

obtained from acetone³ can be raised to nearly 30 per cent by suitable modification of the method. The conversion of the tricarballic derivatives into the corresponding aconitic acids is being investigated.

R. D. DESAI,
Muslim University,
Aligarh.

R. F. HUNTER.
G. S. SAHARIA.

¹ Higson and Thorpe, *J. Chem. Soc.*, 89, 1455 (1906).
² Desai, Hunter, Ghulam Khan and Saharia, *J. Chem. Soc.*, 416 (1936); Waheed Bukhsh, Desai, Hunter and Mehdi Hussain, *J. Chem. Soc.*, 1159 (1936); Desai, Farooq and Hunter, *J. Chem. Soc.*, 1162 (1936).

³ Clemo and Welch, *J. Chem. Soc.*, 2621 (1928).

The Retinal Centre as an Amplifier of Potential Differences

FROM the histological point of view the retina may be regarded as a nervous centre, a piece of the brain, projected on the surface of the body. With other centres it shares the property of responding to stimulation with slow potential changes. Thus, when light falls on the eye, the corneal electrode becomes positive with respect to an electrode behind the eye (vertebrate eye with inverted retina). This change coincides with the appearance of impulses in the optic nerve. Negativity of the corneal electrode coincides with inhibition of the discharge in the nerve¹. Below we are only interested in the initial positive phase of the retinal response, called the *b*-wave (see Fig. 1), known to be a measure of excitation.

Assume that at regular intervals a *b*-wave is elicited by a constant stimulus, and that on top of this *b*-wave is thrown another stimulus. The latter, the 'test light', exceeds the former 'adapting light' in strength and therefore succeeds in eliciting a second small *b*-wave on the falling part of the *b*-wave, caused by the adapting light (Fig. 1).

As 'test lights' are now chosen two stimuli which taken by themselves differ in size by about 8 per cent. They are then in turn superimposed upon the *b*-wave set up by the regularly recurring 'adapting light'. Do the small *b*-waves to which the test lights now give rise still differ by 8 per cent? An experimental answer is easily obtained. The superimposed *b*-waves are found to differ by, say, 34 per cent, to quote figures actually obtained in an individual experiment. Thus the difference between the test lights has been amplified owing to the fact that the retina has been charged by an earlier stimulus. This 'amplifier principle' has been studied in several ways, mostly with fairly strong stimuli, differently introduced with respect to the various phases of the electro-retinogram.

The fact that amplification may occur in a centre is obviously of general interest for all those who in different fields are trying to understand the working of the central nervous system in terms of simple principles. It illustrates a way of attacking the complicated functions involving differentiation. From the point of view of vision, the amplifier principle gives a clue to an understanding of processes of discrimination such as 'visual acuity', 'brightness discrimination', etc., all of which within limits are favoured by bright stimuli and an illuminated background. Together with many other recent results

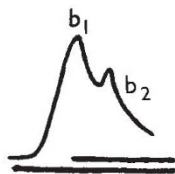


Fig. 1.

RETINAL RESPONSE :
*b*₁ DUE TO 'ADAPTING
LIGHT', *b*₂ TO 'TEST
LIGHT'.

obtained with the electro-retinogram, it points to the significance as well as to the necessity of considering small eye-movements in connexion with visual discrimination.

RAGNAR GRANIT.

Physiology Institute,
University, Helsingfors.
March 4.

¹ Granit, "Die Elektrophysiologie der Netzhaut und des Sehnerven . . .", *Acta ophth., Kbh.*, Supp. 8 (Levin and Munksgaard, 1936).

Perception of Weight and Elasticity

IN experiments on the perception of elasticity, we have found that individuals equate a pull on an expanding elastic spring with a much *lighter* lifted weight impression. Lifting a weight of 2.50 kilograms (for which the psycho-physical limen is of the order 0.10 kilogram) was matched by one person with a pull as large as 6.50 kilograms (probable error 0.20 kilogram). On the average, from results with some fifty persons, a lift of 2.50 kilograms is matched for weight with a pull on a spring of 4.00 kilograms approximately (probable error 0.25 kilogram). The under-estimation of the spring or elastic pull in terms of weight perception is of the same order irrespective of whether the subject begins with a zero pull in the spring, gradually increasing this until a match with the lifted weight impression is obtained, or whether he begins with a pull of the order 8.00 kilograms, gradually decreasing this until a match is obtained. The effects are just as marked, also, when a pull is used as standard for comparison with a series of lifted weights.

This difference between the effects of a pull and a lift points to phenomenological differences in the impressions of weight and elasticity, and has interesting practical bearings on the general psychology of physical training. An account of our experiments will be published, it is hoped, in the *British Journal of Psychology*.

D. KATZ.

Högskola, Stockholm.

W. STEPHENSON.

University College, London.

March 29

Scientific Research in Spain

GRATIFYING evidence that scientific investigation and literary research are by no means at a standstill in Spain has been received by the Society for the Protection of Science and Learning, the permanent successor to the Academic Assistance Council.

With their letter dated February 24, 1937, Prof. Manuel Marquez Rodriguez (dean of the Faculty of Medicine in Madrid), Prof. P. Carrasco (dean of the Faculty of Science in Madrid) and Dr. T. Navarro Tomas (director of the National Library)—all well-known authorities—have sent two copies of recent numbers of the *Anales de Fisica y Quimica*, a copy of *Revista de Filologia Espanola* and a copy of the *Anuario del Observatorio de Madrid* for 1937, which last has recently been referred to in *NATURE* (April 10, p. 624).

The continuation of such original work as is described in the above publications—and others are to follow—has been made possible by the founding by the Ministry of Education of the *Casa de la Cultura* of Valencia, the objects of which appear to be similar to those of this Society. The *Casa de la*