A Natural Proof That the Root Tip Alone is Sensitive to the Gravitation Stimulus.

By Frank Marion Andrews.

Pfeffer* and Czapek* have demonstrated that it is the root tip only that is sensitive to the stimulus of gravitation. In order to accomplish this end they resorted to the following method. Glass tubes of such a diameter as would just fit over the end of the root tip were made by drawing out thick-walled glass tubes. The tubes thus obtained were bent into an L shape, had a total length of about three (3) mm., and weighed about thirty (30) milligrams. They were closed at one end and left open at the other; each limb of the L-shaped tube made in this way had a length of 1.5 mm. The inside diameter of the tube depended on the size of the root for which it was intended. It was necessary in all cases to have this glass tube fit the root loosely. It was connected to a piece of cork and the germinated seedling also fastened to the same cork in such a way that the root tip projected into the glass cap about to the bend. The whole being rotated in a klinostat for some hours the root, freed of the stimulus of gravity, grew into the above mentioned glass cap and finally assumed its L-shaped form. When removed from the klinostat and placed with the curved tip of the root vertical and the rest of the root horizontal no geotropic curvature took place, which shows that since the tip of the root was constrained from bending, the sensitiveness of geotropic stimulus must be located there, else it would have bent at a point outside the glass tube. I have accidentally found a natural proof of this admirable and conclusive discovery of Pfeffer and Czapek. In some germinating corn I observed one instance in which the root of the embryo had not freed itself in the usual way, but instead, the scutellum was broken about midway and carried down by the root on its tip as a mass of tissue. The outer coats were not broken, and these adhering about the scutellum on one side in the usual way made the mass so strong that the root could not grow out of it—at least it did not do so. This mass of tissue when removed weighed fifteen (15) milligrams. The root had turned and grown

*Jahr f. wiss. Bot., 1895, Bd. 27, p. 243, and 1900, Bd. 35, p. 313.

in this mass toward the back of the scutellum at a right angle a short distance from the tip; upon removing all the mass from the root tip, which could be done quite easily, this curving was plainly evident. The root was fixed in a moist atmosphere on a sheet of cork, with the curved part in a vertical position and the rest of the root in a horizontal position, but no geotropic curvature took place. During the time the root was kept in this position it grew almost as rapidly as the control specimens which were used to estimate the growth. While this accidental occurrence of a cap-like mass of tissue on the root-tip showed and verified the same effect on geotropic curvature, as was proved by using the glass caps, nevertheless it eliminated all the dangers of traumatic effects, to which the glass-cap method might render these parts liable in the absence of skillful manipulation, upon which experimentation is being conducted.