

seventeen species are referred to the first three sub-families altogether, the whole of the remainder falling under the fourth, and typical, subfamily.

The sexes are very different, and it is not always easy to identify them, the males being winged, and often much smaller and slenderer than the females. The head, thorax and abdomen are usually sharply separated, and the body is clothed with very thick down, and is more or less brightly coloured, for even where the prevailing colour of the abdomen is black, it is usually marked with bands or large spots of red, yellow or silvery white.

So far as their habits have yet been observed, the Mutillidæ are parasitic in the nests of various ground-bees and burrowing wasps.

We have so recently reviewed one of the volumes of this series that it is, perhaps, unnecessary to say more than that the arrangement of this volume is similar to that of its predecessors and that it appears to be fully equal to them in execution, both as regards the text and plates.

W. F. K.

*Publications of West Hendon House Observatory, Sunderland.* No. 2. By T. W. Backhouse, F.R.A.S. Pp. viii + 161. (Sunderland: Hills and Co., 1902.)

THIS volume contains the detailed observations which have been made by Mr. Backhouse on the structure of the sidereal universe, comets Barnard (1886) and Holmes (1892), the Zodiacal Light, the Aurora Borealis, and variable and suspected variable stars.

The first part of the observations of the sidereal universe was contained in a previous similar publication (No. 1), and in this second part the author deals with the observations of radiating systems, lines and parallelisms amongst the stars, and the Milky Way.

The author has arranged his table of observations of "Auroræ" (which extend from January, 1860, to Midsummer, 1896) so as to indicate whether or not there is any foundation for supposing the appearances of this phenomenon to have a periodic fluctuation. The table, together with the accompanying curve, indicates a period of sixty-five days, which includes a well-marked succession of maxima at intervals of twenty-eight days.

The last section of the book, dealing with the observations of variable and suspected variable stars, includes an introduction on the "Calculation of Star Magnitudes," observations of the "Orange Stars near  $\eta$  Geminorum" and the "Brighter Stars in Hercules and Neighbourhood," together with a descriptive diagram of the variation of  $V$  Aquilæ.

*Buttermaking on the Farm and at the Creamery.* By C. W. W. Tisdale and T. R. Robinson. (London: John North, the Dairy World Office, 1903.) Price 1s.

THIS little book is, strictly speaking, a handbook on practical buttermaking. It has the merit of being thoroughly up-to-date, in that the whole process of buttermaking is dealt with in minute detail, and the practice recommended is based on the latest scientific research connected with dairying. It does not describe dairy implements or breeds of cattle, but simply the making of butter and the management of the milk and cream from which it is produced, and it is probably the best of the handbooks on practical buttermaking. The treatment of milk and cream at the factory is fully dealt with, as well as at the farm, and also such subjects as pasteurisation, ripening of cream on a large scale, purchase of milk according to quality, and the packing and marketing of butter. There are also one or two excellent illustrations, showing the appearance of butter in different stages of churning and making. DOUGLAS A. GILCHRIST.

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## LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

### Sir Edward Fry on Natural Selection.

I HAVE only just read the memoir of Sir Edward Fry in the January number of the *Monthly Review* on "The Age of the Inhabited World." With its general purport I am in sympathy, and I rejoice in the opportunity of offering a tribute of praise to the extreme lucidity of the language in which it is expressed; but for those very reasons I desire to protest against one of his arguments, which seems to me so faulty as to seriously compromise the value of the memoir as a whole. He is endeavouring to show that natural selection is incapable of doing much that has been accredited to its agency, and uses, p. 78, these words in respect to mimetic insects:—

"... the useful deception will not take place until the protected form is nearly approached. Thus during the whole interval occupied in passing from the normal form of group A to near the normal form of group B, natural selection will have been entirely inoperative. . . . Either birds are deceived by a small amount of imitation or they are not. If they are, natural selection cannot have produced perfect imitation; if they are not so deceived, then group A has passed over from its original form to something close upon the form of group B without any guidance from this principle."

I deny this sharp dilemma and assert the existence of many intermediate stages. Two objects that are somewhat alike will be occasionally mistaken for one another when the conditions under which they are viewed are unfavourable to distinction. The light may be faint, only a glimpse of them may have been obtained, the surroundings may confuse their outlines. While these conditions remain unchanged, the frequency of mistake serves as a delicate measure of even the faintest similarity. Prof. McKeen Cattell measured in this way the relative resemblances (in other words the want of distinction) between various printed letters of the alphabet. He placed them on a screen behind a drop slide that had a horizontal slit, giving a uniformly brief glimpse of the letters while the slide was falling. He found, as might have been expected, that "i" was often mistaken for "l," "k" for "h," and so on, each couplet with its own special degree of frequency, which gave a numerical measure of the relative resemblances of the letters. Many other letters that seem ordinarily very unlike were occasionally mistaken for one another, each in a definite percentage of cases. So it must be with insects. If one of the edible group A has individual peculiarities within the limits of variation, that give it a resemblance, however slight, to one of the noxious group B, it will occasionally be mistaken by a bird for a B and allowed to live unharmed. The similarity may be due to a characteristic attitude, to a blotch of colour, to a preference for resting on a part of the foliage to which its own form bears some likeness, or to other causes. In any case, it may well prove to be the salvation of 1, 2 or more per cent. of those that would otherwise have been seen and eaten. If so, the thin edge of natural selection will have found an entrance, and its well understood effects must follow. FRANCIS GALTON.

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### The Principle of Least Action.

MR. HEAVISIDE has done good service in calling attention to the *misuse* of this principle; and certain theories of electromagnetism, which have been recently proposed, afford a striking illustration of the value of his remarks and the limits within which the legitimate application of the principle is confined.

In many branches of physics, the equations of motion and the boundary conditions of the dynamical system under consideration cannot be obtained without making some hypothesis, which may or may not be true. One method of testing the truth of the hypothesis is by appeal to experiment, but the legitimate use of the P. of L. A. frequently supplies another. For the original hypothesis, when expressed in terms of mathematical symbols, leads to an energy function, from which the equations of motion and