



**CALIFORNIA SCIENCE & ENGINEERING FAIR  
2019 PROJECT SUMMARY**

<b>Name(s)</b> <b>Royal Huey</b>	<b>Project Number</b> <b>S1805</b>
<b>Project Title</b> <b>The Effects of Simulated Microgravity on the Root Development of Seedlings</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The goal of this project is to examine the effects of simulated microgravity by using a rotating container that simulates perpetual falling on Raphanus raphanistrum (Champion variety) seeds, especially an assessment of health using the root to stem ratio. The health of the plant would be directly corralative to the viability of sustainable plant based food sources in space.</p> <p><b>Methods</b> <b>ROTATING MECHANISM:</b> Using an Arduino microcontroller, stepper motor, alligator clips, and power supply, a device was created that would rotate a 3D printed "platform" at ten rotations per minute, such that the outer edge of a 9 cm petri dish would be traveling at a slow falling speed. This method is modeled after the 2D clinostat used as ground controls at Kennedy Space Center. The 3D printing was done with help from an student-led club on campus.</p> <p><b>MAINTENANCE AND DATA COLLECTION:</b> Place seeds in a 9 cm plastic petri dish which has been lined with a moist paper towel. After seven days, compare the radish seeds' germination time, direction of growth, and root development in each of the control and experimental conditions: vertical rotation, unmoving vertical, and unmoving horizontal. After removal from the dish, compare cell morphologies and types of seedlings in each of the control groups and experimental groups at 400x magnification using a light microscope.</p> <p><b>RATIONALE:</b> Root and stem growth are often two measures of "plant health". Roots grow in order to access nutrients and water, and movement toward these things are considered healthy. Stem development is a sign that the plant is completing chemical conversions necessary for growth and storage of starches. Examining the root to stem length ratio mitigates the assessment of plant health solely based on water or light availability.</p> <p><b>Results</b></p>	
<b>Summary Statement</b> What the effects of simulated microgravity have on primarily root development, but also overall plant health and growth patterns.	
<b>Help Received</b> Most help came from my high school AP biology teacher, Ms. Claudio but minor help with coding came from Jonathan Kolbeck (George Washington University).	