Undergraduate Research Symposium May 17, 2013 Mary Gates Hall

Online Proceedings

POSTER SESSION 4

MGH 241, Easel 168

4:15 PM to 5:45 PM

Characterizing Neuronal Cell Survival of the Anteroventral Cochlear Nucleus in a Unique Mouse Model of Deafness

Samantha Joyce (Sam) Motley, Senior, Biology (General)
Mary Gates Scholar
Mentor: Edwin Rubel, Otolaryngology, Head and Neck Surgery
Mentor: Melissa Strong, Otolaryngology

In the auditory system the first site of neuronal auditory processing occurs in the cochlear nucleus (CN). All vertebrates studied to date depend on afferent sensory input during a critical period of young life for the normal development of the CN. We are investigating the intercellular and intracellular signaling pathways that lead to neuronal cell death (or survival) following the elimination of sensory input to the mammalian CN using a unique mouse model for deafness. The mouse variant (DTR) has a gene that codes for diphtheria toxin (DTx) sensitivity inserted behind the promoter that controls sensory hair cells. Wildtype mice will have no response to DTx but the DTR mice will have their sensory hair cells destroyed after an injection of DTx. The mice are injected with DTx at 5 days and 30 days of age. At 2 days post injection the majority of the sensory hair cells in the cochlea are destroyed. At the appropriate survival times, 6 and 10 days, the mice will be anesthetized and perfused with paraformaldehyde. Brain tissue will be collected and stained and we will be employing several visualization techniques to quantify and characterize different cell populations in the tissue. We predict that the DTR mice receiving DTx injections will show significantly more neuronal death in the CN as compared to any of the control groups. The amount of cellular death shown will depend on the age at which the mouse received the DTx injection, with younger mice showing increased cell death and the mice of 14 days and older showing less cell death with the neuronal survival rates being dependent on the age at which they received the DTx injection. And thus we will be able to specify more exactly the critical period regarding neuronal survival in the CN of this mouse variant.

POSTER SESSION 4

Balcony, Easel 86

4:15 PM to 5:45 PM

A Web-Based Community Firn Model

Paul Daniel (Paul) Harris, Senior, Applied & Computational Mathematical Sciences (Scientific Computing & Numerical Algorithms)
Mentor: Edwin Waddington, Earth And Space Sciences
Mentor: Jessica Lundin, Earth and Space Sciences
Mentor: Max Stevens, Earth and Space Sciences

The distribution of temperature and precipitation on our planet (i.e. our climate), affects plant growth, animal habitats, and the livability of Earth's varied regions. In order to predict future climate we need to know about our past climate. This is important to better understand how temperature and weather conditions change when the radiative forcing (e.g. CO2 greenhouse effect) on our atmosphere increases. The best way to predict these changes is researching past radiative forcing increases and how these events impacted Earth's climate. Some details of our past climate are discovered by analyzing polar ice and the gas bubbles trapped within. Firn is fallen snow that compacts and eventually turns into glacial ice. During this process gas can move relatively freely throughout the firn. When the firn densifies enough to block the air passageways, young gases are trapped in significantly older ice. This work is building a web-based community firn densification model that allows the user to accurately determine the difference between the age of a gas sample and the age of the ice surrounding it. Our transient model determines this delta age more accurately than current steady-state models by accounting for changing conditions as the firn turns into ice, instead of assuming conditions remain static throughout the firn evolution. This model is open-source, and written using the Python programming language, along with the NumPy library, allowing the model to be free and usable by anyone. Because the model is modular, users can easily change it to fit specific conditions or to incorporate different physical processes. Our goal is to provide a model that is simple to use, freely available, and helpful for developing a more accurate understanding of our past climate.

POSTER SESSION 4

Balcony, Easel 97

4:15 PM to 5:45 PM

Firn Model Inter-Comparison

William Procter (Will) Leahy, Senior, Interdisciplinary Visual Arts

NASA Space Grant Scholar

Mentor: Edwin Waddington, Earth And Space Sciences

Mentor: Jessica Lundin, Earth and Space Sciences

Mentor: Max Stevens, Earth and Space Sciences

Our 800,000-year climate record is dependent primarily on data obtained from ice cores. Analyzing and dating the ice, gas, and sediment in these cores allows us to construct a remarkably accurate historical record of Earth's climate and atmosphere. However, the dating and chronology of the ice record is not as exact as we would like it to be, especially deeper in the ice. Our ability to date ice cores with accuracy depends on our understanding the evolution of glacial firn, fallen snow that gradually compacts into ice. Researchers have developed many different models of firn evolution. The aim of this project is to run these models against each other under the same boundary conditions, so that we may compare their responses and determine the strengths of each model. Participants have submitted their model output and our results have been returned to them. A second inter-comparison will be organized to address issues brought up by our initial results. These comparisons will improve future efforts in firn-modeling, ultimately leading to a better understanding of our climate record.