LETTERS TO THE EDITOR.

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Organic Selection.

IN certain recent publications,¹ an hypothesis has been presented, which seems in some degree to mediate between the two rival theories of heredity. The point of view taken in these publications is briefly this:—Assuming the operation of natural selection as currently held, and assuming also that individual organisms through adaptation acquire modifications or new characters, then the latter will exercise a directive influence on the former quite independently of any direct inheritance of acquired characters. For organisms which survive through adaptive modification will hand on to the next generation any "coincident variations" (*i.e.* congenital variations in the same direction as adaptive modification) which they may chance to have, and also allow further variations in the same direction. In any given series of generations, the individuals of which survive through their susceptibility to modification, there will be a gradual and cumulative development of coincident variations under the action of natural selection. The adaptive modification acts, in short, as a screen to perpetuate and develop congenital variations and correlated groups of them. Time is thus given to the species to develop by coincident variation characters indistinguishable from those which were due to acquired modification, and the evolution of the race will proceed in the lines marked out by private and individual adaptations. It will appear as if the modifications were directly inherited, whereas in reality they have acted as the fostering nurses of congenital variations.

It follows also that the likelihood of the occurrence of coincident variations will be greatly increased with each succeeding generation, under this "screening" influence of modifications; for the mean of the congenital variations will be shifted in the direction of the adaptive modifications, seeing that under the operation of natural selection upon the preceding generation, variations which are not coincident tend to be eliminated.²

Furthermore, it has recently been shown that, independently of physical heredity, there is among the higher animals a process by which there is secured a continuity of social environment, so that those organisms which are born into a social community, such as the animal family, accommodate themselves to the ways and habits of that community. Prof. Lloyd Morgan,³ following Weismann and Hudson, has employed the term "tradition" for the handing on of that which has been acquired by preceding generations; and I have used the phrase "social heredity" for the accommodation of the individuals of each generation to the social environment, whereby the continuity of tradition is secured.⁴

It appears desirable that some definite scheme of terminology should be suggested to facilitate the discussion of these problems of organic and mental evolution; and I therefore venture to submit the following:—

(1) Variation: to be restricted to "blastogenic" or congenital variation.

(2) Accommodation: functional adaptation of the individual organism to its environment. This term is widely used in this sense by psychologists, and in an analogous sense by physiologists.⁵

¹ H. F. Osborn, *Proc. N.Y. Acad. of Sci.*, meeting of March 9 and April 13, 1896; also *Science*, November 27, 1896. C. Lloyd Morgan, "Habit and Instinct," October 1896, pp. 307 ff.; also *Science*, November 20, 1896. J. Mark Baldwin, discussion before N.Y. Acad. of Sci. meeting of January 31, reported in full in *Science*, March 20, 1896; also *Amer. Naturalist*, June and July 1896. The following brief statement has been prepared in consultation with both Principal Morgan and Professor Osborn. I may express indebtedness to both of them for certain suggestions which they allow me to use, and which I incorporate verbally in the text. Among them is the suggestion that "Organic Selection" should be the title of this letter. While feeling that this co-operation gives greater weight to the communication, at the same time I am alone responsible for the publication of it as it here stands.

² This aspect of the subject has been especially emphasised in my own exposition (*Amer. Naturalist*, June 1896, pp. 447 ff.).

³ Introduction to "Comp. Psych.," pp. 170, 210; "Habit and Instinct," pp. 183, 342.

⁴ "Mental Development in the Child and the Race," 1st ed., January 1895, p. 364; *Science*, August 23, 1895.

⁵ Prof. Osborn suggests that "individual adaptation" suffices for this; but that phrase does not mark well the distinction between "accommodation" and "modification." "Adaptation" is used currently in a loose general sense.

(3) Modification (Lloyd Morgan): change of structure or function due to accommodation. To embrace "ontogenic variations" (Osborn), *i.e.* changes arising from all causes during ontogeny.

(4) Coincident Variations (Lloyd Morgan): variations which coincide with, or are similar in direction to, modifications.

(5) Organic Selection (Baldwin): the perpetuation and development of congenital coincident variations in consequence of accommodation.

(6) Orthoplasia (Baldwin): the directive or determining influence of organic selection in evolution.¹

(7) Orthoplastic Influences (Baldwin): all agencies of accommodation (*e.g.* organic plasticity, imitation, intelligence, &c.), considered as directing the course of evolution through organic selection.

(8) Tradition (Lloyd Morgan): the handing on from generation to generation (independently of physical heredity) of acquired habits.

(9) Social Heredity (Baldwin): the process by which the individuals of each generation acquire the matter of tradition, and grow into the habits and usages of their kind.²

Princeton University, March 13.

J. MARK BALDWIN.

Unfelt Earthquakes.

THE Icelandic earthquakes, on several occasions mentioned in NATURE—*e.g.* November 5, 1896—have been recorded also by the horizontal pendulum (system v. Rebeur) of Strassburg. I give the dates in Greenwich M.T.

1896.	h.	m.	s.	End	h.	m.	s.
Aug. 26. Begin 11 22 9 p.m.				Aug. 27	0 58 37 a.m.		
Max. 11 22 37 "				until	0 13 47 "		
" 27. Begin 10 50 18 a.m.				End	11 50 18 "		
Max. 11 1 32 "				{ Succeeded by a series of tremors until }		12 39 38 p.m.	
" 31. Begin 8 17 50 "						11 38 2 a.m.	
Max. 8 29 56 "				End	9 42 12 "		
Sept. 5. Small disturbance at				"	12 50 0 p.m.		
" 6. Begin 0 31 34 "				"	0 41 4 a.m.		
Tremors succeeded Sept. 6 and 12.							
" 12. Begin 8 17 54 "				End	10 41 6 "		
Deduct max. 8 39 38 "				to	10 34 22 "		
" 13. Begin 5 28 56 "				End	6 3 16 "		

The whole of September was very troubled; small perturbations were observed on the 7th, 8th, 14th, 16th, 19th; greater ones on the 22nd, 24th, 25th. The time of the perturbations above agrees very well with the disturbances of the Paris and Edinburgh pendulums.

Prof. Milne (NATURE, February 25), asks for information about some earthquakes observed in February 1897, in the Isle of Wight, in Italy, &c. They disturbed very much the new pendulum of Strassburg, system Ehlert, as described in *Beiträge zur Geophysik*, vol. iii. 209 (Leipzig, Engelmann). The system consists of three horizontal pendulums, smaller than Rebeur's, but much heavier, in one box, each set up 120° from the other, and directed the first from E. towards W., the second from N.W. towards S.E., the third from S.W. towards N.E. The movements are photographically recorded, and very much enlarged.

The disturbance of February 7 was unusually large. It commenced on the first pendulum (E. to W.) at 7h. 49m. 50s. a.m., and ended at 8h. 46m. 19s. a.m.; after-shocks were felt until 9h. 41m. 39s. a.m. The perturbation showed two maximum-periods, each divided into two parts. The second pendulum (N.W. to S.E.) was disturbed from 7h. 45m. 25s. a.m.; maximum, 8h. 2m. 8s. until 8h. 24m. 28s.; end, 8h. 40m. 20s.; after-shocks from 9h. 26m. until 9h. 54m.

Eimer's "orthogenesis" might be adopted, were it possible to free it from association with his hypothesis of "orthogenic" or "determinate" variation and use inheritance. The view which I wish to characterise is in some degree a substitute for these hypotheses.

² Prof. Lloyd Morgan thinks this term unnecessary. It has the advantage, however, of falling in with the popular use of the phrases "social heritage" and "social inheritance." On the other hand, tradition seems quite inadequate; as generally used, it signifies that which is handed on, the material; while in the case of animals, we have to deal mainly with the processes of acquisition. "Social heredity" also calls attention to the linking of one generation to another. However, I think there is room for both terms. For further justification of the terms "social heredity" and "organic selection," I may refer to *Amer. Naturalist*, July 1896, pp. 552 ff.

The greatest disturbance appeared at the third pendulum (S.W. to N.E.), with oscillations 6 cm. large; the maximum, with two well-defined periods, was from 8h. 23m. 52s. until 9h. 8m. 43s. a.m. Tremors followed until 11h. 30m. a.m.; the preliminary tremors of this pendulum, commencing 7h. 45m. 25s. a.m., showed three well-marked maxima. Other very small tremors preceded, the pendulum being troubled all the preceding night, perhaps by the winds.

On February 11, there was a small disturbance on the second and third pendulum 11h. 39m. 48s.; February 13, a very great one on all three pendulums from 2h. 31m. 54s. until 3h. 8m. a.m., with oscillations up to as much as 2.1 cm., and preceded on pendulum three by a preliminary motion, on February 12, from 11h. 2m. 2s. p.m. until 11h. 34m. 38s. p.m.

A very great perturbation was observed on February 19, on the third pendulum, from 10h. 11m. until 10h. 39m. p.m.; and on February 20, from 0h. 11m. 15s. until 1h. 20m. 10s. a.m. The first pendulum (E. to W.) had a very great motion from 0h. 11m. 16s. until 1h. 49m. a.m., February 20, followed by a long series of tremors. The second pendulum was not in activity.

Dr. Ehlert (Strassburg) has put the box with the three pendulums on a short, stout, isolated sandstone pillar, to avoid the earth-waves being concealed or wholly annihilated by the frictions and elastic motions taking place in a large pillar of masonry; and the pendulums, set up in such a manner, give very accurate records of vibrations, change of level, &c. They can be made extremely sensitive. The whole instrument may be purchased for 51*l.*, with recording apparatus and lamp (Strassburg, I. and A. Bosch); and I should like to recommend it, for the seismic survey of the world, for each station of this international survey. The distinct directions and movements of the three pendulums are showing (1) each motion of the earth-crust coming from whatever an azimuth; (2) the chief direction of the seismic wave; (3) the temporary figure of the wave; (4) their splitting-up in different trains of waves. They are disturbed also by vertical shocks.

G. GERLAND.

Strassburg, March 31.

Relationship between the Masses and Distances of the Four Outer Planets.

LET the mean distance of Jupiter be the unit of measurement for the four outer planets. The distances are then as follows.

Jupiter.	Saturn.	Uranus.	Neptune.
I	1.8338	3.6869	5.7765

Now take the following numbers as the masses—

Jupiter.	Saturn.	Uranus.	Neptune.
312	92.513	13.604	15.969

and multiply the masses into the distances. We then obtain

Jupiter.	Saturn.	Uranus.	Neptune.
312	169.65	50.157	92.245
J	S	U	N

Let the last series of numbers be J, S, U, N, respectively. Then

$$\begin{aligned} U S &= N^2 \dots \dots (1) \\ U J &= N S \dots \dots (2) \\ U + N + S &= J \dots \dots (3) \end{aligned}$$

In fact, the numbers are in geometrical progression, having a common ratio $R = 1.8391$. So that

$$\begin{aligned} U R &= N \dots \dots (4) \\ U R^2 &= S \dots \dots (5) \\ U R^3 &= J \dots \dots (6) \end{aligned}$$

The common ratio 1.8391 is nearly the mean distance of Saturn 1.8338, and is one of the solutions of a biquadratic equation

$$x^4 - 2x^3 + 1 = 0.$$

G. E. SUTCLIFFE.

The Hermitage, Coorla, Bombay, March 19.

X-Ray Photography.

It may interest the readers of NATURE, that it is possible to take shadowgraphs (so-called) instantaneously without any special arrangement of induction coil or deviation in the form of Jackson tube.

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The apparatus used consists of 10-inch Apps' induction coil, a Jackson focus tube supplied by Messrs. Newton (one of a set of twenty-five I have in my possession), and a set of small secondary batteries, about 30 ampère hour capacity, six cells in the set. The induction coil is of the ordinary type with ordinary commutator.

For the purpose of obtaining these results in such short exposures, a special choice of tube is necessary, working the tube for a considerable period before desired condition is arrived at, and that condition judged by experience, for no ampère measurement will give the information. The tube must be strongly heated by a spirit lamp, and when the desired condition (tube being of course connected with coil) is arrived at, the exposure must take place.

(1) By instantaneously turning current on and off.

(2) By interposing a $\frac{1}{2}$ -inch iron plate between tube and object to be shadowed, removing plate for the exposure.

Having carefully timed the exposures, I have been able to repeat the experiment with assured success. For some time past I knew that hands and arms of children could be taken in from twenty to thirty seconds, but have now succeeded in taking children's hands in half a second (showing all bones and cell tissue of bones), and adults' hands, bones of wrist, and even arms, with exposure of only one second, again showing cell tissue of bones.

It is interesting to note that everything connected with the production of these results was made in England.

WILLIAM WEBSTER.

Art Club, Blackheath, March 30.

A New Scientific Club.

My attention has been drawn to a circular in favour of a new Club, in which my name appears as one having consented to become a member. I know nothing of the Club, nor have I in any way authorised the use of my name.

12 Arundel Gardens, W., April 9.

W. RAMSAY.

DEEP-SEA FISHES OF THE NORTHERN ATLANTIC.

THE examination of the deep-sea fishes which have been collected by means of the dredge or trawl during the last twenty-five years, has now been almost completed; at least the results of this examination, as far as it has gone, are now before us, and form the most interesting and attractive portion of the ichthyological literature of our time. The harvest reaped by the various expeditions, surveys, and private enterprises, which have been fitted out to explore the mysteries of the sea, has far exceeded the most sanguine expectations, and it is satisfactory to find that the six or seven volumes devoted to ichthyology have been placed before the public in a style and with a wealth of illustration worthy of the interest attached to the subject. The first to appear was the volume descriptive of the deep-sea fishes collected during the Norwegian Expedition to the North Atlantic from 1876 to 1878, by R. Collett (Christiania, 1880, 4to, pp. 166, with five double plates); this was followed, in 1887 by the Report on the Deep-sea Fishes collected during the *Challenger* Expedition (1873-76), in which were incorporated the proceeds of the Faerøe Channel Exploration (1880 and 1882) (London, 1887, 4to, pp. lxx. + 335, with 73 plates); the collections made by the French expeditions of the *Travailleur* and *Talisman* (1880-83) were described by L. Vaillant (Paris, 1888, 4to, pp. 406, with 28 plates); in the Indian Ocean, H.M. Indian Marine Survey steamer *Investigator* has added largely to our knowledge of the bathybial fauna from year to year since 1885, the collections being described by A. Alcock in a series of papers which appeared in periodicals, and were supplemented afterwards by "Illustrations," of which three parts, with fifteen plates in quarto, have been issued under the authority of the Director of the Royal Indian Marine in Calcutta, 1892-95; finally, the collections made in the North Pacific by the U.S. Fish