Oregon NASA Space Grant Consortium

2022 Spring Symposium Proceedings

Featuring projects from students who participated in the following OSGC 2021-22 programs:

AFRIP | Affiliate Faculty Incubator Program

Graduate Fellowships

NASA Center Internships

SCORE | STEM Community College Opportunity for Research Experience Program

STARR | STudent Academic Research Review Award Program

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2022 Spring Symposium Proceedings

Program funded by
Oregon NASA Space Grant Consortium (OSGC)

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Presentation Schedule

Access Zoom links to live presentations via the 2022 Spring Symposium Website
https://spacegrant.oregonstate.edu/student-symposium-welcome-page

9-10am	**WELCOME** | Oregon NASA Space Grant **KEYNOTE ADDRESS** | **Ms. Ali Guarneros Luna** | NASA Ames Research Center ***Becoming Dr. CubeSat***

MORNING SESSIONS

	SESSION A – Ag Production Room	SESSION B – Ag Science Room
	AFRIP **Affiliate Faculty Research Incubator Program**	**STARR Program** **STudent Academic Research Review**
10:20am	**[A-1]** * **Hayden Babst, Lichen McHenry** Portland State University Mentors: Melinda Hutson, Ph.D. and Alex Ruzicka, Ph.D. ***Meteorite Classification: Learning the Tools of the Trade***	**[B-1]** * **Rose Jardine** | Portland State University Mentor: Alex Ruzicka, Ph.D. ***Visual and Tactile Perception in Deep Space: Accommodating a Reduction in Vision***
	NASA Center Internships	
10:40am	**[A-2]** V **Nathan Wiley** | Oregon Institute of Technology NASA Goddard Institute for Space Studies ***Science and Art in the Time of Coronavirus***	**[B-2]** V **Adrian Jimenez** | Portland State University Mentor: Alex Ruzicka, Ph.D. ***The Ocean Worlds: A Frontier in Planetary Science and Astrobiology***
11:00am	**[A-3]** * **Liam Brinton** | Oregon State University NASA Armstrong Flight Research Center ***OSTEM Engagement/AeronautX STEM Support***	**[B-3]** **Hayden Reinhold** | Portland State University Mentor: Sung Yi, Ph.D. ***Deployable Spacecraft Structures and Associated Mechanisms***
11:20am	**[A-4]** V **Mallory Hawke** | Portland State University NASA Glenn Research Center ***Inventory Management Project***	**[B-4]** V **Abigail Velasco-De Jesus** | Pacific University Mentor: Kevin Carr, Ph.D. ***Moving Latino/a Students into STEM Careers by Implementing NASA Resources into a Math Curriculum***
11:40am	**[A-5]** V **Aron Aldridge** | Oregon Institute of Technology NASA Goddard Space Flight Center ***Determining if a Calibration Fixture can be Built to Fit in a Small-sized Vacuum Chamber***	

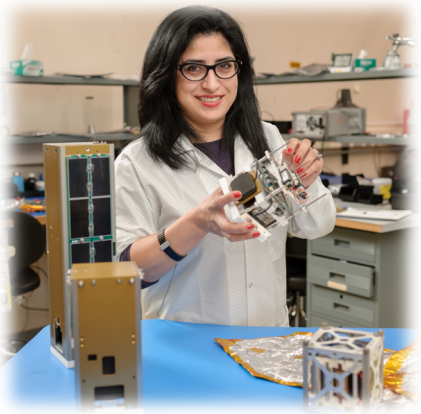
12pm	**LUNCH | NETWORKING | POSTERS** Lunch Provided

AFTERNOON SESSIONS		
	SESSION C – AG Production Room	**SESSION D – Ag Science Room**
	SCORE Program **STEM Community College Opportunity for Research Experience**	**STARR Program** **STudent Academic Research Review**
1:20pm	**[C-1]** **Brad Ackroyd** | Portland Community College RC Mentor: Andrew Hilt ***Travel Times to Tsunami Safety Zones in Seaside OR***	**[D-1]** **V** **Madeline Fischer** | Portland State University Mentor: Erik Bodegom, Ph.D. ***Period of a Leaky Pendulum***
1:40pm	**[C-2]** * **Effy Bishop** | Portland Community College SE Mentor: Eriks Puris, Ph.D. ***Indoor Radon Concentration and Depth to Portland Groundwater***	**[D-2]** **V** **Taylor Lohrie** | Portland State University Mentor: Jay Nadeau, Ph.D. ***Methods in Astrobiology***
2:00pm	**[C-3]** **Jake Bullard** | Southwestern Oregon Community College Mentor: Zinzi Nandi Segura Konig, RN, MPH ***The Application of Radiation Challenges in Simulated Martian Regolith and diazotrophic Cyanobacteria for Selective Breeding of Cold-, Drought-, and Radiation-tolerant Food and Grain Crop Amaranthus hypochondriacus for Human Spaceflight Exploration and Operations to Mars***	**Graduate Fellowship** **[D-3]** * **Daniel Sheikh** | Portland State University Mentor: Alex Ruzicka, Ph.D. ***Physical and Chemical Modification of Lunar Crustal Materials as Observed in Feldspathic Lunar Meteorites***
2:20pm	**[C-4]** **V** **Teresa Nguyen** | Portland Community College SE Mentor: Julia Betts ***Alternative End Cap Designs for Isogrid Propellent Tanks on Low-Cost Launch Vehicles***	
2:40pm	**[C-5]** **Essau Klopfenstein** | Portland Community College SE Mentor: Benjamin Simon, Ph.D. ***The Effect of Ionizing Radiation on Radiotrophic Fungi in the Context of Space Travel***	

3-4pm	**RECEPTION | NETWORKING** Light Refreshments Provided

V=Virtual presentation
*= Physical poster on display at the event
Note: All posters are available online in the virtual poster session

Keynote Speaker



Ali Guarneros Luna

Aerospace and Systems Engineer, NASA Ames Research Center

Project Management for the Space Technology Mission Directorate (STMD), Small Satellite Technology (SST) Program

Project Manager for Tipping Points (TP) and Announcement of Collaboration Opportunity (ACO)

Keynote Talk: ***Becoming Dr. CubeSat***

Bio: Ms. Ali Guarneros Luna is a senior NASA aerospace engineer supporting the Small Satellite Technology (SST) Program at The Space Technology Mission Directorate (STMD), managing Tipping Points program, Announcement of Collaboration Opportunity (ACO) projects, and other small satellites.

Prior to this position, Ali has been involved in many small spacecraft programs including being the Mission Manager of the Technology Education Satellite, (TechEdSat), Deputy Manager for Network & Operation Demonstration Satellite (NODES), System Engineer for Synchronized Position Hold, Engage, Reorient, Experimental Satellites (SPHERES) national lab, and many others at NASA Ames Research Center. She has made significant contributions as a member of the SPHERES Engineering team, a group that helps scientists, companies and government institutions from all over the world access the highly advanced robot platforms that are located on the International Space Station (ISS), as well as the first American satellite deployed form the ISS, TechEdSat.

Ali grew up in Mexico reading about the space shuttle missions and decided she wanted to study Aerospace Engineering. At 14, Ali immigrated to California. After graduating from high school still mastering the English language, she attended San Jose City College where she obtained an A.S. degree and then transferred to San Jose State University (SJSU), Department of Engineering. She graduated from SJSU with a B.S. in Aerospace Engineering and began her career as an intern with NASA Ames Research Center working with the Center's Chief of Technology. She also has a M.S from San Jose State University (SJSU), Department of Engineering. Prior to her move to Code PX, she led a project for human rate vehicles, safety certification, and certifying equipment for flight.

Ali is an active member of the community, participating in multiple STEM related associations, mentoring students ranging from elementary school to the university level. Ali was honored by the Hispanic Engineering National Achievement Awards Conference (HENAAC) Great Minds in STEM with an award Luminary Honorees, in 2014 she was awarded by the office of the International Space Station (ISS) Space Award for her work to SPHERES, MRMSS, NODES, and TechEdSat Series. In October 2015, Ali was awarded the NASA Honor Award - Equal Employment Opportunity Medal. In February of 2018, Ali was awarded the 2017 Space Technology Award for the Project NODES. Ali’s international recognition includes the Ohtli Award or Reconocimiento Ohtli, presented to her May 3, 2018. In October of 2018, Ali received the Women of Color (WOC) Outstanding Technical Contribution in Government Award. In September 2019, Ali was given the Most Promising Scientist or Engineer award at the Hispanic Engineer National Achievement Awards Corporation (HENNAC). In 2020, NASA recognized Ali’s work with a Sliver SNOOPY Award.

Student Presentations

Session A

AFRIP – Affiliate Faculty Research Incubator Program

[A-1] Hayden Babst, Nicole Bintliff, Lichen McHenry
Portland State University | Mentors: Melinda Hutson, Ph.D. and Alex Ruzicka, Ph.D.

Meteorite Classification: Learning the Tools of the Trade

Classification of meteorites provides an opportunity for undergraduate students to engage in space-related STEM research activities, by becoming skilled in the use of an optical microscope and familiar with the manipulation and evaluation of mineral-chemical data. Work performed is scientifically useful and necessary. Two undergraduates (Babst, McHenry) and one post-bac (Bintliff) examined meteorites in thin section using an optical microscope in plane-polarized, cross-polarized, and reflected light. They used Photoshop to process images of their sections taken in all three light modes via a digital camera attached to the microscope. These data were used to determine the shock stages and weathering grades for each sample. Supervisors obtained mineral-chemical data using a Zeiss Sigma VP FEG scanning electron microscope (SEM). Data was transferred to an Excel spreadsheet for evaluation and calculation of end member compositions. Meteorite chemical class and petrographic type were determined from these data. All three meteorites are ordinary chondrites, with the classifications of: CML0627asH5 W3 (two lithologies with different shock stages), CML 0629asL6 S4 W2, and CML1314 as L6 S4 W3. Formal write-ups for the three newly characterized meteorites have been submitted to the nomenclature committee of the Meteoritical Society for official approval and naming.

NASA Center Internships

[A-2] Nathan Wiley
Oregon Institute of Technology | NASA Goddard Institute for Space Studies

Science and Art in the Time of Coronavirus

Purpose: The main goal of this project is to tie together art and science in a way that is impactful. For the science portion, the goal was to see if there was any impact of climate change that will affect farms and crops in Oregon. The art piece was meant to reflect the data.

Methodology: There were four main variables to look at: Well water levels, snow water equivalence, precipitation, and temperature. With the help of the fantastic people I worked with, I was able to learn and use the mapping software QGIS to import and map data sets from gridMET for precipitation and USDA's National Agricultural Statistics Service and National Water and Climate Center for crop yields, well water levels, and snowpack. I also worked with climate model projections using the SSP2-4.5 projection for temperature.

Results: The mapping software really gave a good idea as to what the long-term trends have been in Oregon from 1980 to present day. The trend shows most basins in Oregon getting less snow every year. The well levels show us where the aquifers are gradually decreasing. In general, most of the decreasing wells are grouped in areas that are decreasing in snow water equivalence also. The painting shows a decrease in snowpack, arid cirrus clouds, and reduced crop yields.

Conclusions: The data shows that in Oregon, groundwater and snowpack levels are decreasing as temperatures rise. Eventually, this will start affecting local agriculture and we need to work with farmers to help prevent this.

[A-3] Liam Brinton
Oregon State University | NASA Armstrong Flight Research Center

OSTEM Engagement/AeronautX STEM Support

In my two NASA internships, I worked on three projects. These were the Space Grant Year in Review book, Mag-Sep Demo Device, and X-59 3d-Printing Maker Bundle. The Space Grant Year in Review project was about creating a year in review book for the 52 Space Grant states and territories. This was designed to highlight what each state and territory does. Given the large amount in addition to the other parts of the book, organization and creating an efficient workflow were vital parts to the project's success. Meanwhile the Mag-Sep project entailed creating a demonstration device for a Mag-Sep Unit. This would be used to show off and demonstrate

the features of the Mag-Sep system through a tabletop system. The main parts of the design were aiming to keep the system simple and cheap while enabling flexibility with the design. Finally, the X-59 3d-Printing Maker Bundle project involved creating X-59 models for STEM environments. The goal was to make a model that libraries and educators could use to get young students excited about STEM as a career. This project was completed in solid works and involved lots of 3d modeling.

[A-4] Mallory Hawke
Portland State University | NASA Glenn Research Center

Inventory Management Project

The Bonded Storage team at NASA's Glenn Research Center (GRC) holds custodianship over a large inventory primarily consisting of expensive, bespoke, purpose-built flight and research hardware. These assets have served their original purpose and been retired but may continue to serve NASA, either in part or in whole, in future projects. However, until recently, there was no clear or coherent way for members of GRC to find, or request, pieces of this inventory. The Inventory Management Project (IMP) is a persistent, NASA-internal, web application, which seeks to resolve this tension by serving two primary functions; first, it provides the Bonded Storage team with an intuitive, easy-to-use, tool-suite which allows them to upload, maintain, and track their asset inventory. This tool suite consists of a database management tool, which supports create, read, update, and delete (CRUD) operations and provides basic .csv support, as well as an order management system that allows them to view, update, delete, or fulfill customer orders. Second, it serves as a catalog, enabling the various engineering teams and labs around GRC to easily search through this inventory to find and request assets, or their subcomponents, for use in current projects. IMP has been built exclusively using industry-standard languages, tools, and frameworks such as: NodeJS, Express JS, JavaScript, MySQL, and Passport; this ensures a high degree of application stability, as well as long-term maintainability. As of writing, the application is live on NASA's servers and employs a SAML protocol for single sign-on.

[A-5] Aron Aldridge
Oregon Institute of Technology | NASA Goddard Space Flight Center

Determining if a Calibration Fixture can be Built to Fit in a Small-sized Vacuum Chamber

Research Project: Determining if a calibration fixture can be built to fit in a small-sized vacuum chamber.

Methods: Using Solidworks and a little elbow-grease, we tried different orientations and designs to attempt to fit all of the necessary components within the needed size target.

Key Results: While all of the components were able to be fit inside the desired envelope, once the plumbing would be added, the size would be too large for the smaller-sized vacuum chambers.

Conclusions: It is not possible to create a calibration fixture that contains all of the needed components that could fit within the smaller-vacuum chamber; a larger one is necessary.

Session B

STARR – STudent Academic Research Review

[B-1] Rose Jardine
Portland State University | Mentor: Alex Ruzicka, Ph.D.

Visual and Tactile Perception in Deep Space: Accommodating a Reduction in Vision

This research will provide insight to accommodating Spaceflight Associated Neuro-Ocular Syndrome (SANS) when operating and performing tasks in low-light, no light, and long duration spaceflight, such as the Artemis Missions. Vision is disrupted in about 70% of astronauts, making it necessary to find viable options to mitigate this impaired sense until more research can be completed on this common disorder. There are documented medical cases examining where certain senses compensate for an impairment in others, offering suitable alternative options via enhancing perceptual abilities. Incorporating tactile feedback into a hands-on solution will benefit astronauts' ability to distinguish between a variety of textures and materials, which is useful in a vision impaired environment. Current technologies are already utilizing stochastic resonance to enhance mechanoreception in the fingertips. These devices will provide object and control distinction, as well as a method for communication, utilizing textural differentiation. The International Space Station (ISS) implements The

Gravitational References for Sensorimotor Performance: Reaching and Grasping (GRASP) test in ongoing research. Testing stochastic resonance for mechanoreception in combination with the GRASP test will show promising results in the advancement of SANS research for the future of deep space exploration.

[B-2] Adrian Jimenez
Portland State University | Mentor: Alex Ruzicka, Ph.D.

The Ocean Worlds: A Frontier in Planetary Science and Astrobiology

This project aims to curate and summarize information on the state-of-the-art of "ocean world" research being conducted by astronomers and planetary scientists worldwide. Ocean worlds are any celestial body that contains a significant amount of liquid water, either at or below the surface. The only known planet to harbor life, Earth, is an ocean world. NASA suspects that ocean worlds provide one of the highest possible chances for finding life outside Earth, motivating a wide array of research and exploration into the subject. There are currently nine confirmed or suspected ocean worlds in our solar system: Earth, Europa, Ganymede, Callisto, Enceladus, Titan, Mimas, Triton, and Pluto. NASA has two missions planned for exploring ocean worlds of our solar system: the Europa Clipper and the Titan Dragonfly. Clipper will orbit Jupiter and investigate whether Europa could sustain life, while Dragonfly will explore the surface, atmosphere, and subsurface of Titan. Novel methods such as Clipper and Dragonfly are vital to exploring ocean worlds and advancing the search for life and are a natural next step beyond current remote sensing research. Some vital gaps still exist, particularly concerning the fate and evolution of ocean worlds: for example, NASA suspects that Venus may once have been an ocean world, but current research has not been able to confirm or refute this idea. This paper will particularly focus on these gaps and what methods may fill them.

[B-3] Hayden Reinhold
Portland State University | Mentor: Sung Yi, Ph.D.

Deployable Spacecraft Structures and Associated Mechanisms

A deployable structure is any system that transforms and expands from a volume-efficient stowage state to a fully functional, often significantly larger, operational state. Almost every large structure in space seeks to take advantage of deployment mechanisms to minimize the amount of volume and mass used per launch, but each of these systems have vastly different requirements and thus typically use different methods of deployment. This paper reviews different deployable space structures and systems, as well as some of the specific deployment mechanisms they use. This paper will discuss some of the advantages and disadvantages of those deployment mechanisms and why some deployment mechanism designs might tend to be better for certain systems.

[B-4] Abigail Velasco-De Jesus
Pacific University | Mentor: Kevin Carr, Ph.D.

Moving Latino/a Students into STEM Careers by Implementing NASA Resources in a Math Curriculum

Latinos continue to be underrepresented in STEM related careers. Research suggests that exposure to science, technology, engineering, and mathematics during middle and high school can help increase student interest in STEM. Many schools have implemented STEM enrichment programs in the context of after school activities and summer camps to try and expose students to STEM careers. This study explores the implementation of NASA resources, specifically aspects of the Artemis Mission, in a high school math curriculum. Through these resources, students in the classroom learn about math, the Artemis mission, and space science careers. With these experiences in the classroom, educators can help spark student interest in STEM related careers.

Session C

SCORE - STEM Community College Opportunity for Research Experience

[C-1] Bradley Ackroyd
Portland Community College Rock Creek | Mentor: Andrew Hilt

Travel Times to Tsunami Safety Zones in Seaside, OR

Following a local megathrust earthquake event, subsequent tsunami inundation waters will reach the coastline of Seaside, OR within 10 minutes and the tsunami safety zones in 30 minutes. To evaluate the effort required to

reach the safety zones, I walked and timed the entire length of all primary tsunami evacuation routes in Seaside. Using a least-cost distance (LCD) model, I used a global positioning system (GPS) watch to record the paths, times, and slopes for each route. I used the watch heart-rate monitor to maintain a steady expenditure of energy, sustaining a constant heart-rate within 110-120 beats per minute. This necessitated walking slower in difficult terrain and steep slopes, and faster on the flatter, paved surfaces. The data helped establish a reliable baseline for travel speeds and speed conservation values (SCV) for the varying terrains and slopes. Since travel speeds vary greatly through a given path, I applied modifiers to each of the individual route segments. This allowed me to evaluate how the overall evacuation times were affected by changing the energy expenditure. By comparing the evacuation times against the water arrival times, I was able to identify the level of effort required to safely evacuate each region of Seaside, OR during a tsunami. The data shows that the routes for the most populated regions of Seaside will require a moderate to high level of effort to successfully reach the safety zones before inundation waters arrive. Any delays caused by poor signage, traffic, or obstacles will be costly.

[C-2] Effy Bishop

Portland Community College Southeast | Mentor: Eriks Puris, Ph.D.

Indoor Radon Concentration and Depth to Portland Groundwater

Radon gas forms by the radioactive decay of uranium in rock and soil. Radon exposure has been linked to lung cancer and while there's no safe level of exposure, the current level at which mitigation is recommended is 4pCi/L. Radon is a problem in the Portland Basin due to uranium-rich sediments associated with the ice age Missoula Floods which deposited coarse and fine-grained sediments. Coarse-grained sediments are typically associated with higher levels of indoor radon, which is commonly explained by coarse grained sediments being more permeable, allowing radon gas to escape more quickly. The aim of this project was to evaluate whether depth to groundwater could be a possible control of indoor radon concentrations (IRC). We looked for correlations between IRC and the underlying sediments (coarse vs fine-grained) and the depth to groundwater. Data sources we used included OHA Indoor radon test results, DOGAMI O-18-01 report of radon potential, Geologic Map 3443 of the greater Portland Metropolitan Area, and USGS Scientific Investigations Report 2008–5059 for depth to groundwater. We created geographic polygons based on sediment type and examined how radon levels within these polygons correlated with sediment type and depth to groundwater. Using this method, we discovered a stronger correlation between IRC and depth to water table than between IRC and sediment type, suggesting sediment size may not be the only control of IRC. Further research using more consistent spatial control is required to verify these initial results based on qualitative spatial averaging.

[C-3] Jake Bullard

Southwestern Oregon Community College | Mentor: Zinzi Nandi Segura Konig, RN, MPH

The Application of Radiation Challenges in Simulated Martian Regolith and diazotrophic Cyanobacteria for Selective Breeding of Cold-, Drought-, and Radiation-tolerant Food and Grain Crop Amaranthus hypochondriacus for Human Spaceflight Exploration and Operations to Mars

Some of the highest priority human health risks regarding the exploration of Mars include carcinogenesis, cardiovascular disease, and immune dysregulation induced by cosmic radiation. These health risks can be mitigated, to some extent, with a properly adapted diet. For this project, we will test the hypothesis that selective breeding of *Amaranthus hypochondriacus* in simulated Martian regolith previously inoculated with cyanobacteria will result in a viable cold-, drought-, and radiation-resistant nutrient-rich food source; available from both its seeds and leafy biomass. If adapted to extraterrestrial conditions for growth, this plant could serve as a healthy food source during space travel and exploration of the Martian surface. *A. hypochondriacus* seeds, prior to being planted in simulated Martian regolith, will be challenged with X-rays before germination and in regular times thereafter until leafy biomass and grain have been produced. To assist growth in Martian regolith, we will use nitrogen-fixating cyanobacteria. In regular periods, plant growth and plant nutritional value will be determined by weighing plant mass and measuring nitrogen, carbohydrate, and crude fat content. Nitrogen content will serve as a measure for crude protein content. We expect that *A. hypochondriacus* plants cultured under these conditions will show increased growth and provide higher nutrient value when irradiated with 250-2,000 r as compared to unirradiated plants. This project will yield knowledge on the feasibility that nutrient-rich *A. hypochondriacus* can be adapted to grow in extraterrestrial conditions. Achieving such a food source represents a major milestone in the human exploration of Mars.

[C-4] Teresa Nguyen
Portland Community College Southeast | Mentor: Julia Betts

Alternative End Cap Designs for Isogrid Propellant Tanks on Low-Cost Launch Vehicles

This research focuses on the development of a working prototype of an alternative aluminum endcap shape to reduce weight and decrease complexity for Portland State Aerospace Society's Launch Vehicle 4 (PSAS LV4). Low-cost launch vehicles within student teams are often faced with challenges in manufacturing reliable rocketry components that are affordable. Through generous access to a dedicated manufacturing workspace via McCloud Aero Corporation, prototype research for end cap design was able to continue. I conducted analysis on different end cap shapes, different joining and sealing methods through TIG welding, and assessed the structural integrity of the design. These tests were compared against earlier designs with flat end caps, which were heavier and had more complex T-welds. Design processes were documented in the PSAS Isotank Manufacturing and Testing Process Manual, along with spreadsheets tracking welding analysis and manufacturing statistics. During the life cycle of this research, two mini propellant test tanks were investigated and put through hydrostatic test cycles. In conclusion, the results discovered were that aluminum, semi-elliptical end caps with an integral flange were ideal due to student-level manufacturing accessibility, and aluminum is a common aerospace-grade material choice for sophisticated amateur rocketry design. This research project will serve as archival evidence for incoming PSAS and other aerospace students interested in airframe and liquid propulsion subsystems.

[C-5] Essau Klopfenstein
Portland Community College Southeast | Mentor: Benjamin Simon, Ph.D.

The Effect of Ionizing Radiation on Radiotrophic Fungi in the Context of Space Travel

Objectives: The aims of this project were to 1) investigate whether certain melanin-producing fungi demonstrate increased growth in response to varying radiation levels (this is called radiosynthesis) and 2) to test the ability of the fungi to shield radiation.

Methods: *Cladosporium cladosporioides* was grown in broth medium and on agar plates, both inoculated with or without p-coumarin (an inhibitor of melanin synthesis). Testing groups were exposed to varying doses of radiation from an X-ray machine several times over a 2-week period. X-ray images of the plates were also recorded to estimate radiodensity. Total growth in the broth cultures was measured by dry weight at the end of the experiment.

Results: There was a visible reduction of melanin expression in the broth cultures inoculated with p-coumarin. Dry weight measurements are currently underway for the broth to determine which group produced more biomass. On agar plates, p-coumarin did not appear to affect the development of melanin, though the fungal colonies may have grown more slowly in the presence of p-coumarin. Statistical analysis of the X-ray images is underway and may reveal differences in radiodensity.

Conclusions: These experiments do not conclusively support or refute the hypothesis that *Cladosporium cladosporioides* is able to harness ionizing radiation for cellular energy. The cultures could have been pulling energy from the growth medium for cell repair and not producing it via radiosynthesis; data collection may change this conclusion. The p-coumarin plate's failure to inhibit melanin growth means conclusions about radio shielding effects of melanin cannot be drawn.

Session D

STARR – STudent Academic Research Review

[D-1] Madeline Fischer
Portland State University | Mentor: Erik Bodegom, Ph.D.

Period of Leaky Pendulum

It has been established by Mires and Peters in their 1994 paper *Motion of a Leaky Pendulum*, that if a pendulum's mass decreases with respect to time, the period will increase, then decrease. The purpose of this experiment is to expand on this finding by evaluating what happens to the period of a pendulum with decreasing mass when some of the mass begins above the pendulum's pivot point. Another point is to use sand, which has a density much larger than any liquids used previously. By designing a pendulum using a machined aluminum mount and a glass tube, the period is measured as both liquid water and sand leak from the tube using a photogate. The data are analyzed using Excel and MATLAB. The results of this experiment confirm those of Mires and Peters by

showing that the period of a pendulum that is losing mass will increase, then decrease. Additionally, when the initial liquid level is above the pivot point the period decreases initially, then increases followed by a decrease. Finally, by using liquids of varying densities and assuming we can neglect the properties of the tube suspension system, this experiment establishes that there are two levels of liquid where the period is the same as the empty tube, irrespective of the liquid used.

[D-2] Taylor Lohrie
Portland State University | Mentor: Jay Nadeau, Ph.D.

Methods in Astrobiology

As astrobiology becomes more developed as a field, it's vital that we understand all the tools available for astrobiology research. This white paper aims to present the current methods available, their uses, and their prevalence, as well as discuss the cutting-edge of astrobiology technologies. Astrobiology techniques can largely be broken into two categories: remote sensing and in-situ. Remote sensing studies other planets from afar, using satellites, telescopes, etc. Applications to astrobiology include measuring the chemistry of atmospheres, physical characteristics of planets, and searching for the presence of water. In-situ observations are the exact opposite and are taken directly from and at the location in question. In the case of astronomy/astrobiology, this is almost exclusively done with rovers such as Curiosity and Perseverance. NASA has numerous in-situ and remote sensing projects, such as Perseverance and the recently launched James Webb Space Telescope. This project will present the most relevant of these projects to astrobiology and discuss how remote sensing and in-situ work can form a complete picture of the search for life outside of Earth. We will also provide a cost-benefit analysis of these techniques and discuss what new technologies and methods are being developed for astrobiology research.

Graduate Fellowship

[D-3] Daniel Sheikh
Portland State University | Mentor: Alex Ruzicka, Ph.D.

Physical and Chemical Modification of Lunar Crustal Materials as Observed in Feldspathic Lunar Meteorites

Models for the differentiation of the Moon and subsequent evolution of the lunar crust have relied primarily on the analysis of returned rocks and soils from the Apollo and Luna missions, but lunar meteorites provide a much better random and representative sampling of the global lunar surface. An important challenge with constraining the evolution of crustal anorthosites using lunar meteorites involves disentangling secondary effects of impact bombardment on the lunar surface from primary features inherited by the lunar magma ocean, as the role of impacts must be considered when trying to understand the origin of the lunar crust. The objective of this project is to assess the degree of shock processing within feldspathic lithic clasts from a variety of lunar meteorites through combined chemical-crystallographic techniques to develop a shock transformation index that can be used to filter out heavily shocked clasts from pristine, unaltered clasts; the long-term goals of this project seek to better quantify and understand 1) the role of impacts in modifying lunar crustal materials and 2) the origin of those crustal materials. For the first part of this project, three feldspathic lunar meteorites (NWA 13531, NWA 14446, NWA 14657) were analyzed using a Zeiss Sigma VP FEG SEM to obtain chemical data from a variety of lithic clasts. Lunar clast lithologies vary between samples and include FAN, MAN, Mg-suite, and hyper-ferroan anorthosites. Within these clasts, the relative abundances of smooth vs. cracked plagioclase feldspar regions vary, indicating partial amorphization of plagioclase from variable degrees of shock processing.