with general approval, and it may be now anticipated with confidence that early in the new session Parliament will give the Bill legal effect.

THE Principal, Dr. R. Mullineux Walmsley, in his report at the prize distribution of the Northampton Polytechnic Institute on January 19, said the manufacture of high-class munitions upon a commercial scale, commenced on July 1, 1915, had been continued uninterruptedly to the present time. In the Technical Optics Department the work of training women students in full-time classes in lens- and prism-grinding was vigorously prosecuted. This department has been highly successful, and the value of its work with reference to the prosecution of the war cannot be exaggerated. Attendances at other classes followed much the same course as in the preceding session, the chief feature being the continual draining off of the senior men both for actual service in the forces and for munitions work. As usual, the work has continued to receive the cordial support of the trades affected. What was described in the last report as "looking forward" work, namely, the training of disabled sailors and soldiers to take their places in the life of the country, not only now, but also after the conclusion of the war, was continued. To the end of July, 1917, eleven complete courses for training suitable men as electric power sub-station attendants were given, and the whole of the men trained were placed out. In the session now running further courses have been given, and the sixteenth course of the series has been started. Fifty-eight members of the staff, 542 members and students, and 802 students have joined the colours, and there are 104 V.A.D.'s serving in military hospitals abroad and at home. Of those joining the forces 169 have obtained commissions. Another line of work is the placing of the equipment and staff of the polytechnic at the disposal of the Government. From time to time various members of the senior staff in different departments have been requisitioned for experimental and scientific work intended to aid the prosecution of the war, and as the equipment of the laboratories is, in many directions, very complete, a considerable amount of work has been done.

THE eighteenth annual general meeting of the Association of Public School Science Masters, held on January 8 and 9 at the City of London School, was remarkable for the unanimity shown by members on certain important points. The main aim of the association at the present moment is to make it certain that every boy in the public schools should receive training in natural science. This training should be part of the general education of the boys, and should therefore be on lines suitable for those who will not afterwards make science their special study. Such lines were laid down by the association twelve months ago in a pamphlet known as "Science for All," in which prominence was given to the human and biological aspects of the subject. Since this is non-specialist training, it must be taken in the schools before the average boy reaches the age of sixteen and a half, when a certain degree of specialisation usually begins. These points were referred to by Mr. O. H. Latter, who explained to the members the far-reaching effects of university entrance examinations on curricula. The committee, he said, had been met very sympathetically by Oxford University in this matter, and negotiations were still going on with Cambridge. During the discussion which followed, the Board of Education policy of grouping science with mathematics in these examinations was severely criticised. No enthusiasm was shown for the introduction of "compulsory science" in such examinations, if the main aim can be attained in any other way; on the other hand, the general feeling of the meeting was in favour of removing compulsion (so far as this means that failure to pass in one subject alone necessarily prevents a boy from passing to the university) from all subjects, with the sole exception of English. The moderateness of the association was shown again later, when the following resolution was passed unanimously:—"That it is desirable that opportunities be given to candidates for science scholarships to offer a historical or other literary subject as subsidiary to their main one." Extracts from Sir H. H. Johnston's presidential address are given elsewhere in the present issue.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, January 9.—Dr. Alfred Harker, president, in the chair.—L. D. **Stamp**: The highest Silurian rocks of the Clun Forest District (Shropshire). Clun Forest is a district in which Upper Silurian rocks crop out over a wide area, interrupted by outliers of Old Red Sandstone. The district is separated from the typical Silurian area of Ludlow by the great line of disturbance that passes through Church Stretton and Old Radnor. The succession of beds compares closely with that in the Ludlow district. The main differences are:—(1) That the Aymestry Limestone is represented by mudstones west of the great fault-line, and (2) that all other divisions show increased thicknesses. There is no evidence of any stratigraphical break. The sequence is complete from the Lower Ludlow rocks up into the Old Red Sandstone, and the changes in lithology are gradual. The extent of Old Red Sandstone, as indicated on present maps, must be restricted, since most of the supposed Old Red Sandstone has been found to belong to the Temeside group, which here attains a great development. The Silurian age of the beds is shown by the occurrence of *Lingula minima* and of characteristic lamellibranchs. A comparison with other districts in which Upper Silurian rocks are developed shows that deposition attained its maximum along the Welsh Border, the thickness of the formations decreasing rapidly southwards and eastwards. On the east of the district—in the neighbourhood of the fault-line—the strata are folded along axes ranging north-north-eastwards parallel to the main fault. Away from the major faults the folding is gentler, and folds ranging nearly due east and west make their appearance. Farther west the north-north-eastward folding and fracturing reappear.

Mineralogical Society, January 15.—Mr. W. Barlow, president, in the chair.—Dr. J. W. **Evans**: Diagrams expressing the composition of a rock. These diagrams are intended, like those of Michel Lévy and Mügge, to indicate at a glance the significance of the analysis of a rock or complex mineral silicate. The molecular proportions of the constituents are determined in the usual manner, those of the ferrous and magnesium oxides, however, being doubled. The silica is represented by two rectangles placed side by side, the length of each being half the molecular proportion of silica. In one of these rectangles lengths equal to the molecular proportions of potash, soda, and lime are measured off in succession, and in the other those of alumina, iron oxide, and magnesia. Thus the same space represents both metallic oxide and silica, and so far as felspars, felspathoids, or ægirine are actually or potentially present, the monoxide and sesquioxide they contain are, with two molecules of silica, represented by contiguous portions of the two rectangles. The excess, if any, of lime over available alumina has the silica necessary to form wollastonite, and the excess, if any, of iron oxide over available soda and the magnesia have the silica required to form orthosilicates. The remaining silica space is then divided up to show the additional silica required or available for the felspars, felspathoids, and ægirine, and that available to convert the orthosilicates of iron and magnesium into metasilicates. The remainder represents free silica or quartz.—Dr. G. F. H. **Smith**: The use of the gnomonic projection in the calculation of crystals. If projected on to a plane at right angles to the edge of the zone containing the poles from which bi-angular measurements were made, the diagram takes the form of a net, the nodes of which represent the principal poles. The unit lengths of the net are easily calculated from the data, and once the rectangular co-ordinates of any node with respect to axes on the diagram have been determined those of the remainder follow by simple addition or subtraction; the corresponding spherical angles are deduced by a simple calculation. The accuracy of the calculations may be checked from the diagram at every step. To keep the projection corresponding with any crystal within reasonable dimensions it is sometimes convenient to project on to the faces of a cube. The direction of a zone when crossing from one face to another is very simply found from the diagram.

Mathematical Society, January 17.—Major P. A. **MacMahon**: A method for studying any convergent series.—G. H. **Hardy**: Additional note on Dirichlet's divisor problem.—J. H. **Grace**: Note on a Diophantine approximation.—K. Amanda **Rau**: A note on a theorem of Mr. Hardy's.—C. H. **Forsyth**: Super-normal curves.—Prof. H. **Hilton** and Miss D. S. **Tuck**: Plane quartic curves with a tac-node.

PARIS.

Academy of Sciences, December 31, 1917.—M. Ed. Perrier in the chair.—A. **Lacroix**: The eruption of the Quetzaltepec volcano and the earthquake that destroyed San Salvador (June–July, 1917). A detailed account of the eruption, gathered from the statements of eye-witnesses and from photographs, is given. The great loss of life and damage were mainly due to the earth-