



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

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| Name(s) Matthew R. Johnson | Project Number J1520 |
| Project Title Flow Synchronization in Two Coupled Salt Oscillators | |
| <p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of my project was to determine the effect of hole size in coupled salt oscillators on the period and relative phase to which the oscillators stabilized after achieving synchronization.</p> <p>Methods/Materials Each salt oscillator consisted of a cup of salt water with a small hole in the bottom which is partially submerged in a common, larger container of distilled water. Given certain hole sizes and salt water densities, the two systems will start to oscillate. I ran a series of trials with different combinations of two hole sizes, 0.9 mm and 1.4 mm, and measured the oscillation periods of the two oscillators. A salt water density of 1.05 g/mL was the same for both oscillators and all trials. I used a stopwatch to measure the oscillation periods, a micrometer to measure the size of the hole, scales, measuring spoons, measuring cups and a digital camera.</p> <p>Results I found that the coupled salt oscillators with the same hole sizes (resulting in similar individual periods) stabilized at oscillations with equal periods and a constant relative phase. The salt oscillators with different hole sizes (resulting in different individual periods) stabilized at two different frequencies, with a frequency ratio of about 1:4, and constant relative phases. The oscillations of the salt oscillators consisted of periodic jets of salt water down flow and distilled water up flow. The time elapsed before flow synchronization was observed to vary from 5 minutes to 10 hours.</p> <p>Conclusions/Discussion The coupled salt oscillators did become synchronized with constant frequency ratios and relative phases. However, the time taken for synchronization was very sensitive to the hole size combinations, with 10 hours observed for the two different hole size combination.</p> | |
| Summary Statement The periods of two coupled salt oscillators were measured to see if the flows became synchronized. | |
| Help Received | |