of the organism and its passage through soil has, therefore, an important bearing on the technique of seed inoculation.

A modification of Winogradsky's technique for staining bacteria in soil (1924, *Comptes rend. Acad. Sci.*, vol. clxxix. p. 367) has enabled the present authors to follow the passage of the nodule organism through sterile soil. It has been found that they will progress through light soil at an approximate rate of one inch in 24 hours, though the rate is affected by the soil texture. When a drop of water containing the bacteria in the rod stage is added to sterile soil, the spread of the organisms from the point of inoculation does not begin until after a considerable interval, and its commencement is accompanied by the conversion of a large percentage of the bacteria into cocci. If the inoculum consists of a suspension in milk, the bacteria begin to spread through the soil after a shorter interval. This is perhaps an explanation of the successful results obtained by using a suspension of the bacteria in skim milk for wetting the seed, a technique now practised in Scandinavia for inoculating lucerne. The effect of milk also emphasises how important is the nature of the liquid used in making the bacterial suspension for seed inoculation.

Bewley and Hutchinson (*Journ. Agric. Sci.*, 1921, vol. x. p. 144) found that the production of the motile coccoid stage of *Bacillus radicicola* was greatly stimulated by the presence of phosphates. The effect of inoculating sterile soil with a suspension of the bacteria in skim milk containing 0·1 per cent. soluble calcium phosphate, $CaH_4(PO_4) + 2H_2O$, was therefore tested. It was then found that the spread of the organisms from the point of inoculation commenced almost immediately. It seemed probable that the use of a bacterial suspension in the above solution for wetting the seed would increase the chances of nodule formation by hastening the spread of organisms from the seed-coat, and thus increasing the volume of soil explored by them in a given time. Pot culture tests of seed inoculation were therefore made with lucerne, in which a bacterial suspension in a 0·1 per cent. solution of $CaH_4(PO_4)_2 + 2H_2O$ in skim milk was compared with a suspension in skim milk alone, such as is now in practical use. On averages of 10 parallel pots, increases in nodule numbers of 93 per cent. and 73 per cent. were obtained in two experiments by the addition of phosphate to the milk. There was also a favourable effect on the yield of the crop. The work is being continued and will be published in detail at a later date.

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Capillary Action: Transpiration.

If a capillary tube, A, Fig. 1, with a wedge-shaped cut in it at a distance of about 10 mm. from its upper end, at right angles to, and deep enough to make a breach in one side of its aperture, is lowered slowly into water the rising column of water pauses for an instant when it reaches the gap, which is necessarily higher than the surface of the water into which the tube is being dipped, and then leaps past it and rises to the top of the aperture.

When this tube is fixed in a cork as shown in Fig. 1; the cork inserted as a stopper into the mouth of a cylindrical vessel, B, containing water; the vessel, B, fixed in a circular piece of cork which acts as a stand for it; and a small sheet of thin blotting paper, *b*, drawn far enough into the cut to touch the thread of water in the aperture, the capillary tube acts the part of the stem of a plant, the blotting paper that of a leaf, and transpiration commences and continues uninterruptedly through the latter so long as the water lasts. A current of water flows up the aperture of the capillary tube and through the gap in it to the blotting paper from which it is evaporated continuously without creating any visible disturbance in the thread of water contained in that part of the aperture above the gap. As the surface of the water inside the vessel, B, is being lowered, air flows into the space above it through a fine capillary tube, *a*, which passes through the cork near the larger tube.

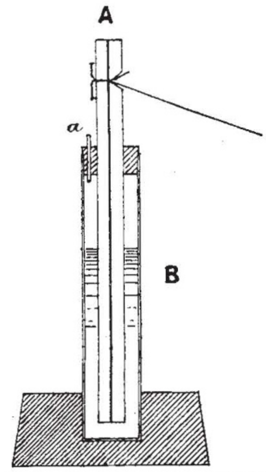

Fig. 1.—Capillary tube to illustrate transpiration. Half real size.

In an experiment with this apparatus carried out in May 1922, the dimensions of the sheet of blotting paper were 33 mm. by 43 mm. The edge of the sheet was drawn into the cut by means of a thread which passed round the back of the capillary tube and slightly compressed a small india-rubber tube which acted as a spring to keep it taut as shown. On placing the apparatus on one scale of a chemical balance in a glass case, in which there was also a basin containing chloride of calcium, and balancing it with weights in the other scale, it was found that when both scales were left free to move, one rose and the other fell so rapidly and continuously that their movement was clearly visible to the unaided eye.

Observed during a period of 491 minutes, it was found that the total weight of water evaporated in that time amounted to 1·1958 gm., or at the rate of 2·43 mgm. per minute. The aperture of the capillary tube was elliptical. Its area in cross-section, ascertained by calibration with a thread of mercury 93·2 mm. in length at 20° C. and weighing 3·21 mgm., was 0·02542 mm². It was thus equal to that of a circle 0·18 mm. in diameter, and the velocity of flow of water in the aperture was at the rate of 95·5 mm. per minute.

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The Ballistic Theory of Light and the Michelson-Morley Experiment.

In a note regarding my theory of variable stars, published in Nature of October 11, p. 550, it is suggested that some difficulties would probably arise on the ground of the Michelson-Morley experiment. As the point is a very important one, I should be glad if space can be given me to make it clear.

The ballistic principle, on which my theory is entirely based, requires that light emitted from a source movable relatively to the observer shall exhibit a velocity compounded of the common velocity *c* and of that of the source. As in the Michelson-Morley experiment the source is at rest in respect to the observer, the ballistic principle requires that light travels with the same velocity *c* in all directions. Hence no displacement of the interference fringes may appear in revolving the whole apparatus. The negative result of Michelson-Morley experiment evidently agrees with the ballistic theory. The same