



CALIFORNIA STATE SCIENCE FAIR 2012 PROJECT SUMMARY

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Project Title Send in the Clones	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals For this project, I used a geranium plant and took cuttings from three different parts; the roots, stems, and the leaves. I regenerated these different parts and tracked their respective growth rates to see which part of the plant regenerates the fastest. In-depth analysis of the regeneration process was one of my goals, and so I engineered the project to help me accomplish that. Mainly, having the opportunity to explore the scientific process was a big motivator to create this carefully-thought-out testing process.</p> <p>Methods/Materials I first took cuttings from the geranium at 50 degree angles. I soaked the cuttings in water and applied Indole-Butyric Acid to the ends of the leaf and stem cuttings to start the process. I then planted them in the side of a clear cup with potting soil. I covered the tops of the cups with plastic wrap to create the humid environment they needed as per common horticultural procedures. I used a spray bottle to mist the cuttings twice a day, and the greenhouse effect caused by the plastic wrap created the humid environment I needed. I used a light bulb for light to keep all the plants at the same temperature and to keep my variables uniform. As the plants grew, I tracked their development through the clear cups by taking pictures and measurements periodically. This process continued for 63 days.</p> <p>Results I found that, after 63 days of testing, the leaf cuttings grew the fastest, at an average rate of 2.9 centimeters per day. This was followed by the roots, growing at an average of 0.44 centimeters per day. The stems died after seven days of testing and did not grow at all.</p> <p>Conclusions/Discussion The leaves had the fastest rate of growth, which completely disproved my hypothesis. I assumed that the leaves would be cumbersome on the cutting and die quickly, but the leaves photosynthesized during growth. The roots also grew because they absorbed nutrients from the soil outside of the plant. The stems did not have any of these organs, and so they couldn't sustain themselves. I used my observations and diagrams to create a process diagram I call the Regeneration Explosion Theory. This asserts that there is a bulge formed by the hormones collecting at the bottom of the leaf cutting, and that new fleshy roots begin to hook and shoot out from it as it gets larger. The theory sets a basis for future studies and provides a visual chronicle of the regeneration process.</p>	
Summary Statement This project focuses on three different areas of the geranium plant- roots, shoots, and leaves- that are regenerated from cuttings, and analyzes both the regeneration process and their respective growth rates after 63 days.	
Help Received I contacted Dr. Gardiner at UCI, who inspired my project idea and helped guide my project's design.	