near Oxford a variant which had vegetative characters nearly those of *J. acutiflorus* and reproductive characters resembling those of *J. articulatus*, and which was quite fertile. This he had called "Large 80" on account of the chromosome complement, and no satisfactory suggestion had been made for dealing with it taxonomically.

In the last paper of the series Dr. R. W. Butcher (Ministry of Agriculture) considered "Some Problems of Water Buttercups". The aquatic Ranunculi provided an exceptionally good example of the effect of environment on morphology, and by growing them in tanks under controlled conditions he had been able to study the effect of depth of water, exposure to air, and the problem of the production of floating leaves. The study of the variants which occurred in rivers showed that there were probably three species, of which one was new.

Throughout the Conference, exhibits of herbarium material, photographs and diagrams were on view to illustrate features of various critical groups. Dr. Butcher, Prof. Clapham, Dr. Sprague and Mr. Watson displayed material referred to in their papers, and some of the other exhibitors gave short talks. Mr. G. M. Ash directed attention to the convenience of having leaves and dissections mounted separately on small cards for ease of comparison, as shown in his exhibit of *Epilobium*. Dr. K. B. Blackburn showed *Limosella aquatica* and *L. subulata* with the fertile colchicine-induced hybrid between them. She had worked on material from Wales supplied by Miss E. Vachell. Mr. C. E. Hubbard (Kew) spoke on his large series of grasses. His account of variation in *Agropyron* and *Poa pratensis* illustrated difficult problems. Dr. J. M. Lambert (Westfield College, London) described the ecology of *Glyceria* very clearly and directed attention to some remarkable variants she had found. Mr. J. E. Lousley outlined the cytogenetical work done on British species of *Rumex* abroad and indicated a number of problems in which he appealed for the assistance of a cytologist in his studies. His exhibits of wild and cultivated material of the tetraploid *R. tenuifolius* compared with the commoner hexaploid *R. Acetosella*, of the sterility of hybrids of the *Lapathum* subgenus, and of variation coupled with geographical distribution in the subspecies of *R. obtusifolius* and *R. pulcher*, and of variation proved to be due to habitat conditions in *R. maritimus*, illustrated various aspects of the subject. Prof. T. G. Tutin (University College, Leicester) showed material of *Bromus*. A plant which occurs at the Lizard is suspected of being *B. Ferronii* Mabille, which was described from western France. Mr. S. M. Walters (Cambridge) spoke on *Alchemilla*, of which he had recently carried out a revision.

The other exhibits included "Variation and Ecology in the British Watercresses" by Mr. H. K. A. Shaw (Kew), *Carex* by Mr. E. Nelmes (Kew), *Agrimonia* by Mr. N. H. Brittan (Newcastle), *Cardamine* by Miss F. Hussein (Newcastle), groups of British *Rubi* by Miss Y. Massey (Newcastle) and *Mentha* by Mr. R. Graham.

It was with certain misgivings that the organisers had arranged a 'brains trust' to conclude the proceedings of the Conference; but this feature proved an outstanding success. Acting as question master, Mr. J. S. L. Gilmour introduced the members of the trust: Miss M. S. Campbell, Profs. C. E. Raven and T. G. Tutin, Dr. E. F. Warburg and Messrs. J. E. Lousley and A. J. Wilmott—with pseudo-scientific names. The questions ranged from such subjects as the spelling of trivials with small initial letters, and estimates as to the relative greatness of field-botanists of the past, to the definition of an 'over-winter annual'. Although the 'brains trust' was arranged as a less serious item in the programme, there can be no doubt that the opinions provided on controversial subjects were of considerable value.

The outstanding feature of the Conference proved to be the revelation of the deeply interlocking nature of the studies of the very varied botanical interests represented. There was a spirit of eager collaboration among the 114 members and guests who attended. Cytologists were eager to help ecologists, amateur botanists to assist professionals, and *vice versa*. The Botanical Society of the British Isles proposes to foster this synthetic approach to taxonomy and, as the president stated in his concluding remarks, the note of collaboration engendered at the Conference will not be allowed to die.

The officers of the Society and in particular the secretary, Miss M. S. Campbell, and the assistant secretary, Mr. W. R. Price, are to be congratulated on the success of the first Conference arranged by the Society. The comfort of those who attended was ensured by the excellent accommodation provided by the Royal Horticultural Society. J. E. LOUSLEY

EMISSION OF Li^8 IN THE EXPLOSIVE DISINTEGRATION OF NUCLEI

By C. FRANZINETTI and R. M. PAYNE

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IN a recent communication from this Laboratory[1], it was shown that unstable heavy nuclei are sometimes emitted during the explosive disintegrations produced in photographic plates by the passage of cosmic radiation. In some cases, these unstable particles, after being brought to rest in the emulsion, give rise to two particles of equal range, emitted in opposite directions. The characteristic tracks thus produced were referred to as 'hammer tracks'; and it was suggested that they are due to the emission of a nucleus of Li^8 during the disintegration, for this nucleus is known to suffer β-decay with a period of 0·88 sec.[2], and simultaneously to decompose into two α-particles. Twenty-eight examples of this process have now been observed in this Laboratory, and it has been possible to establish the correctness of the original interpretation of the phenomenon.

Figs. 1 and 2 show two examples of 'hammer' tracks which are of particular interest. In Fig. 1, the range of the heavy fragment is 60 μ, corresponding to an original energy of emission of the particle of approximately 15 MeV. Fig. 2 shows the tracks resulting from a disintegration, produced at the end of its range by a meson, σ. This transmutation results in the emission of two lightly ionizing particles, p_1 and p_2, which are probably fast protons, together with a fragment which decomposes into two α-particles at the end of its range. The photograph thus provides direct evidence for the ejection of Li^8 in the disintegrations produced by mesons.

In Fig. 3, we show the distribution in range of the α-particles observed in the twenty examples now available for measurement. The corresponding distribution, observed by Christy *et al.*[3], in experi-

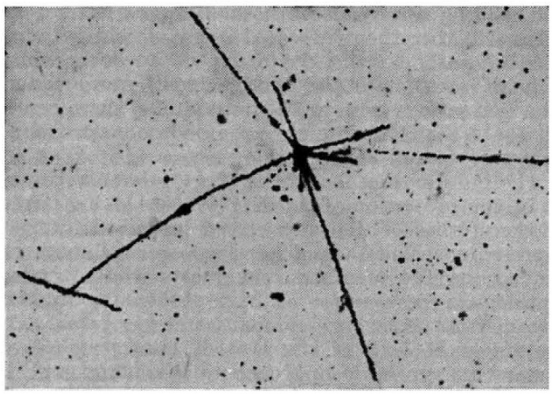

Fig. 1

ments on Li^8 generated in the laboratory in the reaction $Li^7 + H^2 \rightarrow Li^8 + H^1$, is shown by the dotted line in the figure. It will be seen that there is no significant difference in the two distributions. We can, therefore, conclude that the 'hammer' tracks are in fact due to Li^8 nuclei, in accord with the original explanation.

ANALYSIS OF THE 'HAMMER TRACKS'

Number	1	2	3	4	5	6	7	8	9	10	11
Energy of α-pair (MeV.)	4·2	3·8	3·9	5·5	4·3	7·2	5·0	6·7	3·6	2·7	5·8
Angle between α- and Li^8-track	82°	44°	85°	58°	59°	73°	42°	90°	66°	22°	71°

Number	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Energy of α-pair (MeV.)	4·8	2·3	4·6	7·4	2·9	3·9	3·9	2·3	3·7	3·6	2·9	4·0	4·4	1·1	2·6	3·8	2·7
Angle between α- and Li^8-track	—	58°	85°	77°	35°	47°	69°	50°	27°	70°	85°	65°	66°	72°	81°	88°	88°

RELATIVE FREQUENCY OF THE EMISSION OF Li^8 IN THE NUCLEAR DISINTEGRATIONS PRODUCED BY COSMIC RADIATION

Li^8/fission fragments .	= 2·28%
Li^8/fission fragments + α-particles .	= 0·37%
Li^8/fission fragments + α + protons .	= 0·185%

The accompanying table shows the details of the measurements made on the individual events. In accord with the explanation of the phenomena given above, the observations show that the directions of motion of the α-particles are orientated at random with respect to the lines of motion of the parent Li^8 nuclei at the end of their range. The table also shows the frequency with which Li^8 nuclei are emitted, as compared with heavy fragments, protons and α-particles, in the 'explosive' disintegrations produced by cosmic rays.

In the β-decay of Li^8, the momenta of the electron and the neutrino, commonly assumed to be ejected during the transformation, cause the resulting Be^8 nucleus to recoil. It follows that if the disintegration of this nucleus into two α-particles takes place in a time shorter than 10^{-22} sec., the two particles should not, in general, be projected in precisely opposite directions. The average difference between the lines of motion of the two particles in the emulsion will, however, only be of the order of one or two degrees. It would be difficult to establish such a difference in the conditions of our experiment, because of the small-angle scattering of the α-particles in the emulsion. As for the difference in energy between the two α-particles, this would be of the order of only a few per cent, and would not be measurable in our experimental conditions.

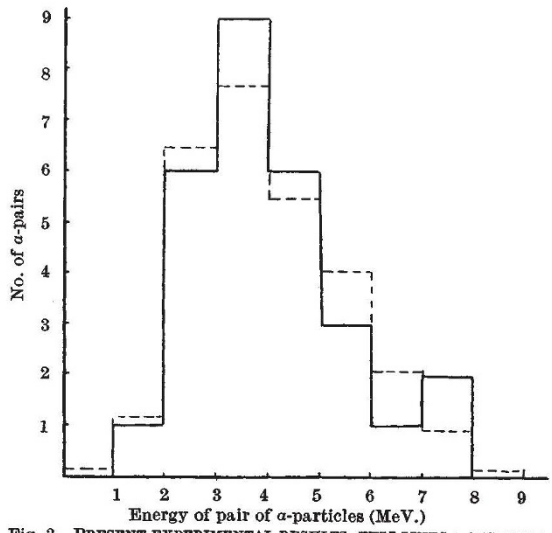

Fig. 3. PRESENT EXPERIMENTAL RESULTS, FULL LINES; DISTRIBUTION OBTAINED BY CHRISTY *et al.*, NORMALIZED TO CORRESPOND TO 28 EVENTS. THE DISTRIBUTION SHOWN IS OBTAINED BY SUMMING THE TWO RESULTS OF THESE WORKERS WITH LITHIUM DEPOSITED ON GOLD AND BERYLLIUM FOILS RESPECTIVELY

In most examples of disintegrations accompanied by the emission of Li^8, it is impossible to identify the original nucleus. Thirteen of the twenty-eight events, however, show that during disintegration, the Li^8 is accompanied by a strongly ionizing particle, probably an α-particle, and a proton. By estimating the energies of the Li^8 nucleus from the known range-energy relation of Lattes, Fowler and Cuer[4], and by applying the principles of the conservation of energy and momentum, it is found that the observations are consistent with the assumption that we are observing the disintegration of C^{12} by a fast neutron.

We are indebted to Dr. C. F. Powell, not only for suggesting this experiment, but also for his continued interest and encouragement; and we take this opportunity of thanking Dr. G. P. S. Occhialini for many helpful discussions and suggestions. One of us (C. F.) was enabled to take part in this investigation by a grant from the University of Bristol, and through the generosity of Mr. A. Giandolini of London.

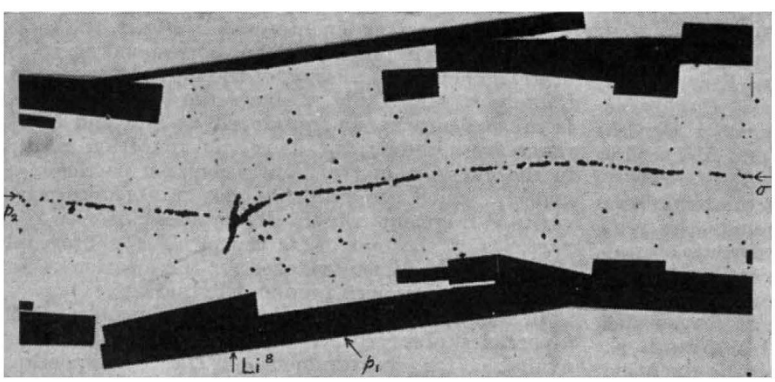

Fig. 2

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[2] Lewis, W. B., Burcham, W. E., and Chang, W. Y., *Nature*, **139**, 24 (1937).
[3] Christy, R. F., Cohen, E. R., Fowler, W. A., Lauritsen, C. C., and Lauritsen, T., *Phys. Rev.*, **72**, 698 (1947).
[4] Lattes, Fowler and Cuer, *Proc. Phys. Soc.*, **59**, 883 (1947).