

Brain Cooling Device

Client

Dr. Ugo Faraguna

Team Members

Jay Sekhon(Leader)

David Leinweber(BSAC)

Jon Seaton(Communicator)

Mark Reagan(BWIG)

Progress Report 3

February 5 to February 12, 2009

Problem Statement:

Sleep is homeostatically regulated; the more we are awake, the more and more intensively we need to sleep afterward. Despite this common notion, the mechanisms underlying the homeostatic regulation of sleep are still unknown. One key question pertains to which brain activities during waking are relevant for the subsequent homeostatic increase in sleep intensity. In parallel, one could argue what is relevant for the homeostatic decline of sleep intensity across the night. In other words what are the mechanisms underlying the idea that the more we sleep, the less we need to sleep. One option is that just the passage of time is relevant for both aspects of the homeostatic process regardless of any specific brain activity. Another option is that specific activities inducing neuronal or metabolic changes during waking are reflected during subsequent sleep. To distinguish these possibilities, an intriguing approach consists of selectively silencing neural activity in brain areas important for the sleep-wake cycle regulation; in particular of locally and reversibly silencing patches of cerebral cortex (where the homeostatic process most likely occurs). The specific aim of the project consists of developing a miniature cooling device able to reversibly silence neural activity in spatially defined brain areas of freely moving rodents.

Last Week's Goals

- Began detailed analysis of design ideas to determine which will be the most effective to meet the clients needs
- Worked on rough schematics for each of the design ideas
- Potentially meet with Ugo to get his input on the designs presented

Summary of Accomplishments

- Began calculations to evaluate design options
- Worked on design ideas and began to evaluate parts and components to make each design
- Calculated requirements for the device to meet certain aspects of the specifications

This Week's Goals

- Finish calculating device requirements to meet specifications
- Meet with Ugo to begin examining vortex tube
- Begin analyzing designs in a design matrix

Individual Goals

- Mark: Looked for additional background literature in tissue cooling and tissue thermodynamics. Worked on designing a Peltier circuit.
- Jay: Looked for additional thermodynamics information. Worked on designing Peltier circuit. Wrote weekly progress report.
- David: Calculated the btu requirement to cool the tissue. Began to think of a way to validate and test the design.
- Jon: Worked on the vortex tube design. Calculated the btu requirements to cool the tissue.

Project Difficulties

There have not been any notable difficulties yet.

Activities

- 2-06-09: Project meeting with Dr. Tyler; Team meeting to begin analysis of thermodynamic requirements.
- 2-07-09: Jon and David met to work on calculating requirements for the device to meet the cooling specifications
- 2-09-09: Mark and Jay began to try to design a circuit that would use the Peltier cooler efficiently
- 2-12-09: Jay wrote progress report.

Expenses

