

of much utility to science. If the height of the barometer be correlated with the frequency of explosions in mines, it would not appear utile to describe the barometer as a "cause" of the explosion. Or, to take another case, which is purely hypothetical, but which will, I think, illustrate Prof. Ray Lankester's point. There is, we will suppose, a purely random distribution of supernumerary teats in cows. But in my particular herd the two best milkers possess supernumerary teats (although there is no correlation between such teats and good milkers in general). I keep the calves of these two cows because they are good milkers, and by reason of this selection supernumerary teats become more and more common in my herd. At last I begin to preserve calves with supernumerary teats, really because this is a test of their descent from the good milkers, practically because I find them in themselves good milkers. Now, because I am a careful breeder, my cows may get a reputation at sales all over the country, and a correlation between supernumerary teats and good milkers may come to be generally recognised. This happens not because supernumerary teats are a cause of good milkers, but owing in the original instance to a *random* association of this variation with a utile variation. Thus, a primarily random association with a favourable variation may by the principle of heredity quite easily lead to a correlation which it would be of no profit to consider causal. If two characters be not correlated, and one be favourable to survival, then any selection of the favourable character, which hits a group of individuals having more than the average of the second character—and this may easily arise if we breed from comparatively few individuals—will by the principle of heredity lead to a *fortuitous* correlation. I do not assert that this is the case in the frontal ratio of crabs, but it seems to me that a link is really missing in the chain of demonstration. All causality is of course correlation, but the converse, which Prof. Weldon seems to hold and Prof. Lankester to controvert, is surely a dangerous doctrine?

KARL PEARSON.

September 10.

#### Specific Characters among the Mutillidæ.

THE discussion in your columns as to the utility of specific characters leads me to offer a few remarks on the Mutillidæ, an interesting family of Hymenoptera. In the arid region of the United States, this family is very numerously represented, and its members may be seen running about in warm weather, especially frequenting sandy places, roads and pathways. It is not at first apparent why the species should be so numerous, living under what seem to be identical or almost identical conditions; in 1893 (*Trans. Amer. Ent. Soc.*, xx, 343), I wrote: "It is difficult to account for the origin of so many species under conditions which can hardly at any time have been very diverse." But the region in question is inhabited by very many species of bees, the modifications of which have relation to a varied flora, as I have illustrated by particular instances elsewhere (*Proc. Ac. Nat. Sci. Phila.*, 1896, pp. 33-41). The various Mutillidæ are parasitic in the nests of these bees, and consequently do not live under identical conditions; we have a varied flora with its varied insect-visitors, and these with varied parasites, the whole series of phenomena intimately connected, though at first sight it would seem impossible to see any connection between the flowers and the mutillids, however indirect.

It must be a long time before the actual host-relations of all the mutillids are known, but I have a species now under observation, which may serve as an example. The bee *Diadasia diminuta* lives in colonies, burrowing perpendicular tunnels in the beaten pathway, which are produced somewhat above the level of the ground by means of fragile cylinders of sandy particles, designed to keep the tunnels from being filled with sand. The little *Spharophthalma heterochroa* is the parasite of this bee, and the females may be seen in numbers running about between the burrows, now and then looking into them or entering. At once we see the utility of one of the specific characters of *S. heterochroa*—its small size. The larger species could not enter the small burrows of the bee.

The females of *S. heterochroa* are splendid little insects, ornamented with scarlet, black, and whitish. Like the females of all Mutillidæ, they are wingless. The much more active winged males, which are not so elegantly ornamented as the females, may be seen bustling about, looking for the latter. In

the Mutillidæ, the females are very varied in colour, markings and structure; while the males are much more uniform. Thus, Cameron says ("Biol. Cent. Amer. Hymenoptera," p. 259): "This general resemblance of the males not only makes their specific determination a work of difficulty, but it adds greatly to the task of assigning them to their respective partners of the opposite sex." If the bright and varied colours and markings were due to activity or a "katabolic tendency," it is in the winged males that they ought to be found; not, as is actually the case, in the wingless females. But on the principle of utility there may be an explanation. The males have to look for their respective females, and I believe the ornamentation of the latter assists their recognition.

There is a whole series of Mutillidæ which are very plainly coloured, from tawny through various shades to black, never with any scarlet, or conspicuous markings. These (*Photopsis* and *Brachycistis*) are all nocturnal, without any exception, and come to lights in the evening. But the systematists who have described many of these insects, were totally unaware of this circumstance until I pointed it out recently!

The moral of all this is, that to understand the real meaning of specific characters we must study the species in nature. We are hardly more likely to understand natural phenomena from the examination of dead animals alone, than a Hottentot would be to understand the apparatus of telegraphy. And eventually, I believe even the pure systematist will have to base his work on biological observation. It has been fondly hoped all along that absolute criteria of specific distinction would be found in the insects themselves, without reference to their habits; and the searchers for such "hall-marks," driven from point to point, have at length taken refuge in the male genitalia. But only a few days ago I received the following in a letter from M. Ernest André, the distinguished French student of Hymenoptera, and particularly Mutillidæ.

"Comme je l'ai dit, je crois qu'on attache aujourd'hui une trop grande importance aux caractères tirés de l'appareil génital mâle. Ces organes sont très variables, difficiles à apprécier, et ne concordent pas toujours avec les autres caractères morphologiques."

T. D. A. COCKERELL.

N.M. Biological Station, Mesilla, New Mexico,  
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#### The Khmer of Kamboja.

IN NATURE, June 11, p. 135, I see a short notice of the work being done in Australia by Prof. R. Semon, of Jena, and that he classes the "Khmer and Chams of Kamboja" as "primitive Dravido-Australians." I hope that some of your anthropological experts will, as soon as possible, correct this serious mistake.

Mr. A. H. Keane, in NATURE, January 6, 1881, p. 222, calls these people "Caucasian"; but I presume they are now (1896) known to be what Captain C. J. F. S. Forbes classed them, *i.e.* Mon-Anam, in his "Languages of Further India."

J. R. Logan, in his "Ethnology of the Indo-Pacific Islands," published at Singapur and Pinang, in the *Journal of the Indian Archipelago* (1847-63), rightly classes them as Mon-Anam, giving their linguistic peculiarities and alliances, pronouns, &c., and numerals up to ten, those from one to five being identical with our Kol, Sontal, Munda, Ho (the most western relatives of the Mon-Anam alliance), and quite different to the Dravidian, numerals.

The now civilised Kambojans admit that the "Khmer dom" are the older and purer stock, whence they are descended, and that they were *hill savages*, which carries out what we know so far of these early *pre-Burmo-Tibetan* races from the Asam side.

Both in physique and languages, the Dravido-Austral aboriginal of India (south of Himalaya) and the Mon-Anam group are very distinct; the former are seen purest in the Andamani and Negrito, in whom there is an entire absence of Tibetan elements.

But the Mon-Anam (which includes the Khmer) were formed, as a race, by the mixture, or fusion, of (Sifan) Tibetans with the Dravidians, lying south of Himalaya from Nipal to East Asam. At one time this "Mon-Anam" race appears to have covered all Northern and Eastern Bengal, the whole of Asam,