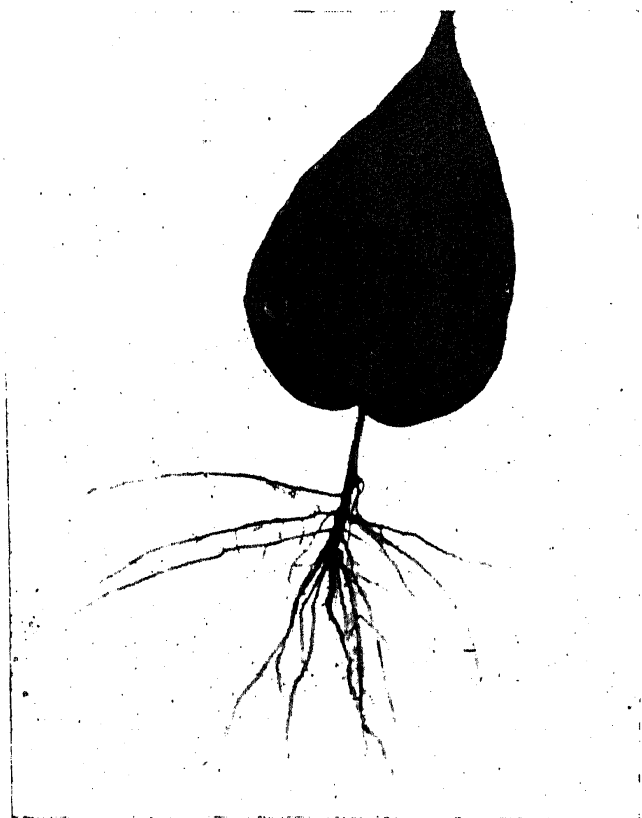


of the leaves from the lower region of the shoot, which appeared to obstruct the fitting up of the apparatus. On the same day (17th July 1934) those plucked leaves were placed in tap water. The cuticle experiment was conducted for a fortnight. During this period the leaves remained in the same water. They did not show any sign of senescence. The leaves were examined on 31st July 1934 to find a possible cause of their remaining healthy, when some root-like structures were found to come out from the callus formed at the base of the petiole. On closer examination they were seen to be real roots with root-hairs and root-caps. On 2nd August 1934, the leaves were placed in fresh tap water, to see if any further change would take place. After a couple of days the first-



formed roots elongated and had developed root-hairs profusely. On 4th August 1934, one of the leaves with roots was placed in moist sand to see if any shoot would come out. This leaf remained healthy for 3 days, but from 7th August 1934, it began to show signs of decay. The other leaf in the meantime had borne several roots right from the severed surface up to the middle portion of the petiole. On the same date this was placed in very dilute nutrient solution (Pfeffer's). The roots elongated and fresh root-hairs came out from the elongated parts. Some roots gave out branches and

the length of the individuals became gradually greater.

The leaf is quite healthy and is living till this day (17th August 1934) when the article is being sent to the press. But no shoot is coming out.

Further work on this is proceeding.

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#### Note on the Theory of Artificial Disintegration.

IN a recent publication<sup>1</sup> I (in collaboration with A. Ganguli) have given the following wave statistical formula for artificial disintegration of nucleus by  $\alpha$ -particles.

$$\lambda = C \frac{\sqrt{E_1 E_2}}{h^2 r_{01}^2 r_{02}^2 \cot \mu_{01} \cot \mu_{02}} \times \dots \quad (1)$$

$$\times \exp. -\{2k_1(2u_{01} - \sin 2u_{01}) - 2k_2(2u_{02} - \sin 2u_{02})\}$$

where the suffixes 1 and 2 are respectively for the bombarding  $\alpha$ -particles and the disintegrating protons. The above formula has been shown to be in good agreement with experiment. The discontinuities in the curve lately found by Chadwick and others<sup>2</sup> can be explained from the above formula on assuming the existence of different groups of protons within the nucleus. Investigation in this direction has already been taken up by M. Ghosh. It should also be noted that the above formula is perfectly general and may be used for any other class of nuclear artificial disintegration.

Since the paper has been published, my attention is drawn to a recent article on the subject by Th. Sexl.<sup>3</sup> After elaborate analyses Sexl finds that the absorption coefficient ( $a$ ) for the  $\alpha$ -particles is given by (in the present notation).

$$a \sim e^{-2k_1(2u_{01} - \sin 2u_{01})} \dots \quad (2)$$

Since  $\lambda \propto a$ , formula (2) obviously corresponds to the first part of my formula (1), which follows directly from the assumption of a viscous phase space for the nucleus.

We should also note that the second part of equation (1) representing the disintegrating protons is taken with a positive sign in the

<sup>1</sup> *Curr. Sci.*, 1934, 2, 471.

<sup>2</sup> *Proc. Roy. Soc.*, 130, 463; 135, 48.

<sup>3</sup> *Zeit. f. Phy.*, 1934, 87, 105.

exponential, whereas in the case of spontaneous disintegration the sign is negative. The solution of the relevant differential equation gives both the signs.<sup>4</sup> As usual we are to fix the sign from a physical consideration of the problem. From the principle of conservation of energy we find that for a given velocity of the bombarding  $\alpha$ -particle the number of protons coming out of the nucleus with a higher velocity is less. So the sign must be taken positive. Conditions are, however, different when the emission is spontaneous.

Lastly, we may remark that in his above treatment Sexl appears to think that when the limit of approach of the bombarding  $\alpha$ -particle is zero, there is usual Rutherford scattering but if, instead, the limit is  $r_0$ , there is an additional term in the perturbation function which represents disintegration. But after Mukherjee's well-known wave statistical theory<sup>5</sup> of anomalous  $\alpha$ -scattering based on the assumption of a critical radius  $r_0$ , the above idea of Sexl should, I think, be discarded.

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#### Determination of $e/m$ and Mass of Individual Charged Particles in Colloids.

It is of great interest to determine the size and mass of *individual* particles in colloids, as the methods hitherto employed give only the *average* values, which are more or less incorrect. I have therefore been working out different methods for the determination of the mass, size and the ratio of the charge to mass of *individual* particles in colloids. One of these has been briefly mentioned in a previous note.\* A short account of another method which has been worked out successfully by me is given below:—

The colloid under examination was contained in a cataphoresis cell, which was so fixed in the ultramicroscope that, when an electric field was applied across the electrodes, the colloidal particles moved up or down depending on the direction of the field. The eye-piece was fitted with a

micrometer scale. Any single particle was selected in the field of view of the ultramicroscope. Then an electric field of 80 or 100 volts was applied across the electrodes and the velocity ( $v_1$ ) of the motion of the single particle in a vertically *downward* direction, *i.e.*, under the combined influence of the electric and gravitational fields, was found. The electric field was then reversed, and the velocity ( $v_2$ ) of the movement of the same particle in a vertically *upward* direction with the force of gravity acting against the electric field was found. Then we have

$$\frac{V_1}{V_2} = \frac{Xe + 4/3\pi r^3 (d_1 - d_2) g}{Xe - 4/3\pi r^3 (d_1 - d_2) g}; \text{ or } \frac{V_1 + V_2}{V_1 - V_2} = \frac{Xe}{m \cdot g \cdot c}$$

( $X$  is the applied electric field,  $e$  the charge of the particle,  $m$  its mass,  $g$  the gravity constant,  $d_1$  and  $d_2$  the densities of the particle and the medium respectively).  $X$ ,  $g$  and  $c$  are constants, the values of which are known. Knowing further the values of  $V_1$  and  $V_2$ , which have been determined experimentally, the value of  $e/m$  for each individual colloidal particle observed in the field of the ultramicroscope could be calculated.

Comparison of the values of  $e/m$  for several particles has shown that the value of  $e/m$  for a certain set of particles is practically the same, that for others a simple multiple of the former, and so on. It is, however, necessary to work with a large number of such particles before a generalisation can be made. I am therefore continuing this investigation and extending it to a number of colloidal systems.

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#### The Development of the Female Gametophyte of *Ludwigia parviflora*, Roxb. and *Jussiaea repens*, Linn.

THE family Onagraceæ has long been of interest to the morphologist and cytologist. The added importance given to it by the series of papers recently published by Dr. Donald A. Johansen of the Stanford University, has prompted us to give here a brief report of our own observations on the development of the embryo sac in two plants of this family, which we had the occasion to collect in our trips to places near about Agra.

<sup>4</sup> Vide solution by Riccatti's method given by Sexl, *Zeit. f. Phys.*, 1929, **56**, 92.

<sup>5</sup> *Phys. Zeit.*, 1933, **34**, 175.

\* *Curr. Sci.*, 1934, **2**, p. 387.