

therefore follows that the responses of shoot and root to the direct and indirect stimulus must be of opposite signs.

The diverse movements of plants are thus explained from the establishment of the general law that direct stimulus induces a contraction and indirect stimulus an expansion.

I have shown, further, the extraordinary similarity of physiological reaction in the plant and animal (Friday evening discourse, Royal Institution, May 29, 1914). The responsive phenomena in plants must thus form an integral part of various problems relating to irritability of all living tissues, and without such study the investigation must in future remain incomplete.

Popular Natural History.¹

(1) THE best popularisers, after all, are the masters—if they care to try; and Fabre's "Story Book of Science" is a fine illustration. It is very perfect—full of interesting material, vividly written, stimulating both observation and reflection. He tells of ants, aphides, long-lived plants and animals, procession caterpillars, bees, spiders, shells, cotton, paper, silk, clouds, thunder, rain, the sea, and more besides—all as if it were a pleasure to him to talk, and just the very easiest thing in the world. The book must have been fashioned long ago, but so wisely that there is little that requires changing; it was meant for the children of more than a generation ago, and it would be a joy of a reading-book in schools to-day; it was written in French, and it reads as if it had been composed in English. The translator, Mr. A. T. De Mattos, has done his work with great skill. We confess that we should not call Hemerobius a dragon-fly, and there must be something wrong in speaking of the "sharp bones" in the silk-moth's cornea, which Fabre described as a rasper for filing at the silk threads of the cocoon. But these are pin-pricks; the book is past praising, and its pages are very pleasant to read—pleasant both to the inner and the outer eye. We should be having a Fabre centenary soon.

(2) A translation of Fabre's "Story Book of Birds and Beasts" is very welcome. The subjects are for the most part familiar, but the handling of them is masterly in its simplicity, grip, and vividness. Fabre had a way of taking the reader into his confidence, and making a sort of partner of him in his observations. But it is a game that only a big man can play with success. We are introduced to the cock and the hen, the egg and the chicken, the duck and the goose and the pigeon, the cat and the dog, the sheep and the cow, the horse and the donkey, and we get inter-

ested in them as if they were novelties. It is high art. The stories should be used in schools.

The book is not without blemishes, of which we venture to give some samples. We do not know what to call the first part of a hen's stomach, but we are sure that it cannot be called "the succenturiate ventricle." The story of the making of the shell of the egg is misleading, and it is not true to say that the hen *must* have carbonate of lime in her food. We are rather staggered by some humming-birds "as small as our large wasps." The account given of "pigeon's milk" is erroneous. It should have been noted that the passenger pigeon, in regard to which Audubon's account is quoted, has now ceased to exist. For the translator's work we have great admiration; but it might have shown wisdom as well as piety to have got an editorial expert to look into points such as we have illustrated. There is no sense in perpetuating mistakes.

(3) Dr. Francis Ward's book is in great part an attempt to take the point of view of the animal under water.

Seen from below, the surface of the water would appear as an extensive mirror, with the river-bed reflected upon it. Immediately above the observer the reflecting surface is broken by a circular hole or "window." Through the surface of the water, in the area of this "window," the sky and objects immediately overhead have their usual appearance, but in addition surrounding objects above the water level are also seen through the "window" as dwarfed and distorted images, suspended, as it were, in the air above the circumference of the circular hole. A ring of iridescent colours separates the "window" from the surrounding reflecting surface.

Many of Dr. Ward's observations have a direct bearing on the concealment of aquatic animals, and deserve careful attention from naturalists. Let us illustrate. The size of the "window" varies with the depth of the under-water observer; when birds and fishes on the surface slip out of the "window" they cease to be conspicuous (to their enemies below) as silhouettes against the sky. Protection under water may be afforded, as in the case of brown trout, by reflection of the surrounding coloration. White animals, such as a white sea-anemone, take up a position where the revealing top light is cut off. Black-plumaged birds, like the water-hen, become mirrors under the water owing to reflection from the air-bubbles retained in their plumage.

After explaining the sub-aquatic conditions as

¹ (1) "The Story Book of Science." By J. H. Fabre. Pp. 299. (London: Hodder and Stoughton, n.d.) Price 7s. 6d. net.
 (2) "The Story Book of Birds and Beasts." By J. H. Fabre. Pp. 315. (London: Hodder and Stoughton, n.d.) Price 7s. 6d. net.
 (3) "Animal Life under Water." By Dr. Francis Ward. Pp. x+178+plates. (London: Cassell and Co., Ltd., 1919.) Price 7s. 6d. net.
 (4) "Birds in Town and Village." By W. H. Hudson. Pp. ix+274. Illustrated. (London and Toronto: J. M. Dent and Sons, Ltd.; New York: E. P. Dutton and Co., 1919.) Price 10s. 6d. net.
 (5) "The Book of a Naturalist." By W. H. Hudson. Pp. viii+360. (London: Hodder and Stoughton, n.d.) Price 12s. net.
 (6) "Wonders of Insect Life: Details of the Habits and Structure of Insects." Illustrated by the Camera and the Microscope. By J. H. Crabtree. Pp. viii+211+32 plates. (London: George Routledge and Sons, Ltd.; New York: E. P. Dutton and Co., n.d.) Price 6s. net.
 (7) "Just Look! or, How the Children Studied Nature." By L. Beatrice Thompson. Pp. viii+204+58 plates. (London: Gay and Hancock, Ltd., n.d.) Price 5s. net.

regards illumination, the author discusses the life and behaviour of a number of types. In connection with diving birds, he suggests that the "flashes" of reflected light from the moving body may attract fishes. Under the water the back of the Great Northern Diver "simulates a shoal of small shining fish." The inordinate appetite of diving birds is emphasised; thus a small cormorant took from Dr. Ward at one time twenty-seven herrings of average size. It seems to us that the author does not sufficiently appreciate

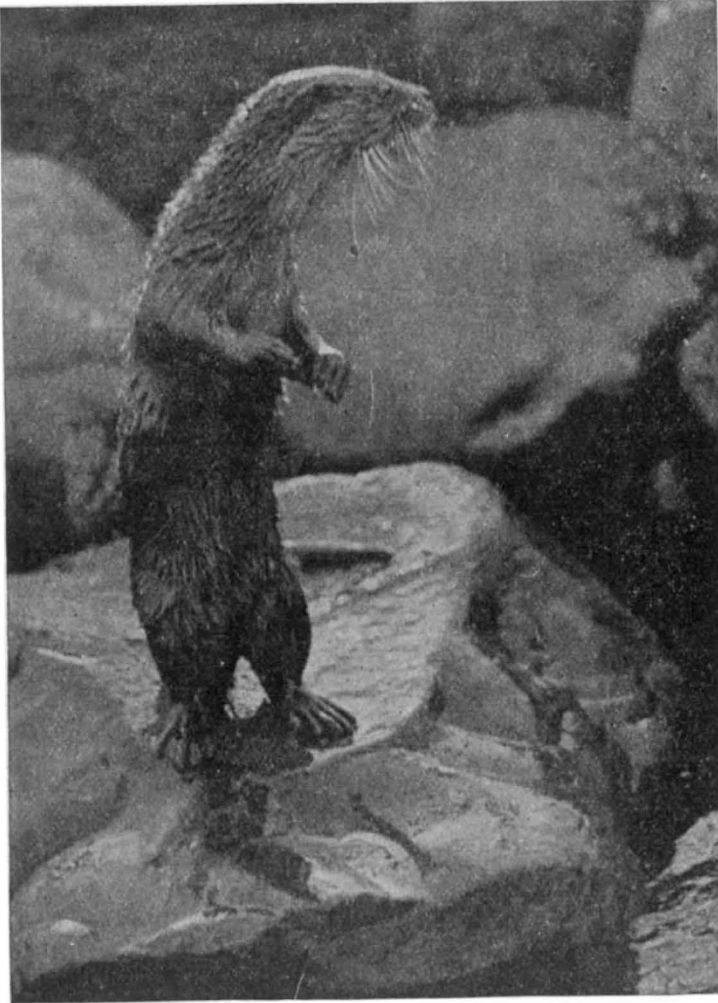
We are not sure that a popular book, especially one with a definite and very interesting problem to discuss—animal life under water—is the place for weighing the beneficial and injurious effects of the activities of particular birds. That should be done in a severely scientific and critical way. Dr. Ward describes, for instance, the contents of the stomachs of thirty black-headed gulls, which show that these birds were "certainly not helping the farmer." But it is easy to get expert records of thirty cases which show the reverse.

The question is to which side the balance inclines in a particular area and through the year. This entertaining and breezy book is copiously illustrated with very interesting photographs. We appreciate these, but we may hint at the injudiciousness of putting even a diagrammatic penguin into a scene on a Highland loch.

(4) Mr. Hudson's "Birds in Town and Village" is based on "Birds in a Village" (1893), his first book about bird life, but much of it is new. It is a continual delight—a succession of fine pictures—and it is very gratifying that the beautiful text should be so successfully illustrated. Mr. E. J. Detmold's coloured drawings are altogether charming. The time is past for speaking of the author's style, his irresistible enthusiasm, his intimate knowledge of birds, and his passion for them. If more people read his books there would soon be no need for a Plumage (Prohibition) Bill.

"The robin is greatly distinguished in a sober-plumaged company by the vivid tint on his breast. He is like the autumn leaf that catches a ray of sunlight on its surface, and shines conspicuously among russet leaves." "The kingfisher, speeding like an arrow over a field of buttercups so close that they were touching, seemed, with the sunshine full on it, to be entirely of a shining, splendid green. . . . Flying so low above the flowery level that the swiftly vibrating wings must have touched the yellow petals, he was like a waif from

some far tropical land. The bird was tropical, but I doubt if there exists within the tropics anything to compare with a field of buttercups—such large and unbroken surfaces of the most brilliant colour in nature." But we might as well quote the whole book. The delightful "Birds of a Village," which forms about half the book, is echoed at the end in a story of the birds in a Cornish village, and between the two there are essays on exotic birds for Britain (we confess to regarding introductions with insular prejudice),



The otter alarmed. From "Animal Life under Water."

the good these birds do from the fisherman's point of view in destroying species which devour food-fishes. There are two sides to most indictments of birds.

In addition to the contributions to the theory of concealment of water animals from enemies or from booty, the book contains many very interesting natural history sketches—of the seal, the heron, the kingfisher, various kinds of gulls, and, best of all, the otter. Indeed, the story of the otter strikes us as the finest part of the book.

moorhens in Hyde Park, the eagle and the canary (concerning cages), chanticleer, and the birds of an old garden. If the birds knew what Mr. Hudson has done for them, they would sing all the year round.

(5) It is difficult to imagine anything more delightful than Mr. Hudson's "Book of a Naturalist," and we wish he had called it vol. i. Why should there not be many volumes, when it is so easy to make one so good? So easy! for all that is necessary is to have (1) an intimate personal experience and a deep understanding of the life and conversation of animals as they live in more or less wild Nature; (2) an artistic or poetic sense which gives Blake's "double vision"; and (3) an ear for words that makes the pages of the book sing. The same subjects are often treated of by many painters, and likewise by many naturalists. Ants and wasps, bats and foxes, moles and earthworms, snakes and toads, pigs and potatoes—these are fair samples of Mr. Hudson's stock in trade; but he is a magician-pedlar, and the familiar things among his wares turn out to have most unexpectedly profound and subtle excellences. Here science and art seem to meet in a deepening of our appreciation of common things, and perhaps this is the biggest service that a man who sees can do to his day and generation.

Mr. Hudson wished to call his book "Diversions of a Naturalist," but Sir Ray Lankester was ahead of him. We do not think he lost much, for what he has given us are really "Appreciations," as Sir Ray Lankester's "diversions" were also. The expert biologists get down to the depths of life in a way that is indispensable and fundamental, but the field-naturalists, among whom Mr. Hudson stands out as Saul among the prophets, get at the heights of life in a way that is indispensable and supreme. What is contributed in these fascinating essays is a wealth of first-hand observations, and to this, of course, there are added the reflections of a highly gifted intelligence. But we submit that there is more—that feeling has a rôle in the interpretation of Nature, and that sympathetic insight (through æsthetic emotion at one pole, and sheer sense of kinship at the other) opens up one of the rights-of-way to reality. This is too academic in its phrasing, and unfair to Mr. Hudson, through whose writings sunlight streams and breezes blow; but we mean that this is the book of an expert naturalist and of a man of feeling as well.

(6) The entomologist is always discovering new wonders, and very frequently he has enthusiasm enough to wish to share his pleasure with others. Mr. Crabtree has the entomological enthusiasm right enough, but we are not sure about all his wonders. In the first place he is too much of an anthropomorphist, for he says the study of insect-life "provides a host of examples and illustrations of such noble aims as 'living for a purpose,' 'striving for the best,' 'helping one another,' 'bearing each other's burdens,' and sympathy in sorrow.'" He has interesting observations to describe, and he tells his story

fairly well; but again there is the false note: he should not speak of his book selecting "representative members of the principal species," or of "the Pulex family." It is a pity that an author who seems to have seen a lot of things for himself should write like this: "The numerous family of Lice that is parasitic on certain animals is classed under the common term Hæmotopinus." Why do not publishers see to it, by utilising readily available advice, that this sort of thing is not printed? It is not good business, for it obscures the book's good qualities.

Many people see common insects like the lady-bird, the devil's coach-horse, the earwig, the frog-hopper, the green-fly, the may-fly, and the wasp, and would like to know more about them, especially if they can get the information not too learnedly expressed. Mr. Crabtree's book is well adapted to meet this reasonable demand. It deals pleasantly with about three dozen common insects, and there is a generous supply of photographic illustrations. But, again, Mr. Crabtree's reach too often exceeds his grasp; thus his story of cuckoo-spit is far from correct; we do not like to hear of female Aphides without ovaries, in which "multiplication occurs by the process of gemmation or budding on the individual Aphis." We are staggered by the crane-fly, the limbs of which are merely hooked together, so that a captured part has only to be hooked off; and we do not think that a wise approach to a very difficult problem is made by saying: "It may be said with sincerity that the development of *instinct* in ants is much akin to *reason* in higher mammals." But, forgiving a lapse in biological philosophy, we are pulled up by errors in grammar, for our eyes have fallen on more than one sentence like this: "To the thorax, or chest, is attached the fly's six limbs." Why should a scorpion be referred to as "the dangerous arachnid of the South American forests," and why should an author go out of his way to use an expression like "of that ilk" when he does not know what the words mean? We believe in popular natural history, but it should have a high standard of accuracy, and it should be written in English worthy of the subject. Mr. Crabtree's studies are interesting; they often describe observations; they are certainly instructive; but we are bound to say that there are too many flies in the ointment. And many of these flies are gratuitous.

(7) Miss Thompson tells in a pleasant way of corals and seeds, of the work of water and ice, of springs and seashore animals, and illustrates her talks with very clever drawings. To those who enjoy talks between a somewhat encyclopædic Miss Marshall and a number of children who ask extraordinarily appropriate and searching questions, the book will be welcome; our own impression, based on some experiments, is that neither children nor adults care for the "Sandford and Merton" mode of imparting instruction. The author has a very skilful pencil and a power of simple exposition; we wish she had chosen the direct method.

J. A. T.