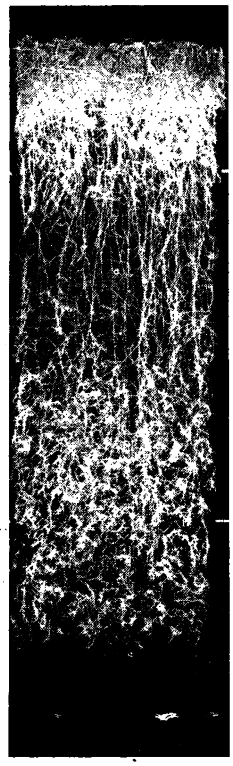

FIG. 1. Portion of a root system of western wheat grass (*Agropyron smithii* Rydb.) 12 in. wide and 36 in. deep. The bottoms of the *A* and *B* horizons are marked by white lines. Only a small portion of the roots in the *C* horizon is shown.

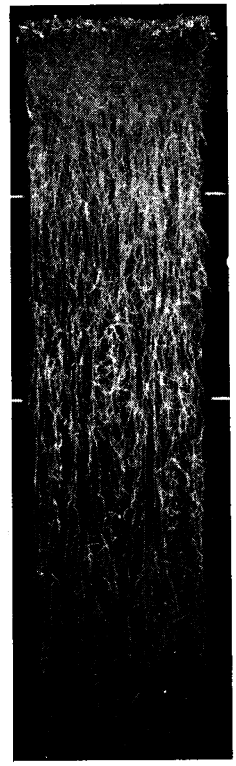

FIG. 2. Upper 4 ft of roots of buffalo grass *Buchloë dactyloides* (Nutt.) Engelm. Upper lines mark the depth of a 12-in. fill which gradually buried the former topsoil (A_{1-1} horizon). 14 in. thick. Note excellent root development in these layers.

depth of the soil horizons it occupied. The roots are then oven-dried and weighed.

The root system in Fig. 1 was taken from Butler silt loam soil 28 in. deep, overlying deep, friable, silty clay loam parent material. The *A* horizon, which is only 7.5 in. thick, contained 67% of the roots by weight. Roots were poorly branched in all but the lower part of the claypan or *B* horizon. Most of the branching occurred in the *C* horizon of less compacted, friable silty clay loam. Roots in the 13 in. below the point of heavy branching weighed 36% more than the 13 in. of poorly branched roots above. The root system in Fig. 2 was taken from Wabash silt loam in a valley between two loess hills. Although the grass is normally only 4–5-in. tall, the roots are 5–6 ft deep.

Descriptions have been made of the profiles of 16 soil types, from which 11 species of grasses were taken in a total of 33 monoliths in 1948.[1] The depth, density, and weight-distribution of roots of the same species in different soil types and of different species in the same soil type have been ascertained. Quantitative data on root distribution in the several soil horizons have also been obtained. The effect of buried profiles on root habit has been examined, as have modifications resulting from the loss of one or more soil horizons by erosion. A detailed account of the work is in press.

[1] Profile descriptions were made by Mr. James Thorp, Principal Soil Correlator, Great Plains States Division of Soil Survey, U. S. Dept. of Agriculture.

References

1. WEAVER, J. E. *The ecological relations of roots.* (Publ. 286). Washington, D. C.: Carnegie Institution, 1919.
2. ———. *Root development of field crops.* New York: McGraw-Hill. 1926.

A Simple Micromanipulator

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For the isolation of one microscopic cell a fine capillary pipette is often used, the point of which is inserted into the drop of fluid containing the organisms; under microscopic control a single cell can then be sucked into the capillary pipette. The difficulty of this operation consists in keeping the point of the pipette motionless, at a magnification of, say, 100 times, in front of the organism, which in many cases has a size of only 10–25 μ.

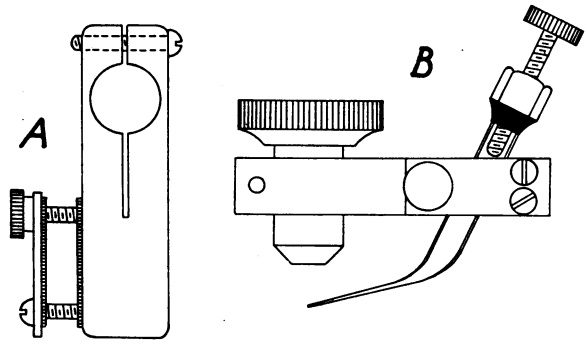

FIG. 1. A. Micromanipulator top view without the capillary pipette. B. Micromanipulator with the capillary pipette, side view, mounted on the objective of the microscope. Three-fourths natural size.

The device described here is one whereby the pipette can be fastened to the objective of the microscope. By means of the mechanical stage of the microscope, the organism can then be moved to the mouth of the fastened capillary pipette and sucked up.

As shown in Fig. 1, the apparatus may consist of a block of metal 55 mm long, 15 mm broad, and 10 mm high, or to avoid scratches on the side walls of the objective, of a corresponding piece of ebonite or plastic used for insulating purposes by the electrical industry. In one end, there is a vertical hole for the objective, and a deep incision so that the walls of the hole can be fastened around the objective by means of a threaded bolt. On the side wall of the other end is placed a retaining plate, so that the capillary pipette can be pressed against one vertical wall of the block by means of three screws. Small pieces of felt or thin plates of

cork glued to the walls of the block and the retaining plate prevent breaking of the pipette.

The capillary pipette is a 5-mm glass tube, one end of which has been drawn into a long, thin point and bent to form an angle of about 135° with the tube. At the other end of the tube, a small but high nut with a threaded bolt to match is fastened by means of glass cement. It is very important that the bolt should fit exactly into the thread of the nut and that it is greased with a heavy lubricant of the kind used for glass stopcocks of burettes, in order to make a completely air-tight connection. It is desirable to have a set of capillary pipettes, the points of which are 25, 50, 100, and 500 μ thick respectively.

When the apparatus is to be used, the block is fastened to the objective, after which the capillary pipette chosen is placed in such a position that the mouth of the pipette is clearly visible in the center of the field of vision (magnification about 100 times) and the point is nearly horizontal.

If a single microscopic organism is to be selected from a fluid suspension of organisms, it cannot be done by lowering the empty capillary pipette into the drop on the slide. The capillary action, which increases with the diminishing diameter of the pipette, will immediately carry fluid with numerous organisms into the tube. The pipette must be allowed to suck up sterile water and by turning the threaded bolt a convenient column of water remains; if the pipette is then let down into the suspension by lowering the tube of the microscope, no organisms will be sucked up. By means of the mechanical stage the slide is now placed in such a position that the organism selected is situated before the mouth of the pipette; a slight counterclockwise turning of the threaded bolt of the capillary pipette will then carry the cell into the pipette, after which the capillary pipette is removed from the suspension containing other organisms by raising the tube of the microscope.

If an organism is wanted for the cultivation of a clone, the following procedure may be used. After the selection of one cell, the slide with the suspension is replaced with a sterile slide, on which a sterile cover glass is placed. The tube of the microscope is lowered until the point of the capillary pipette touches the cover glass; a slight clockwise turning of the threaded bolt will now eject a droplet of water containing the chosen cell onto the cover glass. At a magnification of, say, 200 times it should now be ascertained that the droplet contains one and only one cell. If this is the case, the cover glass can be slipped from the slide into the sterile fluid in which the species is to be cultivated.

The apparatus can also be used for making permanent slides of new or rare species, where only a few individuals were found among many others, for instance, desmid individuals in a plankton sample. Some drops of glycerine should be added to the sample, which is then placed on a watch glass or in a salt cellar to allow a slow evaporation of the water. The specimens wanted can now be selected from the glycerine suspension and placed in a droplet of pure glycerine on a slide for the usual method of preparing the slide.

Pterin-like Pigment Derived from the Tubercle Bacillus. Fluorescence and Absorption Spectral Data for Erythropterin-like Pigment Isolated by Ultrachromatographic Analysis

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The pterins are pigments having a purine or pyrimidine type of structure that were isolated from the wings of butterflies and from the integument of other insects, first by Hopkins (*5*) and later by H. Wieland and his collaborators (1925–1944), and by Schöpf and Becker (*11*), and others. These pigments usually occur as mixtures, have no melting points, and cannot be transformed into derivatives with definite melting points. Hence, they present exceptional difficulties in their separation and purification. The determination of absorption spectra was one of the criteria used, in the studies cited, as tests in successive stages of purification, and in order to characterize the different pterins derived from different sources (*11*).

We present evidence in this report that pterin-like pigments have been isolated from the tubercle bacillus which, to our knowledge, have not heretofore been reported for this microorganism. Fluorescence and absorption spectral data and other physical characteristics are given for material obtained from the acetone and ether extracts of dried virulent human tubercle bacilli[1] after they had been washed with large quantities of sterile distilled water. This treatment is one of the steps in the preparation of antigens used in the complement-fixation test for tuberculosis (*14b*).

Observations in ultraviolet light were made of zones (some not visible in daylight) formed when a few drops of the extracts were placed on the margin of the thin wedge of an adsorbent such as aluminum oxide, standardized according to Brockmann (*1*) by Merck, hereafter called alumina. These zones yielded fluorescence other than the red fluorescence that may be attributed partly to porphyrin and the yellow fluorescence of flavin reported in our previous studies (*4*). This micromethod (*2*) indicated the practicability of separating some of the materials on chromatographs of alumina.

Numerous exploratory experiments indicated that a better separation of zones was effected by the use of benzine-ether 1:1 and chloroform solutions of the residues of ether and acetone extracts than with the original extracts. In some of the experiments the extracts were partitioned with immiscible solvents prior to placing them on chromatographs. The yield of material from the different zones was in each case very small. Hence, it was not possible to make all of the various characterizations

[1] Human tubercle bacilli strains #13 and #48189 were grown for 3–4 weeks in glycerol broth which consists of beef, 450 g; peptone (Fairchild's), 10 g; sodium chloride, 5 g; glycerol, 50 g; and water, 1000 g (*14a*).