is considerable. I make no correction for it here. Presumably we are dealing with an α-ray of the same range as that which must have been concerned in the genesis of the Yitterby haloes.

This range, if taken as 0·005 mm., would correspond to about 1 cm. in air at 15° C. The radioactive element concerned, although associated with the uranium family of elements in the Arendal mica, cannot be a member of that family. This appears from the value which in such a case we must ascribe to λ. It would decay at a rate some billions of times slower than uranium according to an exterpolation on the Geiger-Nutall curve. Now the ring in the Arendal mica must have been formed since early Archæan time and from a nucleus of point-like dimensions.

From all this there seems good evidence that a radioactive element exists (or formerly existed) emitting an α-ray having a range of about one centimetre in air. So far no evidence of its further disintegration has been found.

It seems probable that the development of the small Yitterby halo-spheres represents a very considerable period of time. It will be of interest to see if similar evidence for what appears to be a very long period of Earth-history, seemingly preceding early Archæan time, will be forthcoming from material found elsewhere. It is possible that this period preceded the thermal conditions which generally prevailed during Archæan time and that the survival of the evidence contained in the Yitterby mica was due to local fortuitous conditions. These haloes would, in that case, be a record carried from one geological age to the next.

I wonder am I justified in naming an element from such evidence as I have found—the range of an α-ray? I think it has been done before. If ever it is isolated I would ask the finder to call it Hibernium after this beautiful but most unhappy country.

J. JOLY.

Trinity College, Dublin, April 8.

The Helmholtz Theory of Hearing.

ON a visit to the Cambridge Physiological Laboratory not long ago Dr. Hartridge demonstrated an apparatus of his design that showed the effect of a repeated sinusoid vibration on a series of pendulums of different periods. Each of a series of weights was suspended from a horizontal bar. The strings were all of different lengths; each pendulum had thus a different period. The horizontal bar was connected with a wheel so that it could be moved back and forth harmonically.

When the wheel was started, all the pendulums began to vibrate. As the wheel continued its rotations, the pendulums gradually came to rest—except one, namely, that one the natural period of which corresponded with that of the rotating wheel. This proved that with a continuous series of vibrations only a pendulum with a harmonic period would be maintained in vibration. It also proved that a single vibration set *all* pendulums in vibration no matter what natural periods they might have. Dr. Hartridge has thus demonstrated that if the ear possesses a series of resonating organs *every one* will respond to the first vibration and will come to rest only when this vibration has been several times repeated.

When a person sings a glide from one note to another, his voice produces vibrations that are all different. Every one of these vibrations is the first of its kind, and at no moment is there a succession of waves of the same period. Consequently at every single vibration *all* the resonators in the ear are set in vibration, and this vibration of all of them continues throughout the glide. In speech the voice is never still for an instant. Every vibration from the larynx differs from the one before. Therefore in perceiving speech *every* resonance organ of the ear must act at every instant for every vibration of the voice.

Dr. Hartridge has given a complete and final proof that, if the ear possesses a set of resonating organs, they must all respond together for each new vibration; as the changing tone of speech has a new vibration at every instant, they must all respond alike at every instant and for every tone.

According to the Helmholtz theory each vibration acts on a different resonator in the ear. In the sliding tone always used in speech each single vibration must, according to Helmholtz, pick out a corresponding resonator. It is easy mathematically to show that this cannot be true and that each single vibration of the voice in speech must set all resonators in action. Nobody seems to have thought of this, and it has remained for Dr. Hartridge's highly ingenious apparatus to kill finally the Helmholtz theory of hearing.

In the April number of the *British Journal of Psychology*, Dr. Hartridge gives as the fundamental reason for supporting the Helmholtz hypothesis that the experiments described by him show that there are resonators somewhere. As pointed out above, they show exactly the opposite, namely, that there cannot be any resonators anywhere. If there cannot be any resonators, then the hypothesis that the ear acts as a resonating apparatus becomes an impossible one.

E. W. SCRIPTURE.

Boyle's Experiments on Capillarity.

IN Mr. Hardy's interesting "Historical Notes upon Surface Energy and Forces of Short Range," NATURE, March 23, p. 375, he says that "Boyle tried, but failed, to observe whether the (capillary) rise took place in a vacuum." Boyle writes in Experiment XXXV. of the "New Experiments Physico-Mechanical" that after showing the capillary rise in open air, "We tried indeed, by conveying a very slender pipe and a small vessel of water into our engine (air pump receiver), whether or no the exsuction of the ambient air would assist us to find the cause of the ascension we have been speaking of; but though we employed red wine instead of water, yet we could scarcely perceive through so much glass, as was interposed betwixt our eyes and the liquor, what happened in a pipe so slender, that the redness of the wine was scarcely sensible in it. But, as far as we could discern, there happened no great alteration to the liquor; which seemed the less strange, because the spring of that air, that might depress the water in the pipe, was equally debilitated with that, which remained to press upon the surface of the water in the glass." Boyle was a very careful and accurate experimenter, and he was trying to find whether there was an alteration in the capillary height *in vacuo*. His experiment was quite accurate and is worthy of his great reputation.

SIDNEY SKINNER.

South-Western Polytechnic Institute, Chelsea, London, S.W., April 6.

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