



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Lianna M. Daug	Project Number 34136
Project Title Using Ion Leakage to Assess Cell Membrane Damage Due to Freezing	
Abstract Objectives/Goals The objective of this project is to study the effects of freezing on cells by using ion leakage to assess cell membrane damage. When beet root discs are frozen and thawed, will ion leakage, as measured by the electrical conductivity of the bathing solution, be affected by (1) the temperature at which the tissue is frozen, (2) the duration of freezing, and (3) the use of sucrose as cryoprotectant? Methods/Materials Beet root discs in beakers with distilled water were subjected to different temperatures for Phase 1 and different freezing times for Phase 2. In Phase 3, beets were presoaked in varying sucrose solutions before freezing. Electrical conductivity (EC) of bathing solution was measured at baseline and after freezing/thawing. The beakers were placed in a boiling water bath to completely disrupt cells and EC was measured after cooling, to reflect total EC. Percent ion leakage (PIL) was then calculated for each sample. Results Refrigeration led to lowest ion leakage (22%), followed by room temp (43%). Freezing at -20C had minimally higher ion leakage than -10C (79% vs 70%). PIL for 24 hrs vs 3 days vs 5 days were 77%, 83%, and 85% respectively, showing that there was higher ion leakage with longer freezing times. PIL for 0, 10%, and 20% sucrose setups were 77%, 14%, and 34% respectively. Sucrose proved to have significant cryoprotective effects with the 10% solution performing better than 20%. Conclusions/Discussion This project showed that ion leakage, as expressed by the electrical conductivity of the bathing solution, can be used to assess cell membrane damage due to freezing. Temperature and duration of freezing are factors that affect cell membrane damage. Sucrose has cryoprotective properties leading to decreased ion leakage from cells during the freeze/thawing process.	
Summary Statement My project is about using ion leakage to assess cell membrane damage due to freezing.	
Help Received My mother supervised the cutting of beet roots and the use of the boiling water bath.	