diameter without an immediate commensurate increase in volume[4]. The samples and experiments illustrate the wide range of variation in annual rate of growth, and indicate that well thought out and long standing experiments in the sea are needed in different localities to obtain satisfactory data correlated with the environmental conditions. It is hoped to begin such experiments in the near future.

The relation of mean axis lies somewhat closer than mean diameter to volume and offers a better criterion of comparison between different stocks of oysters. The difference between certain types of Essex natives and Fal Estuary bank oysters already noticed[4] is given definite expression in the deduced graphs (see Fig. 1, R^2 and *F.E.B.*) for the relation of volume to mean axis, details of which will be published later.

The resemblance of the shape of *O. edulis* to a segment of a sphere is real, since the 'heights' (h) of segments of spheres having the same volume and mean diameter as the major oyster samples noted above give the straight line graph in Fig. 1, within experimental error, when plotted against mean diameter. (Prof. L. Rosenhead kindly gave me a formula for finding unknown heights from given diameter and volume.) The fundamental shape of this oyster is therefore a function of that of a segment of a sphere; for a definite relation also exists between segment heights and observed oyster widths, as will be shown when the subject can be treated more fully at a later date.

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Dec. 20.

[1] Orton, J. H., Report on a Survey of the Fal Estuary Oyster Beds, p. 12, Falmouth, 1925.
[2] *ibid.*, Fig. 9, p. 22 and p. 23.
[3] Orton, J. H., Parke, M.W. and Smith, W.C., NATURE, 131, 26; 1933.
[4] Orton, J. H., *J. Mar. Biol. Assoc.*, 15, 367 and 418; 1928.

Detection of Nuclear Disintegration in a Photographic Emulsion

IT has been shown recently by Chadwick and Goldhaber[1], and by Fermi and his collaborators[2], that some light nuclei, particularly lithium and boron, are disintegrated by slow neutrons. In the case of boron, the mass-energy relations seemed best satisfied by assuming a disintegration into three particles[1]. The simplest reaction, namely:

$$B^{10} + n^1 \rightarrow Li^7 + He^4 \quad . \quad . \quad . \quad . \quad . \quad (1)^2$$

should, according to the accepted masses of the particles, release some two million e. volts more energy than is observed. Unless the existence of new isotopes, He^5 or Li^8, of improbably low masses, be assumed, no other disintegration into two particles would fit the mass-energy relations.

To decide the type of reaction directly we have made use of the following method. A photographic plate was soaked in a solution of borax and then dried, thus introducing boron into the gelatine. The plate was then exposed for 15 hours to a radon-beryllium neutron source of strength 80 millicuries, enclosed in a thick lead cylinder to reduce the effect of the gamma-rays. Both source and plate were surrounded by paraffin.

One of us (H. J. T.) has worked for some time on the detection of fast particles by the tracks produced in photographic emulsions. By the courtesy of the research staff of Messrs. Ilford, Ltd., new types of plate have been prepared specially suitable for this work, and we have used these special plates in the present experiments.

The plate impregnated with borax shows, under a high magnification, numerous short straight tracks, of which the equivalent length in air is $1{\cdot}1 \pm 0{\cdot}1$ cm. There are some 50,000 such tracks per sq. cm. of the plate. A photomicrograph of one of the tracks is reproduced (Fig. 1. $\times 1250$). Control experiments with untreated plates show that the tracks cannot reasonably be ascribed to any other cause than the disintegration of boron by slow neutrons.

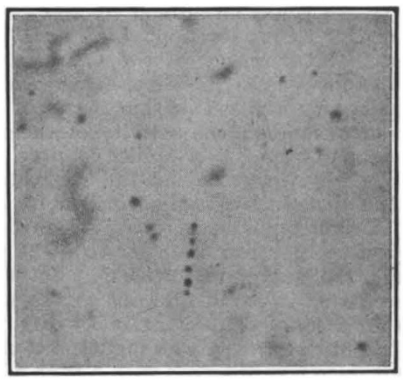

FIG. 1.

Tracks of this kind cannot be due to a three-particle disintegration, and we must therefore conclude that the disintegration takes place according to reaction (1), which requires that the mass of the B^{10} atom should be $10{\cdot}011 \pm 0{\cdot}001$, the other masses being known to within fairly narrow limits.

Note added in proof: In a similar way, by using a salt of lithium, we have obtained tracks which correspond to the reaction

$$Li^6 + {}_0n^1 \rightarrow He^4 + H^3. \quad . \quad . \quad . \quad . \quad . \quad (2)^1$$

The length of these tracks represents the sum of the ranges of the two resultant particles, and is found to be $6{\cdot}9 \pm 0{\cdot}2$ cm. air.

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M. GOLDHABER.

Cavendish Laboratory,
Cambridge. Feb. 11.

[1] NATURE, 135, 65, Jan. 12, 1935.
[2] Amaldi, D'Agostino, Fermi, Pontecarvo, Rasetti and Segrè *Ricerca Scientifica*, VI, vol. 1, No. 2, Jan. 31, 1935.

Directed Diffusion or Canalisation of Slow Neutrons

IT has been shown by Fermi and his collaborators[1] that the efficiency of radioactivation of certain elements by neutron bombardment is greatly increased by surrounding them with water, paraffin or similar hydrogen-containing substances. This effect is attributed to multiple collisions between neutrons and protons, similar to those due to the thermal agitation of gas molecules, producing reduction in speed of the neutrons, which facilitates capture by other nuclei.

It was pointed out to us by Dr. Leo Szilard, who was then working in this laboratory, that this retardation by diffusion should afford a possible method of controlling the direction of propagation of slow neutrons. The mean free path of slow neutrons between successive collisions with protons is considerably less than their range in air. Consequently,