

bromine—the one on which the most trustworthy data have been obtained. Instead of the fluorescent radiation in the particular case carrying away 50 per cent. of the energy of the primary radiation specially absorbed, experiments indicate about 47 per cent. and approximately an equal value for the corpuscular radiation. But there is evidence that with elements of higher atomic weight a limiting value of about 50 per cent. would be obtained. The indication of such a limit gives strong support to the whole theory. On the other hand, from an element of low atomic weight, the experimental value for the fluorescent radiation comes below 30 per cent., and there are indications of even lower values.

It would, however, be remarkable if such a simple theory gave perfect agreement for all elements, and correspondingly all X-radiations. The facts indicated appear of fundamental importance; deviations—real or apparent—will receive investigation and discussion later.

Other important conclusions based on the investigation are that the absorption by an atom is not necessarily in whole quanta of the primary radiation; we have evidence of absorption of primary radiation in quantities of any magnitude between one and two quanta of the primary radiation, or just possibly in fractions of one quantum.

The transformation of primary radiation into fluorescent radiation in certain cases at least is accompanied by little, if any, appreciable loss of energy within the atom.

The energies of X-radiations differing widely in penetrating power are approximately if not accurately proportional to their total ionising powers.

Details of these investigations will be published shortly.

C. G. BARKLA.

Physical Laboratory, The University,  
Edinburgh, February 8.

#### The Green Flash.

So much has been written about the green-ray at sunset that I am somewhat diffident about adding anything. But as I find myself unable to accept the orthodox explanation of the phenomenon usually seen I write this note. This phenomenon, as seen by me on several occasions during the last summer on my way to Australia, always consisted in the last segment of the red sun before disappearance becoming a bright green (without any transition through intermediate tints); this green was as nearly as could be judged the complementary to the red of the sun itself. On one occasion I shut my eyes immediately after the green tint appeared, and it *remained visible*. There could be no doubt that what I saw was the purely subjective after-image of the disappearing segment of the sun. Of course, if this is so, it should be easy to set up a laboratory experiment to imitate the natural phenomenon; and on returning I asked Mr. E. Talbot Paris, research student in this department, to arrange an experiment in illustration. An eccentric hole was made in a disc mounted on an axle. Red glass or gelatine film was fixed over the hole, and a bright light placed behind illuminated the film and produced thereby a miniature sun, which by slow rotation, could be made to "set" behind an interposed card. At the instant of setting, the artificial sun exhibited an exact reproduction of the phenomenon of the green-ray. It was easily possible in this way to obtain a red-ray using a green sun, or a blue-ray with a yellow sun, and so on.

It is easy to give the rationale of the effect. The positive light gradually diminishes as the artificial

sun passes below the horizon; and it only requires a little adjustment of the rate of disappearance in order that the negative after-image excited at a previous instant when the segment was brighter, shall overpower the simultaneous weaker positive image of the remaining segment itself.

It would not be fair for me to dogmatise and assert that this is the only phenomenon which comes under the head of the green-ray. But it is certainly the only one which I succeeded in seeing; and it *must always be present even on the possible rarer occasions when colour changes arising from dispersion are also evident*. It is certainly also what many others saw. At the same time, it must be added that the phenomenon as observed by different persons, even on the same night, was so variously described as to lead one to suppose that the subjective element is sometimes present to even a greater degree than is implied in the above note.

ALFRED W. PORTER.

Physical Department, University College,  
London, February 7.

#### Trenching Ground and Spraying Potatoes.

IN the notice in NATURE, of February 4, of the fourteenth report of the Woburn Experimental Fruit Farm it is suggested that the negative results obtained by us in bastard trenching might have been different had we experimented on vegetables, instead of fruit trees. No doubt the suggestion is correct; and a chance observation last year gave a striking illustration in point. Brussels sprouts were grown in a piece of ground partially occupied by trees; the ground had all been dug, but there were four patches of about four square yards each where it had been practically trenched, by the removal of trees and the digging out of their roots. In each of these patches the sprouts were two to three times larger than those in the intermediate dug ground. Universal experience indicates that a good depth of rich soil is essential for successful vegetable growing; this can only be obtained by trenching and liberal manuring, and nothing in our results should be taken as discountenancing such a practice.

It is also suggested that we should accumulate results on potato spraying to see whether such treatment pays on the average. We are doing so, and those already obtained are nearly sufficient for the purpose. They extend over eight seasons, and are on a fairly large scale, though the diversity in conditions, adopted for other reasons, renders it somewhat difficult to deduce a fair average from them. As it stands, this average is 7.8 per cent. increase on the weight of sound tubers as a result of spraying. Putting the average yield at 7 tons to the acre, and the net price realised at 3*l.* 10*s.* per ton, the value of the increment will be 1*l.* 18*s.* Two sprayings would cost, for materials, labour and use of plant, about 18*s.* to 1*l.* 13*s.*, according to the substance used, and this would leave a margin of profit of from 5*s.* to 20*s.* per acre.

SPENCER PICKERING.

Harpden, Herts.

#### Early Representations of the Giraffe.

THE discussion in NATURE during the past year concerning the first mention in literature of the opossum and kangaroo has suggested a similar inquiry with regard to certain other well-known animals of the New and Old World.

When one examines into the sources whence were derived the illustrations in early printed books on