Spiral Roots in Tobacco Seedling

What is spiral root? Spiral root is better known in scientific circles as negative geotropism or negative gravitropism. A tropic response or tropism is a response to stimulus, in this case gravity. Negative geotropism is a situation where a root does not exhibit the normal behavior of growing toward gravitational pull or down into the media Geotropism in seedling roots of several species has been associated with a gravitational sensitive area in the central cylinder of the root cap. This area contains starch crystals that respond to gravity. Microscopic removal of the root cap of an otherwise healthy root eliminates gravitropic response in most species. Only roots that contain additional sedimentable (moves toward gravity) particles in the root apical zone or regenerates these particles would regain a geotropic response and grow downward into the media. As a seed germinates inside a pellet, damage to the expanding root tip could prevent a normal geotropic response, which we know as spiral root. A possible scenario is that on a microscopic level particles in the seed pellet may cause abrasive damage to the root tip. This may be especially true under conditions were the pellet remains harder than normal, dryer conditions due to media or more intense sunlight or a harder pellet initially.

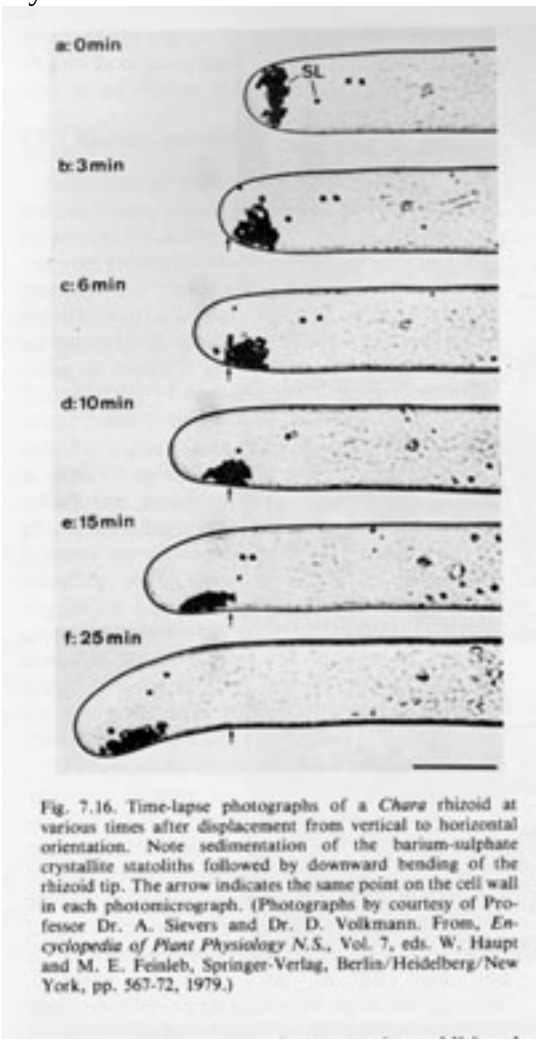

Fig. 7.16. Time-lapse photographs of a *Chara* rhizoid at various times after displacement from vertical to horizontal orientation. Note sedimentation of the barium-sulphate crystallite statoliths followed by downward bending of the rhizoid tip. The arrow indicates the same point on the cell wall in each photomicrograph. (Photographs by courtesy of Professor Dr. A. Sievers and Dr. D. Volkmann. From, *Encyclopedia of Plant Physiology N.S.*, Vol. 7, eds. W. Haupt and M. E. Feinleb, Springer-Verlag, Berlin/Heidelberg/New York, pp. 567-72, 1979.)

Diagram shows particles gravitating to bottom where they influence hormonal actions that slows growth on the underside causing the root to curve downward as the upper side continues to grow.

Growth & Differentiation in Plants. 1981. P.F. Wareing & I.D.J. Phillips. Pergamon Press Inc.

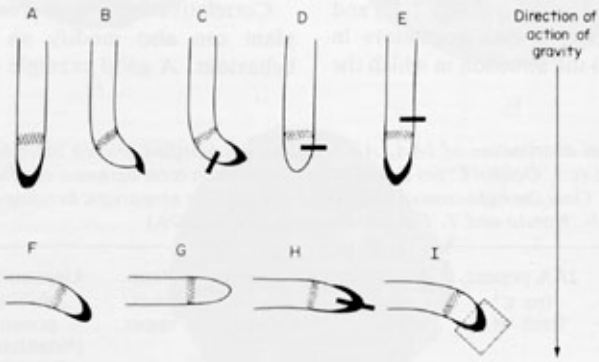

Fig. 7.19. Diagrammatic representation of some of the experiments which have indicated that the root cap is the source of growth inhibitor which is involved in the gravitropic response mechanism in roots. The root cap is shown in black, and the elongation zone of the root is shaded. A. Vertical intact root grows downwards. B. Removal of half the root cap results in bending towards the remaining half cap regardless of the direction of gravity. C. Insertion of a glass barrier between half the root cap and the elongation zone has the same effect as removing half the cap. D. A similar barrier in the absence of the cap has no effect. E. A barrier positioned behind the growing zone is without effect. F. Intact horizontal root executing normal downward gravitropic curvature. G. Removal of the root cap abolishes gravitropism (because it appears to be both the region of graviperception and the source of growth regulating substances). H. A horizontal glass barrier through the root cap and apex abolishes, or largely removes, gravitropism in a horizontal root. I. A glass barrier similar to that in H, but orientated vertically, does not prevent the development of a gravitropic curvature. (Adapted from M. B. Wilkins, *Current Adv. Plant Sci.* **6**(3), 317-28, 1975.)

The effects of root cap removal or manipulation are demonstrated.