



Oral Presentation Titles and Abstracts

A1. "Inducing strokes and exciting brain tumor cells: investigations to study how brain cells communicate"

Jennifer Long, W.T. White High School, Dallas, Texas

Dr. Woo-Ping Ge, University of Texas Southwestern Medical Center, Dallas, Texas

Current stroke models limit researchers seeking to understand how the brain repairs itself due to the high mortality rate, the skill needed to do the surgery, and the limits on imagining that can be done during and after the procedure. Developing the methods to induce a stroke with magnetic nanoparticles enables increased options over where to form an occlusion. Using magnetic nanoparticles also enables the stroke to be reversible, not permanent and the stroke can be induced while imaging is being done simultaneously.

Epilepsy is often either a symptom of brain tumors caused by gliomas or follows the diagnosis. Despite the strong connection between glioblastoma multiform tumors and epilepsy, the mechanism of epilepsy related to brain tumors is not fully understood. By injecting brain tumor cells with a channel rhodopsin virus and stimulating said tumors with blue light, the molecules released by the tumor cells can be identified through mass spectroscopy.

A2. "Investigating the life cycle of the salmonid parasite *Ceratonova shasta* in a polychaete host"

Deidra Spencer, Corvallis High School, Corvallis, Oregon

Dr. Julie Alexander, Oregon State University, Corvallis, Oregon

Fall Chinook and Coho salmon populations have declined in the Klamath River (KR). One major cause of salmonid declines in the KR is the parasite, *Ceratonova shasta* (CS). As the intermediate host, polychaete populations likely drive differences in disease severity among systems. This presentation explores research that works towards characterizing parasite development in the invertebrate host. We will explore polychaete worm mortality in response to increasing CS dose levels, the amount of degree-days between polychaete worm infection by myxospores and release of actinospore, and competition between CS genotypes.

A3. “The synucleins: fibrillation studies and Parkinson’s disease”

Joyce Zimmer, Greenville High School, Greenville, Michigan

Ms. Katelyn Becker, Van Andel Institute, Grand Rapids, Michigan

Synuclein proteins are small proteins (~14kDa) that are expressed predominantly in neurons. Humans have three types of synucleins; α -synuclein (α S), β -synuclein (β S), and γ -synuclein (γ S). Aggregates of α S are found in Lewy bodies which are the hallmark characteristic of Parkinson’s Disease (PD). PD is the second most common neurodegenerative disease. Early symptoms of PD include shaking, rigidity, slowness of movement, and difficulty walking. Later symptoms of PD include thinking and behavioral problems, dementia, and depression.

α S and β S are abundant in the CNS and are found in presynaptic terminals throughout the brain. The N-terminal domains of all these proteins are highly conserved while the C-terminal domains are more diverse. One notable difference is that β S lacks 11 residues found in the central hydrophobic non-amyloid component (NAC) region found in α S. α S is disordered when found unbound in the cytosol. α S mis-folds cause aggregation into oligomers and fibrils. Many studies have indicated that β S is incapable of forming fibrils and suggest it is because of the 11 missing residues in the hydrophobic region.

This study indicated that β S can indeed form fibrils under certain conditions which included using α S to seed fibril growth.

A4. “Genetic screen to identify upstream temporal regulator of lin-4 micro RNA”

Eleanor Williamson, Urban Assembly School of Design and Construction, New York, New York

Dr. HaoSheng Sun, Columbia University, New York, New York

The brain matures as the needs and environment of the individual changes. However, how is neuronal plasticity regulated? We can use *C. elegans* as a model to study the regulation of neuronal plasticity throughout their developmental stages. A transgenic strain was created and synchronized L1 populations of this strain were prepared and sorted. During the time I spent at the lab, 100,000 mutagenized F1 were obtained and 600,000 F2 were sorted, 34 mutants were obtained from the sorter. Seven lines were observed and two of those seven lines were potential mutant but not what we were looking for.

A5. “Self-directed students (no more lectures!)”

Heather DeJonge, Van Andel Institute, Lowell, Michigan

Dr. Jeremy VanRaamsdonk, Van Andel Institute, Grand Rapids, Michigan

After working with *C. elegans* in Dr. Van Raamsdonk’s lab at Van Andel Institute in Grand Rapids Michigan, I brought his exciting research to Lowell High School students through a self-directed STEM class. The students design their own investigations, compare data, and learn through trial and error. They are gaining an entirely new perspective on science and have become personally vested in their research. They will end the trimester with a “Present and Defend” of their research to Van Andel Institute Scientists, teachers, peers and community members.

With Van Andel Education Institute’s help, we are changing how science is taught and learned.

A6. “Exploring pain-sensing pathways in the fruit fly nervous system”

Adam Lewis, City College Academy of the Arts, New York, New York

Dr. Wesley Grueber, Columbia University, New York, New York

Distinct structures and functions of sensory neurons have been extensively identified and mapped within the fruit fly (*Drosophila melanogaster*) nervous system. A specific class of these sensory neurons has been found in fruit fly larvae to be responsible for nociception, or the detection of harmful stimuli. In this study, we explored neural pathways that may connect the sensory neurons that detect noxious stimuli with the motor neurons that direct the bending and rolling escape behavior of *Drosophila* larvae. By activating different sets of interneurons, we hoped to determine which are in communication with other known sensory and interneurons that detect pain and elicit escape behavior. Of the targeted interneuron lines, we found that some may be involved in circuits affecting larval bending behavior as a response to painful stimuli.

A7. “The role of phosphorylation in the activity of ResD response regulator in *Bacillus subtilis*”

Tai Quirke, Sam Barlow High School, Gresham, Oregon

Dr. Michiko Nakano, Oregon Health Science University, Portland, Oregon

The protein ResD, was recently found to activate transcription by interacting with the α subunit of RNA polymerase. The goal was to reveal the functional interaction of this transcription factor to support bacterial growth in anaerobic growth. We postulated that ResD interacts with RNAP before binding to promoter DNA. RNAP was eluted with imidazole and the eluted fractions were run on SDS-PAGE. RNAP and ResD were detected by staining and western blot analysis using anti-ResD antibody, respectively. ResD co-eluted with RNAP; however, we found that ResD itself binds, albeit to less amount, to Ni column.

A8. “A molecular approach to finding candidate genes associated with nicotine addiction in *Drosophila melanogaster*”

David Valenzuela, Madison High School, Portland, Oregon

Dr. Norma Velazquez-Ulloa, Lewis and Clark College, Portland, Oregon

The molecular and genetic basis behind nicotine addiction is extraordinarily complex. One-third of adults consume nicotine by smoking tobacco, and the large majority of people who smoke become addicted. Although addiction to nicotine is relatively common, the biochemical pathways underlying the addiction are not well understood. A person's genetic makeup may determine how they react and metabolize nicotine, which may play a role in the formation of clinical dependence on the drug. In this project, we use the model organism *Drosophila melanogaster* to examine how specific mutations in genes can provide protection or harm when exposed to nicotine during development. *Drosophila* is a frequently used model system to study complex processes in higher-level organisms as they express fundamental mechanisms that are conserved in the animal kingdom. Because of this conservation, *Drosophila* has recently been used to effectively illustrate behavioral and mechanical aspects of common addictions, including addiction to ethanol, cocaine, and nicotine. Here, we employed a genetic screen

coupled to advanced molecular approaches to shed light on how nicotine addiction arises in *Drosophila* and putatively other higher level organisms.

B1. "The distribution of the Pacific Fisher and other carnivores in Southern and Central Oregon"

Megan Miller, Silverton High School, Silverton, Oregon

Dr. Taal Levi, Oregon State University, Corvallis, Oregon

In the last couple years, the Pacific Fisher has been highly publicized. In 2014, the U.S. Fish and Wildlife proposed federal protection for these large weasels under the Endangered Species Act. Two years later, in 2016, the Pacific Fisher is denied protection from logging and suggested to rely on "voluntary conservation measures". One thing that hasn't been certain, though, is how many of these animals actually exist? Where do they live? Which factors are impacting their survival most? In partnership with BLM, U.S. Fish and Wildlife, and numerous major logging companies, we aim to begin to answer this question.

B2. "Ghosts of competition past? The effect of dying high marsh vegetation from increased inundation on the establishment of lower marsh biota"

Erin Cole, Valley Catholic High School, Portland, Oregon

Dr. Catherine de Rivera, Portland State University, Portland, Oregon

Salt marsh ecosystems display distinct elevational community zonation. As sea levels rise, high-marsh plants at the Salmon River Estuary will die due to increased salinization. The loss of this community could be devastating to many ecosystem services. This research investigates whether low-marsh plants can establish quickly in high-marsh soils despite remaining dead roots and differing soil characteristics. Methods include transplantation of high-marsh sections into low-marsh areas to mimic sea level rise, low-marsh rhizome placement, and tracking of plant growth, plant community composition, and soil characteristics over two years. The results of this research have implications towards long-term management strategies.

B3. "'Fearscales and foodscapes': Learning how structural and chemical diversity of sagebrush (*Artemisia* spp.) influence the functional quality of landscapes"

Gina Lockwood, Borah High School, Boise, Idaho

Dr. Jennifer Forbey, Boise State University, Boise, Idaho

Understanding how specific habitat features influence predation and food risks and how prey choose those features to reduce risk is necessary for evaluating habitat quality, for predicting the consequences of habitat change, and for guiding conservation and restoration efforts. The structure of vegetation can create variation in concealment called "fearscales" and the chemical composition of vegetation can create variation in diet quality called "foodscapes". This variation can influence habitat quality and selection of habitat by prey. Sagebrush (*Artemisia* spp.) communities have undergone significant changes in both the availability and the functional quality of existing shrubs for cover and food for herbivores due to invasive species, wildfire, management practices, and climate. There is a need to monitor the diversity of sagebrush and the function of this diversity to create healthy landscapes for wildlife. Remote sensing offers new tools that allow us to map and monitor the structural and

dietary quality of habitats used by wildlife at different spatial and temporal scales. This effort can help us predict habitat use by species of conservation concern such as pygmy rabbits and sage-grouse. Moreover, conserving the chemical diversity of sagebrush has the potential to provide new sources of drugs for human and animal health.

B4. “Yeast cell survival and adaptive mutagenesis when exposed to UV-A”

Nancy Mouat-Rich, Washington High School, Graham, Washington

Dr. Tina Saxowsky, Pacific Lutheran University, Tacoma, Washington

What are the effects of induced oxidative stress on yeast when exposed to UV-A? This project explored if exposure to intense UV A light would affect the survivability of yeast and caused adaptive mutagenesis after exposed. The yeast, *Saccharomyces cerevisiae*, was exposed to UV A light in a light box for varying amounts of time, and then plated on two different types of media plates, YPD and CAN, to measure survival and adapted mutagenesis. Results suggest that yeast cell survivability decreases as exposure time increases.

B5. “How to prepare for the next ‘Sandy’ in NYC?”

Aoife Walsh, High School of American Studies at Lehman College, Bronx, New York

Dr. Kartik Chandran, Columbia University, New York, New York

Following Hurricane Sandy, New York City, the city that never sleeps, paused. The marathon was cancelled. Sections of the city had no electricity. The subway was not working. Large tracts of land were flooded. The city is preparing to avoid similar results from future storms. NYC has constructed bioswales to absorb the excess rainwater. This will reduce the quantity of water entering the combined sewer overflow system. Several bioswales are in the Bronx. In Columbia University, we built three bioswales to determine the flow rate of the water through the bioswale. This can be used to predict their effectiveness.

B6. “Where is the most food for Yellow Warblers”

Steve DeMers, Rocky Mountain High School, Meridian, Idaho

Ms. Heidi Ware, Boise State University, Boise, Idaho

Songbird monitoring and banding was conducted on two ecologically different sites during the summers of 2015 and 2016. The Lucky Peak site, which is a high elevation montane zone and the newly opened Boise River site, which is riparian. The focus of the project was directed towards Yellow Warblers (*Setophaga petechia*) and their fat condition leading up to fall migration. Specific attention was paid to seasonal rates of capture, as well as fat scores and their fluctuations throughout the banding season.

B7. "Assessing disease risk in a population of *Lithobates vibicarius*, a species of conservation concern"

Alicia Cordell, Northwest Nazarene University, Charleston, South Carolina

Dr. John Cossel, Northwest Nazarene University, Nampa, Idaho

Our goal during the first summer of research was to test for the presence of Ranavirus in *Lithobates vibicarius* in Monteverde, Costa Rica using a syntopic species of amphibian. Swab samples were collected from the oropharyngeal areas and skin of the subjects and then analyzed using qPCR to amplify viral DNA. During the second year, eDNA was used to screen for the presence of Ranavirus in the habitat where *L. vibicarius* is found. The eDNA was also analyzed through qPCR. Understanding the presence or absence of Ranavirus among this population will aid in informing and managing endangered species of amphibians.

B8. "The spread and potential impact of aquatic invasive bivalves in the Columbia River Basin: What is the feeding rate of the invasive clam *Corbicula fluminea*?"

Carol Sandison, Columbia River High School, Vancouver, Washington

Dr. Gretchen Rollwagen-Bollens, Washington State University, Vancouver, Washington

My Partners in Science project focused on the Asian clam and their functional feeding habits when presented with varying amounts phytoplankton. To determine the amount of phytoplankton present, we tested for chlorophyll *a* both before and after the specific feeding periods. We also broadened our work this summer to include potential seasonal variations of the clam feeding habits during summer and fall.

C1. "Quantitation of cyanide in blood via indirect silver detection"

Matt Alexander, Pocatello High School, Pocatello, Idaho

Dr. Jeffery Rosentreter, Idaho State University, Pocatello, Idaho

Cyanide (carbon atom triple bonded to a nitrogen atom with a negative charge) is a unique chemical compound that is very useful in modern industry, but it is also harmful and acutely toxic compound to which we are exposed to in our everyday lives. In large amounts the cyanide binds with iron and other metals in biomolecules decreasing the ability of cells to utilize oxygen. Due to the high stability of iron-cyanide complexes, quantitative determination of cyanide in biological fluids is difficult and time consuming. Ongoing research will be presented describing the development of a novel quantitative analytical method for cyanide anions in aqueous blood solutions via silver complexation with indirect measurement using Flame Atomic Absorption Spectroscopy. Feasibility and comparison with Inductively Coupled Plasma Atomic Emission Spectroscopy was also completed.

C2. “The effect of glyphosate (Roundup®) on *Tolypothrix* for potential fertilizer use in agriculture”

Suzanne Poole, Science Park High School, Newark, New Jersey

Dr. Kirsten Heimann, James Cook University, Townsville, New Jersey

Tolypothrix is a nitrogen fixing cyanobacteria that can be grown at a minimal cost, has been shown effective as a fertilizer, and could potentially be used in commercial agriculture for crops such as wheat, corn, and soy. However, before it can be introduced as a fertilizer, its ability to withstand weed killers is currently unknown. The most common fertilizer used in Australia as well as globally is Roundup®. Roundup® is primarily composed of a synthetic molecule called glyphosate. Due to its structural similarities to the amino acid glycine, this molecule has the ability to disrupt a biochemical pathway in the chloroplasts of leaves and therefore works on adult weeds and is administered during the seedling stage of the crops. However, cyanobacteria have an enzyme that, despite its biological role, has the ability to render the molecule ineffective and is not conserved in plants. Therefore it was hypothesized that cyanobacteria would have the ability to withstand Roundup® application and therefore could be used in coordination with Roundup® as a fertilizer for agriculture. *Tolypothrix* was tested in 4 different concentrations of Roundup® determined by the average usage of farmers for 20 days under standard conditions in replicate. Results have yet to be published.

C3. “Using micropatterning to control cell morphogenesis and function”

Brandon Fremd, Columbia Secondary Schools, New York, New York

Dr. James Hone, Columbia University, New York, New York

The concept of shape relating to function manifests itself in many ways in biology. The Hone laboratory is studying how the shape of the substrate where cells are grown can determine their development and function. Their goal is to help *in vitro* podocytes regain their *in vivo* morphology and function. In order to do this, podocytes were grown on different shaped islands and their morphology and protein expression was then examined. It was found that a box shaped island with channels (B+C) helped *in vitro* podocytes recruit actin to the channels and thus imitate the *in vivo* processes native to the *in vivo* cytoskeleton. Further, podocyte specific proteins were not only expressed more in the B+C cells, but the protein expression was higher in the channels than in the body of the cells.

C4. “Food poisoning and vaccines – A connection conundrum”

Sarah Westcott, The Ambrose School, Meridian, Idaho

Dr. Juliette Tinker, Boise State University, Boise, Idaho

Salmonella enterica Typhimurium is an agent of significant foodborne illness in the U.S. Pathogenic strains of this bacterium harbor a protein enterotoxin called artAB. Bacterial enterotoxins including cholera toxin (CT) from *Vibrio cholera* and heat-labile toxin (LT) from enterotoxigenic *E. coli* are protein toxins known to cause clinical infection, but also represent a class of the most effective mucosal vaccine adjuvants. Evidence suggests modulation of the immune system by CT and LT is dependent upon their stable AB protein structure and the high affinity binding of the B subunits to host receptors. The identification and characterization of novel AB5 toxins that possess adjuvant activity, specifically target cells of the immune system and are less toxic for intranasal delivery in humans, would greatly advance the development of mucosal vaccines.

The description of the basic structure, binding specificity and trafficking of artAB from *S. enterica* Typhimurium are the preliminary steps for the characterization of this toxin. The importance of understanding this toxin's role in pathogenicity of *Salmonella* poisoning is highly significant. artAB represents a novel member of this class of toxins and its characterization has the potential to advance basic understanding of the disease as well as application in the development of mucosal vaccines.

C5. "An evaluation of the rates, methods and implications of inorganic carbon accumulation in semi-arid soils"

DJ Eberlin, Borah High School, Boise, Idaho

Dr. Jen Pierce, Boise State University, Boise, Idaho

The storage and flux of carbon from soils strongly influence the global carbon cycle; however, soil carbon amounts and fluxes are poorly constrained. In addition, while many studies have focused on soil *organic* carbon, little is known about global storage of carbon as *inorganic* carbon in soils, nor the rate of accumulation of soil inorganic carbon (SIC). Soil carbon is the planet's third largest pool of carbon; an estimated 40% of this soil carbon is stored as inorganic carbonate materials in arid and semi-arid soils. Soil forming factors controlling SIC storage and flux include climate, organisms, relief, parent material, and time. Precipitation is a primary factor controlling soil development in arid and semi-arid regions where SIC accumulates, but the hierarchy of controls on SIC development is complex.

This study addresses the two primary questions. First, we quantify the rate of accumulation of SIC in soils of the Boise region of southwestern Idaho, using deposits of a known age from the Pleistocene Lake Bonneville flood deposit (~17,500 years B.P.). Second, we compared the traditional calcimeter method to the modified pressure calcimeter method for calculating inorganic carbon.

C6. "Analysis and detection of HFO-1234ze?"

Alberni Ruiz, California State University, Poway, California

Dr. Ben Miller, National Oceanic and Atmospheric Administration, Boulder, Colorado

Currently there is no experimental analysis, for the detection of HFO-1234ze and HFO-1234yf, which are coolants being introduced into air conditioning systems found in cars and homes. Testing for these specific compounds in the atmosphere is important because it will allow us to quantify the concentration of these compounds and detect where the major concentrations of emissions stem from. The objective of this experiment was to identify HFO-1234ze and HFO-1234yf using the gas chromatographer Perseus, thus allowing for calibration of this instrument so we can test for these HFOs in future air samples. Perseus is unique in that it is specifically designed to analyze compounds found in air samples that cannot be analyzed *in situ*. In this experiment we hypothesize that HFO-1234ze and HFO-1234yf will be detected in a gas chromatographer with the reading of their ionic fragment atomic mass peaks 45, 69, 82, 95, 100, 113, 114, with the 82 mass being specific to the ze fragment, and the 100 mass specific to the yf fragment, in a pure sample of the HFOs. We can test this hypothesis by diluting a pure sample of HFO-1234ze and HFO-1234yf in a gaseous state.

C7. "Absorption and effect of contaminants associated with micro-plastic marine debris in seabirds"

Ghodsie Sabri, West High School, Anchorage, Alaska

Dr. Douglas Causey, University of Alaska, Anchorage, Alaska

The toxic effects of chemicals from plastic in marine ecosystems are a growing concern in the North Pacific, a highly important foraging region for migratory and resident marine life. The purpose of this study is to quantify phthalate levels and to fully understand the long-term consequences of phthalate exposure in seabird tissues. Phthalates are chemicals and a particular concern for organisms in the marine environment. To build a foundation of knowledge of phthalate exposure in Bering Sea seabirds. Our results provide data from phthalates analysis on muscle tissue from 42 individuals, representing ten species of seabird breeding in the far western Aleutian Islands. Every individual had detectable levels of at least one of the congeners in their muscle tissue.

The current common method for phthalate quantification uses liquid chromatography tandem mass spectrometry (LC MS/ MS) with atmospheric pressure photo-ionization (APPI). This study focuses on the impact of phthalate exposure on seabird populations, in the Bering Sea seabirds. Detection of phthalates in tissues indicates that these compounds likely are metabolically active and affects the health of seabirds. Understanding the effects of phthalates in marine life will help us better understand the long- terms consequences of phthalate exposure to marine life.

C8. "Surface charge and size comparison of purified buckminsterfullerene oxide (C₆₀O) in aqueous suspension to purified buckminsterfullerene (C₆₀) and a commercially available sample"

Sharon Cates, Capital High School, Boise, Idaho

Dr. Kevin Ausman, Boise State University, Boise, Idaho

Buckminsterfullerene and buckminsterfullerene oxide (C₆₀O) were purified, forced into aqueous suspension, and then the surface charge and particle size were evaluated. Oxides were synthesized by treatment of buckminsterfullerene with an ozone enriched nitrogen/oxygen mixture. Ultra High Performance Liquid Chromatography (UHPLC) was used to isolate and collect buckminsterfullerene and oxides from ozone treated samples. Aqueous suspensions were formed using evaporative solvent replacement. Suspended particles were shown to have significantly different surface charge profiles possibly explaining observed oxidative damage in cell membranes exposed to buckminsterfullerene in aqueous suspension.