produce generations not yet scored beyond the F_1. The flowers have an increased number of narrow petals and, in general appearance, recall those of *R. ficaria*, yet it is certainly *R. acris*. The plant has been multiplied vegetatively, and good specimens are preserved in the Genetical Herbarium at Kew. So far as we know it is the only 'male' *R. acris* plant ever recorded.

We are inclined to think that Mr. Parkin's suggestion that *R. acris* is in the incipient stage from hermaphroditism to gynædiœcism (or even to complete diœcism) is not improbable. We made a similar suggestion in a paper on the genetics of *R. acris* and *R. bulbosus* recently sent to press. Our field observations have proved that in some populations—widely scattered in England and Scotland—the percentage of female or intermediate forms is very much higher than one per cent, and in some counts it even approximated to fifty per cent.

Lastly, we wish to ask any reader observing sex forms or any abnormalities in any British species of *Ranunculus* to send us living specimens for genetical and cytological analysis.

E. M. MARSDEN-JONES.
W. B. TURRILL.

The Herbarium,
Royal Botanic Gardens, Kew, Surrey,
April 27.

The Arc Spectrum of Phosphorus.

THE arc spectrum of phosphorus has been investigated by Saltmarsh and by McLennan in the Schumann region, and the lines belonging to the fundamental transition $2M_2(M_2 \leftarrow\!- N_1)$ have been arranged according to Hund's theory by McLennan (*Trans. Roy. Soc. of Canada*, vol. 21, sec. 3; 1927).

The lines belonging to the second group of transition $2M_2(N_1 \leftarrow\!- N_2)$ lie, according to the horizontal comparison method of Saha and Majumdar, in the region ν 9400-10300-10800 (*Indian Journal of Physics*, September 1928, p. 72). Similarly, the lines due to the transition $2M_2(N_1 \leftarrow\!- O_2)$ have been located at 18000-20518.

The spectrum of phosphorus in the infra-red region has not yet been investigated, but as both silicon and sulphur are present in the sun, it was assumed that phosphorus should also be found. Taking the infra-red solar lines as given in the "Revision of Rowland's Preliminary Table of Solar Spectrum Wave-lengths," I located these lines with the aid of known differences $\Delta P_{1\text{-}2} = 151$, $\Delta P_{2\text{-}3} = 249$, in the regions predicted. The $4P - 4S_2$ lines and $4P - 4\bar{P}$ lines due to the transition $2M_2(N_1 \leftarrow\!- N_2)$ have been found at $\nu = 10555$ to 11095. Attempts are being made to verify the identification by taking a spectrum of phosphorus in this region.

The second group of lines, $2M_2(N_1 \leftarrow\!- O_2)$, were identified in a group of lines obtained by Geuter in the region λ4600-6000, and have been identified with a number of faint solar lines. The identification seems to be unmistakable.

I have thus obtained two successive members of a Rydberg sequence, and calculated the ionising frequency to be $\nu = 86521$, corresponding to a voltage of 10·68 volts. The ionisation potential of phosphorus is thus found to be slightly higher than that of sulphur, the element succeeding it in the periodic table. We have a similar case in nitrogen and oxygen.

The investigation thus establishes the presence of phosphorus in the sun.

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University of Allahabad,
Mar. 18.

An Optical Method for Analysing Photographs of α-Ray Tracks.

MR. L. F. CURTISS, writing in NATURE of April 6, describes a method for examining stereoscopic photographs of α-ray tracks taken by two cameras at right angles. The method which we have been using for some years for the measurement of the lengths and initial directions of emission of β-ray tracks (originally suggested to us by Prof. C. T. R. Wilson) depends on the same essential principle as that described by Mr. Curtiss, and our experience confirms his observation of its accuracy and convenience. We described the method in a paper on "The Ranges of Secondary β-rays" (*Phil. Mag.*, **2**, p. 1110; 1926) as follows: "The lengths of the tracks were obtained from the stereoscopic photographs by replacing the photographic plates in the cameras, illuminating them and tracing out the common image which coincides in space with the original track". We have also used the same method in an examination of the initial directions of emission of photoelectron tracks (*Proc. Roy. Soc.*, A, **121**, p. 612; 1928). In the case of observations with β-rays, since the track is not in one plane, the use of the translucent screen (as described by Mr. Curtiss for α-rays) is not applicable.

In our experiments the axes of the two cameras were not at right angles, but were inclined at a small angle of about 20°. With this arrangement it is possible to *see* the track in stereoscopic relief, if, instead of holding a screen in front of the camera, we look through one lens with the right eye and through the other lens with the left eye. In actual practice this greatly facilitates the measurement of the tracks. A fuller account of the method will shortly be published elsewhere.

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Geotropism and Antennæ.

I HAVE just been listening to a discussion, at the Zoological Laboratory, arising from some interesting observations by Mr. G. L. Clarke on the tropisms of *Daphnia*. A question was asked as to the conceivable mechanism of geotropism in an animal very little heavier than water and with no air-bladder, and an expert in crustacean appendages suggested that, as the animal slowly sinks, fine sensory hairs on the appendages are bent upwards.

It has since occurred to me that, when passively extended, *Daphnia's* two swimming antennæ, branched and set with long fern-like bristles, will offer relatively great resistance to movement downwards through the water, a resistance on a long lever which must be met on the short internal arm of the lever by at least ten times the force in the muscle or ligament involved.

The actual stimulus for geotropy (positive or negative) might therefore be either an increase in tone of the lower muscles of the antennæ, or a decrease in tone of the upper muscles. If this hypothesis be considered plausible, we have an explanation why nauplii and copepods have evolved these two disproportionately long swimming-arms, in place of being content with the series of short equal paddles or cilia which suffice for so many other organisms. It is no longer remarkable that the most prominent swimming organ of the larva should be an important sense-organ in the adult decapod—for i has always been a sense-organ.

GEO. P. BIDDER.

Cambridge, May 1.