



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Michelle Y. Zhu	Project Number S1020
Project Title A Novel, Inexpensive, Portable Medication and Vaccine Refrigeration Device	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective is to build a pocket-sized, user-friendly, everyday refrigeration device suitable for transporting pharmaceuticals in developing countries and other areas where electricity is nonexistent. With a couple of accessories, the device has potential to treat cardiac arrest, stroke, neonatal encephalopathy, Parkinson's disease, and head trauma in active elderly, car crash victims, athletes, service members and more.</p> <p>Methods/Materials The project contains a proof-of the concept prototype and is tested against design criteria. It needs to be inexpensive, small, light, reliable, and able to keep a stable temperature of under 8°C, the temperature that common vaccines need to be stored. The design of the device consists of two parts. One is the thermo electro static refrigeration component that becomes cold when electric current flows through it. The second part is the rechargeable battery power source that can be recharged with numerous sources of renewable energy. The temperature of the prototype was tested with a thermo coupler wire over periods of operation.</p> <p>Results The temperature of the device over three 15-minute operation periods demonstrated its ability to maintain below 8°C for an extended period of time. During its operation, the device was independent from any outside sources of electricity.</p> <p>Conclusions/Discussion This device is inexpensive, reliable, and portable, making it suitable for operation without external sources of electricity. With accessories, it can be used as an everyday medical device to treat cardiac arrest, stroke, Parkinson's disease, neonatal encephalopathy, and traumatic head injuries in active elderly, athletes, service members and more.</p>	
Summary Statement I built a pocket-sized, user-friendly, everyday refrigeration device suitable for transporting pharmaceuticals, with potential to treat cardiac arrest, and other diseases, without external sources of electricity.	
Help Received I designed and built the prototype myself using my school's industrial art facilities. My STEM teacher reviewed my results and made sure safety precautions were followed during experiments.	