



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Brent Peluso</b>	<b>Project Number</b> <b>S0320</b>
<b>Project Title</b> <b>Electrothermally Cooling a Pitcher's Arm</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> Cold temperature therapy using ice is a common method of recovery for baseball pitchers used to reduce inflammation of the shoulder and elbow after pitching. However, ice is usually not readily available to amateur and youth baseball pitchers directly after in-game throwing. Further, the zero degree Celsius temperature of ice may not be the optimal cooling temperature to aid recovery. As is suggested by the fact that ice must not be placed in direct contact with skin and must be kept on only for short periods of time, ice is likely too cold to optimally reduce inflammation. The objective of this thermoelectric cooling device is to provide a convenient alternative to ice with the ability for the user to control the specific cooling temperature. As an additional benefit, the chosen implementation method also provides the ability to heat.</p> <p><b>Methods</b> At its core, the system uses a Peltier device, which is a small, powerful solid-state heat pump, to extract heat from water. The water is cycled through insulated tubing, cooling pad, water reservoir, and water block. The heat extracted and pumped by the Peltier device is dissipated to the ambient through a forced convection radiator. The system is designed for operation from a 12 Volt battery and is controlled by an Arduino microprocessor and an H-bridge driving circuit.</p> <p><b>Results</b> A prototype was built as per the above description. The prototype was tested to be able to cool down the temperature of the internal operating liquid to temperatures as low as zero degrees Celsius and to heat up to 60 degrees Celsius. The prototype was also able to regulate a user-selected temperature when applied to an arm.</p> <p><b>Conclusions</b> The initial objective of creating a portable battery powered cooling/heating device was achieved. Several applications beyond a Pitcher's arm exist for this device, including general injury rehabilitation and improving human performance in suboptimal temperature conditions.</p>	
<b>Summary Statement</b> This device is a cooling/heating system created to provide a more convenient, safer, more readily accessible alternative to ice that allows the user to control the temperature to both heat and cool.	
<b>Help Received</b> My father, who is an electrical engineer, explained to me the principles of Peltier devices and the Peltier effect as well as providing insights to creating my Arduino program.	