LETTERS TO THE EDITORS

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Liquid-Emulsion Methods in Electron Track Radiography

IN an earlier communication¹ reference was made to the possibility of using track radiography as a means of detecting and estimating the content of radioactive isotopes in biological specimens. Since that note was published, further work using a new 'liquid-emulsion' technique has brought us nearer the goal of successful quantitative estimations. The experimental technique employed was briefly as follows.

A suitable culture of *Paramecium caudatum* was washed by centrifuging, and resuspended in a fresh culture medium containing phosphorus-32 at an activity of 0.01 $\mu\text{C./ml.}$ After one hour in this medium, the organisms were centrifuged out and washed three times rapidly with a non-radioactive medium, fixed in 10 per cent formalin and stained with Mayer's 'Haemalum' after photographic processing. The washed suspension of fixed and stained Protozoa was added in darkness to a few drops of freshly melted unhardened Ilford G.5 emulsion (previously stored in a refrigerator). The emulsion containing the organisms was poured on to a glass slide, rapidly dried in the dark by a current of air at a relative humidity of approximately 60 per cent, and the preparation was left for 24 hr., at the end of which time the emulsion was developed by the normal low-temperature cycle technique employed for thick emulsions.

In such a preparation the tracks of electrons originating from each organism can readily be seen and, with care, counted. A frequency polygon of the number of electron tracks from 136 individuals is shown in Fig. 1; Fig. 2 shows a few of the tracks at a single focal level in the plane of one organism. The very marked skewness of the distribution is a constant feature of such experiments, and further studies are being made to determine the factors responsible.

The use of liquid emulsion in this work permits a most intimate and permanent contact of specimen and emulsion, not readily obtainable in any other way. The possibility of following the tracks from the organism eliminates any artefacts due to chemical action of the organism on the emulsion². The refrigerated emulsion does not accumulate latent tracks

Fig. 1

Fig. 2

from cosmic ray sources during storage, and will keep fresh for weeks and possibly months without deterioration. Exposure times can thus be adjusted to the tracer content of the organism with a minimum background error, and organisms containing as few as 100 atoms of phosphorus-32 can be employed—with, of course, a correspondingly high statistical uncertainty in their content of phosphorus-32.

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¹ Harris, Sloane and King, *Nature*, **166**, 25 (1950).² Boyd and Board, *Science*, **110**, 586 (1949).

Radioactivity of Rocks: an Improvement in the Photographic Technique

EXISTING methods¹⁻³ for the study of the radioactivity of thin sections of rock using 'Nuclear Research' photographic plates suffer from difficulties in technique. The use of a photographic plate to study the distribution of radioactivity in a thin section of rock entails the removal of the rock section from the emulsion during processing, followed by accurate replacement so that emulsion and section can be examined together. Accurate replacement of the section by mechanical means in its original position relative to the emulsion is obviously difficult, and in addition, since emulsion and thin section must be viewed through the thickness of the glass plate, normal immersion objectives of high resolving power cannot be used. The accurate correlation of alpha-tracks in the emulsion with specific mineral grains or boundaries is also complicated by the presence of an air gap between section and emulsion during exposure, especially in the case of alpha-tracks which may enter the emulsion at small angles of incidence. The error in correlation due to the presence of this air gap may be aggravated if distortion of the emulsion should occur during processing, or if the surface