Mapping Subsurface "Hot Spots" on Mars using THEMIS Thermal Infrared Radiance Data
Rebecca Mei (Rebecca) Wu, Sophomore, Center for Study of Capable Youth
NASA Space Grant Scholar
Mentor: Joshua Bandfield, Earth And Space Sciences

Liquid water cannot currently exist on the surface of Mars because of its low surface temperature and atmospheric pressure, but subsurface liquid water could exist near a location of subsurface volcanic or hydrothermal activity, creating an environment that might potentially house Martian life. Finding subsurface heat sources using solely surface temperature data is ineffective, though, because the diverse physical properties of the Martian surface make even nighttime temperatures highly variable. The Thermal Emission Imaging System (THEMIS) on the Mars Odyssey spacecraft, which measures the surface radiance at 9 different wavelengths in the infrared spectrum at a spatial sampling of 100 meters per pixel, can be used to better detect subsurface volcanic or hydrothermal heat sources. Because variation in temperature has different effects on the radiance values at different wavelengths, surfaces with a small contribution (<1% surface area) of temperature irregularities can be more accurately detected by comparing the radiance values of each pixel at band 9 (12.57 microns) and band 4 (8.56 microns) with the values expected of an isothermal surface. Pixels of interest correspond to locations on the Martian surface that can be mapped using the Java Mission-planning and Analysis for Remote Sensing (JMARS) program in order to determine its local geological context, and are then further examined using high resolution visible images. Thus far, research of this sort has not detected any geothermal or hydrothermal activity, but this type of analysis can continue to be improved and used in order to search for locations of thermal anomalies as small as 10 meters across. This process can also be used to provide insight into more general Martian surface properties and geologic processes.

Crystallographic Constraints on Magnetite Formation in Plagioclase
Max Mousseau, Senior, Environmental Science, UW Tacoma
Mentor: Peter Selkin, School of Interdisciplinary Arts & Sciences
Mentor: Joshua Feinberg, Geology & Geophysics, University of Minnesota

Much of the multi-billion year history of the Earth’s magnetic field is understood from looking at patterns of magnetization in microscopic particles of the iron oxide magnetite in the calcium-aluminum silicate plagioclase. As rocks cool from high initial temperatures, trace amounts of iron are ejected from the plagioclase structure, forming magnetite. As the magnetite cools, it acquires a magnetization in Earth’s magnetic field. Geoscientists commonly assume that magnetite forms before reaching its Curie temperature (~570 °C), which is the temperature at which it becomes permanently magnetized. This study tested this assumption by examining the relative crystallographic orientations of magnetite inclusions and their host plagioclase crystals. In other mineral systems, this relationship varies with temperature. We examined a total of 28 plagioclase crystals from two sites in the Stillwater Complex in Montana using electron backscatter diffraction (EBSD) and scanning electron microscopy. In these, we found six magnetite inclusions with mostly acicular to tabular crystal habits. We determined the magnetite’s temperature of formation by comparing our measurements to minimum-strain orientations of magnetite in plagioclase calculated at a range of temperatures. Our findings will have the potential to negate an assumption many other studies make regarding geomagnetism and the history of Earth’s magnetic field.
**Monitoring Martian Inter-annual Climate Variability**  
*Laura Cristina (Laura) Mayorga, Junior, Astronomy  
NASA Space Grant Scholar  
**Mentor:** Joshua Bandfield, Earth And Space Sciences*

Similar to satellite measurements on Earth, scientists are starting to assemble a multi-annual record of surface and atmospheric temperatures on Mars. By monitoring the Martian atmosphere, it may be possible to provide insight about global climate change and apply those findings to similar problems on Earth. On Mars, the movement of dust is a dominant and dynamic factor that drives both surface and atmospheric temperatures. Using data returned from the Thermal Emission Spectrometer (TES) onboard the Mars Global Surveyor (MGS), we can retrieve atmospheric temperature profiles as well as surface temperatures. By monitoring the global changes over the course of over four Martian years, seasonal and annual differences are mapped and plotted. Our study has found that even after a global dust storm that resulted in significant regional changes in surface albedo, the temperatures and planetary albedo have returned to normal by the next year. This result contradicts work done by earlier studies, whose data was altered by calibration artifacts. The information acquired from the analysis of our data will lead to a better understanding of the magnitude of inter-annual climate variability and its driving factors.

**SESSION 1Q**

**CONSERVATION AND RESTORATION OF NORTHWEST ECOSYSTEMS**  
*Session Moderator: John Marzluff, Environmental and Forest Sciences*  
**Mary Gates Hall Room 295  
1:00 PM to 2:30 PM*

*Note: Titles in order of presentation.*

**Assessment of Species Sensitivity to Climate Change in the Pacific Northwest**  
*Yingqi (Fred) Liu, Junior, Exchange - Engineering  
**Mentor:** Joshua Lawler, School of Environmental and Forest Sciences  
**Mentor:** Michael Case, Forest Resources*

In the Pacific Northwest, over the next several decades, scientists have projected that both the average temperature and the frequency of extreme precipitation will continue to increase. These trends may lead to shifts in species’ distributions and impose adverse impacts on species vulnerable to environmental change. Although resource managers and conservation specialists have developed tools to mitigate climate change, it is still important to assess the potential vulnerability of species to climate change and to identify the species that are most sensitive. Such an evaluation helps managers to set conservation priorities for different species and to make efficient conservation-investment decisions with limited resources. At this stage of the ongoing sensitivity assessment project, we are aiming to assess the sensitivity to climate change of species in Washington, Oregon and Idaho. We classify species into 14 categories: fungi, non-tree plants, tree plants, clitellata, gastropoda, malacostraca, bivalves, insects, lamprey, fish, amphibians, reptiles, birds and mammals. In the assessment of species sensitivity, we adopt two independent methodologies: synthesis from literature review and direct contact with species experts. For each species, we base our estimation of sensitivity on factors including dispersal ability, dependence on disturbance regimes (e.g. fire, flood), dependence on other species, physiological sensitivity to physical conditions (e.g. temperature, salinity, precipitation), reproductive strategy and susceptibility of the habitat to climate change. We are working with species experts both individually and in workshops to help them enter their rankings of sensitivity of species into the online database. For the final product, we will produce a database of species sensitivity to climate change, which will assist conservation planners and resource managers in setting conservation priorities and maximizing return on conservation investment.

**POSTER SESSION 2**  
*MGH 241, Easel 174  
2:30 PM to 3:30 PM*

**Hippocampal Sclerosis in the Population-Representative Adult Changes in Thought Study: Prevalence and Relationship to other Common Neuropathologies of Aging**  
*Michelle Stacey (Michelle) Christopher, Senior, Neurobiology  
**Mentor:** Joshua Sonnen, Pathology*

Hippocampal sclerosis (HS) is a neuropathology thought to underlie age-related cognitive impairment and dementia. It has been suggested that HS is related to other pathologic processes, specifically Alzheimer’s disease or vascular disease. Our objective was to determine the prevalence of HS within our autopsy cohort and determine whether HS correlated with other neuropathologies. 323 consecutive autopsy cases from the Adult Changes in Thought (ACT) study, an ongoing, community-based, longitudinal study of brain aging and cognitive decline, were evaluated. Subjects were ACT participants 65 years or older who were cognitively intact at the time of enrollment in the Group Health Cooperative in King County, Washington. Hippocampi were sampled in the coronal plane at the level of the uncus and the lateral geniculate body. HS was defined as marked neuronal loss and
gliosis in the CA-1 region and subiculum of the hippocampus. The sample set was evaluated for associations between clinical diagnosis of dementia and multiple neuropathological findings using pairwise correlation analysis. Complete neuropathologic evaluations were available on 309 cases. Of these cases, there were 14 (4.5%) with complete HS. Six individuals with HS were clinically diagnosed with dementia. Clinical dementia status was not significantly correlated with postmortem pathologically diagnosed HS. Seven of the cases with HS occurred in the setting of Braak stage V or VI. HS correlated with high Braak stage (p>0.05), but not with any other neuropathology. Complete HS was relatively rare in our cohort, but occurred in the setting of high Braak stage more often than would be predicted by chance alone. HS was not a strong correlate of dementia. These findings suggest that HS may be related to Alzheimer’s disease, but appears to be insufficient by itself to cause clinical dementia.