Plant Tissues that Fail to Regenerate Undergo Early Steps of Remodeling but Fail to Induce a Cytokinin Hormone Response

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Plant roots are susceptible to damage from insects, microbes, and poor soil conditions, but their high capacity for regeneration gives them the ability to recover. Many of the molecular steps in root regeneration have been described, but a working model has yet to be developed to explain which processes may be blocked when tissues fail to regenerate. This study compared successful and failed regenerations, by injuring roots in zones that are either competent or incompetent to regenerate, to determine the steps necessary for regeneration in Arabidopsis thaliana. Our novel results indicate that while regeneration fails on a morphological level, cell types still dedifferentiate, the supportive cell of the stem cell niche reforms, and an auxin response returns to the root. These processes are also present when regeneration successfully occurs. Additionally, within failed regenerations, a cytokinin response never returns to the root and cell type respecification largely fails. These results suggest that dedifferentiation in plant cells may be somewhat independent of cytokinin and auxin responses that characterize early regeneration responses, and that the inability of some tissues to regenerate may be due to a failure to induce a cytokinin response. This first ever model of failed regeneration suggests that cytokinin treatment can be tested as a potential agent to promote regeneration, an important means of propagation. Promoting regeneration could potentially increase crop yields, thus creating solutions to food insecurity.

Awards Won:

First Award of $5,000