Scintillations produced by the Electronic "β-Rays" emitted by Radium.

As the β particles emitted by the radio-active elements are analogous to the α particles, inasmuch that they may be considered as parts of the disintegrated atom, and not in any sense true rays, I have been conducting some experiments with the view of ascertaining if, in any circumstances, their action upon fluorescent screens caused recognisable scintillations. It will be obvious that if the radium used be placed too near the screen, the effects of the combined β and γ rays will produce a fluorescence sufficiently vivid to mask any scintillations due to the individual electrons which compose the β stream. In order to diffuse this action and allow the β particles to separate to such a degree that the flashes produced shall not overlap, recourse may be had to three methods:—

(1) Increasing the distance between the radium and the screen.

(2) Making the stream pass through material offering resistance to its passage.

(3) Reducing the quantity of radium used and "diluting" the action by mixing it with non-active substances.

I have tried these methods separately, and in each case have obtained results which were fairly satisfactory considering the difficulties attending this class of observation.

In these circumstances the screen, when viewed with a lens having a focus of about half an inch, was seen to be fluorescing with a faint glow, which was, without doubt, of an unsteady and flickering character.

The phenomena involved are delicate and difficult to observe, requiring the best possible conditions. It is very important that the eyes are thoroughly rested before the observation is made, but the fact that the glow is flickering and strongly suggestive of scintillations is, in my opinion, beyond dispute. After trying various combinations of the above methods, I have obtained results sufficiently decided to justify the statement that the screen was lit up by scintillations properly so called. A screen of zinc sulphide, so very excellent for viewing the scintillations produced by the α particles, does not give satisfactory results for the β stream.

Willemite and barium-platino-cyanide are both fairly good, the latter being rather the better of the two. I have obtained the best results with an ordinary X-ray screen. Having enclosed about 15 or 20 milligrams of radium-barium-bromide (1 per cent.) in a small glass tube, I placed over it a sheet of mica. Over this was placed a sheet of cardboard, and above this again, at a distance of about half an inch, was the screen. When the lens was focused on the screen, a dim fluorescence, due to the γ rays, was seen as a sort of background, on which were visible faint nebulous scintillations coming and going in a manner very similar to the scintillations produced by the α particles on a zinc sulphide screen.

C. W. R.

February 2.

The Effect of Food on the Colour of Moths.

IN a very interesting paper published in the *Journal of Economic Biology* (1905, No. 1), Mr. W. E. Collinge describes and figures a remarkable series of specimens of the magpie moth (*Abraxas grossulariata*, Linn.), obtained as the result of raising the larvæ on lettuce, the ordinary food being currant. The specimens all differed from the type in the direction of great loss of markings, the most extreme one representing the aberration known as *dohrni* or *deleta*. The same sort of effect has been produced on the tiger moth by G. Koch, as a result of feeding the larvæ on lettuce; and a good account of various experiments of the same kind is given by Dr. Vernon on pp. 288–9 of his work on "Variations in Animals and Plants" (1903).

The effect produced in the cases cited may be regarded as a sort of compulsory mutation, though we do not know whether it could in any case be inherited in such a manner that it would remain constant under different conditions. If the normal maculation, which has existed for countless generations, can be transformed in a single one by a new food-plant, it is not likely that the alternate type can be any better fixed.[1] The species must be regarded as potentially dimorphic, indeed, polymorphic, for other quite different aberrations occur. There arises, however, an interesting possibility. Mr. Collinge found that the insects were raised with difficulty on lettuce, and he doubted whether it would be possible to raise three successive generations exclusively on that plant. Suppose, however, that among many which fed on lettuce (or any unwonted food) a few were able to survive, and consequently a lettuce-feeding race became firmly established. Such a race would show the same marked differences from the type which appeared in the first generation, and it is not unlikely that at length it would be as difficult to get its members to live on currant as it originally was to get the currant-feeders to survive on lettuce. We should then have a lettuce-feeding form, very easily distinguished from the currant-feeding one, and nobody would hesitate to call it a distinct species. If it absolutely refused to feed on currant, the peculiar markings would be as fixed as in any species known.[1]

[1] In this connection, *cf.* "The Principles of Heredity," by G. Archdall Reid, 2nd edition, Appendix A, pp. 355–356.

These suggestions appear to have the more force from the fact that some of the lettuce-fed examples strongly recall *Abraxas sylvata*, which feeds on elm, and is universally considered distinct. This *A. sylvata* and its allies form a group of closely allied races in the Palæarctic and Oriental regions, and it would be extremely interesting to ascertain whether these several forms have different food-plants, and whether by changed conditions they can be derived from one another. Many years ago I had occasion to tabulate these forms, using the material in the collection of the British Museum, and in the hope that the matter may be taken up by some eastern entomologist I give here the brief table I made:—

A.—*Markings strongly developed.*
- (*a*) Expanse about 34 mm.; Europe, Siberia, &c. . . . *sylvata*, Scopoli.
  - (α) Markings stronger than type or darker; brown anal blotch more reduced; Japan, &c. . . *sylvata* var. *intensa*, Warren.
- (*b*) Larger; nearly always more than 40 mm. expanse.
  - (α) Markings strong and dark. China and Japan . . . *miranda*, Butler.
  - (β) Markings paler. India . . . *leopardina*, Kollar.
- (*c*) Still larger; expanse more than 50 mm.; markings rather pale.
  - (α) Markings more suffused. N. China . . . *plumbeata*, Warren.
  - (β) Markings less suffused. Silhet . . . *illuminata*, Warren.

B.—*Markings much reduced, but the brown blotches remaining well developed.*
- (*a*) Expanse more than 40 mm.; markings rather more developed than in *pantaria*. India . . . *paucinotata*, Warren.
- (*b*) Expanse more than 35 mm.; Europe . . . *pantaria*, Gn.
- (*c*) Expanse about 30 mm.; markings still more reduced. Europe . . . seasonal form *calaria*, Gn.

Since the physiological adaptation to the new food-plant is not really connected with the change of colour or maculation, it may frequently take place without any externally visible signs, or such signs may only arise after a long period. In this way we get "physiological species," which are no doubt more numerous than is generally supposed.

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[1] Pictet, quoted by G. A. Reid, reported that after several generations on a new food-plant, certain butterflies which had at first been modified reverted to the original type. Of course, the case I have imagined is one in which this does not take place, but experiment is needed to test the possibilities indicated.

A Correction.

IN the review of Prof. Fr. Czapek's "Biochemie der Pflanzen" (NATURE, vol. lxxiii. p. 192) I mentioned that I missed a certain paper by Schjerning. The author's name should have been Weis.

I also overlooked the reference to a paper by Cornevin.

An index of authors' names would enhance the utility of the book.

F. ESCOMBE.