central fields of the Franklin-Adams plates and on the standard polar area. The actual procedure consists in giving an exposure of 5m. on a field taken at the same altitude as the pole, two exposures on the pole, and then a second exposure on the field. These will serve to determine standard magnitudes down to the 13th or 14th magnitude on the Harvard photographic scale. With these short exposures it will be possible to make several determinations for each field required. For the fainter stars photographs will be taken with a wide grating and the magnitudes derived by comparison with the diffracted images of the brighter stars. These determinations have the advantage of being independent of the changing transparency of the sky. The star-images are compared with a scale formed by taking a number of different exposures on the same plate—the scale being calibrated by the Harvard standards.

With the astrographic equatorial 176 photographs have been taken on fifty-nine nights. Of these, 154 were for the determination of the photographic magnitudes of the stars in the Greenwich section of the Astrographic Catalogue by the method described in last year's report, and 107 of them were considered satisfactory for the purpose. There are now twenty-nine plates on the working list to be taken to complete the series.

Attention is directed to the determination of the position of the sun's axis which has been carried out by Mr. Maunder. The attempt has been made to utilise as fully as possible the long series of measures of the positions of sun-spots made at Greenwich. Although Carrington's determination proves to be only a few minutes in error, it is desirable that the position of the sun's axis should be obtained with all possible precision, and that the limits of accuracy should be known. A redetermination should be made at each sun-spot cycle.

An apparatus was set up on July 5 for the reception of the wireless time-signals from the Eiffel Tower and Norddeich. The signals have been constantly observed since that date, the morning signals being observed each day (except Sundays). The night signals from the Eiffel Tower have been observed on 128 and the rhythmic signals on eighty-two occasions. The night signals from Norddeich have been observed on 124 occasions. The morning signals from the Eiffel Tower were observed by both Mr. Lewis and Mr. Bowyer on 167 days; there is a mean difference L−WB = −0·066s. in their times of observation with an accidental discordance of ±0·06s. between the observers. Similarly in the receipt of the Norddeich signals the two observers showed a mean personal difference L−WB = −0·043s., and a similar accidental discordance. Thus the ordinary signals are observed by either observer with a mean error of less than ±0·05s. The rhythmic signals are apparently received with an error of less than ±0·01s., and the mean discordances between these and the ordinary signals are less than ±0·05s.

As regards the actual difference between the time sent out by the Eiffel Tower and that of the Greenwich 10h. and 1h. signals, from 184 observations Mr. Lewis makes the Eiffel Tower signal 0·256s. late on Greenwich, and Mr. Bowyer from 234 observations makes it 0·313s. late. It is supposed that the difference is mainly due to the difference of personal errors of the standard observers at Paris and Greenwich. The mean discordance after allowing for this constant difference is ±0·11s.

The Norddeich signals are, according to 160 observations of Mr. Lewis, 0·297s. late on the Greenwich time signals, and 0·340s. late according to 229 observations of Mr. Bowyer. Allowing for this there is an accidental discordance of ±0·23s.

The daily comparison of the Eiffel Tower signal affords a useful regular check on the time as determined at Greenwich. At the request of the director of the Paris Observatory, this comparison has, since the installation of the receiving apparatus, been forwarded daily to him as a check on the rate of the clock at Paris. These comparisons are specially serviceable in cloudy weather. In October the Astronomer Royal attended the "Conférence internationale de l'heure" as one of the British delegates, where the further development of the wireless time-service was discussed. The distribution of time in this way is of great value to navigators, and is likely to be of importance in the determination of longitude on land.

ORNITHOLOGICAL NOTES.

THE May number of the New York Zoological Society's Bulletin is devoted to the needs and results of wild-life protection in America, more especially as regards birds. A feature of this issue is a coloured plate representing five species of brilliantly coloured birds—the quezal, the great bird of paradise, the scarlet ibis, the cock-of-the-rock, and the white egret—which are in special danger of extermination in various parts of the world. Altogether, it is estimated that something like one hundred species are in danger owing to the feather trade or on account of their value as food. It is no answer to say that the present comparative abundance of some of these species renders protective measures unnecessary, for it is pointed out that the same argument was used in 1857 in the case of the passenger-pigeon and Wilson's snipe, the former of which is now extinct, save for one survivor in the zoological gardens at Cincinnati. The purchase of Marsh Island as a bird sanctuary by Mrs. Sage is recorded as an important step in the right direction.

In connection with the above may be noticed an article by Mr. B. H. Grove in the May number of *The American Naturalist* on the influence of agricultural development in Wyoming on the bird-fauna, in which it is pointed out that several species are on the increase, while others—notably the quail—have made their first appearance, as new-comers, into this State during the last few years.

The January number of *The Emu* contains the report of a committee of the Royal Australasian Ornithologists' Union appointed to consider the nomenclature of Australian birds and to publish a revised list of names. Although the list which accompanies the report is not based on absolute priority, the committee acknowledges its indebtedness, in its compilation, to the one recently published by Mr. G. M. Mathews, in which that principle is adopted throughout. Trinomialism is rejected.

In an article by Capt. H. Lynes on the drumming of snipe in the May issue of *British Birds*, it is pointed out that the performance is normally connected with the sexual function, but that it may occasionally take place at other seasons, although always within the limits of the breeding area. R. L.

THE AMERICAN PHILOSOPHICAL SOCIETY.

THE annual general meeting of the American Philosophical Society was held in Philadelphia on April 17–19 inclusive. A large number of papers was presented, their general character being of a high order of merit, and it is possible here to refer only to a few of them. The president, Dr. W. W. Keen, was in the chair at most of the meetings.

In a contribution on the flora of Bermuda, Mr.

Stewardson Brown, conservator of the botanical section of the Philadelphia Academy of Natural Sciences, said that more than 1450 separate collections of plants have been made from all parts of the archipelago, with the exception of a few of the smaller islands which are only rocks with but little vegetation. The native species of flowering plants and ferns, exclusive of the endemic forms, number 155, all of which are identical with those existing on the American mainland or the West Indian islands. The fourteen endemic species, four of which have been added through these studies, are all more or less nearly related to those of the south-eastern United States, West Indies, or tropical continental America, and are probably derived from such ancestors by modification during long periods of isolation. It would appear that the greater portion of the native flora has come to Bermuda from the south-west through the agency of ocean currents, hurricane winds, and migratory birds, of which a considerable number of species visit the islands regularly each year.

Prof. George E. Coghill, professor of zoology, Denison University, Granville, Ohio, read a paper on the correlation of structural development and function in the growth of the vertebrate nervous system. Recent studies in comparative neurology have resolved the central nervous system of vertebrates into four longitudinal divisions which are severally functional units. Among lower vertebrates the relative development of these divisions, the somatic sensory, the visceral sensory, the somatic motor, and the visceral motor, has been in a significant manner correlated with the behaviour of the species. Such correlations by the comparative method formed the point of departure for this study on the correlation of the behaviour of embryos with the developing structures in the growth of the nervous system. Some of the more general results of this method of study are (1) the demonstration of the nature of the primary reflex arc of the vertebrate nervous system; (2) the discovery of the adaptive nature of the early reflexes when considered from the phylogenetic point of view; (3) proof that the final common path of the most primitive reflexes is elaborated into the nervous mechanism of locomotion; (4) the explanation of the typical behaviour of a vertebrate upon the basis of demonstrable reflex arcs; (5) a distinctive contribution towards a biological neurology.

Prof. Victor C. Vaughan, professor of hygiene and physiological chemistry in the University of Michigan, dealt with the nature and significance of fever. It has been shown experimentally that fever is due to the digestion of proteins in the blood and in the tissues. Bacteria are living proteins. They get into the body and grow, converting the proteins of man's body into bacterial proteins. After a period of incubation the cells of the body pour out a ferment which digests and destroys the bacteria. In this process fever originates. In itself fever is beneficial; it is a manifestation of the attempt on the part of nature to destroy the invading organism. However, nature may overdo the matter, and fever *per se* become dangerous when it goes much above 105°. Any kind of fever, acute fatal, intermittent, remittent, or continued, may be induced in animals by repeated injections of properly graduated doses of foreign protein.

Prof. Mazÿck P. Ravenel, professor of bacteriology in the University of Wisconsin, described the control of typhoid fever by vaccination. In the United States vaccination against typhoid fever was recommended in 1909. The results were so favourable that it was made compulsory for all officers and enlisted men under forty-five years of age in 1911. The most striking results were obtained during the mobilisation of troops in Texas in 1911. There were 12,801 troops in Texas, all vaccinated. There was only one case of typhoid fever, occurring in a private of the hospital corps, who had not completed his immunisation. The case was mild and resulted in recovery. In 1898 10,759 troops were stationed in Jacksonville, Florida, under very much the same conditions as regards climate, &c. Vaccination was not practised at that time. There were 2693 cases known or believed to be typhoid fever, with 248 deaths. The French troops in Morocco, under most unhygienic surroundings, have entirely escaped typhoid fever where vaccination was practised. In Wisconsin the State Laboratory of Hygiene sends out the vaccine free of charge to all physicians in the State. In more than 3000 vaccinations only two cases of typhoid fever have come to notice; both these cases mild and atypical.

A paper on Guatemala and the highest native American civilisation was read by Prof. Ellsworth Huntington, of Yale University. Among the native civilisations of the western hemisphere that of the Mayas was decidedly the highest. Not only did they develop the arts of architecture and sculpture to a surprisingly high point, but they were the only American race to evolve the art of genuine hieroglyphic writing. To-day the magnificent ruins of the later, decadent Maya period, dating about 1000 A.D., are relatively accessible, as they lie in the dry and well-populated strip which borders the peninsula of Yucatan on the north. The oldest ruins, however, those representing the period of highest development a few centuries after the time of Christ, are located in one of the most inaccessible regions of America. In the last 1500 years, more or less, there must have taken place a change of great magnitude. Three possibilities present themselves. First, the Mayas may have possessed a degree of energy, initiative, and of resistance to fevers much in excess of that of any other known people. Secondly, in their day tropical fevers of the more destructive types may have been unknown in Central America. And thirdly, the climate may have changed. Alluvial terraces and their relation to such ruins as Copan furnish strong independent evidence of climatic pulsations during the past 2000 years.

Prof. W. M. Davis, of Harvard University, discussed Dana's contribution to Darwin's theory of coral reefs, and an account of his paper has already appeared in these columns (February 6, 1913, p. 632.)

Dr. Charles D. Walcott, secretary of the Smithsonian Institution, gave illustrations of a remarkable and ancient fossil fauna discovered by him in the mountains of British Columbia, 2000 ft. above Field, on the Canadian Pacific Railway. The fossils are most beautifully preserved, and include such delicate forms as Medusæ, holothurians, finely preserved marine shells of various kinds, and a variety of crustaceans. Some of the latter are so perfectly preserved that the branchia, legs, and alimentary canal are shown, and even in several forms the liver is so perfect that the ramifications of the tubes through it are reproduced by photography. Altogether more than eighty genera of invertebrate fossils have been found from a bed not more than 5 ft. in thickness. They are all of marine origin, and lived at a period when there were no vertebrates in existence.

The Alleghenian divide and its influence upon freshwater faunas was described by Dr. Arnold E. Ortmann, curator of invertebrate zoology in the Carnegie Museum of Pittsburg. Although it is known that the Allegheny Mountains form a boundary between the aquatic forms inhabiting their western and eastern slopes, particulars about the relations of the two faunas were missing. Dr. Ortmann furnished facts

for a number of aquatic forms of life, chiefly the fresh-water mussels, the Pleuroceridæ, and the crayfishes, covering the region from the New York-Pennsylvania State line to the northern boundary of Tennessee. The main results are that the groups mentioned have not been transported overland to any extent, and consequently are apt to furnish evidence as to the former drainage conditions. The Allegheny Mountains have acted most of the time as an effective barrier to the dispersal of fresh-water life, at least since the end of the Cretaceous. The Atlantic side received its fauna from the interior basin—not across the mountains, but around the northern and southern ends. A few instances are known where single species crossed the divide, and these cases are found in two sharply restricted regions.

Progressive evolution among hybrids of Œnothera was discussed by Prof. Bradley M. Davis, of the University of Pennsylvania. Certain cultures of hybrids between *Oenothera biennis* and *O. grandiflora* have presented in the second generation a high degree of progressive advance in flower size and in the size of the leaves and the extent of their crinkling. An hypothesis for such progressive evolution is offered by the Mendelian principle of recombination of factors for large size on the assumption of multiple factors for the dimensions of organs, but this hypothesis also demands the presence in the same culture of groups of plants containing the factors for small size. When in an F_2 generation there is a considerable group of plants with flowers larger than those of the larger parent there should also be expected corresponding groups with flowers as small as, or smaller than, those of the smaller parent. In F_2 generations of about 1000 and 1500 plants respectively there were no groups of plants with flowers as small as, or smaller than, those of *O. biennis*, the small-flowered parent. The cultures as a whole presented a marked advance in flower size. A similar situation was presented by the character of the foliage in certain F_2 generations The leaves throughout the mass of these cultures were much larger than those of the parents and generally much more crinkled. It is difficult to explain the results on strict Mendelian principles of segregation. Admitting the complexity of the situation when such an extreme cross is made as that between *O. biennis* and *O. grandiflora*, there still appears to Dr. Davis sufficient reason in the data at hand to present the problems as material for reflection on the Mendelian theory of the stability of factors and the principles of their distribution unchanged in the organisation of gametes.

Attention was given to the subdivision of the United States into climatic areas more or less susceptible of quantitative definition by Prof. Burton E. Livingston, professor of plant physiology in Johns Hopkins University, in a paper on climatic areas of the United States as related to plant growth. From a thorough study of the climatic data which are at hand, it appears that any two systems of isoclimatic lines, one system representing the geographical distribution of temperature conditions and the other representing that of moisture conditions, have a strong tendency to cross each other, thus dividing the country into climatic areas, each one capable of quantitative description.

Dr. William Duane, late of the Curie Radium Laboratory, University of Paris, referred to some unsolved problems in radio-activity (illustrated). He discussed such questions as: How can atoms which are physically and chemically similar to each other yet be so different that some of them will disappear immediately and others not for a long time? The explanation of this probably lies in the internal structure of the atom and not in external causes, for external conditions have no known effect upon the phenomenon. The second unsolved problem to which attention was directed was connected with the rays given off by the substances during their transformations. The third problem had to do with the γ rays. He asked: Is the γ ray a wave form spreading out as sound waves do from their source, or is it of corpuscular nature resembling the sparks projected from an exploding rocket? The fact that the β ray, which the γ ray is capable of producing, does not depend upon the distance from the source of the γ ray to the point at which the β ray is produced seems to indicate that the latter hypothesis is correct.

Dr. Edward C. Pickering, director of the Harvard College Observatory, introduced the subject of the determination of visual stellar magnitudes by photography. Ordinary photographic plates are most sensitive to blue light, while the yellow rays are those that effect the eye most strongly. Accordingly, blue stars appear brighter and red stars fainter in a photograph than to the eye. Isochromatic plates are, however, manufactured which are very sensitive to yellow light. If a yellow screen is interposed, the blue light is cut off and red stars appear even brighter, relatively, than they do to the eye. By using a thin yellow screen which cuts off only a portion of the blue rays it is possible to obtain plates having the same colour index as the eye. To fulfil this condition several blue and several red stars have been selected near the north pole. Photographs are then taken with different screens until one is found which gives images of the same relative brightness as the naked eye. With the 16-in. Metcalf telescope at Harvard, stars as faint as the twelfth magnitude may be photographed in this way with an exposure of ten minutes. With an exposure of two hours, stars can be photographed about as faint as they can be seen with a telescope of the same size. On a perfectly clear night a photograph is taken of the north pole with exactly ten minutes' exposure, then similar exposures on four different regions, then a second time on the north pole, on five other regions, and a third time on the north pole. The twelve plates are developed together and various precautions taken to secure uniform results. The magnitudes of numerous stars near the north pole have been measured with great care, and the magnitudes of the stars on the other plates can thus be determined on the same scale.

The spectroscopic detection of the rotation period of Uranus was the subject of a paper by Dr. Percival Lowell and Dr. V. M. Slipher, of the Lowell Observatory, Flagstaff, Arizona. By means of the spectroscope, it is possible to measure the speed of approach or recession of a luminous body; for the lines of the spectrum are shifted toward the violet or red in proportion as the body moves toward or from the observer. Hence, if the image of a rotating planet be so thrown upon the slit of the spectroscope that one end of the slit is illuminated by light from the approaching side of the planet and the other end by light from the receding side, the lines will be tilted through an angle which measures the speed of rotation. In this way, from spectrograms obtained at the Lowell Observatory in 1911, the authors determined the rotation of the planet Uranus about its axis to take place in ten hours and fifty minutes, in a direction opposite to that of the rotation of the planets nearer the sun. Thus, for the first time, an authentic determination of the rotation of this planet has been made by a direct method.

Dr. V. M. Slipher also described the spectrum of the nebula in the Pleiades. Two photographs of the spectrum of the faint nebula near Merope, a bright

star in the Pleiades, were obtained in December, 1912, with a slit spectrograph attached to the Lowell 24-in. refractor. The two plates were exposed five and twenty-one hours respectively. They agree in showing a continuous spectrum crossed by the dark lines of hydrogen and helium, the spectrum of the nebula being a true copy of that of the brighter stars of the Pleiades. The light of the nebula is thus shown to be of stellar origin. As it seems improbable that a mass of stars, all of the same spectral type as the Pleiades, should so group themselves behind the Pleiades as to give the appearance of a nebula, the author believes it more probable that the nebula consists of diffused material surrounding the stars and shining by reflected starlight. This is the first successful observation ever published upon the spectrum of this faint nebula.

A symposium on wireless telegraphy and telephony was an important part of the meeting. Among the papers read was one on radiated and received energy, by Dr. Lewis W. Austin, head of the U.S. Naval Radio-Telegraph Laboratory. Mathematical theory indicates that the energy radiated from a radio-telegraphic antenna will produce an electromotive force on a receiving antenna proportional to the current in the sending antenna, to the height of the sending antenna, to the height of the receiving antenna, inversely proportional to the wave-length, and inversely proportional to the distance between the two antennas. Since the loudness of signal is proportional to the square of the current in the receiving antenna, the signal falls off as the square of the distance between the two. This law has been verified by the experiments made by the United States Navy Department between the new high-power station at Arlington and several other stations situated in and near Washington. Observations at distances above 100 miles show that in addition to the diminution in intensity of signal with the distance, there is in an absorption either in the atmosphere or ground, such that at a distance of 1000 miles over salt water, with a wave-length of 1000 meters, the received current is only approximately 1/25; that is, the received signals are reduced to 1/600 of what they would have been had there been no absorption. The absorption decreases as the wave-length is increased, so that for communication over great distances, long waves 4000 to 7000 metres in length are used, while for short distances of a few hundred miles short waves are better, since they are radiated more energetically. These facts apply to daylight communication only, which is in general regular, night ranges, though greater than day, being freakish and uncertain. The absorption over land is much greater than over water, especially for the shorter wave-lengths. In recent tests between the Arlington station and the scout cruiser *Salem*, on its voyage to Gibraltar and return, messages were received from Arlington in the day-time on the *Salem* up to a distance of 2100 nautical miles, and at night as far as Gibraltar. A comparison was also made of the action of two types of sending sets, one being the regular spark-sending set and the other a set in which the waves are produced from an electric arc. It has been claimed that the continuous waves emitted by the arc are less absorbed than the broken-up trains of waves produced by the spark. Up to 1000 miles no difference in the absorption was observed, but at 2000 miles the observations indicated that the received arc energy was relatively four times greater than that of the spark.

During the meeting Sir A. J. Evans, Sir Joseph Larmor, and Dr. Schuster were elected foreign members of the society.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—Prof. W. S. Boulton, professor of geology at University College, Cardiff, has been appointed to succeed Prof. C. Lapworth, F.R.S., who is retiring at the close of the present session. Before his appointment to University College, Cardiff, Prof. Boulton had been assistant lecturer in geology at Mason College, under Prof. Lapworth.

Dr. O. J. Kauffmann has been appointed successor to Prof. A. Carter, as joint professor of medicine, and the chair of surgery, vacated by Prof. G. Barling, on his election as Vice-Chancellor, has been filled by the election of Mr. W. P. Haslam.

Dr. T. Stacey Wilson has been invited to deliver the Ingleby Lectures for 1914.

Dr. P. T. Hughes is to represent the University at the International Congress of Neurology and Psychiatry at Ghent.

LEEDS.—At the request of the Development Commissioners, the University has undertaken the preliminary arrangements for an investigation in flax growing and in the methods of retting which would be suitable for a central rettery. Selby has been chosen as the chief place of experiment, and 120 acres of land have been sown with various selected types of seed. Negotiations are in progress for the establishment of a central rettery where the whole crop may be treated. The Treasury has sanctioned a grant from the Development Fund to cover the cost of the preliminary steps. The question of the subsequent control and direction of the experimental station is still being considered by the Development Commissioners.

OXFORD.—The annual report of the delegates of the Oxford Museum, which was presented to Convocation on June 10, is a lengthy document occupying thirty-two pages of the *University Gazette*. It includes separate reports of the museum departments, prepared by the regius professor of medicine, the professors of pathology, physiology, human anatomy, comparative anatomy, zoology, experimental philosophy, physics, engineering science, chemistry, geology, rural economy, and mineralogy, by the curator of the Pitt-Rivers Museum, and the reader in pharmacology. The introductory matter records the resignation of Prof. Odling, and the election of Prof. Perkin to the vacant chair of chemistry, together with the appointment of Mr. J. A. Gunn to the newly established readership in pharmacology. The reports of the several professors give evidence of much activity in both teaching and research; in most cases they include lists of important additions to the collections of specimens and the stock of apparatus. The longest and most elaborate contribution is that of the Hope professor of zoology (Prof. Poulton), whose account of the work of his department takes up more than half of the whole publication. The events of which he makes special mention are the taking over by his department of the lower portion of the south room of the old Radcliffe Library, and the meeting of the International Congress of Entomologists at Oxford last August. Attention is directed to many valuable additions to the collection, and particularly to the African insects presented by Messrs. K. St. A. Rogers, W. A. Lamborn, J. A. de Gaye, and Dr. G. D. Carpenter. An interesting list of accessions to the Pitt-Rivers collection is given by the curator (Mr. H. Balfour), who makes special mention of stone implements collected in Ashanti by Mr. R. S. Rattray, a former diploma student in the department. Space will