



**CALIFORNIA STATE SCIENCE FAIR  
2009 PROJECT SUMMARY**

<b>Name(s)</b> <b>Luke P. Bockman</b>	<b>Project Number</b> <b>J2002</b>
--	---------------------------------------

**Project Title**  
**Effect of Centripetal Force on Length and Angle of Carrot Plant Growth**

**Abstract**

**Objectives/Goals**  
Carrots will grow sideways when grown in a constantly spinning cage. Based on my research, I believe that the stem of the plant will grow toward the light but the roots will grow in between and toward both forces (gravitational + centrifugal). Also, the roots will grow longer with a stronger resultant force. The centrifugal force was caused by the rotation of the pots inside the spinner. The resultant force was calculated at a 127.5 degree angle starting from vertical and equal to almost 1.6X the gravity force (51.2ft/s<sup>2</sup>).

**Methods/Materials**

1. Construct a structure to hold and rotate the potted plants.
  - a. Build frame that holds the plants.
  - b. Attach the crosspieces that hold the frame and put it on the bearings.
  - c. Take apart dryer to get electric motor and attach it to the frame.
  - d. Put in the lights.
  - e. Pot and plant the seeds.
  - f. Attach the pots to the outside frame.
2. Grow plants in rotating structure and grow non-rotating plants.
  - a. Turn on the lights for 12hrs per day and start the electric motor (run 24 hr/day, 7 days/wk)
  - b. Water the plants every 2-3 days until they are finished growing.
3. Take the plants out and unearth them to get results after 6 weeks of growth.
  - a. Measure root angle and length of 4 rotating and 4 stationary control pots (4 plants in each pot)
4. Organize the results into graphs and write report.

**Results**  
The plants that were in the spinner grew longer than the ones on the ground. The average was a 77% increase in length (1.77times). In addition, the angle of growth was between 114 degrees and 135 degrees (measuring from vertical). The average angle was 125 degrees.

**Conclusions/Discussion**  
My hypothesis was correct. The roots grew at almost exactly the angle than I predicted. The roots of the plants in the spinner grew longer than the roots of the plants on the ground, just as I had predicted.

**Summary Statement**  
How creating artificial gravity in carrot plants changes their growth and development.

**Help Received**  
Dad helped take apart a clothes dryer, set up the drive system and build the structure for the pots, Mom helped typed the report.