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

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interactions of these substances with calcium and magnesium carbonates, *e.g.*

$$2NaCl + CaCO_3 \rightleftarrows Na_2CO_3 + CaCl_2$$
$$2NaCl + CaCO_3 + CO_2 + H_2O \rightleftarrows 2NaHCO_3 + CaCl_2$$
$$Na_2SO_4 + CaCO_3 \rightleftarrows Na_2CO_3 + CaSO_4,$$

but it is not easy to understand how such interchanges could result in the production of more than a mere trace of the alkali. A more probable explanation assumes as the first stage a reduction of sulphate to sulphide by organic matter, living or dead, with a subsequent displacement of sulphuretted hydrogen by carbonic acid:—

$$Na_2SO_4 - 4O = Na_2S,$$
$$Na_2S + CO_2 + H_2O = Na_2CO_3 + H_2S, \text{ \&c.}$$

In support of this view there are quoted statements by Lunge that the springs "are full of algæ," that "at a distance of three feet from their origin they begin to give off sulphuretted hydrogen," and that the "odour becomes more intense a little further on, but ceases at a greater distance."

The Wadi Natrun deposits were probably the oldest known occurrence of natural soda in the world, and they constituted the principal source of supply of that commodity for thousands of years. They are at present worked by the Egyptian Salt and Soda Company, who took them over from the Société Anonyme des Soudes naturelles d'Egypte, to which latter company the Government had granted at the end of 1897 a concession for fifty years. The company makes caustic soda and soda ash, and, in addition, extract and sell both natrun (raw soda) and salt. According to the customs returns the exports include 1200 tons of caustic soda, value about 10,000*l.*, and about 800 tons of natrun. But both these products are sold also for use in the country, and the company uses considerable quantities of caustic soda at its own soap factory.

The Wadi Natrun is connected with the State railway system by means of a narrow-gauge railway 50 kilometres long, running from Khatatba to the centre of the Wadi. T. M. L.

AGRICULTURE IN INDIA.

THE Agricultural Journal of India (vol. vii., part iv.) contains several articles which testify to the assiduity with which various questions are being investigated. Dr. C. A. Barber contributes a paper on seedling canes in India, and gives a brief outline of the chief phases in the cane-sugar industry and the causes which led to the raising of seedling canes in Java and Barbados. Similar work has been carried out in India, and records are being accumulated, in order to afford data for a general classification of the canes of the country. Difficulty was experienced in procuring sugar-cane arrows with a fair proportion of anthers containing fully matured pollen; in fact, the only native cane possessing this property was the Cheni of Mysore.

Mr. C. E. Low writes on the supply of agricultural cattle in India, and after giving statistical information and a description of the present situation regarding cattle supply, with an examination of the various features involved, discusses the question of the food supply in times of famine and the measures which the Government is adopting to cope with various causes which tend to a diminution in the number or efficiency of agricultural cattle. It is interesting to note, in connection with the storage of fodder as reserves for seasons of famine, that "the main objection to this proposal in the popular mind seems to be that the possession of stored fodder tempts a hostile neighbour to revenge himself by setting light to the stack."

Messrs. E. J. Woodhouse and T. Bainbrigge Fletcher report the adoption of systematic hand-picking of the caterpillars of *Agrotis ypsilon*, and the use of the Andres Maire moth-trap in the Mokameh Tal. During the season of 1911 upwards of 60,000 caterpillars were hand-picked, and 2000 Agrotis moths were caught in November by one trap. It is estimated that by the above means 6000 acres of crops were saved.

Mr. F. M. Howlett discusses the possibility of the introduction of yellow fever consequent on the opening of the Panama Canal and the shortened route from the fever-zone in the West Indies and Central America. It is pointed out that, if yellow fever were introduced, and *Stegomyia fasciata* proved to be the only effective carrier, the disease would be more or less confined to the coast districts and seaport towns, while if *S. scutellaris* also proved effective, there is no reason why it should not spread infection throughout the country. The distribution of the different species of Stegomyia in the larger seaports is now being ascertained by means of a systematic survey.

NATURAL SCIENCE PAPERS AND MEMOIRS.

IN the sixth volume of *Fortschritte der naturwissenschaftlichen Forschung*, Prof. W Halbfass reviews the recent work on the topography, hydrography, and geology of the lakes of Asia, Africa, America, and Australia. Dr. A. Rühl, in his paper on a new method in geomorphology, pleads for the application of the deductive method to the borderland between topographical geology and geography. The exposition of the peneplain theory of Prof. Davis, as well as of other points bearing on normal marine, glacial, and arid cycles, is illustrated by photographs and diagrams. The results of recent researches in radio-activity, particularly on uranium, thorium, and actinium, form the subject of a review by Prof. Otto Hahn and Dr. L. Meitner.

In the same volume the classification of functional mental disorders, and the existence of fundamental differences between organic and functional psychoses, are discussed by Prof. O. Bumke. The problem of regeneration, in its inorganic, botanical, and zoological aspects, is surveyed by Prof. D. Barfurth, who appends to his memoir a selected bibliography containing about 500 references. After examining the various theories of regeneration, he regards that of Roux as being most nearly in accord with the facts observed, *i.e.* that, in cases where regeneration can take place, disturbance of the living organism in an adult individual gives rise to formative stimuli in the reserve germ-plasm of the adult cells or of cells not yet fully differentiated, which lead to the re-establishment of the organism as a whole. Dr. W. Hausmann, in a paper on optical "sensibilisators" in plants and animals, concludes that several pigments which occur commonly in nature are photo-biological "sensibilisators," which react under definite physiological and pathological conditions.

Dr. W. G. van Name (in Proc. Boston Soc. Nat. Hist., vol. xxxiv., pp. 413–619, plates 43–73) gives an account of the simple Ascidians of the region from the Gulf of St. Lawrence to Long Island Sound. This coast is not rich either in number of species of Ascidians or in those presenting striking structural characters. Leaving out of account all uncertain forms, thirty-four species (seven of which are new) are recorded. The genus Bostrichobranchus, known only from the Atlantic coast of North America, is the most interesting Ascidian described in this memoir. Dr. van Name regards this as the most highly specialised genus of Ascidians, and as having been derived from the genus Eugyra.

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