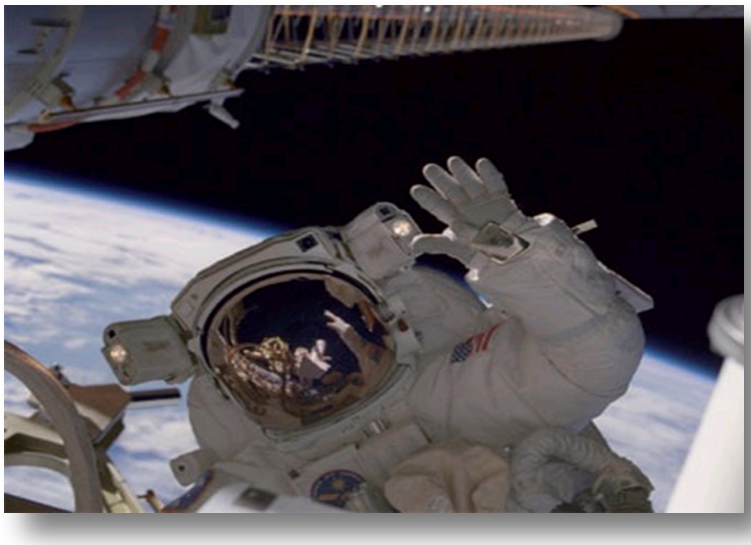
Oregon NASA Space Grant Consortium

2018 SCORE Student Symposium Proceedings

June 1, 2018

9:00 am - 2:20 pm

LaSells Stewart Center
Ag Science Room
Oregon State University



featuring presentations from
OSGC STEM Community College Opportunity for Research Experience (SCORE)
award recipients

2018 SCORE Student Symposium

Hosted by
Oregon NASA Space Grant Consortium (OSGC)
June 1, 2018

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Presentation Schedule

8:30am	**POSTER SET-UP** - Breakfast provided for presenters
9:00am	**OPEN POSTER SESSION**
9:45am	**DIRECTOR WELCOME** Dr. Jack Higginbotham, Director, Oregon NASA Space Grant
10:00am	**KEYNOTE ADDRESS** Dr. Matthew Andrews, Executive Associate Dean, College of Science, OSU

TIME	Presenter
10:40am	**Audrey Vaughn** Linn-Benton Community College Title: *Controlled Altitude Pressure Valve*
11:00am	**Andrew Jozwiak** Portland Community College - Sylvania Title: *The Modern Eddington Experiment*
11:20am	**Emma Frazier** Portland Community College - Southeast Title: *A Search for Urban Micrometeorites in Portland, Oregon*
11:40am	**Caleb Marshbank** Portland Community College - Sylvania Title: *Glacier Melt Rate Measurement*
12:00pm	**LUNCH/NETWORKING/POSTERS** - Food and refreshments provided for presenters
1:00pm	**Myka Kang-Lanz** Portland Community College - Rock Creek Title: *Genome Re-annotation of Desulfurobacterium thermolithotrophum*
1:20pm	**Marshall Andersen** Linn-Benton Community College Title: *Polarized Light of the Sun's Corona*
1:40pm	**Eleanor Paige Nicholson** Portland Community College - Sylvania Title: *Glacier Melt Rate Measurement*
2:00pm	**ADJOURN**

Keynote Address

Dr. Matthew Andrews
Executive Associate Dean, College of Science
Oregon State University

Title: Hibernation and its Potential Application to Human Space Travel

Abstract

Hibernating mammals provide a unique system for identifying molecules that are important in regulating metabolism, body temperature and food intake. In a state of deep hibernation body temperature is only a few degrees above 0°C, oxygen consumption holds at 1/30 to 1/50 of the aroused condition and heart rate can be as low as 3-10 beats/minute, compared to 300-400 beats/minute when the animal is awake and active. Using multi-omic approaches we have identified genes, proteins and small molecules that are responsible for the physiological characteristics of hibernation in the thirteen-lined ground squirrel, *Ictidomys tridecemlineatus*. Determining the function of gene products and small molecules involved in hibernation is one of the main goals of the laboratory and has applications in the areas of hypothermia, organ preservation, ischemia/reperfusion injury, and human space travel.

Student Presenters - Abstracts

Marshall Andersen
Linn-Benton Community College
Polarized Light of the Sun's Corona

During the total solar eclipse on August 21st 2017, I captured a sequence of three photographs through a polarizing filter whose transmission directions were oriented at three unknown angles; two additional photographs were captured without a polarizer. I present the analysis of these photographs and the results that compare the degree of polarization as recorded by this sequence to coronal polarization data collected by a team of researchers in Madras, Oregon during the same eclipse.

Emma Frazier
Portland Community College - Southeast Campus
A Search for Urban Micrometeorites in Portland, Oregon

Micrometeorites fall from space, pass through the atmosphere and land on the Earth's surface. Jon Larson (2017, In Search of Stardust: Amazing Micrometeorites and their Terrestrial Imposters) was the first to demonstrate that micrometeorites could be recovered from urban settings such as rooftops. Micrometeorites are typically small about 50um to 2 mm in size, dark magnetic spheres. On January 18, 2018 I collected dust from the roof of the Student Commons Building at the Southeast Campus of Portland Community College. The weather was rainy so the particles were collected from sediment in the puddles on the rooftop. The collected sediment was filtered, dried, and sieved from 500 microns down to 63 microns before using a magnet to separate the magnetic particles. The separated particles were examined with a binocular microscope. 50 hours of examination identified 12 possible candidates which were then examined using a SEM. SEM observation revealed several particles to be aggregates and only one particle with a surface texture similar to the micrometeorites documented by Larson (2017). I had intended to use chemical analysis to further confirm the candidate particles as micrometeorites, unfortunately the EDS unit on the SEM was not working at the time of this study. This research has identified only one strong candidate which leads to a new question: as the roof I collected the samples from was only four years old, Does roof age make a difference?

Andrew Jozwiak
Portland Community College - Sylvania Campus
The Modern Eddington Experiment: Reconfirming General Relativity

Modern cosmology emerged in 1915 when Albert Einstein published his *General Theory of Relativity* (GTR) which unified space and time into a 4-dimensional surface curved by mass. This theory predicted that light waves will be *bent* or 'lensed' around massive objects. Einstein computed this deflection to be 1.75 arcseconds at the Sun's limb, and in 1919, Arthur Eddington conducted an experiment measuring this deflection during a total solar eclipse. The experiment was successful, with deflections measured within two standard deviations of GTR's predictions.
On August 21st, 2017, with student researchers, faculty mentors, and local astronomers, this experiment was recreated with modern astrometry equipment. Our goal was to record starlight deflection within 5% of Einstein's predicted value at the Sun's limb. A Televue NP101is refractor, SBIG ST 8300 CCD, SBIG STT-FW8G, Celestron AVX mount, and the MaximDL software suite were the peripherals. With similar methods, two

disparate experiments were conducted; one in the Ochoco National Forest, and one in Lyons, OR, at astronomer Richard Berry's Alpaca Meadows Observatory (AMO). Images from the Ochoco National Forest were laden with electrical interference, while those from AMO have proven robust, with a 23 image-composite showing ~30 background stars. The rigor of Python programming and data reduction is, however, formidable, and our team continues to work through reducing cubic distortions, thermal contraction expansion error, atmospheric distortion, and star centroiding. This has been a remarkably enriching experience and bolsters my desire to continue relativistic research!

Myka Kang-Lanz
Portland Community College - Rock Creek Campus
Genome Re-annotation of Desulfurobacterium thermolithotrophum

Purpose: *Desulfurobacterium thermolithotrophum* uses sulphite, sulphur, and thiosulphate, but is unable to use nitrate as a final electron acceptor in anaerobic respiration. However, many related species can utilize nitrate in anaerobic respiration, such as *Desulfurobacterium pacificum*, and *Thermovibrio ammonificans*.
Methodology: By referencing Kyoto Encyclopedia of Genes and Genomes, the necessary enzyme was identified as periplasmic reductase NapA. A homolog was identified in the genome of *Desulfurobacterium thermolithotrophum* to be formate dehydrogenase, subunit A.
Results: Formate dehydrogenase, subunit A and periplasmic reductase NapA are closely related genes. It was determined that the NapA gene in *Desulfurobacterium thermolithotrophum* is not capable of reducing nitrate and only reduces formate. Analysis of the nitrate reductase pathway revealed that it is only functional when all genes are arranged together in the genome as an operon. *Desulfurobacterium thermolithotrophum* does not have the genes arranged together in the genome whereas *Desulfurobacterium pacificum* and *Thermovibrio ammonificans* have them all arranged properly. It also appears that NapD is essential for nitrate reduction, but this gene is absent in *Desulfurobacterium thermolithotrophum*.
Conclusion: Without NapD or a clear operon within the *Desulfurobacterium thermolithotrophum* genome it is possible that these are the reasons for a nonfunctional nitrate reductase pathway. This may be of evolutionary significance because understanding of how these extremophiles adapted to live in such harsh environments is vital to understanding how life may be possible other than on Earth. Further research is needed to decipher what caused the nitrate reductase pathway to become nonfunctional.

Caleb Marshbank
Portland Community College - Sylvania Campus
Glacier Melt Rate Measurement

The purpose in asking for this grant was to find a way in which we could measure the ablation rate of a glacier in a cheap, accurate, non-time consuming way. We did this by using a cryoconite, LabQuest, and thermistor. The whole premise of this experiment is based on the rock we used, called a cryoconite. This is a fancy name for a rock sitting on top of a glacier. The name literally means "ice rock". There is a type of cryoconite that rests on top of a glacier, with its underside directly level with the glacier. Thus, the temperature of the bottom of the rock is the same temperature as the ice, which is zero degrees C. We can say this because it is not melting into the glacier at all. So, we take the top temperature of this rock over a period time using our LabQuest and thermistor, and then integrate the graph of all our temperature data points to get the thermal energy of the rock over that period of time. We can use this data to find the ablation rate (melt rate) of the glacier over that period of time. This is a very simple and cost effective method of measuring glacier melt rate that only requires a LabQuest, thermistor, and a cryoconite. In conclusion, we have created an effective, simple, and accurate way to measure the melt rate of glaciers.

Eleanor Page Nicholson
Portland Community College - Sylvania Campus
Glacier Melt Rate Measurement

Our goal in this project was to create a device (which we decided to call the Glacier Energy Monitor, or GEM for short) that would be able to measure the melt rate of a glacier using only a cryoconite and a thermistor. We are able to do this because of cryoconites, or rocks that sit on a glacier. When a cryoconite is 20 cm in height, it will stay on the surface of the glacier as it melts and refreezes. This is because the rock receives the same amount of energy as the glacier. Our mentor, Toby Dittrich, went to Alaska and studied trends with cryoconites. When the rock is smaller in height than 20 cm, the cryoconite will sink into the surface of the glacier, creating boring cylinders. When the height of the cryoconite is larger than 20 cm, the ice melts around it and a rock table is created. We used the 20 cm cryoconite, because we can use the change in temperature from the top of the rock to the bottom to give us the energy flowing through it. This energy is the same as the energy going through the glacier, giving us the ablation rate. The project was a major success and we have created a working GEM. We have run multiple tests with positive results, and we are elated to say that we have completed all of the goals which we set for ourselves.

Audrey Vaughn
Linn-Benton Community College
Controlled Altitude Pressure Valve

The ACES (Altitude Control Exhaust System) is a device that uses a ball valve and an Arduino to exhaust helium from a high-altitude weather balloon. The purpose of the ACES is to increase the flight time of weather balloons for longer duration experiments in the stratosphere. This system was tested using Matlab simulations prior to build and will be field tested within the next month. The simulations conclude that the system will succeed in extending the flight of a balloon by keeping the volume below its burst capacity.