

to which I have no reply to make, except that if they thought as we do, they must have an immortal soul as we have, which is not likely, as we should apply the argument to all animals, such as sponges, oysters," &c. I am sure these ideas are not unfrequently repeated in his correspondence, as for example, in one of his replies to Morus (vol. i. No. 67 of the 4th edition, in Cousin's Edition, x. p. 204 *et seq.*). He there even talks of two souls, an *âme corporelle* which is the cause of passions and affections, and an incorporeal principle of thought, which he elsewhere says was infused by the Deity into man at the first moment of his existence. He also observes, I think logically enough, that as no boundary line can be drawn elsewhere, we have no choice between conceding a soul to oysters or refusing it to all animals save man. I am not however concerned to defend the validity of his reasons, but rather to contribute this information as an historical point of interest.

Trin. Coll., Dublin, Nov. 11

J. P. MAHAFFY

Plane-Direction

I THINK "plane-direction" is the best of the competing names. The planes of cleavage in a crystal are the "plane-directions" in which it is most easily split. They cannot be called either "aspects" or "positions." The opposite faces of a cube certainly cannot be said to have the same "aspect."

If a rigid body receives a movement of translation, it retains something unchanged. What is this something to be called? It might be called "lie" or "set," but both names are equivocal. Two equal and similar figures possessing this something in common might be very well described as "similarly laid," "similarly set," or "similarly placed." We may say that they have "similar positions," but we can scarcely say that they have "the same position;" for change of position is commonly held to include movements of translation as well as of rotation, and a point is usually defined as having position but not magnitude. I think it is worth while to consider whether "position" cannot be restricted to the more limited sense, "place" being employed in the wider sense.

I wonder that no one has yet raised a murmur against the proposition itself, which your correspondents are so anxious to render literally into English. It appears to me that the plain English form in which Mr. Wilson first stated it is clearer and more precise than the German abridgement. In the strictest sense of "determine," one "Richtung" determines one "Stellung" and one "Stellung" determines one "Richtung," inasmuch as to one plane-direction there corresponds one normal direction.

In a special sense it is true that two "Richtungs" determine a third (perpendicular to them both), and that two "Stellungen" determine a third (also perpendicular to both); just as two points may be said to determine one plane (bisecting their joining line at right angles). In all these instances the fact is that not one only but many are "determined," but all except one come out in pairs or multiples of two. It is this one, which has no fellow, that is in a special sense "determined."

I think it is paradoxical and misleading to state, without qualifying words, that two lineal directions determine one plane-direction; inasmuch as two lineal directions really serve to define as many different pairs or multiple pairs of plane-directions as we please, and if we are permitted to distinguish the two lineal directions by different names, three plane directions can be separately defined by them without any ambiguity. Similar remarks, of course, apply to the other half of the proposition.

J. D. EVERETT

Rushmere, Malone Road, Belfast, Nov. 11

"Wormell's Mechanics"

WILL you do me the favour of inserting a brief reply to the few remarks made concerning the above text-book in last week's NATURE?

I. On page 8 of the book occurs an explanation of what is usually termed the transmissibility of force, and a statement of the axiomatic principle that we may imagine a force to be applied at any point in the line of its direction, provided this point be rigidly connected with the first point of application. On page 14 a deduction from this principle is made and employed to prove

the rule for finding the directions of the resultant of two forces acting on a point. The reviewer says that this deduction, "if true, would assert that the attraction of the sun and the earth upon the moon might be transferred to any heavenly body in space which happened to be in the line of direction of the resultant of the forces." If the restriction laid down with emphasis in the book, and printed in italics as quoted above, be not ignored, this is a legitimate inference, and if the point to which the forces are transferred parallel to themselves be rigidly connected with the moon, any conclusion having reference to the magnitude or direction of the resultant action on the moon derived as a consequence of the imaginary transposition of the point of application of the forces will be correct.

2. In finding the direction of the resultant of two parallel forces, the same transposition of the point of application is employed, and, of course, it is understood with the same proviso. This proof your reviewer qualifies as "meaningless," whereas I feel sure that, taken in connection with the original axiom and the deduction above referred to, it would be accepted by any mathematician as both intelligible and correct.

3. The next statement is that the definition of a rigid body is given as a property of forces. This is not so, but the whole theory of statics, when developed independently of dynamics, rests on the properties of a force and the properties of a rigid body jointly.

4. The reviewer next dwells upon a curious error which unfortunately escaped my notice until it was pointed out but a short time ago by a schoolboy, and which forms one of three corrections on a slip of errata. Any student would, however, have been able to make the correction for himself by the help of the preceding pages and the applications to the following exercises, a circumstance which I think an unprejudiced critic should not have overlooked.

5. Your reviewer next remarks that a student who tries an experiment with a block and tackle would naturally be surprised at finding that the result of experiment does not agree with that of the theory, and adds, "nor can we find a single word in the book which would enlighten his difficulty." The reviewer cannot have read section 71.

6. The subjects included in the book are such as comprise the course described in the curriculum and examination papers of the University of London, and if occasionally the discussion of unpractical arrangements of mechanical powers is required, I am not answerable. Indeed, I hope to see the day when a reform of this part of the curriculum will necessitate my rewriting the work on an entirely different plan, namely, one according to which kinematics forms the first part, kinetics the second, and statics the third, the propositions of the third part being special cases of those of the second. But that at present it answers the purpose for which it is intended, is proved by the fact that all the questions set this year can be answered from it.

So far as most of the facts and illustrations are concerned, "I am but a gatherer and disposer of other men's stuff," and a writer of an elementary text-book to suit the requirements of a particular examination could not easily be more.

The tone of depreciation with which the writer of the article has been pleased to refer to the work, so directly opposed to a previous notice of the same book in the same journal, seemed to me to call for some reply, and I should wish to describe more fully the objects I have aimed at in compiling the work, but that I know I have already taken up enough of your valuable space.

RICHARD WORMELL.

ONE OF THE GREATEST DIFFICULTIES OF THE DARWINIAN THEORY

SIR JOHN LUBBOCK has done good service to science in directing attention to the metamorphoses of insects, by admitting freely the great difficulty in conceiving "by what natural process an insect with a suctorial mouth, like that of a gnat or butterfly, could be developed from a powerful mandibulate type like the Orthoptera, or even from that of the Neuroptera" (NATURE for Nov. 9, page 28). Such "difficulties" have struck many from the first, and it is in no small degree encouraging to those who love the liberty of science, to find that the time is ap-