In his book "The Interaction of Pure Scientific Research and Electrical Engineering Practice" (1927), Sir Ambrose Fleming describes the phenomena and on p. 72 remarks:

"In the Lecture above mentioned Mr. Mordey discussed the various causes to which the above effects may be due, and he came to the conclusion, with which the author of this book agrees, that the effective source of the repulsion is magnetic hysteresis."

The Athenaeum, London. March 4. W. M. MORDEY.

THE necessary brevity of the Research Items paragraphs makes it impossible to introduce the reservations and qualifications which would be appropriate in fuller accounts. In the item referred to, the purpose was to direct attention to the main points in a paper by H. S. Hatfield. Reference was made to the earlier work of W. M. Mordey, but full justice could not be done to it. To Mr. Mordey is due full credit for the discovery of the effects in question, and for his admirable investigations of them. His work demonstrated very clearly a dependence on hysteresis. This, however, does not enable an immediate explanation of the effects to be given. In the last part of his Royal Institution lecture, Mr. Mordey appears to admit that he cannot find a satisfactory explanation of the phenomena; and there seems to be no suggestion of an interpretation on the lines proposed by Hatfield. Until Hatfield put forward his convincing and essentially simple explanation of the observed movements of the particles, it seems fair to say that a full explanation of the phenomena had not been given.

THE WRITER OF THE NOTE.

Definition and Measurement of General Intelligence

THE fundamental reason why general intelligence cannot be measured exactly by a hierarchical set of tests even if we agree that they define it (unless one of them tests nothing but general intelligence) is that in such a set there is always one more Spearman 'factor' than the number of tests: for each test has its own specific factor, and in addition there is the general factor.

Let z represent a set of k hierarchical test-scores, each test standardised to unity, that is, let $z = Ls$, or

$$\begin{bmatrix} z_1 \\ z_2 \\ z_3 \\ \cdot \end{bmatrix} = \begin{bmatrix} l_1 & m_1 & \cdot & \cdot & \cdot \\ l_2 & \cdot & m_2 & \cdot & \cdot \\ l_3 & \cdot & \cdot & m_3 & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \end{bmatrix} \begin{bmatrix} s_0 \\ s_1 \\ s_2 \\ s_3 \\ \cdot \end{bmatrix} \quad (l_i^2 + m_i^2 = 1)$$

where s_0 occurs in every test, the other s's in one each. Further, let q be the column vector $\{q_0\ q_1\ q_2\ q_3\ .\ .\ .\}$ where $q_0 = -1$ and $q_i = l_i/m_i$ ($i = 1, 2, 3\ .\ .\ .\ k$). After q_k the q's are entirely at our disposal. q' is the transposed of q, and I the unit matrix. Then the orthogonal matrix

$$B = I - 2qq'/q'q$$

has the property that $L\bar{B} = L$, where $\bar{B}$ is the first $k+1$ rows of B. We can therefore write $s = \bar{B}t$ where it is clear that the 'factors' t are different from the 'factors' s although every test is still 'two-factor' and the correlations are unchanged. Thus even if we agree that these tests define general intelligence, we do not know whether it is s_0, or t_0, or u_0, or v_0, or any of the infinite possibilities, all giving different measures for the general intelligence of the whole population. We can rid it of this indeterminateness by adding one or more 'singly-conforming' tests (a better term I think than 'non-conforming' which I used in NATURE of January 12, p. 71).

Whether what the tests thus define is general intelligence is a question for the psychologist, not the mathematician.

University, Edinburgh. Jan. 28. GODFREY H. THOMSON.

Biology of Growth and Breeding

THE observations by Cottam[1] on reproduction and growth of the sea-grass, *Zostera marina*, are of considerable biological interest. He suggests that perhaps the *length* of the growing season may be an important factor in determining the breadth of the leaves in any habitat, and points out that Setchell has shown that reproduction in the species occurs between 15° and 20° C. and growth in the range 10°–20° C. In recent work on increase in shell-area in the oyster[2], I found that there is large spring as well as autumn growth in the Fal Estuary, but only a trace of growth in spring, with a large summer or autumn growth in the River Blackwater. Now in the Fal Estuary the temperature rises slowly from about 10° in winter, whereas in the more insular Blackwater oyster beds the rise is very rapid. Breeding begins in the oyster[3] at about 15°–16° C., and increase in shell-area ceases at the onset of the breeding season. There is thus a longer spring growing period in such hydrographical situations as the Fal Estuary than in localities like the Blackwater.

The parallel of growth and breeding in the oyster with *Zostera marina* is striking, as also is the convergence in their biology. It is well known that many animals breed at a relatively small size under relatively high temperatures[3], and the explanation offered[2] is that there are, in many non-stenothermic animals, growth and breeding metabolisms governed by different temperature ranges, which give rise to a physiological antagonism between breeding and growth. It may therefore be deduced that when such an organism has attained a *certain level of maturity*, it will begin to breed providing temperature and other conditions are suitable. This level of maturity may occur at a small size, and if breeding conditions do not then obtain, growth may continue and produce a larger or different facies of organism before breeding occurs. There are winter as well as summer breeders, and the habitat and rhythms of the whole life cycle need to be studied in each species for a full understanding of the biology. The observations made in the study of the habitat of the oyster and the cockle[4], it is interesting to note, may be of value in leading to an understanding of the broad-leaved *Zostera* found in deeper water off the coast of Great Britain.

Department of Zoology, University, Liverpool. Feb. 22. J. H. ORTON.

[1] Cottam, C., NATURE, 135, 306, Feb. 23, 1935.
[2] Orton, J. H., *J. Mar. Biol. Assoc.*, 15, 384, 419; 1928.
[3] Orton, J. H., *ibid.*, 12, 339; 1920.
[4] Orton, J. H., Johnstone Memorial Volume, p. 97, 1934.