(*Beih. z. bot. Centlbl.* 39:19, 1922) that the same applies to the chloroplasts and to the xanthophyll grains in the petals. Also in the experiments of Bottomley (Proc. Roy. Soc. B, 89: 481-507, 1917), on the effect of auximones in stimulating the growth of Lemna, his figures show (see pl. 22) that not only the cells and nuclei but also the chloroplasts are conspicuously increased in size.

In *Œnothera gigas* the gigantism of these structures is inherited, while in the Lemna experiments presumably it was not. Incidentally, this is an example of the same character being inherited in one case and not in another. But in its bearing on the fern chloroplasts it is interesting as showing how the cell as a whole controls the characters of its contained chloroplasts. The abrupt change from large dark to small pale chloroplasts in the fern prothallia seems to be of the nature of an "all or none" reaction in the genesis of the cell.

That such abrupt transitions do not always occur, however, is shown by certain striped varieties of maize (Randolph, *Bot. Gazette*, 73:337, 1922) in which there is a transition zone where the cells contain plastids of many intermediate sizes and depths of colour even within a single cell.

R. RUGGLES GATES.

King's College, Strand,
London, W.C.2,
April 18.

Nightingale in Uganda.

ORNITHOLOGISTS may be interested to know that in March, when in camp in the part of the Northern Province of Uganda known as West Madi, on two successive mornings I heard a nightingale singing vigorously about 8-9 A.M.: the bird did not commence at daybreak, nor did he sing at night.

From the unfinished character of the song, and the lack of fulness and richness of the notes, I suspected that the individual was a young bird which had not yet fully developed his powers.

My attention was attracted on March 13, the day I reached the camp, about 8.30 A.M., by the familiar sound, so different from that of any African bird of the locality: unfortunately, I could not see the bird in the thick bush. The spot was just such as would have been chosen by a nightingale in England: a large clump of big trees with underbush like a small copse.

The camp was Moyo, about twenty miles west of the Nile and some ten miles south of the Uganda-Sudan frontier.

I should be glad to know whether nightingales are often heard to sing south of the Sahara. I imagine that this bird was perhaps making its way northwards from its winter quarters.

G. D. HALE CARPENTER.

Uganda Medical Service, Khartoum,
April 23.

Photography of Balmer Series Lines of High Frequency.

I HAVE recently performed a simple experiment with the luminous discharge through hydrogen, which has given results of some interest.

As is well known, it is difficult in the laboratory to photograph more than the first few members of the Balmer series, although higher members are well developed in the stars and nebulæ.

Prof. R. W. Wood has shown recently that fifteen or twenty of the Balmer lines can be photographed in a specially constructed tube running under very particular conditions, but I have found that an easy way of securing what appear to be similar results is merely to evacuate the hydrogen tube to a very low point, and then to cause the discharge to pass by the use of a glowing cathode.

Under these conditions, the Balmer series is brightened relatively to the secondary series; moreover, the brightness of the higher frequency lines is enhanced.

The experiment is clearly suggested by the atomic model of Bohr.

I hope to publish a detailed account of the investigation shortly, as I am not aware of any previous experimental work along these particular lines.

R. WHIDDINGTON.

The University, Leeds,
April 21.

Mechanism of the Cochlea.

I THINK it is evident that Prof. H. E. Roaf (NATURE, April 14, p. 498) and I approach the problem of the action of the cochlea from different aspects. He says: "A variation in pressure applied to the *fenestra ovalis*, if it is to cause a movement of the basilar membrane, must cause movement of the liquids in the cochlea." Most writers on the cochlea have started with this assumption, which is fundamental for the theories of Wrightson, Lehmann, Meyer, ter Kuile, and Hurst. But it is not possible to explain in this manner the fact that sounds can be conducted through the bones of the skull, and analysed in the cochlea in the same way as air-borne sounds. The bone-conducted sounds must be conveyed through the cochlea fluids to the basilar membrane as waves of condensation and rarefaction in the fluid. The impulses thus given to the basilar membrane must set swinging the sector of the basilar membrane in tune with their frequency. It is impossible for the sector to move without setting in movement the fluid columns between the sector and the round and oval windows which constitute its "load." Thus, the movement of the cochlea fluid originates *at the basilar membrane*. This phenomenon of bone conduction is illustrated quite clearly in my model, which gives localised responses at the same levels whether the tuning-fork is applied to the stapes or to the front or back of the brass case.

There is no reason to suppose that the case is different for air-borne sounds. We can state positively that the waves of sound do produce alternating pressure changes in the cochlea fluid, but we cannot be certain that any movement of the cochlea fluid results from these pressure changes until one or more of the sectors of the basilar membrane is set swinging.

Regarding the action of the cochlea entirely as a resonance manifestation, fluid friction counts only as a damping factor. It has important bearing on sharpness of resonance and persistence of vibration, but its magnitude is very difficult to estimate.

I am afraid I do not quite follow Prof. Roaf's suggestion as to the spiral ligament. He says "the greater bulk of the spiral ligament [in the basal coil] may be merely to resist a greater strain." Does he mean bending strain or breaking strain? If the former, the only way in which it could so act would be by producing increased tension, as I (following Gray) have supposed. If the latter, the breaking strain of the basilar membrane would be determined by the strength of its weakest part. However strong the spiral ligament might be, it could not prevent the basilar membrane being torn if excessive force were applied to it.

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