

LETTERS TO THE EDITOR.

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The Statistical Investigation of Evolution.

MR. THISELTON-DYER states that Prof. Weldon has shown that "selective destruction" takes place in early life amongst individuals which deviate from the "mean specific form." He further says that the actual statistical demonstration of the fact that "minimum destruction is in position coincident with the mean of the whole system," deserves to rank amongst the most remarkable achievements in connection with the theory of evolution. But, to judge from the paper by Prof. Weldon, printed in NATURE of March 7, he does not claim to have made this remarkable achievement. He says that, according to the results of the statistical investigation, in two dimensions of the shore crab, the frequency of deviations increased during an early period of growth, and that in one case the increase was followed by a decrease; in the other case it was not. Prof. Weldon states that if a certain law of growth can be shown to be true by experimental tests, then the result implies a selective destruction in the one case and not in the other. So that all we have is the possibility in the future of a statistical demonstration of selective destruction in the case of one particular dimensional character, and the rigid proof in the present that in the case of the other dimensional character selective destruction does not take place. Surely every man of science must admit that Prof. Weldon's results, on his own showing, have done more against selective destruction than for it.

Prof. Weldon says that if we know that a given deviation from the mean is associated with a greater or less percentage of death-rate, we do not require to know how the increase or decrease of death-rate is brought about, and all ideas of functional adaptation become unnecessary. This may be his own state of mind on the subject, but I venture to state that it is not Darwinism, and that he cannot shut out others from the most interesting and most important fields of biology in this way. Darwinism states that selective destruction is caused by the struggle for existence, and that a selected character confers an advantage in the competition to get food and beget offspring. If a certain deviation is shown to be associated with an increased or decreased chance of life, we want to know how it acts, and no statistical Gallio can prevent us trying to find out.

It does not require much search to find deviations which are associated with an increased death-rate. In the human subject cyanosis, due to the retention of the foetal communication between the two sides of the heart, is a well-known abnormality or deviation in the infant; but I believe few, if any, children born in that condition reach the age of 20. Here we have no difficulty in understanding the reason: the deviation necessarily leads to death. But now, in comparison, take the case of a child born blind, or deaf and dumb. Here there is no intrinsic reason why life should be shortened; but in a severe competition, if the individual depended entirely on his own exertions, he might be, probably would be, starved or trampled to death before he had lived very long. I think it is of some interest and importance to know of any given character or deviation, whether it is intrinsically harmful or beneficial, extrinsically so (*i.e.* in the struggle for existence and reproduction), or quite indifferent.

Prof. Weldon is silent, to some extent, about the cases which tell against the idea of selective destruction. He found that deviations in *Aurelia* were as numerous in the adult as in the Ephyrae. He told me in conversation, and did not say it was in confidence, that he abandoned some experiments on the selection of *Daphnia*, because he found that the mere fact of keeping a large number in the same water caused a progressive disappearance of a certain conspicuous spine. His investigations also entirely ignore the diagnostic value of the characters he deals with. It seems to me that a more valuable result would be gained if a parallel investigation were made of two characters—one obviously diagnostic, the other obviously adaptive. Such characters could be found in a swimming crab.

But above all, what we want is a comparative investigation of the results of selection without change of conditions, and of change of conditions without selection. I began, not long ago,

to try to inaugurate a society for carrying on a thorough investigation of this kind, but have not at present received enough support to carry out the scheme. The method of the investigation is fairly obvious and not difficult, but the difficulty is to get the money and the time to carry it out. I differ from Prof. Weldon in thinking that the questions raised by the Darwinian hypothesis are not purely statistical, but experimental, and I agree with Mr. Thiselton-Dyer—that to talk of experimentally checking the hypothesis by the statistical method is a contradiction in terms.

J. T. CUNNINGHAM.
Cleethorpes, March 15.

A True Spectrum Top and a Complementary One.

To make a true spectrum top—which is not copyright, so far as I know—take a disc of white paper, and one of black, of equal size. Spin the white one on a disc of cardboard mounted on a nail, and while it is spinning draw a small brush well charged with lamp-black water-colour paint, steadily and not too slowly from centre to circumference of the disc, thus describing a spiral line. Make a radial cut in each of the discs, and after interlocking them as in the well-known colour discs, place them on the top. We thus obtain a top in which the lines are spiral, and the relative sizes of black and of white areas are easily regulated by turning one disc to right or left, while the other is held still. If the lines be not too thin or too thick, and not too near together, and if the relative areas of black and white be adjusted suitably to the light, the top exhibits, when spun, broad bands of colour, each band containing all the colours of the spectrum in their natural order. The spaces between the lines should be not less than five times as broad as the lines themselves. The brightest effects are produced in my own case, by lamplight, with the areas of light and dark almost equal; by daylight, with the dark area about three times as great as the light. Other proportions, however, seem to give better results with other people.

A "complementary top," yielding colours complementary to those of the spectrum (*i.e.* the colours of mother-of-pearl) in a continuous band ranging from lemon-yellow, through puce to electric-blue-green, is made in the same way, except that the spiral line is to be drawn in white on the black disc.

In both cases the colours are somewhat dilute, but the proper regulation of the relative areas of black and white reduces this defect very considerably, and I have obtained bands on my spectrum top brighter and purer than any which I could get by painting a spectrum with colours on paper.

I communicate this description before my experiments are complete, in order to prevent anyone who may make the same discovery, from obtaining a copyright for the design of either these tops or of earlier ones which I made, in which one half the disc was black and the other white, with a white spiral on the black, or a black spiral on the white, or with both at different distances from the centre on the same top. Anyone who wishes to do so may make as many tops or lantern-discs as he chooses from the above description, provided he does not attempt to hinder anybody else from making or selling similar ones.

C. HERBERT HURST.

Owens College, Manchester, March 24.

A Foucault Pendulum at Dublin.

IT may perhaps interest some of your readers to learn that Foucault's pendulum experiment has recently been performed in Trinity College, Dublin, with complete success.

Immediately under one of the glass domes, by means of which the hall of the New Building is lit, a cast-iron bar was securely bolted, which terminates in a cylindrically-shaped piece of metal the axis of which is vertical. Into this cylinder a steel plug was inserted, which was drilled to receive the upper end of the wire supporting the bob, which was fitted with a screw. By placing the upper end of the wire in this position, Prof. FitzGerald and I secured a length of 45 feet for our pendulum; but, under the circumstances, we were unable to use the same weight as that adopted by Sir R. Ball when making the experiment, viz. 300 lbs., and were obliged to content ourselves with a bob weighing 16 lbs., which, however, answered admirably.

The experiment is made in the following manner:—About two feet behind the position of equilibrium of the bob, we place the electric lamp, and at a suitable distance in front a lens, so

arranged that when the bob is swinging, and in the position of maximum amplitude nearest the lens, the shadow of a portion of the wire immediately above the bob, thrown on a screen some 32 feet distant, is clear and distinct, and coincides with a vertical black line thrown on the white screen.

The bob is drawn back towards the lamp about eight inches, by a loop of thread, and when we wish to experiment the thread is then burned in the usual manner.

When the pendulum completes its first oscillation, the shadow falls exactly on the black line traced on the screen. In about five minutes the shadow has moved to the left of the line, and in ten minutes conspicuously so. In this time the maximum amplitude has decreased so little that the image on the screen is still distinct and clear when the pendulum is in a position nearest the lens.

W. R. WESTROPP ROBERTS.

Trinity College, Dublin.

Snake Cannibalism.

HAVE read with interest the numerous accounts of snake cannibalism which have lately appeared in NATURE. During my residence in South Africa, I have come across several instances of a similar nature. A few weeks ago I received a large roughals (*Sefedon hamachate*) which had swallowed another one of the same kind and of nearly its own length. As the swallowed individual was too long to disappear completely before the front portion of its body was digested, its tail was sticking out of the mouth of the swallower by about six inches. I have dissected two yellow cobras (*Naja haji*), each of which had swallowed a puff adder (*Viper arietans*) more than three feet long. This case is very interesting, as the puff adder has much larger fangs than the yellow cobra, and in a fight the latter would probably succumb. To mention only one more case, I received, some years ago, the skins of a cross-marked schaapsticker (*Psammophis crucifer*) and a spotted schaapsticker (*Psammophylax rhombatus*), the former of which had swallowed the latter. In all cases which have come under my personal observation the swallowed snakes had entered head first, and thus probably they were simply drawn in after having caught hold of the same prey as the swallowers. In conclusion, I may mention that cases similar to the above are frequently described in the South African newspapers.

J. SCHÖNLAND.

Grahamstown, South Africa, March 1.

American Fresh-water Sponges in Ireland.

A SHORT time ago, Dr. R. F. Schaff, Dublin, sent me a small collection of Irish Spongillidæ. The examination of the material resulted in the discovery of two or three American species, obtained from the West of Ireland, viz. *Heteromeyenia ryderi*, Potts, *Tubella pennsylvanica*, Potts, and (?) *Ephydatia crateriformis*, Potts, the first of these three species having been identified by Dr. W. Weltner, Berlin. All these species are new to Europe, and as they were found in a small collection taken more or less at random, it is probable that if the fresh-water fauna of the West of Ireland were thoroughly investigated, a great many more American species would be discovered.

Details will be published in the May number of the *Irish Naturalist*.

R. HANITSCH.

University College, Liverpool, March 13.

Peripatus in the West Indian Islands.

WEST INDIAN records show that occasionally single specimens of various species of *Peripatus* have been found in the different islands. During the past week, Mr. Lunt, my assistant, found a single specimen, and a further search being organised, resulted in the capture, by two collectors, of fifty specimens. These, it is believed, belong to two different species, and a goodly number of the specimens have been sent for determination to the British Museum.

Either the animals are more numerous than usual, or the previous search for them has not been a very careful one, as the whole of our specimens were found within the precincts of the Gardens.

J. H. HART.

Royal Botanic Gardens, Trinidad, March 6.

Planetary Photography.

I UNDERSTAND that in photographing a planet, such as Mars, only a short exposure can be allowed, because there is no way of compensating the planet's axial rotation. But, while following the planet with the equatorial, would it not be possible to compensate this axial movement by slowly sliding the plate, so that certain features of the planet should fall always on the same parts of the plate? If this is so, an exposure of some length might be available for the more central portions of the disc, those portions for which, during the interval, no serious alteration due to foreshortening comes into play.

Cardiff, March 23.

C. T. WHITMELL.

Cleaning Tobacco Pipes.

I HAVE discovered a new method for cleaning pipes which have become foul. A shallow cork, through which a hole is bored large enough to enable it to fit tightly on to the nozzle of a soda-water syphon, is fitted into the bowl. The nozzle is inserted, the mouth-piece directed into a vessel, about a wine-glassful of soda-water forced through, and the pipe is clean!

This is not a scientific discovery, but it may be of use to those scientific men who are smokers. Rubber stoppers answer better than corks.

CECIL CARUS-WILSON.

THE HABITS OF LIMPETS.

SOME observations made by the present writer at the Scottish Marine Station during July 1884, were published in NATURE for January 1, 1885. These observations confirmed the statements previously made by various naturalists, from Aristotle onwards, that the common limpet (*Patella vulgata*) settles down on some eligible spot (its "scar") between tide-marks, and makes a home, to which it returns after having been out to feed. The conclusion was drawn from various data that this "locality sense" is independent of smell, sight, and touch so far as the head-tentacles are concerned. Prof. Lloyd Morgan, in a letter to NATURE ("Homing of Limpets," December 6, 1894), has shown that the limpet possesses an even greater power of "homing" than previous observers have suspected, and he believes that the head-tentacles are the sense-organs concerned.

Since 1884, I have made further notes, and aided by a grant from the Research Grants Committee of the Royal Society, to whom my best thanks are due, have pursued the subject with some care during the past year. The results, apart from those connected with histology, here follow.

The limpets observed live on a reef, which extends several hundred yards seawards (practically west) from the front of Aberystwyth College. The rocks are Silurian grits and imperfect slates, alternating in a very regular way, striking north and south, and tilted at high angles. At low tide the *Laminaria* zone is well exposed, and for some yards above this the rocks are somewhat bare, except that they are thickly encrusted with small *balani*. Nearer the land various brown seaweeds (mostly *Fucus serratus*, *F. vesiculosus*, and *Ozothallia nodosa*) thickly cover the reef, except towards high-water-mark, where they become scanty. Throughout this area limpets of all sizes abound, being specially numerous, however, on the barnacle-encrusted rocks above mentioned. Groups of them were here marked with enamel paint, and watched. A number of observations were also made on the small limpet, which lives on *Laminaria*, and has its shell marked by three diverging blue streaks (*Helcion pellucidum* = *Patella pellucida*).

Food and Feeding.—As before, the chief food noticed consisted of the minute algæ coating the *balani* and rock-surfaces. Specimens were also found feeding on the calcareous seaweeds *Corallina* and *Melobesia*, on *Fucus*, and on *Laminaria*. It was suggested in the previous notes that the great length of the radula is perhaps