LETTERS TO THE EDITOR.

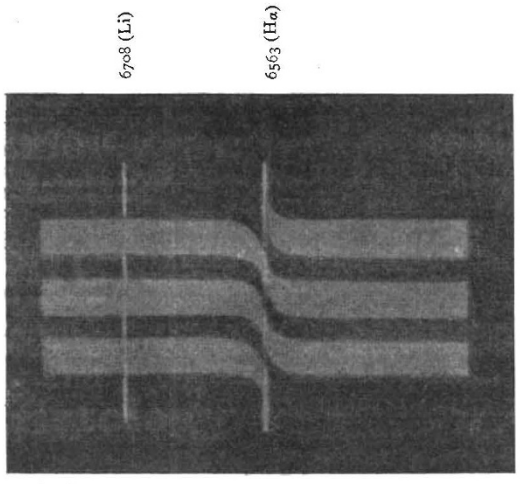
[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE.

Anomalous Dispersion of Luminous Hydrogen.

ON pp. 413 and 607 of vol. lxxvii., and p. 55 of vol. lxxviii., of NATURE, Prof. Schott and Mr. Norman Campbell discuss the question of "The Theory of Dispersion and Spectrum Series." Though not desirous of reopening this discussion, we think the readers of NATURE may take some interest in the results of experiments we have just finished upon the anomalous dispersion of luminous hydrogen.

We used the continuous spectrum given by a narrow capillary tube when filled with hydrogen at nearly atmospheric pressure, and traversed by a convenient current given by a large induction coil. In that spectrum we generated horizontal interference fringes by using a Jamin interferential refractor (*cf.* L. Puccianti, *Nuovo Cim.*, ii., p. 257, 1901), and we sent one of the two rays between the Jamin mirrors through a Geissler tube filled with hydrogen of about 4 mm. pressure.

When this tube is put in series with the capillary tube above mentioned, the interference fringes at both sides close to the red hydrogen line (Hα) suddenly change their direction, as in the accompanying figure, showing directly the



anomalous course of the refractive index near the "absorption line." By measuring the maximum variation of the refractive index (8×10^{-7}) and the breadth of the Hα line (2–3 Å) we find, according to the Drude-Voigt theory of dispersion (*cf.* W. Voigt, "Magneto u. Electro-optik," p. 114, 1908), that the ratio of the number of "electrons of dispersion" to that of molecules of hydrogen is only about 1 to 50,000, and that the damping-constant (*cf.* Voigt), measured in wave-lengths, is of the order 2–3 Ångström units.

We have not succeeded in detecting anomalous dispersion at the other hydrogen lines, which is expected to be much smaller than that at the Hα line, on account of the smaller absorption (*cf.* R. Ladenburg, *Verh. d. deutschen phys. Ges.*, x., p. 550, 1908).

We conclude that our experiments show that it is not possible to explain the dispersion of luminous hydrogen by the existence of one class of electrons only as in the case of non-luminous hydrogen; we have to introduce new "electrons of dispersion," and the frequencies of these seem to be those of the lines of the so-called first series of hydrogen.

RUDOLF LADENBURG.
STANISLAW LORIA.
Physical Laboratory, University of Breslau,
October 17.

The 4·79 Period of Sun-spot Activity.

IN NATURE of August 13 (p. 351) the photograph is published of two groups of sun-spots taken on August 6, and attention is directed to the remarkable fact that such an outbreak should occur two years after the sun-spot maximum. This renewed sun-spot activity is connected with the 4·79 period, which I have shown to have been quite persistent—even more so than the eleven-year period—since sun-spots were first systematically observed. In a paper published in the Philosophical Transactions for 1906 I gave the times of maxima of this period as being $1903{\cdot}72+4{\cdot}79\,n$. This would bring the maximum to 1908·51, or to about July 1 of the present year. A retardation of one month in a period of more than four years' duration is, of course, insignificant.

Simla, October 19. ARTHUR SCHUSTER.

Memory in the Germ Plasm.

DR. ARCHDALL REID repeats (NATURE, October 15, p. 605) his well-known opinion that from infancy forwards a man develops physically and mentally, principally under the stimulus of use, and he adds, "*the muscles of an infant's limbs do not grow unless used.* His mind is almost blank at birth, but grows under the influence of experience (use). In this way *he learns to coordinate his muscles*, and a vast deal more."

There are no italics in the original, but it is to these two statements that I desire to direct attention.

In regard to the first of them, we may well ask what evidence Dr. Reid can adduce for such a statement. It would be nothing but a vague and even false analogy if he relies upon what happens when limbs are paralysed owing to damage to the spinal cord. Physiologists generally would surely believe that the muscles of an infant tend to grow after birth, just as its bones tend to grow—those of the skull, for instance—quite irrespective of use, however much the process may in some cases be accelerated by use.

Then, again, there are crucial facts to show that in regard to many most complicated movements it is not necessary for a child to "learn to coordinate his muscles." On the contrary, the possibility of coordinating very many muscles, even for such very complex acts as speaking and walking, is brought about as a result of the inheritance of cell and fibre groupings in the brain and spinal cord which only become perfected after birth. It is true that for both these complex muscular acts it commonly happens that trials and failures are made while the nerve mechanisms are developing—hence children may seem to acquire these accomplishments solely as a result of experience. But the real all-important share of inheritance in bringing about the possibility of performing the complex muscular acts in question is conclusively shown by cases in which, from some cause, speech or the ability to walk is delayed to a comparatively late period—when the related nervous mechanisms have had time to become developed. Then, under the influence of some strong excitement, a child who has never spoken a word up to two or even five years (but whose sense of hearing is good) may suddenly begin to speak clearly without antecedent attempts of any kind. Cases of this sort may be found recorded in my work "Aphasia and other Speech Defects" (pp. 5–8).

The same kind of thing may occur in regard to walking. When mentioning the cases of untaught speech above referred to one day to the late Sir Richard Quain, he told me that one of his children, up to the age of two years, "had not walked a step, or even tried to walk, when one day he put her down in the standing position, and to his great surprise, as well as to that of the nurse, she walked from one side of the room to the other." This also was an untaught act, as there had been no previous trials and failures" ("Brain as an Organ of Mind," p. 607).

Thus, because insects and many other animals, as Dr. Reid says, "come into the world fully equipped physically and mentally to cope with their environment," and man does not, it does not at all follow that the inherited formative tendencies of man may not go on to a considerable extent after birth, even though use, in the majority of cases, does come in as a cooperating cause