

ciently detailed to make the construction of the table readily understood, assuming a knowledge of the use of logarithms. The book will prove a handy substitute for more bulky volumes in cases where extreme accuracy is not required, such as computations in chemistry and physics.

LETTERS TO THE EDITOR.

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Panmixia.

MY letter of March 6 commenced with the remark that, without entering into controversy, I proposed to draw attention to the opinions expressed concerning the inheritance of acquired characters by Mr. Darwin. The reasons for my own beliefs on the questions at issue I have given in "The Principles of Biology," § 166, and, with other illustrations, in "The Factors of Organic Evolution." Here it must suffice to say that I have seen no reason to abandon the conclusions there set forth.

Respecting the doctrine of "panmixia," either as enunciated by Prof. Weismann, or as recently presented in modified forms, I will say no more than that I should like to see its adequacy discussed in connection with a specific instance—say the drooping ears of many domesticated animals. "Cats in China, horses in parts of Russia, sheep in Italy and elsewhere, the guinea-pig in Germany, goats and cattle in India, rabbits, pigs, and dogs in all long-civilized countries, have dependent ears."

Here the influence of natural selection is almost wholly excluded; nor can artificial selection be supposed to have operated in most of the cases: save, perhaps, in some pet animals, selection has been carried on to develop other traits. In the cases of most of these creatures, too, artificially fed and often over-fed, it does not seem that individual fates can have been affected by economy of nutrition, either general or special; since there has been no struggle for existence to cause the survival of those in which nutriment was most advantageously distributed. Further, the parts in question are not of such sizes that economy in nutrition of them could sensibly affect the fates of individuals, even had the struggle for existence been going on. Again, it seems that in respect of the ears themselves (though not in respect of their motor muscles) there has been extravagance of nutrition rather than economy of nutrition; since even where selection has been carried on for increasing other traits, the ears have not dwindled but rather increased. Lastly, at the same time that there has been this superfluity of nutrition in the ears themselves, their motor muscles appear to have dwindled either relatively or absolutely—at least relatively, we must suppose, where the weight of the ears has increased, and absolutely where the weight of the ears has not increased.

The question presented by these facts is one in the solution of which the theory of "panmixia" may, I think, be satisfactorily tested; and without expressing any opinion upon the matter myself, I should be glad to see it discussed.

HERBERT SPENCER.

I AM not aware how far Prof. Ray Lankester is disposed to acknowledge his obligations to Prof. Weismann for what I am glad to see he now calls his "anti-Lamarckian" (as distinguished from "pure Darwinian") proclivities. Therefore I do not know how far he professes to be one of "the followers of Prof. Weismann," to whom my previous letter on this subject was addressed. But it seems desirable that I should take some notice of the altogether distinct question which he has now raised—viz. whether, or how far, Prof. Weismann's anti-Lamarckian views were anticipated by Mr. Darwin.

His argument is that Darwin must have been a Lankesterian anti-Lamarckian in disguise; and, more particularly, that "the doctrine of panmixia is recognized and formulated in the last (sixth) edition of the 'Origin of Species' published in 1872."

Taking the most general statement first, Prof. Lankester represents it as not improbable that "when Darwin refers, here and there throughout his works, to a reduced or rudimentary

condition of an organ as 'due to disuse,' or 'explained by the effects of disuse,' he does not necessarily mean such effects as the Lamarckian second law asserted and assumed (though often he does appear to mean such); but he may mean, and probably had in his mind, the effects of disuse as worked out through panmixia and economy of growth."

Now, here we have a specimen of Prof. Lankester's dialectic at its worst. Truly, with such an interpreter, Darwin "may" be made to "mean" anything. First it is represented as seeming "not at all improbable that when Darwin refers" to one principle, "he does not necessarily mean" what he says; and then it is concluded that "he may mean, and probably had in his mind a totally different principle." Moreover, what is represented as mere references, "here and there throughout his works," are, as all the world knows, one whole and "highly important" (though still subordinate) side of Darwin's system. Yet again, in all passages where the meaning assigned to his term "disuse" is explained, there can be no shadow of ambiguity attaching to it, and everywhere it is alluded to as a principle wholly distinct from the "economy of growth"; while panmixia, as I shall presently prove, is nowhere mentioned at all. This, indeed, is clearly shown even in the passages quoted by Prof. Lankester, and now re-quoted below. For it is there said that, could a certain explanation be found, "then we should be able to understand how an organ which has become useless would be rendered, independently of the effects of disuse, rudimentary." Obviously, in this context, "the effects of disuse" cannot possibly mean "the effects of disuse as worked out through panmixia and economy of growth": they can only mean the direct effects of disuse itself in causing inherited atrophy. And now, lastly, "the effects of disuse" are habitually pointed to by Mr. Darwin in association with the "effects of increased use"; and how he can "seem" to have "explained" these either by the economy of growth (which he fully recognized), or by panmixia (which he never recognized), I must leave Prof. Lankester to indicate.

It will be observed, from the point last mentioned, that this attempt to read the doctrines of Weismann into the writings of Darwin must equally collapse, whether or not any other human being can be found to follow Prof. Lankester in his commentary on Darwin's "here and there" references to "the effects of disuse": the equally constant and as frequently detailed references to "the effects of the increased use of parts, which I have always maintained to be highly important," are of themselves sufficient to dispose of the Lankesterian gloss. Nevertheless, it remains worth while to see whether there is any shred of evidence in support of the narrower or more particular statement, that the principle of panmixia is to be found "already indicated" in the "Origin of Species." The following are the passages upon which this statement is founded—passages, I may remark, which have certainly neither been "missed" nor "neglected" by me.

(1) "If under changed conditions of life a structure before useful, becomes less useful, its diminution will be favoured, for it will profit the individual not to have its nutriment wasted in building up a useless structure. . . . Thus, as I believe, natural selection will tend in the long run to reduce any part of the organization as soon as it becomes, through changed habits, superfluous, without by any means causing some other part to be largely developed in a corresponding degree" ("Origin of Species," sixth edition, p. 118).

(2) "Organs, originally formed by the aid of natural selection, when rendered useless, may well be variable, for their variations can no longer be checked by natural selection. . . . It is scarcely possible that disuse can go on producing any further effect after the organ has once been rendered functionless. Some additional explanation is here requisite, which I cannot give. If, for instance, it could be proved that every part of the organization tends to vary in a greater degree towards diminution than towards augmentation of size, then we should be able to understand how an organ which has become useless would be rendered, independently of the effects of disuse, rudimentary, and would at last be wholly suppressed; for the variations towards diminished size would no longer be checked by natural selection. The principle of the economy of growth explained in a former chapter [cited in quotation No. 1], by which the materials forming any part, if not useful to the possessor, are saved as far as possible, will perhaps come into play in rendering a useless part rudimentary" ("Origin of Species," sixth edition, pp. 401-402).