as the rays become harder. This result is in agreement with that given by Mr. Eve. I find also that in hydrogen, in which the ionisation is much less than in air, the ionisation increases relatively to that in air with the increase of hardness of the rays.

The experiments are not quite completed yet, but it is hoped to publish a full account of them shortly.

R. K. McCLUNG.

Cavendish Laboratory, Cambridge, March 12.

Polarisation in Röntgen Rays.

In a paper on secondary radiation from gases subject to X-rays (*Phil. Mag.* [6] v., p. 685, 1903), I described experiments which led to the conclusion that this radiation is due to what may be called a scattering of the primary X-rays by the corpuscles (or electrons) constituting the molecules of the gas. More recently I have found that from light solids which emit a secondary radiation differing little from the primary, the energy of this radiation follows accurately the same law as was found for gases, so that the energy of secondary radiation from gases or light solids situated in a beam of Röntgen radiation of definite intensity is proportional merely to the quantity of matter through which the radiation passes. Experimental evidence points to a similar conclusion even when metals which emit a secondary radiation differing enormously from the primary are used as radiators, though I have as yet only shown that the order of magnitude is the same in these cases. The conclusion as to the origin of this radiation is therefore equally applicable to light solids, and probably to the heavier metals.

As explained by Prof. J. J. Thomson ("Conduction of Electricity through Gases," p. 268), on the hypothesis that Röntgen rays consist of a succession of electromagnetic pulses in the ether, each ion in the medium has its motion accelerated by the intense electric fields in these pulses, and consequently is the origin of a secondary radiation, which is most intense in the direction perpendicular to that of acceleration of the ion, and vanishes in the direction of that acceleration. The direction of electric intensity at a point in a secondary pulse is perpendicular to the line joining this point and the origin of the pulse, and is in the plane passing through the direction of acceleration of the ion.

If, then, a secondary beam be studied, the direction of propagation of which is perpendicular to that of the primary, it will on this theory be plane polarised, the direction of electric intensity being parallel to the pulse front in the primary beam.

If the primary beam be plane polarised, then the secondary radiation from the charged corpuscles or electrons has a maximum intensity in a direction perpendicular to that of electric displacement in the primary beam, and zero intensity in the direction of electric displacement. Prof. Wilberforce first suggested to me the idea of producing a plane polarised beam by a secondary radiator, and of testing the polarisation by a tertiary radiator.

The secondary radiation from gases is, however, much too feeble to attempt the measurement of a tertiary. From solids I think it will be possible, and hope shortly to make experiments on this.

It occurred to me, however, that as Röntgen radiation is produced in a bulb by a directed stream of electrons, there is probably at the antikathode a greater acceleration along the line of propagation of the kathode rays than in a direction at right angles; consequently, if a beam of X-rays proceeding in a direction perpendicular to that of the kathode stream be studied, it should show greater electric intensity parallel to the stream than in a direction at right angles.

I therefore used such a beam as the primary radiation, and studied by means of an electroscope the intensity of secondary radiation proceeding from a sheet of paper in a direction perpendicular to that of propagation of the primary beam.

By turning the bulb round the axis of the primary beam studied, the intensity of this beam was not altered, but the intensity of the secondary beam was found to reach a maximum when the direction of the kathode stream was perpendicular to that of propagation of the secondary beam, and a minimum when these two were parallel.

In one series of experiments the intensity of secondary radiation in a direction perpendicular to that of the primary beam was compared with that in a direction making a small angle with the axis of the primary beam. The latter, according to theory, should not vary with the position of the X-ray bulb.

In a second series of experiments the intensity of secondary radiation in a direction perpendicular to the axis of the primary beam was compared with that of a small portion of the primary beam itself, when the bulb was in different positions.

Lastly, the intensity of secondary radiation was measured in two directions perpendicular to that of propagation of the primary radiation and perpendicular to each other, while the intensity of the primary beam was measured by a third electroscope.

The three methods gave similar results.

In the last case, as the bulb was turned round as described, one secondary beam reached a maximum of intensity when that at right angles attained a minimum. When the bulb was turned through a right angle the former produced a minimum of ionisation while the latter produced a maximum.

Two bulbs were used and the sizes of the apertures were varied, but the results were similar in all cases.

The variation of intensity of the secondary beam amounted to about 15 per cent. of its value, but this, of course, does not represent the true difference, as beams of considerable cross section were studied, consequently secondary rays making a considerable angle with the normal to the direction of propagation of the primary rays were admitted into the electroscope.

The experiments are being continued.

These results, however, are in agreement with the theory, and I think show conclusively that the X-radiation proceeding from a bulb is partially polarised.

CHARLES G. BARKLA.

University of Liverpool, March 10.

The British Government and Marine Biology.

In a note in your issue of February 25 announcing the appointment of Mr. James Hornell, who, it is stated, acted as Prof. Herdman's assistant during the Ceylon pearl oyster investigation, to the post of marine biologist to the Government of Ceylon and inspector of the pearl banks, it is said that "the appointment is of interest as showing how in the recognition of science some of our colonies are in advance of the mother country. We have no 'marine biologist to the Government' here."

Now although the latter statement may be verbally accurate, it appears to me to be misleading, and one would seem to be justified in supposing that it has been made without full knowledge of the facts.

At the present time the British Government is committed to an expenditure of 42,000*l.*, to be spread over a period of three years, for the purpose of carrying out the British portion of the international fishery investigations, the programme of which, conceived in an eminently scientific spirit, has been drawn up by an international council comprising amongst its members some of the most distinguished of European marine biologists. In addition to this the Government has made for a number of years, and still continues to make, a grant of 1000*l.* a year to the Marine Biological Association, the declared object of which is the promotion of both scientific and economic marine biology; public money has been spent on scientific fishery investigations in both Scotland and Ireland, and the Government has quite recently appointed Dr. A. T. Masterman, a well known and capable marine biologist, to the post of inspector of fisheries.

To decline to acknowledge what is already being done is surely not the way to obtain increased support for scientific investigations in the future.

E. J. ALLEN.

Marine Laboratory, Plymouth.

THE brief statement contained in the note was quite correct, and although it might be expanded and illustrated, it needs no qualification. We were well aware of all the facts stated by Dr. Allen.