

Fireball

READING W. G. Smith's remarks on lightning in last week's NATURE (p. 241), recalls to my mind a ball I saw during a storm in the autumn of 1881. The storm had lasted some time, and I sat reading a little back from an open window but facing it. Suddenly it became so dark that I could no longer see. I dropped my book and looked out. A ball of fire was passing through the window into the room. It moved very slowly onwards and downwards towards me, and became almost stationary over my book. At first I thought it rested upon it, but I soon saw it was moving slowly across. Having passed over the book, it turned in the direction of my hand, paused just beneath it, and then sank towards the carpet. At this instant a peal of thunder crashed over the house—it was the very loudest I have ever heard.

ANNIE E. COCKING

The Elms, Bedford Park, Chiswick, W., July 14

Butterflies as Botanists

THERE can be no doubt, as pointed out by Fritz Müller in your last issue (p. 240), that the habits of insects often indicate affinities in plants. There is doubtless a strong affinity between the Solanaceæ and Scrophularinæ; the small oval pollen is almost identical in both. The habits of fungus parasites sometimes disclose similar relationships, often more real than is at first apparent; we have an example of this in the fungus of the potato disease, *Peronospora infestans*. This parasite is almost peculiar to the Solanaceæ, being especially destructive to Solanum, Lycopersicum, and Petunia, but at times it invades the Scrophularinæ and grows on Anthocercis and Schizanthus. It is not common to find one parasitic fungus attacking the members of two natural orders of plants, but other examples could be given.

W. G. S.

A Cannibal Snake

ABOUT eighteen months ago, just previous to my leaving India, at Devalah in the Wynaad, the horsekeepers chased and killed a large cobra, 5 feet 4 inches; previous to death it was thrown down in front of the door of our house, when, after a good deal of twisting and wavy contortion of the body, it disgorged a small rock snake over 4 feet in length. I had heard of the same thing before in India, so that I do not think cannibalism in snakes is so uncommon as Mr. Evans thinks.

JOHN FOTHERINGHAM

96, Netherwood Road, West Kensington Park, W., July 12

FOURTH NOTE ON THE ELECTRICAL RESISTANCE OF THE HUMAN BODY

IN my communication to NATURE (vol. xxix. p. 528) I described the use of alternating currents and the telephone for the above purpose, and promised to endeavour to obtain at least an approximate measurement of the E.M.F. developed in the secondary coil of an induction apparatus. This promise I now propose to fulfil. But before proceeding to the special subject of the present note, I should wish to draw attention to a paper which appeared on the 15th of the same month in the *Asclepiad*, by that able experimentalist Dr. B. W. Richardson. He therein describes not only experiments made with the large induction coil of the Polytechnic, but also others made as early as 1868 in conjunction with the late Mr. Becker, the object of which was to obtain a measure of the resistance of animal structures.

"The results," says Dr. Richardson, "were not fully satisfactory. They were variable even when the conditions under which the experiments were made were entirely the same. This variability we found to be due to decomposition of the animal substance, a decomposition which, however feeble the battery, was sufficient to destroy the precision we desired to obtain." Putting the more recently coined word "polarisation" for decomposition, this expresses exactly the difficulty described by me in my first note. "It was, however, possible," says the doctor, "to make out that blood conducted better than any other structure of the body, and better than water."

I can now fully corroborate this excellent observation, and perhaps extend its application.

Physiological and even pathological fluids, such as the serum of dropsy, conduct far better than muscle, bone, and nerve. One instance out of many may serve. In the very first case recorded in my communication to NATURE (vol. xxviii. p. 151) the lowest resistance obtained from foot to foot was 2300 ohms. The patient was then very emaciated, but quite free from dropsy. Towards the end of the case, which after death proved to be one of ulcerative endocarditis, as I had considered it to be during life, slight but distinct dropsical effusion in the lower extremities set in; the resistance sank at once to 700 ohms, and I had to discontinue my observations from the evident change of electrical conditions. I have since verified the same fact many times, and on it I partly found the belief, already several times stated, that "the human body, in spite of its large amount of liquid constituents, follows a similar thermal law of resistance to that influencing solid conductors, though in a very much higher ratio" (NATURE, vol. xxviii. p. 152).

Dr. Richardson does not seem to have attempted to determine the resistance of the living body, which Du Moncel, in 1877, did, and with fairly accurate, if unpleasant, results (NATURE, vol. xxix. p. 528). On the discovery, however, in 1879, of Prof. Hughes's electric balance, he resumed his observations, this time with an alternating induction current, though he does not himself notice the important change. His results are unfortunately taken in arbitrary units on the graduated scale of 200 parts originally applied to Prof. Hughes's instrument. If there is any way of reducing these fictitious to absolute values, my work will be both lightened and assisted by a proved observer. Blood-clot and serum, white and gray nervous substance, muscle, bone, coagulated albumen, gelatine, and pus were all tested. Some of the results were excellent. For instance, fat, which by one experimenter has been stated to increase the conductivity of the body, is found by Dr. Richardson, as I also have found it, to be an absolute non-conductor. It is almost unnecessary to say that, with so skilled a chemist and physiologist, all proper temperature corrections and other similar precautions were most strictly observed.

I can now proceed to the main topic of my present note. On receipt of the Wurzburg dynamometer it was put in adjustment, and a strenuous effort made to compare the indications given with a constant and an alternating current, to both of which it is sensitive. But the movable suspended coil made of an ivory core, with a double weight of silk-covered copper wire, hung by a platinum hook, and dipping by its other termination into a vessel of strong sulphuric acid by means of a platinised platinum plate, is very heavy; takes a long time to get to its full deflection, thus allowing the battery to run down sensibly, and, what is worst of all, has a tendency to "integrate." By this I mean to sum up, by its mechanical inertia, a large number of small, intermittent pulls as given by the reversed current, into an almost identical deflection (less, of course, losses) with that given by the one steady pull of a continuous current. In spite of its beautiful workmanship, it had to be discarded for the present research. Somewhat in despair, I fell back on a similar instrument, shown by me at the Oxford meeting of the Physical Society in June 1882, and there heavily abused. The moving coil in this is made of silk-covered aluminium wire to insure lightness, and the bifilar suspension is made of the silver-gilt wire used for military epaulettes and facings. It is the work of my own poor hands.

Herr Obach then stated, and the statement was repeated in your columns, that this material had already been used by Messrs. Siemens for their "dust-recorders," but had failed by difficulty of making contact. On testing my little toy, I found its resistance had not