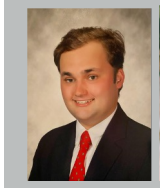


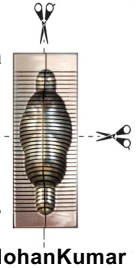

Cooling a Brain Sectioning Device

Team Members: Nicholas Cox, Anastasia Marx, Conner Sweat, and Grace Yankus

Faculty Advisor: Dr. Cheryl Gomillion

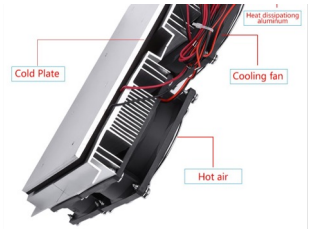
The Problem

Our client works to study neurotransmitters in mice brains. In order to effectively study their properties, the brains need to maintain a temperature between 0-10℃. If the temperature is below the range, the brain will become too brittle, causing inaccurate cuts during sectioning. If the temperature is above the range, the neurotransmitters will degrade.



Our task was to develop a device that Dr. MohanKumar can use for sectioning of the brains, which will maintain the brains within this temperature range while processing the tissue for her work.

The Method



The device utilizes thermoelectric cooling through the use of Peltier plates

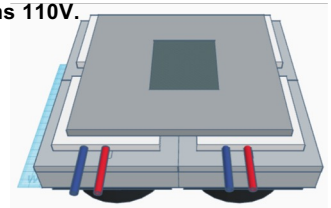
Thermoelectric cooling was chosen over liquid cooling. Peltier plates are more simple, secure, and easily replaceable/maintained than liquid cooling methods.

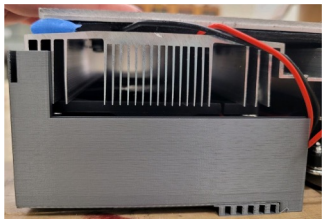
Thermoelectric cooling works through voltage differences across semiconductors. The higher the voltage difference, the higher the temperature difference between the hot and cold side.

The Design

Our developed device consists of 4 Peltier cooling units and 4 cooling fans. Peltier units are wired with 2 pairs of 2 units wired together to the power source and all 4 fans are wired together to the source. The power source runs 110V.

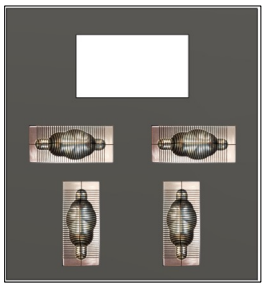
The top of the chassis restricts lateral movement of the brain matric and keeps it held secure against the cooling plate of the peltier device.



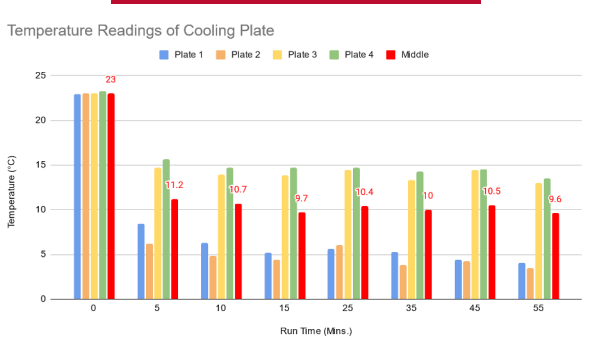


The bottom of the chassis secures the wires and keeps the unit secure with rubber feet to prevent sliding and airways to allow efficient heat dispersion by the fans.

The top has different slots available for the multiple different sizes of the matrices available. There is also an opening that allows for access to the top of the device that can be used to keep the slices cool after sectioning.



The Data



Temperature readings were taken for different quadrants on the cooling plate and on the middle, indicating that the desired temperature range was successfully reached.

The Result

Through multiple functionality tests, the device achieved the desired temperature range of 0 °C- 10°C, maintaining said temperature range for over an hour. The device is compact and has a 3D printed casing, protecting the user from skin contact with the cooling plate.

Acknowledgements

The team would like to acknowledge and thank Dr. Mark Haidekker for assistance and advice in the project design, and the College of Engineering for providing a place to work and learn.

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Sponsor/Client: Dr. Sheba MohanKumar, UGA College of Veterinary Medicine