asks how I manage to direct that energy along a definite path so as to produce a willed result. The only answer I know is, "By a nervous impulse liberated from brain centres." But what is it that is thus liberated? and what pulls the trigger to liberate it?

By mechanical analogy one would say that energy can only be guided by force, and that force must therefore be exerted in the brain cells; but, if so, the relation between force, which is a mechanical thing, and will or life, or whatever it is, which is a psychological thing, demands investigation.

I trust that Mr. Lloyd Morgan will help me to get my ideas on these subjects straighter, and will point out if I have made any assertions which are obviously erroneous or grotesque. The borderland of psychology and physics is the last place in which I would like to dogmatize; and in a letter like this I see no harm in airing confessedly immature and groping notions, in the hope that ventilation may clear the air. So far as physics only is concerned, I have stated how I regard the phrase "expenditure of energy" in the *Philosophical Magazine* for June 1885.

With regard to the crux raised in Mr. Dixon's last paragraph, that nothing but matter can exert force, because the acting matter must receive an equal opposite momentum, it may perhaps be just worth noticing that an infinite mass can absorb any amount of momentum without receiving a trace of energy or being itself in any way affected.

OLIVER J. LODGE.

Liquid Prisms.

I OBSERVE in NATURE of July 2 (p. 207), that it is stated Herr Wolter has recently recommended α -monobromnaphthalene as a substance peculiarly fitted for study of the ultra-violet part of the spectrum, by reason of its high dispersive power and transparency for the ultra-violet rays.

Perhaps I may be permitted to state that Mr. Madan published an account of its dispersion and refractive power in the *Phil. Mag.*, and recommended its use in liquid prisms. Having made use of many other substances, including methyl salicylate, I gave this a trial. For ordinary work it would be excellent if colourless; but unfortunately, no matter how free from colour it may be when freshly prepared, long-continued use causes it to become yellow, and in considerable thicknesses even dark brown. For the ultra-violet rays it is undoubtedly better than carbon disulphide, but nevertheless practically useless, as the line N, which it is said to transmit, has a wave-length of 3580, so that only about one-half of the ultra-violet solar rays are observable with it. In metallic spectra almost all lines of interest lie between 3580 and 2000. A liquid which I considered to possess much superior optical properties is *mercuric methide*; it is perfectly colourless, and of such density that flint glass will float upon it. When the glass is immersed it becomes invisible, consequently the refraction and dispersion of the liquid are probably exceptionally high. As far as I can recollect, being without access to my notes, a thickness of 50 millimetres freely transmitted all rays to about λ 2900—that is to say, the entire solar spectrum. Unfortunately, it has its drawbacks, in being somewhat volatile, and its vapour highly poisonous.

Stonehaven, N.B.

W. N. HARTLEY.

The Identification of Templeton's British Earthworms.

BETWEEN the years 1829 and 1836 the first series of Loudon's *Magazine of Natural History* appeared in nine volumes. In the last volume we find some notes on earthworms by Templeton, which have proved somewhat puzzling to students of more recent times. I have been fortunate enough to follow Templeton in some of his researches, and am able to correct and verify certain of his statements.

The *Lumbricus xanthurus*, Temp. (*op. cit.*, ix. 235), is the angler's gilt tail, and as such is synonymous with *Lumbricus puter*, Hoffm., and *Dendrobana Boeckii*, Eisen. *Lumbricus gordianus*, Temp. (*loc. cit.*), is undoubtedly the mucous worm (*Allolobophora mucosa*, Eisen), or one of its near allies, all of which are to be found of a pale rosy colour coiled up into a knot at certain times of the year.

It is to *Lumbricus omilurus* (= *Omilurus rubescens*, Temp., *loc. cit.*), however, that I wish to direct special attention. Grube, in 1851 ("Familien der Anneliden," p. 101), placed it, with Templeton's other worms, in a list of species which were insufficiently characterized for systematic purposes. Vejdovsky, in 1884 ("System und Morph. der Oligochæten," p. 62), places it among

the questionable species without note or comment, and, so far as I can gather, no one has been able to throw light upon it since.

Templeton says the worm is never larger than half the size of *L. terrestris*, L., is of a bright reddish-brown, with the tail very flat, and the body unfurnished with a belt at the position of the sexual organs. It would be very easy to suppose from this somewhat vague account that the writer had only seen immature specimens; but a little careful study of his words shows that he knew what he was writing, and that his worms were mature. Now a mature species of *Lumbricus* without a clitellum is certainly an anomaly, and needs investigation.

While collecting Annelids recently, I came across half-a-dozen specimens which at first sight exactly resembled *Lumbricus rubellus*, Hoffm. I took them home for verification, and immediately observed the difference. I had obtained with them typical specimens of *rubellus*, which enabled me to make a careful comparison of the two species in a living state.

The following is a description of the worm as I wrote it down before observing Templeton's account.

Colour dark brown, iridescent on the dorsal surface anteriorly, becoming lighter towards the posterior extremity, which is flesh-coloured or light red, pink ventrally. Prostomium dovetailing completely into the peristomium, and possessing a transverse groove in the middle, as shown in the accompanying sketch.

Lumbricus rubescens. Segments 1 to 3 with prostomium entirely cutting the first segment or peristomium.

Segments not annulated (or divided by transverse rings). Length about 3 inches, total number of segments about 120. Setæ in couples as in typical *Lumbricus*. Male or spermiducal pores on segment 15 with papillæ, which, however, do not extend over the neighbouring segments. Body cylindrical in front, flattened posteriorly. The dorsal pore between 5 and 6. It appeared at first between 7 and 8, but by using polarized light on the cuticle when spread on a glass slip the whole series of pores in one or two specimens became clearly visible from the fifth segment backwards.

On the ventral surface prominent papillæ appeared on segments 28 and 29, such as are often seen on typical *L. agricola*, Hoffm. Now came the crucial question, Is there no clitellum? By studying all the examples carefully, I found that they agreed in one particular. The segments 34 to 39 differed in structure from the rest on the dorsal surface. On the under surface from 33 to 40 were differentiated, and showed a glandular structure, while the band representing the tubercula pubertatis extended distinctly along the ventral surface of 35, 36, 37, 38.

This description of the external characters shows the worm to be a decided *Lumbricus*, tested by Dr. Benham's definition in "An Attempt to Classify Earthworms"; but it differs from every one of our British species, especially in the backward position and inconspicuous nature of the clitellum. I am unable to refer it definitely to any of the European species, and propose that for the present it should be known as *Lumbricus rubescens* (Temp.), thus retaining the two names from Templeton's synonyms which are most appropriate to what I regard as the species intended by him.

I may add that I have recently found one or two other earthworms in Yorkshire which have not yet been recorded as British, and will form interesting additions to our Annelid fauna.

Idle, near Bradford, July 15.

HILDERIC FRIEND.

Copepoda as an Article of Food.

DURING recent years a good deal has been said amongst marine zoologists of the use, as a food supply, that might be made of the enormous numbers of Copepoda that swarm in the surface-waters of the sea, and the Prince of Monaco has pointed out the value this widely-distributed nutritious matter might have to shipwrecked sailors; but I am not aware that anyone has yet actually made the experiment of cooking and eating Copepoda, so the following record may be of some interest.