ii. as against 1158 in vol. i. Under *Arctiidæ* the author includes the following groups as sub-families, which have usually been treated as families by previous authors:—*Arctiinæ*, *Lithosiinæ*, *Nycteolinæ*, and *Nolinæ*. The *Agaristidæ* are a small family of handsome day-flying moths, and certainly look rather out of place in the position which they occupy in this book. The extensive family of *Noctuidæ* is divided into ten sub-families (*Trifinæ*, *Acontiinæ*, *Palindiinæ*, *Sarrothripinæ*, *Euteliinæ*, *Stictopterinæ*, *Gonopterinæ*, *Quadrifinæ*, *Focillinæ*, and *Deltoidinæ*), of which the two last are held over to the forthcoming third volume of the book.

Concerning the *Noctuidæ*, Mr. Hampson remarks, "The lowest forms are those of which the larvæ have five pairs of abdominal prolegs, and the perfect insects have vein 5 of the hind wing fully developed, and from the centre of the discocellulars, this ancestral form being only found in some *Deltoidinæ* and *Sarrothripinæ*."

As the plan of the second volume is identical with that of the first, which we had the pleasure of noticing in NATURE for February 23, 1893 (pp. 387–388), we need only add that there seems no falling off in its execution. It is hoped that the third volume, including the *Epicopiidæ*, *Uraniidæ*, *Epiplemidæ*, and *Geometridæ* will be completed in the course of the present year.

W. F. K.

LETTERS TO THE EDITOR.

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Panmixia.

MR. ROMANES has requested those students of natural history who cannot accept the doctrine of Panmixia to show the error which they believe to lie in his reasoning. I therefore ask leave to explain why I am unable to accept either the first proposition put forward by Mr. Romanes in NATURE of to-day, or the doctrine itself. Mr. Romanes says:—

The survival-mean must (on cessation of selection) fall to the birth-mean, &c. This statement involves neglect of a way in which selection may, and often must, operate. A simple example will show this. The mean height of adult Englishmen is roughly 67½ inches; and if I offer to enroll in a regiment every adult Englishman who is more than 66 and less than 69 inches high, the mean height of my regiment will, as every statistician knows, be still 67½ inches, but I shall be obliged to reject more than half the population. A form of selection, involving the destruction of more than half the population, may therefore occur without affecting the mean value of the character selected. I hope shortly to publish evidence, based on the measurement of many thousands of animals of one species, at many stages of growth, showing that selection does in fact operate in this way in particular cases. That it must so operate in many cases is obvious from the fact that many wild animals remain for several generations without sensible change in their mean character. In these cases either selection acts as I suggest, or it is incapable of affecting a change in the mean, or it does not act at all.

The second and third propositions put forward by Mr. Romanes are not demonstrated by any statistics with which I am acquainted; and with regard to the extreme statement that "*any* failure in the perfection of hereditary transmission will be weeded out" by selection in a wild state, I would urge the need, which has lately been well pointed out by Bateson, of a *quantitative* measure of the efficiency of selection. The frequency of even considerable abnormalities in specialised organs of wild adult animals, of which so many admirable examples are described in Mr. Bateson's recent work on variation, show, if it needed showing, that natural selection is in most cases an imperfect agent in the adjustment of organisms.

But my main difficulty is that neither Mr. Romanes, nor Prof. Weismann, nor any other advocate of the doctrine, has shown that in some given case Panmixia does in fact occur, and that the results predicted are in fact produced. On the other hand, Mr. Galton has shown that civilised Englishmen are themselves in a condition of Panmixia, at least with respect to several characters, especially stature and the colour of the eyes. Now the mean stature of Englishmen is known to be slowly increasing, and there is no evidence of the disappearance of coloured eyes.

My objections to the position of Mr. Romanes and others are therefore two: first, that it is based on the assumption that selection, when acting on a species, must of necessity change the mean character of the species—an assumption incompatible with the maintenance of a species in a constant condition; and secondly, that in the only case which has been experimentally investigated, the consequences said to result from a condition of Panmixia do not, in fact, occur.

W. F. R. WELDON.

University College, London, April 26.

On Some Sources of Error in the Study of Drift.

As a general rule we may feel sure that the boulders scattered over the surface of a district which consists chiefly of boulder clay, have been derived from the underlying deposit. There are, however, some cases in which the inference is unsafe. For instance, the Thames now marks the southern limit of the glacial drift—a curious circumstance, and one of which a wholly satisfactory explanation has not been given. Many think that this sharp definition of the southern limit of the glacial drift is so improbable that they would fain attribute some deposits in North Kent to the glacial period, or at any rate would expect to find a few sporadic boulders stranded on the slopes of the North Downs; and there far-transported fragments do not unfrequently occur.

But there is this great source of error. All along the lower Thames barges carry refuse and rubbish of every description from London, and this is taken, such as it is, and laid on the adjoining lands.

So you find carried on, with road scrapings, fragments of every kind of road metal; with soil turned out in digging foundations, specimens of all the materials used for building; with the contents of middens, every variety of object of domestic use or ornament. It is marvellous what large lumps get on to the land in this way. When, then, anyone produces a specimen, even a large specimen eight or ten inches in diameter, and perhaps taken out of a deep loam, the evidence is rejected. The stone may have been carried on to the land with the manure, and the loam may in that district be quite recent rain-wash. It may be that some of them were really of glacial origin, but all are equally distrusted. Some of them certainly cannot be referred to ice action. I have seen large pieces of Napoleonite found on the surface in North Kent. By what accidents they came to be there we cannot tell, but we may, at any rate, acquit the ice of having had anything to do with the transport of that peculiar Corsican rock.

When walking along the base of a cliff of boulder clay, we may generally infer that the far-travelled boulders that lie at its base have just been washed out of it. In most cases they have been; but in some, and those often the cases in which it is of greatest consequence to have the origin of the boulders clearly established, we have another serious source of error, of which I have just seen a good example.

A Norwegian vessel, carrying timber from Christiansund to Boston, in Lincolnshire, ran aground and became a total wreck off Old Hunstanton last winter. I saw her in January. The vessel looked sound enough to a landsman's eye; but she was dismasted and gutted, and the salvage was on the sand dunes close by. About her a pool of varying breadth had been formed by the swirl of the water round the hull. The currents had been deflected by various circumstances here and there, as especially where a quantity of ballast had been thrown out. This consisted of large boulders of various kinds of gneiss and porphyry, and the weighty pile looked as if it were little affected by the currents of the incoming and receding tides.

In April, I visited the spot again, expecting to find that the boulders had been driven along the shore by the fierce storms which had raged along that coast since my previous visit, and intending to make note of their dispersal and the distance to which they had travelled. I found, however, that the keel and a portion of the lower part of the wreck remained, and that the surrounding pool was greatly deepened and extended.