Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 114.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Production of Positron and Electron Pairs by Bombardment of Mercury with β-Particles of Low Energy

SKOBELZYN and Stepanowa[1] have reported the production of positrons when β-particles of energy 1–3 MV. impinge on solid lead. In order to conserve electric charge, the phenomenon must have involved the production of a pair of positive and negative electrons. Examination of about a thousand photographs of the tracks of β-particles from radium E in a mixture of 5 per cent mercury dimethyl vapour and 95 per cent nitrogen, in a Wilson chamber, has rather surprisingly yielded two definite cases of the production of pairs of positrons and electrons by β-particles of energy just greater than 1 MV. It is quite clear that phenomena of this kind would be very difficult to detect unless the bombarded element was in gaseous form. Measurement of the best pair gave the following result, where E_β is the kinetic energy of the incident β-particle:

MV.					
E_β	E_+	E_-	ψ_+	θ_-	$(\psi_+ + \theta_-)$
1·10	~0·15	0·013	48°	77°	125°

The energy of the electron was determined from its range, that of the positron from its radius of curvature. The latter could not be determined with great accuracy owing to the shortness of the illuminated portion of the track, but energy appears to be approximately conserved. The absence of a second negative electron track at the point of creation of the pair is of considerable interest. Its energy, after escape from the nucleus, may have been less than 2,000 volts, rendering the track of the particle undetectable; but the possibility of absorption by the nucleus must not be left out of account.

The total length of track of β-particles between 1 MV. and 1·3 MV. was about 40 metres and the effective cross-section of the mercury nucleus would accordingly be about 10^{-22} cm.^{2}. Statistical fluctuations would prevent any great reliance being placed upon this figure, but it is in approximate agreement with that deduced by Skobelzyn and Stepanowa. Previous results[2] have shown that not one pair is produced in 200 metres of similar track in nitrogen. It would therefore appear that the probability of pair production by β-particles of low energy (*a*) increases rapidly with the atomic number, (*b*) is large in the region $E_\beta \sim 2mc^2$. Unfortunately, there does not seem to be as yet any theoretical treatment of the production of pairs by a β-particle which has itself a kinetic energy just greater than $2mc^2$.

It is plausible that there may be also an 'internal production' of pairs by the nuclear β-particles. Possibly a part of the γ-radiation from radium E, found by G. H. Aston[3], may arise from the annihilation of the positrons formed by the internal conversion of the β-rays of energy greater than $2mc^2$. If this effect is at all appreciable, it will have to be taken into account in interpreting experimental data on the energy distribution in continuous β-ray spectra, since it would lead to a preferential weakening above 1 MV. and a corresponding increase in the region of low energies.

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[1] *J. de Phys. et le Radium*, **6**, 1 (1935).
[2] Champion, *Roy. Soc. Proc.*, A, **153**, 353 (1936).
[3] *Camb. Phil. Soc. Proc.*, **23**, 935 (1927).

Porphyrins of the I and III Series in Congenital Porphyrinuria

As the result of a detailed chemical examination carried out *post mortem* upon a bovine suffering from congenital porphyrinuria[1], and my paper appearing in the *Onderstepoort Journal of Veterinary Science* (vol. 7, No. 2), I have been able to isolate porphyrins similar to those found by Fischer[2] and his collaborators in the human porphyrinuric 'Petry', but in addition have also obtained coproporphyrin, ester m.p. 243–44°, from the *blood plasma* and of m.p. 241° from the washed *erythrocytes*; both uroporphyrin, ester m.p. 276–77°, and coproporphyrin, ester m.p. 244–45°, from the *bone marrow*; uroporphyrin, ester m.p. 278°, from the *spleen* and uroporphyrin together with its copper complex, ester m.p. 313°, from the *liver*.

The isolation of coproporphyrin I from the blood is important as supplying a basis of explanation for the photosensitivity exhibited by the animal.

The melting points of the uroporphyrin esters, including those from the bones and urine, approximated to 278°, whilst Fischer reported 293° for pure uroporphyrin I, thus suggesting that a mixture of isomers might be present. This suspicion was enhanced by the isolation from the mother liquors of the crystallization of the bone product of a uroporphyrin ester with m.p. 253–55°. A scheme of chromatographic separation of the I and III series porphyrin isomers has been worked out using a column of alumina and dioxan as the solvent. A note upon the separation of uroporphyrins from urine and bones in these cases into I and III series isomers is attached as an appendix to my publication, already referred to, which is in the press. The bile coproporphyrin (m.p. 237°), after similar treatment melted at 246–48°, whilst a trace of pigment remaining in the column was found also to have a coproporphyrin spectrum; the quantity was insufficient for crystallization.