THE NEXT RETURN OF ENCKE'S COMET.—In a communication to M. Flammarion, Mr. F. E. Seagrave gives the results of his calculations concerning the return of Encke's comet in 1914. From the elements, corrected for the Jovian perturbations, it is seen that perihelion passage should take place on December 5·89, 1914, while the ephemeris shows that the comet should be circumpolar and near to the earth about October 27, 1914; on this date its distance from us will be about 42 million kilometres (26·2 million miles), and the comet should be of about the fourth magnitude. The period found by Mr. Seagrave is 1204·8001 days. (*L'Astronomie*, December.).

THE MAGNITUDE AND COLOUR OF BROOKS'S COMET, 1911*c*.—In a note appearing in No. 4619 of the *Astronomische Nachrichten*, Herr Max Valier gives the magnitudes, diameters, and colours of Brooks's comet (1911*c*), as observed by him during the period September 7 to November 4, 1911. Both magnitudes and colours were regularly progressive until October 21, the former going from 5·0 to 1·8, the latter from bluish, through blue, greenish, greenish-yellow, yellowish-red, to white; the order was then reversed in both cases.

JOHN GOODRICKE.—A portrait of John Goodricke, the astronomer who discovered the periodicity of Algol in 1783, and suggested the accepted explanation of the star's variability, has recently been presented to the Royal Astronomical Society by Mr. C. A. Goodricke, of Hampstead. It is not generally known that John Goodricke was deaf and dumb from birth, yet, although he died in 1786, at the early age of twenty-two, his scientific attainments had earned for him the fellowship of the Royal Society and the award of the Copley medal; his astronomical work was done at York. An interesting letter, giving the chief facts concerning Goodricke's life, appears in No. 1, vol. lxxjii., of *The Monthly Notices*.

"THE COMPANION TO THE OBSERVATORY."—This useful annual, for 1913, contains practically the same matter as last year, with the various tables revised. Messrs. Denning and Lewis have revised the "Meteor Showers" and "Double Stars" sections respectively, and a welcome addition is a list of the principal star clusters and nebulæ. It is interesting to note, from the page dealing with the universal time system, that every State of any importance, except Russia, now uses a standard time directly depending upon the Greenwich meridian; Russian time depends upon the Pulkowa meridian, and is 2h. 1m. fast on Greenwich. We remark that the editorship of *The Observatory* has changed hands, the new editors being Mr. F. J. M. Stratton, of Cambridge, and Mr. A. S. Eddington and Dr. S. Chapman, of Greenwich, in place of Messrs. T. Lewis and H. P. Hollis. The "Companion" is published by Taylor and Francis at 1s. 6*d*., and should be in the hands of every astronomical observer.

DEVELOPMENTS OF NATIONAL EDUCATION.

THE papers read at the North of England Education Conference, at Nottingham, on January 2, 3, and 4, give evidence of a growing realisation of the principal weaknesses of English public education. One of the most remarkable and significant developments in national education, and one to which considerable prominence was given in papers read by the Rev. W. Temple, headmaster of Repton School, and Mr. P. E. Matheson, New College, Oxford, respectively, is the valuable work of university level being done by the Workers' Educational Association. Mr. Temple stated that there are now more than 100 university tutorial classes in different parts of the country, with nearly 3000 students, which have been organised and provided by this association. These classes are limited to thirty students, who undertake to attend throughout a three-years' course. The class meets once a week for twenty-four weeks during the winter session. Each student writes an essay once a fortnight. The essays are pronounced by distinguished scholars to be equal in value to the work done in Oxford by men who take a first class in the honours history school. Mr. Temple concludes from the experience of the association, that "not only is a vast amount of intellectual capacity going to waste in England at this moment for lack of opportunity," but "that men who have only had an elementary education and no secondary can none the less do work of a university type at the proper age. Of course, they have not the *knowledge* . . . but apparently their intellectual capacity has gone on growing."

The advantages of practical and manual work of various types in elementary schools were frequently insisted upon. Mr. Bird, superintendent of handicraft, Leicester Education Committee, criticised effectively the defects of the present methods of manual training in schools, in which so much stress is laid upon mere copying of models, and so little attention given to developing the ingenuity and originality of the boys. A suggestive criticism was made by Mrs. Ogilvie Gordon in a paper on "trade schools" upon the much-quoted Continuation Trade Schools of Munich. She stated that "a weak point in the Munich system, and in most of the Continental systems, is that there is no easy bridge by which the public elementary and trade continuation class scholar can pass into the higher ranks of his vocation and complete his studies in the polytechnic or university. The avenue to these higher courses is solely through the gymnasial high schools."

Sir William Mather, in a weighty and important paper on the cooperation of employers and education authorities, complained "of the want of aptitude and intelligence, application and interest, displayed by a considerable majority of the boys and girls coming to work direct from the elementary schools." From his experience as an employer who had for some years made attendance at evening continuation schools compulsory upon his junior employees, he strongly urged a similar course of action upon all employers of labour. In a paper upon the educational responsibilities of the employer, Councillor George Cadbury, jun., described the remarkably complete scheme of continued education (mental and physical) in operation at the Bournville Works for the junior employees. The main features of the scheme are (1) compulsory attendance at evening continuation school, with remission of fees, and the award of prizes; (2) physical exercises and swimming during the firm's time; (3) special technical and commercial classes within the works during working hours. J. WILSON.

THE INHERITANCE OF FECUNDITY IN FOWLS.[1]

THE application of Mendelian principles to the inheritance of an economically productive character of an animal has a twofold importance, viz. first, because it may be questioned whether or not it is possible to apply a Mendelian interpretation to the facts, and, secondly, the data and conclusions arrived at make it possible for others to outline a practical scheme of breeding with the view of an increased egg-production.

In the study before us, Mr. Raymond Pearl, an investigator well known by his work on the fecundity and breeding of fowls, sets forth in great detail the

1 "The Mode of Inheritance of Fecundity in the Domestic Fowl." By Raymond Pearl, *Journ. Exp. Zool.*, 1912, pp. 153-268.

results of five years' work which has involved thirteen generations and several thousand individuals. Two very definite results have been obtained, and it is important that these should be grasped at the outset, viz.: (1) that the record of egg-production of a hen is not of itself a criterion of any value whatsoever from which to predict the probable egg-production of her female progeny—in short, there is no correlation between the egg-production of individuals and either their ancestors or their progeny; (2) notwithstanding the above-mentioned fact, fecundity is, in some manner or other, inherited in the domestic fowl.

The mere fact that a fowl is anatomically normal is not sufficient to ensure the laying of eggs; two physiological factors or groups of factors are essential. The first of these is termed the "normal ovulation" factor, *i.e.* the complex physiological characters which in their entirety determine the normal reproductive activity and definite periods of productivity, what are termed the winter and summer cycles, depending upon differences in the complex physiological mechanism concerned with the maturation of the oocytes and ovulation.

Winter egg-production is chosen as the basis of measure, representing as it does the cycle in which the widest difference is found between birds of high and low fecundity. Three well-defined classes are apparent; these include birds with high winter records, those with low, and those that do not lay at all. In respect to these three divisions there is a definite segregation in the Mendelian sense.

As the result of considerable work supported by a mass of evidence, the author concludes:—

There are three distinct and separately inherited factors upon which fecundity in the female fowl depends.

The first of these factors (which may be called the anatomical) determines the presence of an ovary, the primary organ of the female sex The letter F is used throughout to denote the presence of this factor.

There are two physiological factors. The first of these (denoted by L) is the basic physiological factor, which, when present alone n a zygote with F, brings about a low degree of fecu idity (winter record under thirty eggs). This factor is under no limitations in gametogenesis, but may be carried in any gamete, regardless of what other factors may be also present.

The second physiological factor (denoted by L_2), when present in a zygote together with F and L_1, leads to a *high* degree of fecundity (winter record more than thirty eggs). When L_1 is absent, however, and L_2 is present, the zygote exhibits the same general degree of fecundity (under thirty) which it would if L_1 were present alone. These two independent factors, L_1 and L_2, must be present together to cause high fecundity, either of them alone, whether present in one or two "doses," causing the same degree of low fecundity.

The second physiological factor, L_2, behaves as a sex-limited (sex-correlated or sex-linked) character, in gametogenesis, according to the following rule: the factor L_2 is never borne in any gamete which also carries F. That is to say, all females which bear L_2 are heterozygous with reference to it. Any female may be either homozygous or heterozygous with respect to L_1. Any male may be either homozygous or heterozygous with reference to either L_1, L_2, or both.

Numerous other matters of great interest are lucidly set forth, to which want of space forbids us to refer The whole piece of work is an excellent example of the practical applicatio n of Mendelian principles to an important economic question, and deserves most careful study. WALTER E. COLLINGE.

EGYPTIAN SODA.

A REPORT by Mr. A. Lucas on "Natural Soda Deposits in Egypt" has been issued by the Ministry of Finance as "Survey Department Paper, No. 22." Natural soda occurs in Egypt principally in the Wadi Natrun in the Libyan desert, but it is also found some fifty kilometres due north of this, at El Barnugi, in Lower Egypt, and at Mahamid, in Upper Egypt. The principal soda-lakes are in a valley the bottom of which is about 27 metres below sea-level; the lakes extend over a range of 30 kilometres, the nearest being about 38 kilometres from the Nile. In ancient times there were two lakes, which became united when water was most abundant, but at the present time they are divided into about a dozen separate areas, the smaller of which dry up almost entirely in summer, leaving only a few pools of water. The soda is found in solution in the water of the lakes, in a solid form at the bottom of some of the lakes and as an incrustation on the adjoining ground.

Analyses of the water are given for ten of the twelve lakes. In the case of the most concentrated the figures were:—Specific gravity, 1·260; Na_2CO_3, 62·15; NaCl 252·35; Na_2SO_4, 64·54; total 379·04 grams per litre. The lakes are largely fed by springs in the bed of the lakes, but also by water trickling in from the surrounding ground. At low water one of the springs is so powerful that a boat trying to pass over it is driven forcibly back; another spring, round which an iron cylinder had been placed, was found to be flowing at a height of 80 centimetres above the lake level at the end of February. These springs flow energetically all the year round, but in one case at least there is increased activity about October. Analyses of the spring and well water showed total solids ranging from 0·3 to 4·6 grams per litre, the quantity of soda ranging from 0·2 to 1·2 grams per litre, almost all in the form of bicarbonate; it is therefore probable that the soda is carried into the lakes by the inflowing water, and is there concentrated by evaporation.

The water-level in the lakes falls in summer, begins to rise again in October, and reaches a maximum in March. This variation might be attributed to the different rates of evaporation in summer and in winter; but there appears to be a definite increase of flow in October; this precedes the slight autumn rains, and must be due to an increased flow of underground water. The underground flow is from the north-east, in which direction the Nile lies nearest; this is also the side on which the visible flow into the lakes takes place. The fact that the lakes fall whilst the Nile is rising, and conversely, may be due to lag; in the case of some wells in the neighbourhood of Cairo, under constant observation for thirteen years, the time required for the water-levels to be raised by the influence of the Nile flood varied from 25 to 55 metres per day.

The lakes deposit both salt and soda. The former is practically pure, at least after washing; the latter consists mainly of the compound

$$Na_2CO_3,NaHCO_3,2H_2O,$$

but may contain an excess either of carbonate or of bicarbonate; it is often mixed with large quantities of salt (from 2 to 27 per cent.), and of sodium sulphate (from 0 to 39 per cent.).

The salt is probably of marine origin. The large excess of sulphate and the absence of iodides and bromides may be explained by the separation of gypsum and of salt on partial evaporation, and the subsequent washing away of the mother-liquors, *e.g.* by a fresh influx of sea water. The conversion of chloride and sulphate into carbonate and bicarbonate has been explained as due to a reversal of the usual