

never responded to the challenge, I maintain that he has no right in a scientific discussion to reiterate a statement in support of which he has produced no definite observed evidence. He now returns the challenge to me. But it is no affair of mine. I simply take note of the fact that Prof. Lankester pointed out that the Duke's case collapsed unless the challenge was met, and that the Duke acquiesced by silence.

Just, however, as with the question of acquired characters, the Duke in defect of direct evidence now tries an *a priori* argument. He reminds us of the well known principle of embryology, sometimes called the recapitulation theory. Darwin states it in this form: the embryo is "a picture, more or less obscured, of the progenitor, either in its adult or larval state, of all the members of the same great class."

Now, of course, in the development of the individual organism, we have "a series of incipient structures on the rise for actual use," if by "on the rise" we mean in process of nutritive growth. This is, however, not necessarily true of the recapitulative structures which may or may not be temporarily utilized. When they are not so utilized they are mere survivals, and we know that survivals constantly so completely fall out of use, that by mere inspection it is often difficult to conceive what could have been their original function. I may give a single illustration. In flowering plants the homologue of the spore of the vascular cryptogams is still preserved. *Within* it, previous to fertilization, certain rudimentary structures are developed. It has been shown that these are the last recapitulative remnant of an independent series of structures developed *outside* the spore in the fern. In that type they form the prothallus, which possesses all the attributes of an independent organism, assimilates, respire, often reproduces itself asexually, and finally bears the sexual reproductive organs. All this in the flowering plant is not merely reduced to scarcely intelligible rudiments, but, in accordance with a well-known principle in embryology, it is thrown backwards in the order of development, and never emerges from the spore at all, instead of as in the fern being wholly external to and independent of it.

In this case we know the recapitulation and the thing recapitulated. We infer from their comparison that a fern-like plant was amongst the ancestry of the flowering plant. But I defy anyone, from a mere inspection of what happens in the latter, to form any idea of what happens in the former. From cases such as these it is obvious that the analogy between the development of the individual and the evolution of the race only holds for the broad facts of the sequence of stages, and does not give us any information as to the inutilty of the structures of the ancestral organisms, or even, indeed, as to the precise period in their life when such structures made their appearance. The Duke's argument may now, I take it, be stated as follows:—

In the development of the individual organism, incipient organs are useless.

The development of the individual organism is a recapitulation of the evolution of the race.

∴ Incipient organs in the evolution of the race are useless.

I observe that the Duke's estimation of my logical powers is the reverse of flattering. I abstain, therefore, from criticizing this piece of reasoning. For my part I must confess I do not possess an *a priori* mind. No argument, however ingenious, is as convincing to me as accurately observed facts. If the Duke's convictions are laws of Nature, the objective verification ought to be forthcoming.

W. T. THISELTON DYER.

Royal Gardens, Kew.

THE Duke of Argyll supports his assertion that "all organs do actually pass through rudimentary stages in which actual use is impossible" by reference to the stages of embryonic growth. Surely the assertion remains merely an empty repetition of the Darwinian position that the development of the embryo summarizes the morphological history of the race.

The modern dress coat has developed from a mere blanket, but even the useless parts of the modern coat can be easily shown to have had their use in some anterior forms of completed coat. The embryo, like the coat, preserves traces of evolutionary stages at which what now appear useless characters were in reality actual useful characters.

What the Duke has to show is some instance of a completed organ in a completed organism, useless to that organism, not phases in the growth of an organ affording a blurred copy of some form of the organ existent at an anterior stage of the organism, and then useful to it. So far he has merely

confounded ontogenal steps of growth with phylogenal phases of plan.

F. V. DICKINS.

Burlington Gardens, February 3.

Eight Rainbows seen at the Same Time.

THE following letter which I have just received from Dr. Percival Frost of Cambridge, may interest your readers.

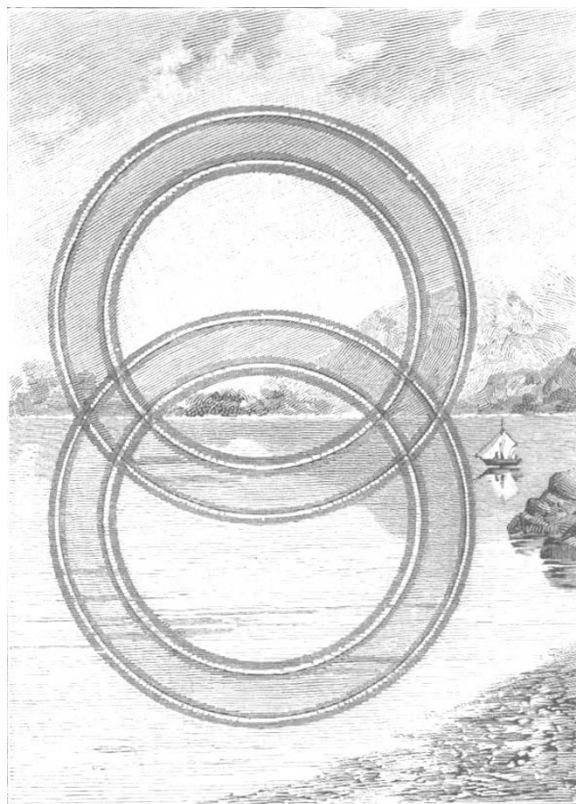
A statement that rainbows are produced not only by the sun itself directly, but by the image of the sun reflected from still water, is given in Prof. Tait's book on "Light." The phenomenon seems to have been observed by Halley in 1698 (see NATURE, vol. x. pp. 437, 460, and 483 for interesting correspondence on the subject).

The diffuse rainbow produced by the image of the sun reflected from a white cloud after sunset, described by Mr. Scouller, is, I believe, a novelty.

WILLIAM THOMSON.

The University, Glasgow, January 31.

IN NATURE (January 23, p. 271) you give a letter from Mr. Scouller describing an interesting case of a rainbow, due to the image of the sun in water, which, with the ordinary, primary, and secondary bows, make up (there being no secondary to that formed by the reflected sun) the *three* which he saw. Here is a short account of what I saw long ago, almost in prehistoric times, in Scotland, where such sights ought, according to your correspondent, to be very commonly seen. I may mention that I saw at the same time, lasting some five minutes, *eight* well-defined rainbows of one sort or another.



In 1841, during the time of a long vacation party, spent at Oban, I walked out with my brother to Dunstaffnage, and we were on the top of the Castle, somewhere between 3 and 4 p.m., on a day in the middle of August. Not a breath of wind, bright sun over, I think, Lismore Lighthouse, dusky clouds all over Ben Cruachan and Conoll Ferry; the sea in the bay (bounded by Dunstaffnage in the west) as smooth as a pond. Gradually there appeared before us the astonishing sight of the aforesaid *eight* distinct rainbows, viz. primary and secondary ordinary bows; primary and secondary bows by reflected sun; primary and