Starch Statoliths as Gravity Sensors in Arabidopsis thaliana

Tian, Anru (School: Athens High School)

One theory of how plants detect a change in gravity is the starch-statolith hypothesis. The hypothesis states during a change in gravity, statoliths, starch-containing organelles, settle to the bottom of the cell thus alerting the plant of the change. This experiment was designed to test the relationship of starch and the gravitropism mechanisms of wild type Arabidopsis. Starch is made during the day from photosynthesis and is used up during the night. First, to determine the number of days Arabidopsis starch reserves would be depleted, wild-type seedlings were grown until their roots reached 2-4 cm. Seedlings were placed into cardboard boxes to deplete their starch reserves through light starvation. After each day of light starvation, root tips were stained with Lugol's Solution and viewed through a microscope to observe the presence of starch. After 3 days of light starvation, starch reserves were depleted in Arabidopsis root tips. Based on these results, more seedlings were grown and split into two groups: with or without light. Then, after the seedlings were grown to about 2-4 cm in root length, the light starvation group was placed into boxes for 3 days, while the other group continued to grow under long day conditions (16 hr light /8 hr dark) for 3 days. Afterwards, all plates were rotated to 135 degrees to induce a gravitropic response. Root curvature was recorded every 30 minutes and curvature compared between light grown and dark grown seedlings. Those seedlings grown in the dark (light starved) showed a significantly reduced gravitropic response as compared to light grown. Because the dark grown seedlings lack starch, these result indicate the presence of starch is necessary for a full gravitropic response in wild type Arabidopsis plants.

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