yet been published, and even a fragment like the present, containing a list of the species of a neighbouring region, is a welcome addition to our knowledge. Four other "Parts" have been issued on the Insecta—the "Neuroptera" and "Hymenoptera" (both in 1878), and the "Lepidoptera" and "Rhynchota" (both in 1879); the last Part of the whole series being the "Araneidea" (1885).

Popular Astronomy. By Sir George B. Airy, K.C.B. Seventh Edition. Revised by H. H. Turner, M.A., B.Sc. (London: Macmillan and Co., 1891.)

ALTHOUGH our astronomical knowledge has been enormously extended since the lectures forming the basis of this well-known book were delivered (1848), Mr. Turner has not found it necessary to make any very considerable revision, for the reason that the advances have been chiefly on the chemical and physical sides. Still, in the lapse of time, methods of observation have been improved, and accounts of these find a place in Mr. Turner's notes. Among these are short descriptions of the chronograph and the new "electrical controls" for the driving-clocks of equatorials. One of the most noteworthy points brought out in the new edition, however, is the modern estimate of the value of observations of the transit of Venus as a means of determining the solar parallax. It was formerly supposed that this would be one of the best methods, but the difficulties encountered in 1874 and 1882 prevented observations of the necessary degree of accuracy; and now most astronomers are of opinion that this method can never give more than an approximation to the truth. Numerous minor additions have also been judiciously made.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Force and Determinism.

"THE relation between force, which is a mechanical thing, and will or life, or whatever it is, which is a psychological thing"—a relation which, as Dr. Lodge rightly says, "demands investigation"—presents itself to some of us as follows.

When a stimulus received by an organism gives rise to a response, however particular to the individual respondent, there are (1) a number of complex but determinate molecular changes in the organic tissues; and (2), accompanying some of these changes, certain psychological states. Are these psychological states produced by the molecular changes? or are the molecular changes produced or in any way guided by the psychological states? Neither the one nor the other. The molecular changes and the psychological states are different aspects of the same occurrences. In other words, they are distinguishable (and the distinction is absolute), but not divisible.

"The energy displayed by a gang of navvies is not theirs, but their victuals'; they simply direct it." In physiological language it is the outcome of the proper functioning of their cerebral control-centres. Now we believe that, although we can at present by no means adequately explain them, all the molecular occurrences within the organism, forming, as we believe they do, an orderly and determinate sequence between stimulus and response, whether they involve force or energy, are of such a nature as to be explicable in physical and physiological terms. The fact that certain phases of the sequence have also a subjective or psychological aspect does not, it is held, justify us in changing our point of view, and ignoring the distinction between the psychology and the physiology of the process.

Now to say that mind, or will, or consciousness directs the organic energy along a definite path we regard as incorrect, because it ignores a distinction which we hold to be valid and valuable, and conducive to clear thinking on these difficult subjects. But we have no such objection to the statement that the energy is guided by molecular forces which have for their subjective aspect certain states of consciousness. To unscientific folk this may sound mere quibbling; but to physicists, who have done so much to teach us the vital importance of accurate language for clear thinking, we look for support in drawing this distinction, unless the distinction can be shown to be either invalid or useless.

This distinction between force, energy, and the physical series (what I have elsewhere spoken of as *kinesis*) on the one hand, and thought, consciousness, and the psychical series (what I have elsewhere spoken of as *metakinesis*) on the other hand, we hold to be absolute; while at the same time we hold that consciousness is indivisible from particular (neural) modes of kinesis. And this distinction we hold to be especially valuable when questions of the origin and development of consciousness are under consideration. This may, perhaps, best be expressed by a diagram.

Now, looked at from above, this wriggle is supposed to represent the development, from simple forms of molecular transactions, of that complex form of kinesis which we call neurosis. From this point of view, all is force and energy or kinesis, and can become nothing else. Looked at from below, we have the development of consciousness. From what? We must not say from lower forms of energy or kinesis, because that involves jumping across the line, or, in other words, ignoring the distinction. From what, then? From those lower forms of "something-which-is-not-yet-consciousness-but-which-may-develop-into-consciousness," for which I have ventured to coin the term metakinesis.

I have elsewhere endeavoured to show that this view is not open to the objection that, since the kinetic sequence is a continuous and determinate one, consciousness is merely a by-product, and that an unconscious Darwin might have written and influenced the conduct of unconscious Englishmen. For consciousness, though it is distinguishable from, is, according to the hypothesis, no less inseparable from, certain complex modes of the kinetic process. As the world is constituted, such supposed kineses, separated from their metakinetic aspect, would not be the same kineses but something altogether different. In other words, it is with certain molecular transactions which have also a conscious aspect that, in the world of living beings of which we have practical knowledge, we have to deal.

It is essential that physicists and psychologists should work hand in hand. Both are endeavouring to explain the phenomena on positive lines. And if there is anything in the views that I have briefly sketched in the preceding paragraphs which runs counter to the conclusions of physics, it must go by the board, and give place to a more widely-consistent conclusion, to which physics, speaking with the voice of authority in its own special province, can give a cordial assent. C. LLOYD MORGAN.

I AM afraid that, as Prof. Lodge has accepted my "middle paragraph" so easily, he has failed to appreciate its point. For, if that paragraph is correct, the Professor's assertion, "Force is certainly necessary to direct the motion of matter," is only a truism, similar to the important geometrical theorem, "In any right-angled triangle, one angle is equal to 90°." On the other hand, Dr. Croll's assertion, to the effect that guidance is effected by "determinism," and *not* by force, is a contradiction in terms. For, by definition, that which changes motion *is* force. If, therefore, Prof. Lodge's assertion has any real meaning, he must have some independent definition of "force," and I should very much like to know what that is.

Again, Prof. Lodge in no way answers "the crux in my last paragraph." Prof. Lloyd Morgan implies in his last letter that, in the case of the sun altering the direction of motion of the earth, no energy is expended. This is, of course, only approximately true; and even in the case of his twirling his stick round his finger and thumb, as the stick is elastic, its forces of cohesion in reality do some small amount of work. It is indeed true that, if two particles were once connected by an *absolutely* inextensible string, the cohesion of the string would do no work. But what I pointed out was that, in order to bring such