



**CALIFORNIA STATE SCIENCE FAIR  
2010 PROJECT SUMMARY**

<b>Name(s)</b> Nolan A. Palmer	<b>Project Number</b> <b>J1315</b>
-----------------------------------	---------------------------------------

**Project Title**  
**Respiratory Physiology: Does Elevation Affect Vital Capacity?**

**Abstract**

**Objectives/Goals**  
My objective was to determine whether the lung capacity of middle school students who live continuously at high elevation differed from that of the same aged students who live continuously at sea level.

**Methods/Materials**  
Approximately 130 student volunteers between the ages of 12 and 14 consented to participate in this study. Fifty percent live in San Diego, at sea level and fifty percent live at elevations above 9,000 feet in Colorado. The protocol consisted of students completing a questionnaire regarding their activity level and length of time living at this elevation, as well as the length of time their parents and grandparents have lived at this elevation. They then began the experiment by filling their lungs as fully as possible and exhaling forcefully and completely into a balloon. The diameter of the balloon was then measured (in cm). Three attempts per person were made and averaged, with the average being plotted on a graph to achieve a conversion to volume and determine the actual lung capacity. Height and weight were used to calculate body surface area to determine an estimated vital capacity for each person. Actual capacity was then divided by estimated vital capacity and recorded as a percentage for each participant, and as a gender group by location. These averages were compared in order to draw a conclusion.

**Results**  
Subjects at the highest elevation used the greatest percentage of vital capacity (82%), while those at the lowest elevation used 10% less vital capacity (72%). This was consistent between the gender groups. 64% of students at the highest elevation had lived their entire lives at that elevation and 24% of these were the third generation to have lived their entire lives at that elevation. Likewise, 64% of those at sea level have lived their entire lives at that elevation, though only 11% of them were the third generation to do so.

**Conclusions/Discussion**  
My findings proved that those who live continuously at high elevations have a greater lung capacity than those who live at sea level.

I would like to do further investigation to see whether subjects living at an intermediate elevation have vital capacities that fall correspondingly between the two groups that I studied.

**Summary Statement**  
My project studies whether living continuously at high elevation increases one's vital lung capacity.

**Help Received**  
Mr. Degen and Ms. Slifka,, science teachers in Colorado, helped their students participate in research and sent me the results Mrs Deppe, science teacher in Apple Valley, helped me figure out how to compare estimated and actual vital capacities. . My mother helped record measurements, typed report and helped