LETTERS TO THE EDITORS

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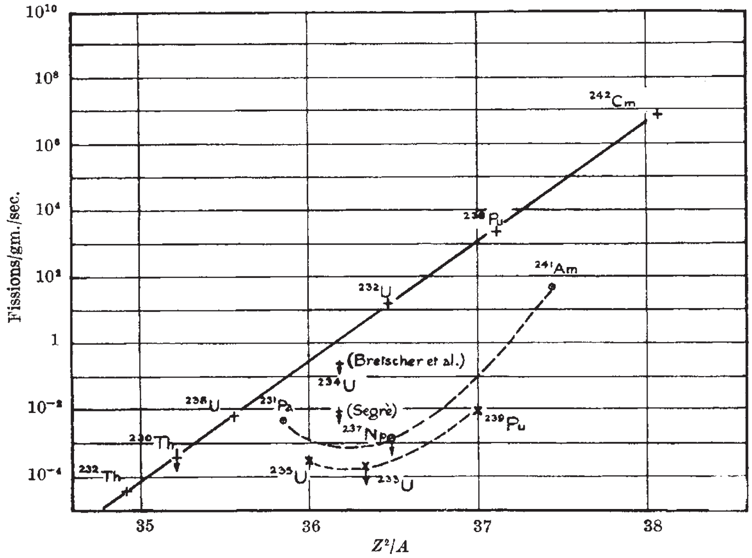
Spontaneous Fission Rates

MEASUREMENTS of the spontaneous fission rates of nearly twenty nuclides have recently been published. Most of these are given in a paper by Segre[1], in which he describes the work carried out at Los Alamos during the War, and also sums up the results of other experiments. Measurements on curium-242 have been published by Hanna *et al.*[2].

The purpose of this communication is to point out the consequences of plotting the spontaneous fission rates against the parameter Z^2/A, which plays so important a part in the liquid drop theory of fission[3]. This is done in the accompanying graph. A number of the spontaneous fission rates are quoted only as upper limits, indicating, as a rule, that no fissions have been observed after a certain period of counting. This is shown in the diagram by a downward arrow from the point in question. The points for radium-226 and neptunium-239 have been omitted from the diagram, since there is reason for believing that the upper limits quoted are very much above the true values.

It will be observed, first, that all the spontaneous fission rates of the even–even isotopes lie, with one exception, very nearly upon a straight line. There are indications that this is actually a shallow curve, concave upwards, but the present data do not justify any estimate of its curvature. The exception of uranium-234 is so striking that the question of experimental error cannot be dismissed. Three separate counts have been made[1,4,5] upon two separate specimens of this isotope, and no fissions have been observed. The only possibility of error lies, therefore, in the preparation of the specimens and the estimation of the content of uranium-234.

The spontaneous fission rates of the odd–even and odd–odd isotopes are less than those of the even–even isotopes by several orders of magnitude. Experiments upon them are therefore more difficult and there are correspondingly fewer accurate data. There are, however, indications that the points for these isotopes lie upon two curves, and that the rates for the odd–even isotopes are in general lower than those for the odd–odd isotopes.



Spontaneous fission rates as a function of Z^2/A: +—+—, *A* even, *Z* even; ⊙—⊙—, *A* odd, *Z* odd; ×—×—, *A* odd, *Z* even

The method of plotting the spontaneous fission rates which has been employed here has the advantage of using only the experimental results and the parameter Z^2/A, which, while it is commonly employed in the liquid-drop model of the nucleus, is not related to the details of any particular theory. In fact, none of the current theories of fission appears to offer any explanation of the marked dependence of the spontaneous fission rate upon the exact number of protons and neutrons in the nucleus.

We have been given to understand that similar considerations have been put forward by Dr. Seaborg and his colleagues.

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Harwell, Berks. Nov. 12.

[1] Segre, E., *LADC* 975.
[2] Hanna, Harvey, Moss and Tunnicliffe, *Phys. Rev.*, **81**, 466 (1951).
[3] Bohr and Wheeler, *Phys. Rev.*, **55**, 426 (1939).
[4] Bretscher, Cook, Martin and Poole, British Report *BR* 384.
[5] Blanchard, Gofman and Seaborg (quoted by Segre).

The Lotmar–Picken X-Ray Diagram of Dried Muscle

DURING the past twenty-five years, four samples of dried muscle have been made which show a striking X-ray diagram, with sharp diffraction maxima superimposed on the α-keratin pattern usually obtained from muscle. These samples of muscle were from the frog (sartorius muscle, Herzog and Jancke[1]), the mussel *Mytilus edulis* (Lotmar and Picken[2]; we have been informed by these authors that the muscle used was the anterior byssal retractor, rather than the posterior adductor, as stated in their paper), the scallop *Pecten* (adductor muscle, Bear and Cannan[3]), and the squid *Loligo* (funnel retractor muscle, Bear and Cannan[3]). Lotmar and Picken proposed a monoclinic unit of structure, with $a_0 = 11 \cdot 70$ A., $b_0 = 5 \cdot 65$ A., $c_0 = 9 \cdot 85$ A., $\beta = 73 \cdot 5°$, and they suggested that the crystalline substance, assumed to be protein, contains nearly extended polypeptide chains, parallel to the *b*-axis (the fibre axis), with two of these chains (four amino-acid residues) per unit cell. We have also discussed the X-ray pattern, on the assumption that the crystalline substance is a protein, and have suggested that the structure of the protein is that of the 3·7-residue helix[4].

Recently, Bear and Cannan[3], and also Bamford and Hanby[5], have pointed out that the length of the unit cell along the fibre axis is not 5·65 A. but only 5·3 A., and Bear and Cannan also have expressed serious doubt that the crystalline material is a protein. Some months ago, Dr. L. E. R. Picken and Dr. W. Lotmar kindly sent us their original photographs, and also their original sample of dried muscle. The sample of muscle no longer gives the crystalline pattern. On re-measuring the Lotmar–Picken photo-

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