

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 η 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.

Hotel Europe, Rome.

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

the boundary conditions can be obtained by the aid of the P. of L. A.; and if the application of this principle leads to results which are dynamically unsound or impossible, the original hypothesis is vitiated even though the formulæ to which it leads should be found to agree with experiment. To endeavour to explain some new phenomenon by introducing a hypothetical term into the energy function, and to deduce the equations of motion and the boundary conditions by means of the P. of L. A., is perfectly legitimate as a tentative process; but the results thereby obtained require careful examination in order to ascertain whether or not they violate any of the fundamental principles of dynamics.

In some theories on the action of magnetism on light, the hypothetical term introduced into the energy function gives rise to certain additional terms in the equations, by means of which the motion and forces are specified, which make some of the forces discontinuous at the surface of separation of two different media. Theories of this kind consequently violate Newton's third law of motion, and can at best be only regarded as stop-gaps until some better theory has been discovered. On the other hand, the introduction of hypothetical terms into the equations which determine the forces, or some of them, may lead to an energy function which fails to reproduce the original expressions for the forces when the P. of L. A. is applied; and in cases of this kind the principle affords a valuable test of the correctness of the previous work. The principle, like a great many other mathematical theorems, has its uses, but to convert it into a "graven image" is to court disaster. A. B. BASSET.

Fledborough Hall, Holyport, Berks, January 30.

The Horny Membrane of *Neohelia porcellana*.

Two years ago, Miss Edith Pratt published in vol. v. of Willey's "Zoological Results" a paper on the anatomy of *Neohelia porcellana*. In this paper attention was directed to a horny membrane lining the hollow tube which forms the axis of the colony, and the suggestion was made that this horny membrane is secreted by the *Neohelia* itself. The single specimen which Miss Pratt had to investigate was, unfortunately, a small one, and in the criticisms which appeared some doubts were expressed as to whether this horny membrane was not secreted by some tubicolous worm which formerly inhabited the hollow tube of the corallum, and not by the *Neohelia* itself. I have recently had the opportunity of examining specimens of two species of the closely related genus *Amphihelia*, one (*A. oculata*) from a depth of 240 fathoms off the coast of Florida, the other (*A. ramea*) obtained by H.M.S. *Porcupine* in the Faeroe Channel, 363 fathoms. In both of them there is a horny membrane similar in character and position to that described for *Neohelia*. Now it is difficult to believe that a worm forming the same kind of tube, with the same habit of mysteriously disappearing when the corals are preserved, occurs in such widely separated districts as Florida, deep water, New Britain, shallow water, and the Faeroe Channel, deep water. The only reasonable conclusion is that these madrepores do actually secrete this horny membrane themselves.

SYDNEY J. HICKSON.

Owens College, Manchester, February 2.

Genius and the Struggle for Existence.

MR. BULMAN, in NATURE of January 22, urges that what is good for the individual or race will survive unaided. But surely this is contrary to well-known facts. Man, with the increase of specialisation, which (whether it be an unmixed good or no) we find associated with his advance to a greater mastery over the rest of Nature, has become, so to speak, a polymorphic species, like the ants, bees or termites; and while in all species we find more or less mutual aid, in polymorphic species it is especially obvious that it is not the isolated individual types, but the total combination that natural selection regards, since the isolated types may be quite incapable of reproducing their kind and performing their special duties unaided.

In all such cases, the "survival" of the individual types,

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and of the community as a whole, depends, not on the competence of individuals to survive unaided, but on the recognition, instinctive or conscious, of each other's value, and the resulting mutual aid, given either under instinct or in conscious exchange. Now, as I understand, Sir O. Lodge has simply pleaded that steps be taken which, while (*pace* Mr. Bulman) not interfering one whit with the education of the 9999, shall lead to the recognition of the one exceptional genius, with a view to mutual aid, *i.e.* so that he may be set free to do the work of pioneer and leader, which he alone can do; and early, because *ars longa, vita brevis*.

We know that genius can be reared in night-schools, and about Palissy the potter; but ought we to count on our potter burning his furniture for our good, if we, with plenty of ordinary fuel, deny it him?

In the essay to which he refers in his letter in NATURE of January 29, Dr. Wallace attaches less importance to the rearing of a few men of exceptional qualities than to the weeding out of the worst and raising the average; but surely, without giving undue and exclusive credit for advance to the pioneers and prophets, we may take it that men like Darwin and Wallace himself, to mention only one type, will, under natural selection, render the later more conscious steps of man's evolution easier.

Dr. Wallace, in the letter referred to, speaks of the "fittest" not surviving under existing civilisation, meaning that many of the specialised types, which form important elements in our polymorphic communities, are not fittest to survive, and continue to reproduce their kind in more primitive or more ideal communities. But this, of course, accords well with the principle of the "survival" of those types "fittest" to the actual environment. (Survival, of course, does not postulate direct reproduction any more than it postulates long life; the "worker" bees "survive.") Further, Dr. Wallace's hopeful attitude shows that he really trusts "natural selection" to steer the best races of man to a point whence their further, more self-conscious, progress (still, as always, under natural selection) will be more and more in accord with Nature's will, and so less wasteful and pain-fraught.

Man is a self-conscious part of Nature, with the power to "look before and after"; and doubtless the races of man, which will rise highest under natural selection, will not let their faculty of taking counsel from natural and human history rest idle; but, just as Dr. Wallace himself showed years ago that "sexual selection," in the sense of choice of mates, had no power at all *against* "natural selection" (such selection being, I would say, of a faculty or instinct developed by natural selection, and from time to time modified by natural selection to suit changes in the environment), so this conscious "human selection" is but a faculty of man that is being developed (indirectly, perhaps) by natural selection, and can have no power at all to thwart "natural selection," though its wise use may save our race much of the pain that results from fruitlessly "kicking against the pricks."

G. W. BUTLER.

February 3.

It is, of course, true that genius has no survival-value in the struggle for existence between individuals or against physical conditions. But the case is very different when we come to the struggle between groups—tribes, village communities or nations. A tribe which produces a fine bard has far more fighting power than a tribe which has no singer. The possession of a noble literature makes England far more formidable than she otherwise would be. And from the days of flint instruments until now, the inventor has been the salvation of his people.

F. W. HEADLEY.

Remarkable Meteorological Phenomena in Australia.

ON Wednesday, November 13, 1902, we experienced here in Australia some most extraordinary meteorological phenomena. For the previous five or six days, exceedingly hot, dry weather had prevailed, owing to winds blowing from the Australian interior, where a huge anticyclone was resting, in a coastward