LETTERS TO THE EDITOR.

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A Measure of the Intensity of Hereditary Transmission.

THE possessors of certain hereditary characters are unquestionably *sub-prolific;* that is, they eventually contribute less than their average share to the stock of the future population. It may be that they die before the age of marriage, or that they are sexually unattractive or unattracted, or that if married they are comparatively infertile, or that if married and fertile the children are too weakly to live and become parents. It is very probable, though I have no trustworthy facts to confirm the belief, that persons affected with hereditary insanity are sub-prolific because their families, if they have any, are apt to contain members who are afflicted in various ways that render them less likely than others to live and to marry. But I do not propose to go into the details of this or of any other malady, but merely mention it as an illustration of what is meant, when I assume that the possessors of some particular characteristic, not necessarily a morbid one, and which may be called A, are sub-prolific on the average.

It is a familiar statistical fact that the characteristics of a population, taken as a whole, who live under uniform conditions, change very little during many successive generations. So many per million of them are always found to be affected in this way, so many per million in that. The birth-rate continues the same, so does the death-rate; similarly as regards the various kinds of accident, and also, it may be inferred, as regards each form of disease, though it would be difficult to prove this in all cases, owing to improvements in diagnosis and nomenclature which make the statistics of disease for one period not comparable on strictly equal terms with those of another. It is therefore reasonable to discuss what might occur in an ideal population, which we will call P, whose characteristics are absolutely unchanged during successive generations, and to make such small corrections in the results as the conditions may require when dealing with real populations.

P and A being thus defined, it is obvious that the characteristic A must be transmitted with exceptional intensity in P. The possessors of A leave comparatively few descendants, consequently those few must be over-richly endowed with A; otherwise the number of the possessors of A would steadily diminish, and a P population would be impossible. Wherever a P population occurs, there must exist an inverse relation between the intensity with which A is hereditarily transmitted, and the prolific faculty of those who possess it.

This consideration may be of practical importance to actuaries in enabling them to estimate more justly than at present, the weights to be assigned to different hereditary diseases. It is a most difficult and delicate matter to attack this question directly, namely by making exhaustive inquiries into the life-history of all the near relatives of those who suffer from any serious hereditary malady. The difference in the results arrived at by different inquirers proves this, and shows the need of some second and independent method of investigation. The above considerations supply such a method in all cases where the frequency of the disease is found to have been approximately constant during successive generations of the population taken as a whole.

All that will then be needed, is to find how far those affected by the disease in question have been prolific, testing their capacity in that way by the number of their adult descendants in (say) the *second* generation, those in the first generation indicating little more than their fertility, which, as the children may be weakly, is not the same thing as the capacity of the parents for contributing to the future population. When the descendants in the second generation are neither more nor less numerous than the generality, the intensity of the transmission of the disease would be the same as that of any neutral quality, such as a moderate difference of stature. But if those descendants were more numerous than the generality, the intensity of transmission must be less than the average, while if the descendants were less numerous, the intensity would be greater.

It must be clearly understood that this method is of general application, and is not intended to be confined to morbid characters only. FRANCIS GALTON.

Triboluminescence

THE interesting list of substances mentioned in to-day's review in NATURE of a paper on the subject of the above phenomenon, mentioning as substances in which it is conspicuous, cane-sugar, saccharin, hippuric acid, and some still more complex organic bodies, might lead one to suppose that only substances of an organic nature, in a crystalline state exhibit the kind of triboluminescence seen as a flash of light when a crystal of such substances is crushed between two glasses. But this is not quite exclusively the case, because crystals of uranium-nitrate, and perhaps other crystallised salts of uranium, emit a very bright greenish-yellow flash when pressed to pieces between glass plates. The property seems permanent in these crystals, and it is also apparently independent in them of chemical impurities, since any crystallised sample of the nitrate, as far as I have tried, shows the light flash very strongly, without any apparent loss of brightness by long keeping.

The ruddy light which gleams from under glass or from a flint pebble when ground with strong pressure on a grindstone, must apparently be a true example of luminescence produced by friction, since it is equally visible under water on a thoroughly wet, as on a dry, grindstone, where it can hardly be supposed to result from high temperature producing actual incandescence. But examples of crystals which emit light by fracture do not, it appears, present themselves in nearly such abundance among mineral substances, as they have now been shown in the above-mentioned paper to do in so many cases among organic bodies.

A rather interesting observation of thermoluminescence once befel me while making trials of that property in minerals; and as it may afford, perhaps, a ready means of tracing lime or calcareous ingredients in certain minerals, it may be useful to mention it here, although the mode of excitation used in that instance was not by crushing or rubbing, but by heating the material. Some fine dust and grains obtained from the interior portion of the mass of the Middlesborough aërolite, when the meteorite was first being chemically and microscopically examined, were found, to my considerable surprise, to glow quite distinctly, though not very brightly, with yellowish-white light, when sprinkled in the usual way for these experiments on a piece of nearly red-heated iron in the dark. No such luminescence would, I believe, be evolved by that means from pure terrestrial specimens of the pair of double silicates of magnesia and iron (olivine and bronzite, much less from the moderate sprinkling of nickel iron, and perhaps of iron-sulphide found with them), of which the stony matter of the meteorite in the main consists. But as its stony mass was considered, in the exact chemical analysis of the meteorite made by Dr. Flight,[1] to contain probably, besides, an appreciable amount of labradorite or lime-felspar, the source of the light may have been this calcareous ingredient of the stone, as calciferous rocks and minerals, for the most part, shine brightly with various shades from light- to reddish-yellow, in the dark, when strongly heated. To whatever chemical materials in the stone, however, the light was really due, it afforded, at all events, clear proof that no heat of exceedingly high temperature can ever have penetrated to the interior of the meteorite, even when it was passing at its fall, in a fireball through the atmosphere, since the time when it was broken off from some parent rock and projected on a celestial course about the sun; for a very moderate degree of heat suffices to expel completely from minerals of these luminescent natures all the store of thermoluminescent energy which, either originally communicated to them from without by radiation near some exposed or denudated surface, or else contracted by them in some more mysterious way at great subterranean depths, they more or less abundantly possess. A. S. HERSCHEL.

Observatory House, Slough, April 27.

The New Zealand Godwit (*Limosa novæ-zelandiæ*).

THE Maori of New Zealand have an ancient saying or proverb, "Who can tell where the kuaka (the godwit) has its nest?" No doubt the Maori were well acquainted with the singular habit of these birds, in that they leave the shores of New Zealand, for a distant land across the seas, about the same time that other migratory birds, which have wintered on the Pacific Islands located nearer the tropics, are nesting and

[1] *Proceedings* of the Royal Society, vol. xxxiii., p. 347, February 1882.