

What is biology? Who are biologists? So far as I am able to judge, biology is commonly regarded as a side-show of natural history; and any zoologist and botanist is supposed to be, *ex officio*, a biologist. But biology is an interpretative science, and systematic zoology and botany are purely descriptive. They may furnish valuable evidence, but they do not necessarily do so. The zoologist or botanist trained in observation and description may interpret skilfully, but such skill is not a necessary outcome of his studies. Zoologists and botanists have themselves proclaimed the inadequacy of their evidence by founding the experimental and biometric schools, which began as violently opposed sects, and so continue.

To my thinking, biology is that science which sits at the hub of all the studies concerned with life—zoology, botany, physiology, psychology, medicine, bacteriology, embryology; anatomy, palæontology, sociology, even pedagogy and history—gathers evidence from them all, and deals especially with problems too big or deep for these individual studies, e.g. problems of heredity, evolution, development, and the like. If the biologist be controlled by the rules which ordinarily guide scientific procedure—for example, the rule that all verifiable and relevant facts (no matter how, or by whom, or when, or where collected) are equal before science, by the rule that all hypotheses must be crucially tested (*i.e.* so tested by *fresh* and *unlike* facts that every alternative hypothesis is rendered inconceivably as true), and by the rule that a fully established theory must be accepted as true regardless of all preconceptions—then a very splendid future immediately awaits not only biology, but also science in general; for the claim of science to the deciding voice in the settlement of numerous burning problems of immense importance will become irresistible.

By way of demonstrating that I am not vapouring, I shall venture to give one or two examples of evidence ignored and problems neglected by biology "as she is spoke" in a future communication. Meanwhile, there is a little more in Mr. Cunningham's letter with which it is necessary to deal. He says that naturalists would not admit that man, as an animal, is "higher" than an insect. It is pleasant to find him so careful of meanings; but will he please excuse the expression as "technical"? It is in common use and deceives no one. He declares that I give no evidence of the evolution of the power of developing in response to use. Is there any need? A man develops from birth to death mainly in response to this influence; does Mr. Cunningham believe that a butterfly develops in the same way to an equal extent? Consider mind. All learning, thought, intelligence, and reason depend on the growth of the mind through functional activity. Mr. Cunningham has done magnificent work on hormones. Does he think a beetle could learn what he has taught? What is intelligence but a power of developing in response to experience, of growing mentally in response to functional activity? What is stupidity but a "natural" or "acquired" incapacity so to profit? A human infant can learn, but has not learned. A human idiot cannot learn, and has not learned. A normal man can learn, and has learned. Almost all that separates the normal adult mentally from the infant and the idiot develops in response to use. The perfect idiot cannot even learn to walk or to speak. From the human point of view every dog is an imbecile, every cat an idiot, every beetle a perfect idiot. The beetle is more efficient than the human idiot merely because he is more completely equipped with instincts and instinctive actions, which, unlike human habits, habitual actions, and the rest, do not develop through use.

For example, the beetle does not learn to use his limbs. Does not the difference between man and the beetle indicate an evolution of the power of developing in response to use? What more evidence does Mr. Cunningham want?

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The "Flight" of Flying-fish.

IN NATURE of April 21 Prof. Wood-Jones presents some interesting observations on the "flight" of flying-fish made from an especially favourable vantage-point—the overhanging bow-sheaves of a cable ship.

While crossing the Gulf of Mexico on various occasions I made some observations on the same subject with the aid of powerful binoculars (Goerz prismatic, magnifying 12 diameters). With these I had been used to following birds in flight, and with a little practice found that I could keep flying-fish under continuous observation during their passage through the air.

I can confirm Prof. Wood-Jones's account in the following important particulars:—

(1) The initial impulse is always given by rapid lateral strokes of the tail as the fish leaves the water. Since the lower lobe of the caudal fin is elongated, the fish can continue to propel itself in this manner for some time while the whole of its body is out of the water. On very calm days the moving lower lobe of the tail leaves a track in the water in the form of an interrupted line. Presumably the interruptions represent the times of violent lateral motion. The uninterrupted sections of line are each 2-3 in. long, the interruptions rather longer, the whole line often continuing for 5-6 ft. After this, of course, the fish rises wholly into the air.

(2) The fish may regain impetus by again vibrating its tail when it has dropped far enough for the lower tail-lobe to be once more in the water. Fresh impetus may be gained in this way once, twice, or even three times in a flight without the body ever touching the water.

(3) The pectoral fins are usually held stiffly out, as Prof. Wood-Jones states, and act as planes. I have, however, on several occasions seen rapid vibration of the pectoral fins for a short period; but whether this was actual "flight," as I at the time supposed, or whether it was due, as Prof. Wood-Jones suggests, to a passive vibration caused by the air meeting the fin at a certain angle, I am unable to say. The impression made upon me at the time was that the *normal* means of propulsion in air was the tail, but that the pectoral fins *could* be used as supplementary flying organs on occasion. Of the truth of the first part of this impression I have no doubt whatever; Prof. Wood-Jones's anatomical studies make me doubt the second part. However, a good binocular in the hands of anyone trained to field observation will put the matter to the test.

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The Concept of "Space" in Physics.

PROF. EDDINGTON (NATURE, April 14, p. 201) expresses well the properties that a substratum of matter, light, and electric force should have, and the reasons for combining space and æther, the two different, but always co-existing, substrata of the older physics, into one. What is not clear is why he stops there. The ancient rule, "Entities are not to be multiplied beyond necessity," is as applicable now as ever. If a physical æther is to be postulated, it is for those who advocate it to show their reason for doing so,