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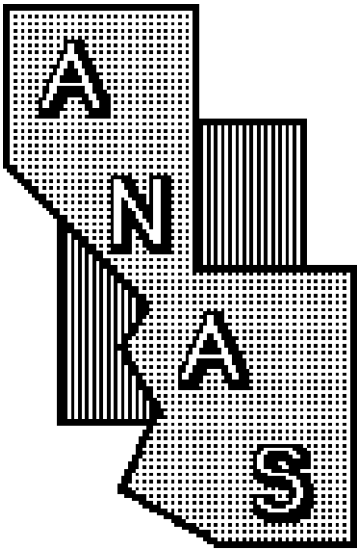

SIXTY SECOND ANNUAL MEETING

April 21, 2018

Joint meeting with the American Society for Microbiology
University of Nevada at Las Vegas
Las Vegas, NV

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ABBREVIATED SCHEDULE AND ACTIVITIES LOCATIONS

Friday, April 20, 2018

Board of Governor's meeting:

6:00-8:00 PM

Saturday, April 21, 2018

7:00-8:00	Check-in; Registration: White Hall Auditorium (outside)
8:00-8:15	Welcoming Remarks: White Hall Auditorium
8:20-9:40	Paper Session Biology/Hydrology/Geology: Bigelow Health Sciences (BHS) 132
9:40- 10:00	Coffee Break: BHS Foyer
	Poster Set Up: Bigelow Physics Building Hallway
10:00-11:00	Paper Session Continues: BHS 132
11:00-11:30	Lunch Lines Open: White Hall
11:30-12:20	Keynote Address and Lunch: White Hall 197
12:40-2:20	Poster Session: Bigelow Physics Building Hallway
2:20-3:00	ANAS Business Meeting and Awards Ceremony

SUMMARY OF SECTION MEETINGS

Section	Time	Room
Biology/Hydrology/Geology	8:20-9:40 10:00-11:00	Bigelow Health Sciences 132
Poster Session	12:40-2:20	Bigelow Physics Building Hallway

LUNCHEON SPEAKER

BERONDA L. MONTGOMERY

FIRST INSIGHT INTO SECOND MESSENGERS: ROLES OF CYCLIC DINUCLEOTIDES IN ENVIRONMENTAL RESPONSES IN *CYANOBACTERIA*

Dr. Beronda L. Montgomery is MSU Foundation Professor of Biochemistry & Molecular Biology and Microbiology & Molecular Genetics in the Department of Energy Plant Research Laboratory and Assistant Provost for Faculty Development research at Michigan State University. Dr. Montgomery's laboratory investigates the mechanisms by which organisms such as plants and cyanobacteria which have limited mobility are able to monitor and adjust to changes in their external environment.

The ability of these largely immobile organisms to adapt their patterns of growth and development to fluctuations in external environmental parameters, such as light and nutrient availability, increases their survival and maximizes their growth and productivity. Dr. Montgomery also conducts scholarship and training initiatives on mentoring, including issues related to mentoring diverse students and junior scientists, as well as faculty development.

Her scholarly efforts have been recognized by receipt of an NSF CAREER Award, selection as a finalist in the 2014 Howard Hughes Medical Institute (HHMI) Professors Competition, and as 2015 Michigan State University Nominee for the Council for Advancement and Support of Education (CASE) U.S. Professor of the Year Award.

BIOLOGY/GEOLOGY/HYDROLOGY SESSION

SESSION: **8:20**

LOCATION: **Bigelow Health Sciences (BHS 132)**

CHAIRPERSONS: **Paula Rivadeneira, Boris Poff, Robert McCord**

8:20-8:40
***USING SOIL ORGANISMS IN MOJAVE DESERT ECOLOGICAL RESTORATION**
Lydia Bailey, Anita Antoninka and Matthew Bowker (Northern Arizona University, Flagstaff, AZ)

Using soil organisms to improve restoration outcomes is an emerging field that may be especially important in the Mojave, where extreme aridity and invasive plants make restoration challenging. Both biological soil crusts (BSCs, the community of mosses, lichens and cyano-bacteria which cover the soil surface in arid landscapes) and mycorrhizal fungi have proven useful in restoration of other ecosystems. BSCs have a large influence on soil temperature, water retention, nutrient cycling, and soil stabilization which in turn affects the vascular plant community. Arbuscular mycorrhizal fungi (AMF) form symbiotic relationships with vascular plants which can help the plant cope in nutrient and water deficient environments. We are testing the use of these important organisms to facilitate restoration in two unique projects in the Mojave Desert: 1) recovery of endemic plants and soil stability on gypsum soils and 2) restoration of soil stability using biocrusts under utility scale photovoltaic facilities in the Las Vegas Basin. In the spring of 2018, we installed a factorial restoration experiment of ten treatments combining BSC inoculation, seeding of gypsophilic forbs, and planting dominant shrubs grown with and without root symbionts from their site of origin. The 13 experimental blocks are on gypsum soils that have undergone disturbance from vehicles, construction, or mining. While cultivating shrubs for out-planting, we found that that the 7-day germination rate for seeds planted in a band of live soil (containing AMFs, as well as other organisms) collected from the seed source was more than twice as high as those planted in a sterilized band of the same soil. We will test similar techniques at a larger scale on gypsum mine tailings with the intent to establish populations of gypsophilic plants, including the Las Vegas Bearpoppy (*Arctomecton californica).*In the fall of 2018, we will test the use of biological soil crusts in place of chemical soil tackifiers within a utility scale photovoltaic facility, where BSCs may provide the same dust abatement services as traditional tackifiers while improving biological functionality of the site and its subsequent

restoration potential. In October of 2017 we began mass-cultivating BSCs at the Las Vegas Springs Preserve (growing a larger volume from a small amount of wild-collected inoculum) using a burlap shade cloth and irrigation to improve growth rates, and have seen increases in cyanobacteria and moss cover after five months. We will compare the outcomes of 1) using BSC inoculum collected directly from the field vs bulked inoculum and 2) varying water regimes to determine the most efficient way to rapidly establish a crust community beneath solar panels.If these soil-organism treatments are successful, they may unlock a currently underutilized approach to affordable and effective desert restoration.

8:40-9:00

EXPRESSION OF RECOMBINANT ZIKA VIRUS-LIKE PARTICLES IN *NICOTIANA BENTHAMIANA

Michelle Di Palma, Siavosh Naji-Talakar, Andy Diamos, Lydia Meador, Joe Hunter, Mary Pardhe, Hugh Mason and Tsafrir Mor (Arizona State University, Tempe, AZ and Arizona State University, Biodesign Institute CIVV, Tempe, AZ)

Zika virus is a member of the *Flaviviridae* family of RNA viruses composed of a single stranded positive sense RNA genome and it is roughly 10,600 nucleotides long. Mosquitoes, specifically the mosquito *Aedes aegypti,* serve as a reservoir, host and vector for the virus. Zika virus particles contain a lipid bilayer, one genome RNA and three distinct viral proteins: envelope (E), membrane (prM) and capsid (C). By expression of the envelope (E) and pre-membrane (prM) Zika virus proteins in *Nicotiana benthamiana* through agroinfiltration, virus-like particles (VLPs) should self-assemble within the host plant. Development of VLPs in plant expression hosts such as *Nicotiana benthamiana* will allow production of vaccine candidates at substantially low cost and time due to the ease of manipulation and production of plant vectors. Plant viral vectors such as Yellow Bean Dwarf virus allow ease of expression of single proteins or co-expression of multiple proteins within *Nicotiana benthamiana*. Initial confirmation of single expression of E has yielded positive results through Western Blot analysis and ELISA. This result has verified the ability for *Nicotiana benthamiana* to correctly produce and post-translationally modify the Zika E protein. Future prospects will involve confirmation of the M protein and visualization of a formed virus particle through Cryo-electron microscopy. Co-expression of both the Zika E and prM may lead to viable expression of VLPs allowing for the production of transgenic plants to further progress vaccine candidates.

9:00-9:20

***A PLANT BASED VACCINE FOR NECROTIC ENTERITIS IN CHICKENS**

Joseph G. Hunter, Andy Diamos, Kenneth Roland and Hugh Mason (Arizona State University, Tempe, AZ and Arizona State University, Biodesign Institute CIVV, Tempe, AZ)

Clostridium perfringens, the causative agent for avian Necrotic Enteritis (NE), is estimated to

result in a global economic loss of 2 billion dollars annually. NE presents as necrosis of the intestinal tract and easily spreads through fecal to oral transmission. While historically controlled with antibiotics, the decrease in antibiotic use has led to the consideration of other approaches, primarily vaccination, to control the disease. Two major toxins are produced by C. perfringens which cause NE, α-toxin and NetB. While it does not play a direct role in NE pathogenesis α-toxin immune responses have been shown to be partially protective. NetB on the other hand is directly associated with NE symptoms and like α-toxin immune responses against NetB have been shown to be partially protective. Herein we have developed a NE vaccine which is a fusion of a non-toxic C-terminal domain of α-toxin (PlcC) and an attenuated form of the NetB toxin (W262A). To this fusion a 6-His tag and ER targeting peptide was added resulting in the vaccine dubbed 6H-PlcC-netB. This vaccine, after codon optimization, was produced in N. benthamiana using a geminiviral replicon transient expression system. Acid precipitation, metal affinity chromatography, and dialyzation were used to purify the vaccine which was then used to immunize broiler chickens. Immunized broilers produced strong IgY responses against the 6H-PlcC-netB vaccine and were protected against challenge with virulent *C. perfringens*. These results indicate that 6H-PlcC-netB is a promising candidate for NE vaccination in poultry.

9:20-9:40

PLANT CLONES OF THE ARIZONA SONORAN DESERT: ABUNDANCE, RELATIVE COVER AND ADAPTATIONS

Matt Haberkorn (Phoenix College, Phoenix, AZ)

Previous studies have identified between 28 and 80 percent of plants within various ecosystems have some form of clonal or vegetative reproduction. Clonal plants have been found to be in greatest abundance in habitats and ecosystems of extremes, such as those with cold, wet or dry conditions. The majority of clonal plant research has focused on Eurasian temperate and arctic regions, with few studies having examined arid regions. Within arid North America, clonal plant studies generally have been limited to examination of a relatively few species, or single species, such as *Larrea tridentata*. Within this study, 67 perennial plant species within the Sonoran Desert of Arizona were examined for clonal reproduction, of which 30 have confirmed and an additional eight have suspected clonal reproduction. Relative cover of clonal plants varied by geomorphic surface (ANOVA p=0.0004) and was found to be 95.5 percent (0.8 SE) on lower bajadas, 48.5 percent (5.9 SE) on upper bajadas, 49.3 percent (2.5 SE) on mountain slopes, 18.8 percent (12.1 SE) on lower bajada washes, 69.2 percent (4.6 SE) in upper bajada washes and 56.9 percent (7.1 SE) in mountain washes. Clonal reproduction strategies were also found to vary by geomorphic surface. The most common clonal reproductive adaptations of these plants included rhizomatous reproduction, often in geomorphically unstable soil surfaces, and axial splitting, which is typically viewed as a drought related adaptation. Some specific plant species varied between vegetative and sexual reproduction, or differing forms of clonal reproduction, depending on geomorphic surface. Variation in clonal plant relative cover and reproductive

strategy was most likely a result of varying soil structure and processes which strongly affect water availability and soil surface stability. Based off of preliminary results, clonal plant species relative abundance and cover appear to be most common primarily on the most drought prone soils such as lower bajadas, and secondarily on geomorphically unstable surfaces, such as upper bajada washes.

9:40 -10:00

COFFEE BREAK: BIGELOW HEALTH SCIENCES FOYER

POSTER SET UP: BIGELOW PHYSICS BUILDING HALLWAY

10:00-10:20

BIODIVERSITY, CONNECTIVITY AND HYDROLOGY IN THE EASTERN MOJAVE DESERT

Boris Poff (Bureau of Land Management, Southern Nevada District, Las Vegas, NV)

The Eastern Mojave Desert contains several hotspots of biodiversity. The Spring Mountains are a sky island containing over 39 tree species, 600 vascular plants as well as numerous endemic fauna. Ash Meadows contains over 24 endemic species, several of them endangered. It has the highest concentration of endemic species in the United States and the second highest in North America. The Amargosa River also boasts over 20 sensitive species several of which are endemic and/or listed as threatened or endangered. While these three hotspots of biodiversity are spread out over the eastern Mojave, they have one thing in common that does not necessarily meet the eye. They are hydrologically connected. At the same time the Eastern Mojave is home to one of the fastest growing metropolitan areas in the US. As a growing population competes for the same water resources, federal land managers face challenges to ensure the survival of the endangered species while accommodating anthropogenic needs. How will this conflict be resolved?

10:20-10:40

DECREASING FOOD SAFETY RISKS IN FRESH PRODUCE FIELDS WITH FALCONRY

Paula Rivadeneira (University of Arizona, Yuma, AZ)

Wild and domestic animals can pose significant food safety risks to fresh produce crops due to their inadvertent deposition of feces on or near the crops. While all animals that intrude into produce fields are considered a threat to food safety, birds are one of the most challenging animals to manage. Growers have tried countless methods to deter them, and while some of these methods work some of the time, none provide stand-alone protection. Recently there has been

interest in developing high tech solutions to deter nuisance birds from fresh produce fields, while others are exploring more natural methods, including falconry. With the support of fresh produce growers in Yuma, AZ, we are conducting a controlled scientific study to determine if falconry could be an effective tool to deter nuisance birds from their fields in a desert growing environment, and if so, how we can make it an economically feasible option on a large scale. Preliminary data indicate that falconry is a very effective abatement tool in the desert environment, which is consistent with findings from vineyards and orchards, but more research is needed to determine the specific logistics required to protect each crop in various types of landscape.

10:40-11:00
MAKE LIKE A RANGER: CONNECTING YOUR SCIENCE TO YOUR AUDIENCE
Melissa K. Giovanni (College of Southern Nevada, Las Vegas, NV)

Have you ever visited a national or state park and attended a ranger program? If so, you probably left with a feeling of connection to the park and inspired to learn more. Wouldn't it be great if your students feel that way when they leave your classroom? Or your audience when you give a public lecture? The art of interpretation is the craft of park rangers, but it is really teaching at its best. Scientists are great at communicating with each other… but when it comes to helping students and the public understand why our science is so important, we often fall short. This talk will introduce the basic tenets of interpretation – how to build a connection between your subject matter and your audience's lives; how to make them see the relevance of this new knowledge to their own experiences; and how to inspire them to want to keep learning. We can all be park rangers!

11:00-11:30 Lunch lines open in White Hall (WHI)

11:30-12:20 KEYNOTE ADDRESS BY DR. BERONDA MONTGOMERY AND LUNCH (WHI 197)

POSTER SESSION

SESSION: 12:40-2:20

LOCATION: BIGELOW PHYSICS BUILDING HALLWAY (BPB)

CHAIRPERSON: Earl Yoon

MICROBIOME OF *LARREA TRIDENTATA* GROWING IN URBAN AND RURAL AREAS OF THE SONORAN DESERT

Brenda Arvizu, Luisa Zamora, Samantha Faltermeier, Joshua James and Ainsley Chapman
(Phoenix College, Phoenix, AZ)

Humans affect the environment wherever they settle, often impacting the environment in ways that can be detrimental to plants and animals. Studies have been conducted to explore the impacts humans have on vegetation, animals and microbial communities. *Larrea Trident*ata (creosote bush) is a common shrub located throughout the Southwestern United States and Northern Mexico. In this study we attempt to determine if differences in microbial communities of creosote bushes can be found between urban and rural areas. The relationship between bacterial communities and proximity to an urban area or major highway may give information regarding the effects of CO2, heat islands, or air pollution have on microbiomes of native plants. In order to determine these relationships, samples were taken from urban creosote bushes within metro Phoenix Arizona and various rural locations outside of Peoria and Tucson Arizona. It was hypothesized that there would be a difference between the number of more colony forming units (CFU's) and bacterial species found between urban and rural bushes. Preliminary results indicate a greater number CFU's and a greater number of group diversity in rural samples.

ONGOING COASTAL STREAM MONITORING IN AMERICAN SAMOA REVEALS POLLUTION FROM PESTICIDES, PAH'S, AND PHTHALATES

Fiona Bellows[1], Beth A. Polidoro[1], Mia T. Comeros-Raynal[2], Thomas Cahill[1] and Cassandra Clement[1] ([1]Arizona State University, Glendale, AZ and [2]American Samoa Environmental Protection Agency, Pago Pago, American Samoa)

Coastal marine pollution is a growing concern on islands whose nations have an increasing amount of solid waste and inadequate waste management infrastructure. Local streams are often used as dumping sites, many landfills are at capacity, and climate change-related storm activity leads to waste deposition in nearshore coastal ecosystems. In addition to solid waste, liquid waste from agricultural, municipal, and industrial runoff can add further pollutants to nearby

waterways. This pilot study was conducted to determine the presence and concentration of hydrophobic organic contaminants in American Samoa coastal streams and sediments to establish whether further monitoring and/or conservation efforts are necessary. Seven coastal streams and one surface water site on the island of Tutuila were sampled for water and sediments. Sites were chosen for their high observed amount of solid waste. Data analysis showed that several pesticides were in concentrations above chronic toxicity values for fish and aquatic invertebrates, many PAH's were present but below EPA water thresholds, and diethyl phthalate was found to be above the EPA estuarine water threshold. These contaminants are dangerous for marine and human health, so this study indicated the need for further monitoring of the marine environment and initiatives to reduce land-based pollution. Additional sampling was begun in August 2017 in order to retrieve more data on the existence of organic contaminants in near-shore coastal sites in American Samoa. This project sampled microplastics, waters, sediments, and bivalves from the three most polluted sites found in the baseline study in 2015, and is currently undergoing processing and analysis at Arizona State University. Ongoing sampling will occur for 24 months, and subsequent data analysis will provide further information on the state of the coastal marine health in American Samoa.

THE PRESENCE OF MICROFIBERS IN THE CITY OF PHOENIX DRINKING WATER

Samantha Gonzalez Faltermeier and Matthew Haberkorn (Phoenix College, Phoenix, AZ)

Phoenix is the 5th largest city in the country and the eighth fastest growing city in the United States and provides drinking water to approximately 1.5 million people. An estimated 95% of the drinking water provided by the City of Phoenix comes from rivers and lakes, which are water sources known to contain microplastics and microfibers. Furthermore, microfibers and microplastics may enter water sources through the treatment or delivery process. It is imperative to research drinking water for microplastics and microfibers because there is currently no publicly available research on these materials in the city's drinking water. Only one other known study has tested for microplastics in drinking water throughout the world, including some parts of the United States. However, this research contained no information on Phoenix drinking water or the Southwestern part of the United States. The purpose of this experiment is to identify if microplastics and microfibers are present in the drinking water throughout the City of Phoenix and to contribute to the emerging field of microplastic pollution. Water samples from villages located within the City of Phoenix limits are being collected; a vacuum filtration system is being used to remove microfibers, and filtered samples are then stained and analyzed through a dissection microscope. Preliminary results have demonstrated that microfibers may be present in drinking water.

WATER QUALITY IN METRO-PHOENIX AND HOW IT RELATES TO HUMAN HEALTH AND AQUATIC LIFE

Cecilia F. Fernandez, Cassandra Clement, Fiona Bellows, Sonia M. Lopez and Beth Polidoro (Arizona State University, Glendale, AZ)

There are a large number of urban lakes and ponds in the Metro-Phoenix area that support recreational fishing, yet are not monitored frequently by state agencies, even though the majority of urban fishers report eating the fish they catch. Therefore, we sampled water from urban lakes and ponds over the past 4 years to determine the presence and concentration of any organic contaminants that may pose either a health or aquatic life risk. Surface water samples collected from the urban lakes and ponds contained a number of persistent contaminants of concern, including Polychlorinated Biphenyls (PCBS), brominated flame retardants (PBDEs), pesticides, phthalates, and polyaromatic hydrocarbons (PAHs). The results of this study will provide a number of state agencies, including the Arizona Game and Fish Department, with information needed for improved monitoring, water quality management, and for potential consumption advisories if needed.

DOES INCREASED AEROBIC FITNESS AND CARDIAC FUNCTION FOLLOWING HIIT YIELD LASTING EFFECTS?

Brittney Hornsby[1], Ochuko Ojameruaye[1] and Chris Baldi[2,3] ([1]Northern Arizona University, [2]University of Otago Department of Medicine and [3]Dunedin Hospital, Dunedin, New Zealand)

Type II diabetes is a leading cause of death in the United States. It can be prevented and reversed based on various risk factors such as: diet, physical activity, lifestyle, and family history. An approach to aid in controlling and reversing Type II diabetes is high intensity interval training (HIIT). HIIT involves short cycles of intense exercise followed by one to two-minute recovery periods between each interval. HIIT improves aerobic fitness, cardiovascular health, body composition, blood pressure, and insulin sensitivity. The purpose of this study was to improve aerobic capacity and cardiac function in diabetic verses non-diabetic patients and determine whether improvements were maintained three months following the end of HIIT. All patients received six months of HIIT and had follow up three months after training ended. The measurement outcome was VO_2 max following an intensive exercise session which measures the maximum rate at which one's heart, lungs, and muscles consume oxygen and change in heart rate one and two minutes post VO_2 testing. Three months after the end of HIIT intervention, all individuals independent of their diabetic status maintained their post VO_2 levels but did not maintain heart rate recovery. These results demonstrate that increased aerobic fitness and cardiac function following HIIT displays lasting effects.

COOPERATIVE INHIBITION OF WNT/ß-CATENIN SIGNALING BY KLOTHO AND VITAMIN D: IMPLICATIONS FOR CHEMOPREVENTION

Sameera Khan[1], Zainab Khan[1], G. Kerr Whitfield[2], Mark R. Haussler[2], and Peter W. Jurutka[1,2] ([1]Arizona State University, Phoenix, AZ and [2]University of Arizona College of Medicine, Phoenix, AZ)

The *Klotho* gene has been closely associated with delayed onset of aging. Inhibition of the klotho protein promotes aging-like phenotypes, while its overexpression has been found to extend

lifespan in mice. The single-pass transmembrane isoform of klotho (m-klotho) forms a receptor complex with the fibroblast growth factor (FGF) receptor to create a high-affinity binding site for FGF23, a hormone involved in phosphate homeostasis and suppressing vitamin D activation. In contrast, secreted klotho (s-klotho) forms via ectodomain shedding of the membrane-bound isoform or through alternative splicing of the *Klotho* gene. It exhibits pleiotropic functions presumably via its weak glycosidase activity, including the inhibition of the insulin/insulin-like growth factor 1. The proposed anti-aging properties of s-klotho have already been demonstrated by its endocrine role in reducing oxidative stress and promoting cardiovascular protection. Due to its potential role as a tumor-suppressor, we have focused on how s-klotho interacts with a known chemopreventative agent and steroid hormone, 1,25-dihydroxyvitamin D_3 (1,25 D), and its nuclear receptor (VDR) to inhibit the activity of target proto-oncogenes. One such target for 1,25D/klotho interaction is β-catenin. Mutations in the Wnt/β-catenin signaling pathway have been implicated in numerous cancers, particularly colorectal neoplasia. In this study, the activity of β-catenin was analyzed *in vitro* using transcriptional luciferase assays and western blotting as a response to modulated levels of exogenous klotho, 1,25D, and VDR. In addition, quantitative polymerase chain reaction (qPCR) was utilized to evaluate the ability of s-klotho and 1,25D to inhibit the expression of known β-catenin target genes including cell cycle regulators such as cyclin D1 and c-myc, as well as the apoptosis inhibitor survivin. Our results revealed that s-klotho stimulated VDR transactivation while inhibiting β-catenin activity independently as well as synergistically with VDR and 1,25D. These findings were further supported by the 1,25D/klotho-mediated down-regulation of cyclin D1, c-myc, and survivin expression. The dual isoforms of klotho exhibited functional differences, as lower concentrations of m-klotho were found to boost β-catenin activity, implicating the secreted isoform of klotho in directing its hypothesized anti-aging properties. Our findings indicate that the crosstalk between vitamin D and klotho may promote healthful aging in part due to their cooperative tumor-suppressive role and inhibition of factors implicated in oncogenic signaling.

POMEGRANATE-DERIVED NUTRACEUTICALS ACTIVATE THE VITAMIN D SIGNALING PATHWAY

Sarah Livingston[1], Daniel Lucas[1], Marya S. Sabir[1], Sanchita Mallick[1], G. Kerr Whitfield[2], Mark R. Haussler[2] and Peter W. Jurutka[1,2] ([1]Arizona State University, Phoenix, AZ and [2]University of Arizona College of Medicine, Phoenix, AZ)

The active vitamin D hormone, 1,25-dihydroxyvitamin D (1,25D), mediates its biological effects by binding to the nuclear vitamin D receptor (VDR) and promoting heterodimerization with retinoid X receptors (RXRs). The VDR-RXR heterodimer regulates gene transcription in vitamin D target tissues including the colon, kidney, and brain thus effecting epithelial cell proliferation, differentiation, neuromodulation, and chemoprevention. The vitamin D signaling pathway has been postulated to interact with various nutraceuticals, including resveratrol (a natural phytochemical and antioxidant) and curcumin (a turmeric-derived polyphenol and antioxidant). More recently, health benefits attributed to pomegranate have been associated with its high content of polyphenols, specifically ellagitannins, which are metabolized by the gut microbiota to produce urolithins. Urolithin is thought to be the putative bioactive compound underlying the health benefits derived from pomegranate extract and other ellagitannins-rich sources. Urolithin

A (UA) is the most abundant of the urolithins and is found in the greatest concentration in human serum. In this study, we investigated the ability of UA to modulate 1,25D signaling via transcription-based assays and qPCR. We hypothesized that vitamin D in combination with urolithin will stimulate VDR activity more than vitamin D alone, and will increase transcription of vitamin D target genes (e.g., CYP24), including those genes that boost cellular anti-oxidation pathways (e.g., Nrf-2). The increased activation of anti-oxidation genes by 1,25D and UA could help combat reactive oxygen species (ROS) and attenuate cellular "aging". Our results indicate that there is a significant increase in VDR transcriptional activity when HEK-293 kidney cells are treated with UA in conjunction with 1,25D, and the stimulation by UA is apparent at several 1,25D concentrations. A similar effect was also observed using three structurally-distinct vitamin D response elements (VDREs) resulting in subtle differences in UA-mediated enhancement of VDR activity. Additionally, the expression of exogenous RXR did not augment the effect of UA, nor did UA promote an enhancement in VDR-RXR heterodimerization in a mammalian 2-hybrid (M2H) assay, suggesting that UA does not facilitate increased VDR activity by stimulating VDR-RXR heterodimerization. The potentiation of VDR activity via UA retains receptor-selectivity since UA did not promote further activation of estradiol-bound ER on an ERE, or RXR-RXR homodimerization as assayed via the M2H platform. Finally, HEK-293 cells treated with 1,25D and increasing concentrations of UA demonstrated a dose-dependent, positive trend in transcriptional activation employing both luciferase and qPCR assays. Taken together, our novel results position gut microbiota-derived urolithin A as a putative VDR modulator, suggesting that the influences of 1,25D and UA converging on VDR may potentially mediate anti-aging and promote longevity.

ORGANIC CONTAMINANTS IN COMMUNITY LAKES, PONDS, AND CANALS IN THE PHOENIX-METROPOLITAN AREA

Sonia M. Lopez, Cassandra Clement, Fiona Bellows, Cecilia Fernandez and Beth Polidoro
(Arizona State University, Glendale, AZ)

Located in the Sonoran Desert, residents in the Phoenix-metropolitan area experience nearly 300 days of sunshine per year. With an average precipitation of less than 8 inches per year, the city is characterized as being in a perpetual state of drought. The Central Arizona Project (CAP) and Salt River Project (SRP) ensure that Phoenix has an efficient water supply management for it residents through a system of canals and rivers with dams. Many of the canals, rivers, and associated community lakes and ponds are hydrologically connected to irrigation and other waste waters being transported through the canals while a few are groundwater fed. However, with 7 superfund sites located across the Phoenix-metropolitan area, some groundwater resources are known to be polluted. The Arizona Game and Fish Department's Urban Community Fishing Program oversees 26 community lakes and ponds throughout the Phoenix-metropolitan area. Unfortunately, community lakes and ponds are generally not well monitored for the presence of potentially harmful organic contaminants in water and recreationally-caught fish. Consequently, over the past three years, we sampled water from 22 community lakes, ponds, and canals in the Phoenix-metropolitan area to identify and quantify organic contaminants sorbed to suspended solids (TSS) within the water column. From our analysis, we detected over 30 different organic compounds, including pesticides, polychlorinated biphenyls, phthalates, and poly aromatic

hydrocarbons, etc. Since high concentrations of suspended solids and the associated organic contaminants can pose serious ecological and human health risks, it is necessary to continue monitoring and assessment of these community lakes and ponds, as well as to determine if recreationally-caught fish consumption advisories or water quality mitigation measures are needed.

VITAMIN D STIMULATES SEROTONIN PRODUCTION VIA INDUCTION OF TRYPTOPHAN HYDROXYLASE 2 IN RAT MEDULLARY NEURONS

Daniel A. Lucas[1], Marya S. Sabir[1], Sanchita Mallick[1], G. Kerr Whitfield[2], Mark R. Haussler[2] and Peter W. Jurutka[1,2] ([1]Arizona State University, Phoenix, AZ and [2]University of Arizona College of Medicine, Phoenix, AZ)

The active hormonal metabolite of vitamin D, 1,25-dihydroxyvitamin D (1,25D), and serotonin (5-HT) are postulated to play significant roles in abnormal social behavior associated with psychiatric conditions including autism spectrum disorders and depression. Moreover, it has been reported that 1,25D regulates synthesis of two isoforms of tryptophan hydroxylase (TPH), the rate-limiting enzyme in the 5-HT biosynthetic pathway, including induction of tryptophan hydroxylase 2 (TPH2) in the central nervous system (CNS) and suppression of tryptophan hydroxylase 1 expression in specific peripheral tissues. Interestingly, a key characteristic associated with autism may involve the combination of low concentrations of serotonin in the CNS and elevated levels of serotonin in the periphery. To investigate the ability of 1,25D to stimulate production of 5-HT in neuronal cells, rat serotonergic medullary neurons (RN46A-B14) were treated with vehicle or 10 nM 1,25D for 24-, 48- and 72-hour time points. A 5-HT ELISA assay was subsequently performed to obtain 5-HT concentrations in the media supernatant for each treatment group. The results revealed a statistically significant increase (57%, $p < 0.05$) in 5-HT production following treatment with 1,25D for 24 hours versus vehicle, with subsequently larger percent-increases in 5-HT synthesis observed at 48 and 72 hours (64% and 103%, respectively, $p < 0.05$). These results suggest that 1,25D stimulates the formation of serotonin, likely through the induction of the neuronal TPH2 gene, and the time-course of this effect appears to lag the induction of TPH mRNA which peaks at 24 hours. The production of 5-HT also demonstrated a 1,25D dose-response, and 10 nM 1,25D elicited the highest amount of 5-HT synthesis, directly mirroring the pattern observed with vitamin D-mediated induction of TPH2 mRNA. In summary, this study illuminates a coordinated biochemical and regulatory interaction between two neuromodulators, vitamin D and serotonin, thereby identifying a potential connection between serum vitamin D levels and the occurrence of psychiatric disorders commonly linked to an imbalance in CNS serotonin production, including autism and depression.

GROWTH, PHYSIOLOGICAL AND MOLECULAR TRAITS ASSOCIATED WITH SALINITY TOLERANCE IN RICE

E. Nsende[1], K. Khan[1], A.M. Ismail[2], J. Edgane[2] and M. DeOcampo[2] ([1]Northern Arizona University MHIRT Flagstaff, AZ and [2]International Rice Research Institute, Los Baños, Laguna, Philippines)

In Experiment 1, salt-tolerant rice varieties in Southeast Asia (Philippines) were bred using screening techniques. In Experiment 2, physiological characters were identified in rice genotypes for their ability to remove sodium (Na+) and potassium (K+) in the sheath and blade of their third and fifth leaves. Hydroponically, seventeen rice varieties grew in a greenhouse. Upon harvest, the rice genotypes scored for salt injury and screened by the following techniques: plant vigor, biomass, sodium/potassium determination, and chlorophyll determination. InDel markers located known salinity tolerant genes with Polymerase Chain Reaction (PCR) and gel electrophoresis. Salinization decreased the plant vigor, decreased the biomass, and decreased levels of chlorophyll compared to the control data set. The percentage of sodium present in tolerant rice varieties was higher in younger leaves, while the percentage of sodium in saline rice varieties was higher in older leaves. The presence of InDel markers, SO103B, SO2057B, SO306B, SO4128, SO5009, SO6124, SO7053, SO8055, SO9026B, S10015, S11033, and S12209B were indicative of saline tolerant genes. Rice genotypes that were found to be the most tolerant in saline soils were varieties NSIC Rc334 (Salinas 15), NSIC Rc340 (Salinas 18), BINA dhan 8, BRRI dhan 47, and FL478.

IDENTIFICATION OF AIR POLLUTION IN METEORIC WATERS AND THEIR DISTRIBUTION ACROSS THE LAS VEGAS VALLEY, NEVADA (USA)

Douglas B. Sims, Amanda C. Hudson, Christopher J. Collumb, David Ferrari, Lauryn Guerrissi, Alejandro Lopez-Santiago, Camryn Schroeder, James Stordock and Ryan Taggart (College of Southern Nevada, Las Vegas, NV)

Air pollution contains hazardous substances (e.g. toxic elements, oxides, carbon, and sulfur) discharged to the environment by a number of natural and human ("anthropogenic") activities. Combustion processes are the major anthropogenic sources of air pollutants during the production and use of energy. The combustion process produces carbon dioxide (CO_2) and water (H_2O) as the main products. Additionally, it produces several by-products, which originate either from incomplete fuel oxidation (e.g. CO, hydrocarbons, aerosol particles etc.) or from the oxidation of non-combustible species present in the combustion chamber (e.g. NO_x, SO_x etc.). Furthermore, the combustion also discharges trace elements (heavy metal) derived from contaminants released into the atmosphere by automobiles (fossil fuel combustion) and other physical routes (e.g. metal refining, vehicle brake wear, and tire and pavement wear). Meteoric water samples were collected from two-day storm (August, September, and January) events across 2017 and 2018. Samples were analyzed for metals (Al, Ba, Cu, Fe, Mg, Mn, Ni, Zn) and oxide pollutants (SO_x, NO_x). Data shows that summer precipitation contained 10x more metal pollutants then winter storms; e.g. average of 219 mg L^{-1} of Al (August 23, 2017), 523 mg L^{-1} (September 7, 2017) and 0.09 mg L^{-1} (January 8, 2018), respectively. Nutrients showed a similar distribution pattern with, for instance, 3.01 mg L^{-1} (August 23, 2017), 2.87 mg L^{-1} (September 7, 2017) and 0.71 mg L^{-1} SO_4^{2-} (January 8, 2018), respectively. Additionally, the first day of the storm contained significantly higher levels of pollutants than the second day suggesting an initial purge of pollutants.

ASSESSMENT OF NOVEL VDR ANTAGONISTS THAT MEDIATE SUPPRESSION OF VITAMIN D SIGNALING

Lech J.P. Staniszewski[1], Pritika Shahani[1], Sameera Khan[1], Michael Heck[1], Dania S. Hasan[1], Carl Wagner[1] and Peter W. Jurutka[1,2] ([1]Arizona State University, Glendale, AZ and [2]University of Arizona College of Medicine, Phoenix, AZ)

Antagonists are chemical compounds that bind to receptors without eliciting activation of signaling, therefore the biochemical response to the receptor ligand can be blocked or significantly decreased. Receptor antagonists display varying levels of binding affinity but do not produce the agonist-mediated response upon binding. The vitamin D receptor (VDR) binds with high affinity to its endocrine agonist, 1,25-dihydroxyvitamin D_3 (1,25D) to regulate the expression of a suite of genes in target tissues including kidney, intestine, and bone to control biological processes such as calcium and phosphate bone mineral homeostasis. In conditions of VDR hyperactivity, excess vitamin D production, or significantly increased intake via diet or supplementation, there are risks associated with potential resultant hypercalcemia including kidney stones, GI dysfunction, behavioral changes such as depression, and cardiac problems. In the present study, we synthesized novel VDR antagonists to create synthetic ligands that have high affinity for VDR, and consequently inhibit the activation of 1,25D-VDR regulated genes that lead to hypercalcemia. It is well established that agonist-bound VDR forms a functional DNA-binding heterodimer with the retinoid X receptor (RXR) that associates with vitamin D responsive elements (VDREs) to either induce or repress transcription. Therefore, we exploited this agonist-dependent VDR-RXR heterodimerization pathway as an initial screening assay to evaluate the efficacy of our putative VDR antagonists. The initial test employed the mammalian two-hybrid assay (M2H), which can assess if the novel antagonists compete with 1,25D and bind to VDR to prevent the formation of a heterodimer with RXR, a prerequisite step in VDR signaling. A second assay utilized VDRE-linked luciferase reporter plasmids to measure antagonist activity in the more natural environment of the VDRE DNA platform. This assay was followed by a third screen to determine the specificity of antagonist binding to VDR versus other closely related receptors in the nuclear receptor superfamily. Results from these assays revealed that two novel analogs bind as *bona fide* antagonists to the VDR, albeit with different affinity. Our findings also suggest that additional chemical modification of antagonists may result in analogs with enhanced ability to suppress 1,25D-VDR activation. Thus, this study further broadens our understanding of VDR-ligand binding interactions, and may facilitate the development of novel therapeutic compounds with the potential for clinical applications in treating VDR-directed hypercalcemia.

*THE UTILITY OF MALDI-TOF MASS SPECTROMETRY FOR PHYLOGENETIC ANALYSIS OF ENVIRONMENTAL BACTERIAL ISOLATES

Chad M. Albert[1, 2], Stacy E. Scholz-Ng[1, 2], Melinda E. Wall[1,2], Anthony J. Gutierrez[4], George T. Noutsios[4], James M. Tuohy[1], Sabrina R. Mueller-Spitz[3] and Todd R. Sandrin[4] ([1]Glendale Community College, Glendale, AZ, [2] Western New Mexico University, Silver City, NM, [3]University of Wisconsin–Oshkosh, WI and [4]Arizona State University, Glendale AZ)

Characterization of microbial environmental isolates by MALDI-TOF Mass Spectrometry (MS) has been used recently to ascertain taxonomic information at the genus and species levels[1]. Our goal in this study was to investigate whether MALDI-TOF MS affords higher taxonomic resolution when examining proteomic profiles below the species level. Nineteen isolates of *Deinococcus aquaticus* were obtained from diverse biofilm habitats in and around the Lake Winnebago – Fox River system in Wisconsin, USA. We developed a methodology to produce rapid and reproducible MALDI-TOF spectra by: 1) design of sample preparation techniques to reduce proteomic background noise and 2) use of comparative integration of multiple DNA profiling methods such as 16S rRNA gene sequencing and BOX-A1R fingerprinting. Our results suggest that MALDI-TOF MS shows greater taxonomic resolution than either 16S rRNA gene sequencing or BOX-A1R fingerprinting. Two separate subgroups were characterized by spectra that contained features that appeared unique to each group. We conclude that MALDI-TOF MS represents a rapid, high resolution, and readily reproducible method for the proteomic characterization of environmental isolates of the *Deinococcus* genus. Future work will include application of current methods to additional members of the genus.

*USE OF COMPUTATIONAL NEURAL NETWORKS FOR RAPID BACTERIAL STRAIN IDENTIFICATION USING *DEINOCOCCUS AQUATICUS* ISOLATES OBTAINED FROM BIOFILM SAMPLES

David Ayodele, Stacy Scholz-Ng, Chad Albert and James Tuohy (Glendale Community College, Glendale, AZ)

The spectra produced from cell protein extracts using Matrix-assisted laser desorption/ionization Time of Flight (MALDI-TOF) mass spectrometry has been shown to contain characteristic fingerprints of specific organisms[1]. In this study, such spectral data were inputted into a machine learning algorithm in order to develop a rapid method of bacterial strain identification. Essentially, a training dataset of 20 biofilm derived strains of *Deinococcus aquaticus*[2] were mapped to their MALDI-TOF spectra using a computational neural network (machine learning) algorithm. The algorithm was written in the Python 3 language using the Jupyter/IPython application environment. MALDI-TOF spectral data was converted to array (vector) data using the Numpy open-source numerical analysis library for Python. The training data was fed into machine learning functions created using the Keras open-source neural network library for Python and a predictive model was generated. Model (fitting) parameters of note include the use of ReLU (Rectifier Linear Unit) as the model activation function, and categorical cross entropy as the loss function. Exactly 32 iterations were used in the modeling process. A series of spectra of unspecified strain origin were then passed into the model prediction function. The resulting Keras predictions were then analyzed using standard error analyses to quantify the efficacy of this method for strain identification.

*USE OF MALDI-TOF MASS SPECTROMETRY TO DERIVE TAXONOMIC RELATIONSHIPS AMONG SPECIES OF THE BACTERIAL GENUS *DEINOCOCCUS*

Stacy E. Scholz-Ng[1,2], Chad M. Albert [1,2], Benita L. Barnes[1,2], George T. Noutsios[4], Sabrina R. Mueller-Spitz[3], James M. Tuohy[1] and Todd R. Sandrin[4] ([1]Glendale Community College, Glendale, AZ, [2]Western New Mexico University, Silver City, NM, [3]University of Wisconsin–Oshkosh, WI, [4]Arizona State University, Glendale, AZ)

MALDI-TOF Mass Spectrometry (MS) of whole cell protein extracts has been shown to produce a summary spectrum and a characteristic fingerprint for a given organism[1]. In the present study we used MALDI-TOF MS data to derive phylogenetic relationships between nine representatives of the bacterial genus *Deinococcus*[2]; namely; *D. aquaticus*, *D. caeni*, *D. deserti*, *D. geothermalis*, *D. gobiensis*, *D. grandis*, *D. indicus*, *D. misasensis*, and *D. sonorensis* as well as two outlier species, *Pseudomonas fluorescens* and *Vibrio fischeri.* This analysis was evaluated against a dendrogram derived from 16S rRNA gene sequencing and yielded congruent findings. However the MALDI-TOF approach is rapid, economic and technically straight-forward and as such recommends itself as a phylogenetic tool when contrasted with traditional 16S rRNA gene sequencing.

DOES COLONIZATION OF MICROPLASTICS BY *PSEUDOMONAS FLUORESCENS* AID IN MICROPLASTIC BIODEGREDATION?

Ibrahim Ibrahim, Kassandra Barrera, Maria Rodriguez, Enas Ibrahim, Jasmine Hernandez, Amber Neal, and Matt Haberkorn (Phoenix College, Phoenix, AZ)

It was recently discovered that 94.4% of tap water samples in the US contain microplastics which are fragments of plastics that are 5 millimeters or smaller in size. The human and ecosystem health implications of this are not fully known. However, this is an emerging issue that will most likely require innovation and the design of strategies to reduce the amount of microplastics contaminating our recreational and drinking water sources. One proposed solution is the use of microbes to aid in the biodegradation of microplastics. Several studies have demonstrated that Pseudomonas putida and *Pseudomonas fluorescens* have been found to grow on polyvinyl chloride (PVC), while *Pseudomonas stutzeri* has been found to grow on hydroxybutyrate. Other studies have shown that, in addition to colonizing microplastics, Pseudomonas species may play a role in the decomposition of plastics such as polyvinyl alcohol (PVA), polypropylene and polythene. This raised the question of, what types of microplastics can different *Pseudomonas* species colonize and biodegrade. The purpose of this project was to determine if *Pseudomonas fluorescens* along with other *Pseudomonas* species (*Pseudomonas aeruginosa, Pseudomonas putida,* and *Pseudomonas stutzeri*) are capable of colonizing the following types of plastic: type 3 (polyvinyl chloride, PVC), type 4 (low-density polyethylene, LDPE), type 5 (polypropylene, PP), and type 6 (polystyrene, PS). The initial goal of this project was to establish protocols for the colonization, isolation, and identification of different *Pseudomonas* species from each of the four microplastics tested. To achieve this goal,

Pseudomonas fluorescens was grown on selective media, Pseudomonas Isolation Agar (PIA) and *Pseudomonas fluorescens* (PF) agar and identified by pigment production and colony morphology. After identification by colony morphology and PCR, each *Pseudomonas* species was co-incubated with the four plastic types tested and imaged using SEM. Future studies will determine which *Pseudomonas* species aid in the biodegradation of microplastics PVC (#3), LPDE (#4), PP (#5), and PS (#6).

AMPHIBIANS AS ECOSYSTEM BIOINDICATORS: THE IMPACTS ON FLUCTUATING ASYMMETRY (FA) FROM PESTICIDE APPLICATION IN FILIPINO RICE PADDIES

Riley Smith[1], Mildred Diaz[1], Grant Singleton[2], and Catherine Propper[1] ([1]Northern Arizona University Flagstaff, AZ and [2]International Rice Research Institute, Los Banos, Laguna, Philippines)

In the Philippines, since the 1970's, there has been heavy increases of pesticide imports and application in rice fields. Insecticides, molluscicides, fungicides, and weedicides have been shown to bioaccumulate in and affect development of organisms in aquatic ecosystems. Amphibians can act as bioindicator species that reveal the condition of the environment. Developmental instability (DI) can be monitored by measuring the symmetry of bilateral structures or fluctuating asymmetry (FA) to understand developmental impacts from pesticide application. At the International Rice Research Institute (IRRI), face FA and limb FA of 2 frog species (*Rhinella marina* and *Fejervarya vittigera*) in heavy pesticide application areas were compared. FA was also compared between populations of *R. marina* in heavy pesticide application areas and light pesticide application areas. Analysis between *R. marina* and *F. vittigera* revealed no significant differences in FA of the face or the limbs. While comparing DI within-species, there were different levels of FA. *R. marina* populations in heavy application areas had significantly greater levels of FA in the face. Conversely, the levels of FA of the limbs were significantly greater in light application areas than for frogs in heavy pesticide application areas. Many studies have either measured the FA of the face or the limbs, and these findings suggest that monitoring both total face and total limb asymmetries should be incorporated for monitoring developmental stability of frog populations.

APPLICATION OF CRISPR-CAS SYSTEM TO EDIT ANTIBIOTIC RESISTANCE GENES IN *ESCHERICHIA COLI*

Shao M. Chen, Brianna Balsamo, Jacob Osorio, Chika Adiele, K. Kimberley, J. Theoret, and DV Harbour (College of Southern Nevada, Las Vegas, NV)

CRISPR-Cas system is a bacterial immune system that can be modified and be used to quickly and effectively carry out genome editing using homologous recombination. The system includes the use of guide RNA which consists of crRNA, a region complementary to the target gene to be edited and trans-activating (tracer) RNA which combines with the Cas9 endonuclease protein. Template DNA is used for homologous recombination by editing the target gene to the desired

sequence. Using a previously described system with gRNA, a plasmid with the cas9 gene and template DNA, we transformed *E. coli* using heat shock and were able to edit the rpsL gene. The gene encodes for a ribosomal protein that the antibiotic streptomycin binds, resulting in sensitivity. If a mutation occurs on the rpsL gene, streptomycin no longer binds and resistance is established. After editing of this gene, we showed that growth in the presence of streptomycin occurred in the transformed and mutated DNA in the *E. coli* cells indicating that our system worked. We used a knock out method of the cas9 gene with a chloramphenicol insert to verify that the Cas9 protein was responsible for rpsL gene editing. We also attempted to mutate the gyrA gene which codes for a topoisomerase protein important in DNA replication and is the target of the quinolone, ciprofloxacin. We designed several gRNAs with crRNA regions complementary to two locations in the quinolone resistance determining (QRDR) of the gyrA gene. Mutations in this region show the highest level of resistance to the antibiotic ciprofloxacin. We sequenced the amplified QRDR region both before and after editing but were unsuccessful in changing the nucleotide sequence. As the sequence indicated, our transformations did not exhibit growth in the presence of ciprofloxacin. We have used the CRIPSR-Cas system in antibiotic resistance gene editing. Future research should be focused on designing new guide RNAs used to edit more antibiotic target genes to induce resistance.

PHOSPHORYLATION OF TROPONIN I IN DIABETIC AND NON-DIABETIC HEARTS

Marisa Erazo[1], Tomoko Wilson[1], and Jeff Erickson[2] ([1]Northern Arizona University, AZ, [2]University of Otago, NZ)

Diabetic patients have been shown to have an increased risk for cardiovascular disease. Previous research has shown that diabetic rat hearts exhibit a decreased force of contraction compared to hearts from their non-diabetic counterparts. This decreased force of contraction has been attributed to altered transient calcium and sarcoplasmic reticulum calcium loads. However, our lab recently showed that there was no change in calcium flux when force was restored through the inhibition of CaMKII. This finding led us to look at the level of the myofilament, specifically, cardiac troponin I (cTnI) which plays an important role in contraction and relaxation. We hypothesized that there would be differential phosphorylation of cTnI at Ser23/24 and Thr144, critical sites within cTnI, between diabetic and nondiabetic hearts. Western blots and immunohistochemistry were utilized to measure the phosphorylation of the amino acid sites and the total amount of cTnI in human right atrial appendages in diabetic and non-diabetic hearts. Ser23/24 and Thr144 did not produce any significant phosphorylation differences; however, total cTnI protein was significantly different in the non-diabetic western blot group that had an ejection fraction below 50. Due to a small sample size for both assays, no definitive conclusions can be drawn. An increased sample size is recommended to further investigate this hypothesis and aid in future treatment for diabetic cardiac pathogenesis.

HUMAN INFLUENCE ON WILDLIFE ACTIVITY ALONG THE ARIZONA-MEXICO BORDER

A. Bowser, M. Buono, H. Vega, A. Johnson, R. Crawford, K. Hilliard, and E. Priddis
(Cochise College, Sierra Vista, AZ)

Southeastern Arizona is perhaps the most biodiverse area in all of North America due to its unique position at the convergence of four major deserts and the presence of mountain ranges scattered throughout the semi-arid landscape called "sky islands." The unique biodiversity is enhanced as the region sits on the border between two countries and many of the species found here are at the northernmost reach of their range. Within this region are a number of waterways that transverse the border and may act as important corridors for species movement and migration. Human activity along the border between the two countries has the potential to drastically impact wildlife in this crucial habitat. This study compares the activity of species captured on camera at sites on federal conservation land that lie within the border region, including the human activity also "captured" in these locations. High output covert infrared detecting camera traps were deployed at each of the sites in the U.S. and Mexico. Pictures were gathered through March 2018. The relative abundance of species at each location, seasonal variations in species' abundance, and species pair activity similarity were examined.

GENE FLOW DYNAMICS AND PHYLOGENETICS OF *ZOSTERA MARINA ATAM* USING PHYLOGEOGRAPHY TECHNIQUES IN THE CANAL DE INFIERNILLO

Frank Emmanuele[1], Abby Bowser[1], Mark Buono[1], Maria Diaz[1], Paulette Iniguez[1], Lauren Loreto[1], Nick Massoni[1], Ernesto Ramirez[1], Hector Vega[1], David Hanna[2], and Lisa Floyd-Hanna[2]
([1]Cochise College, Sierra Vista, AZ and [2]Prescott College, Prescott, AZ)

Zostera genera are being studied across the world as indicators of climate change. For instance, *Zostera japonica* is a non-native species that was introduced into the Pacific in the late 50's, however now according to Shafer and Kaldy (2012), *Z. japonica* is moving into the natural territory of *Zostera marina* (the native species in this area). The movement of *Z. japonica* southward and northward in latitude is creating more competition with *Z. marina*. *Z. marina* are found in thermal clines, and Franssen, *et al.* (2011) show that gene transcription changes occur over time more in areas where *Zostera* species are not adapted to higher temperatures such as those in higher latitudes. Besides being an indicator of climate change, the *Zostera marina atam*, which is specific to Mar de Cortez of Bahia de Kino, Sonora, Mexico is of major ecological importance for many bird species and to the protected Sea turtle. *Zostera marina atam* is also very important to the culture of the indigenous people of the Comcaac of this region. Prescott College and Comcaac have been working together to create theoretical maps using the Comcaac tribal knowledge passed down generations and satellite data to create predictions of where *Z. marina atam* will be found within the region of the Canal de Infiernillo. Satellite data was used to create a density and location map of *Z. marina atam* using ArcGIS software. An exploratory testing of this predictive density map was done by the Comcaac tribe via drone technology. We accompanied the Prescott College researchers and checked random points to test the accuracy of the predicted density/location map. As we tested random locations and their density, we obtained samples from 6 different locations (4 locations from dense areas and 2 from sparse locations). *Z.*

marina atam is considered to be a unique subspecies found in this area. Muniz-Salazar, *et al.* (2005) mention that gene flow is very high around the western coast of Baja California but even higher within the eastern coast in the Mar de Cortez. Also Muniz-Salazar, *et al.* state that genetic variation is higher within the Mar de Cortez. These findings support the creation of our hypothesis that *Z. marina atam* is a unique genetic variant and further genetic analysis of all our samples may show significant phylogenetic relationships with those mapped in other *Zostera* and related species phylogenetic studies. Our study will create a data aggregation map which can be used to monitor location, density, genetic variance, gene expression variation of *Zostera marina atam*. Conservation of seagrass and the organisms that depend on these plants can further benefit from eventual conclusion of this aggregation map which will help study gene flow and expression in relationship to the environmental variables of water currents, temperature, etc.

2:20-3:00 ANAS BUSINESS MEETING AND AWARDS CEREMONY: BHS 132

ACADEMY BUSINESS AND ANNUAL REPORTS

OFFICERS 2017-2018

ELECTED

Brian Wainscott ..... President
Paula Rivadeneira …… President-Elect
Angela Schwendiman ..... Membership Secretary
Pedro Chavez ..... Permanent Secretary
Karen Conzelman..... Treasurer
Robert Bowker……...Recording Secretary
Ty Ferre..... Director, Southern Arizona
Aregai Tecle..... Director, Northern Arizona
Jennifer Hackney……...Director, Central Arizona
Boris Poff..... Director, Nevada
Pamela Marshall..... Director at Large

APPOINTED

Robert McCord ..... Editor, Journal
Florence Slater ..... Editor, Proceedings
Rhett Michelson ..... Webmaster

SECTION CHAIRS

Paula Rivadeneira ..... Biology/Biotechnology
Robert McCord ..... Geology
Boris Poff..... Hydrology
Joseph Borromeo ..... Mathematics/Statistics
Earl Yoon..... Posters

PRESIDENT'S REPORT

Thank you for your participation in the Arizona-Nevada Academy of Science! I would like to extend my appreciation to Theo Manno for his service as the former President of our Academy and thank the many Board of Governors that voluntarily serve to maintain the multitude of Academy functions. I would also like to acknowledge the long-term service of Robert Bowker who will be retiring as Recording Secretary at the conclusion of the 62nd Annual Meeting. Finally, I would like to recognize Rhett Michelson for his tireless pursuit to modernize the Academy's website (https://aznvas.org).

It has been a turbulent year for science policy as consequence of new executive orders and legislation from the incoming White House Administration and the 115th Congress. Some of these changes will have lasting impact on the science infrastructure in the United States of America. The Arizona-Nevada Academy of Science joined The American Association for the Advancement of Science and nearly 100 other partner institutions to denounce proposed changes to immigration and visa policy that will have an erosive influence on our science infrastructure (https://www.aaas.org/page/aaas-statements-letters-and-testimony). The Academy will continue to support multi-organizational efforts to comment on policy changes that will potentially weaken the influence of science in public policy. By the time you read this report, the second annual March for Science will have likely emboldened even more scientists to speak out against diminishing the science infrastructure of the USA. Locally, the Academy has focused on its mission of promoting science in the great states of Arizona and Nevada. During 2017 we had our 61st Annual Meeting at Glendale Community College in Glendale, AZ. I want to thank Karen Conzelman, Florence Slater, and Robert Bowker for organizing the Annual Meeting. We also awarded Grant-in-Aid funding to support student research, awarded an academic scholarship, continued to support the Science Olympiad by funding tournament travel and expenses, and published a new volume of the Journal of the Arizona-Nevada Academy of Science (JANAS).

In 2018, I look forward to joining the American Society of Microbiology for our 62nd Annual Meeting at the University of Nevada, Las Vegas in Las Vegas, NV. I want to thank Brian Hedlund and Kurt Regner for organizing the joint meeting with me. The 62nd Annual Meeting is the second meeting in Nevada since 2016 and serves as an example of how I am trying to increase Nevada participation in the Academy. I am also encouraging more of my Nevada colleagues to serve in existing Board of Governor's positions and I am working toward adding an additional Director in Nevada to help further bolster Nevada's presence in the Academy. This year we also seek to increase the number of submissions to JANAS (https://www.aznvas.org/publications/). Please consider submitting your research for inclusion in your Academy's journal! We look forward to your continued involvement in our Academy. If you are not a member, please join (https://www.aznvas.org/membership/) today! If you are already a member, please renew your membership and consider increasing your involvement by serving on the Board of Governors, organizing/hosting an Annual Meeting, and/or nominating worthy persons for one of our many awards (https://www.aznvas.org/Funding/).

Brian C. Wainscott
President

NOMINATING COMMITTEE REPORT

The following members have been nominated to serve as officers on the Board of Governors:

Treasurer (2018-2019): Karen Conzelman

Membership Secretary (2018-2019): Angela Schwendiman

Recording Secretary (2017-2018): Linda Loverro

Director, Central Arizona: (2018-2020): Jennifer Hackney Price

Director, Northern Arizona (2018-2020); Aregai Tecle

Director, Nevada (2018-2020): Boris Poff

Appointed Board of Directors Positions:

Proceedings Editor (2018-2020): Florence Slater

Webmaster (2018-2020): Rhett Michelson

ANAS FELLOW NOMINATION

ROBERT BOWKER

Dr. Bowker is an emeritus faculty member in the biology department at Glendale Community College in Glendale AZ. He served as Section Chair for Biology at the ANAS annual meetings for many years. In addition, he has served as recording secretary for the organization. He was recognized for the Outstanding Service Award by the Academy. Among his community outreach activities was a longstanding commitment to the annual AZ Science Olympiad tournament for 9^{th} – 12^{th} graders.

NECROLOGY REPORT

We sadly report the passing of Dr. Milton Sommerfeld, a professor at Arizona State University's Department of Applied Biological Sciences at the Polytechnic School, who died on May 16, 2017. Dr. Sommerfeld enjoyed an expansive ASU career sparkling with accomplishment. He was a long time member of ANAS and received the Outstanding Service Award in 2002.

During 48 years as a professor, his advancement to department chair, then to associate dean and finally to co-director of the Arizona Center for Algae Technology and Innovation, he kept education and research firmly at the foundation of his success.

Much of Dr. Sommerfeld's legacy lies in the inception of the Laboratory of Algae Research and Biotechnology as the first national test bed for outdoor algae cultivation. He was critical in developing the Algae Testbed Public Private Partnership now key to researchers and companies looking for third-party technology verification. With AzCATI, Dr. Sommerfeld envisioned a place where students could gain the knowledge necessary to become tomorrow's workforce in the expanding field of algal biotechnology, and that is precisely what it has become.

MINUTES OF THE ANNUAL BUSINESS MEETING

AND AWARDS LUNCHEON

APRIL 1, 2017

Board members in attendance: Rob Bowker, Pedro Chavez, Karen Conzelman, Shafiu Jibrin, Bob McCord, Theo Manno, Rhett Michelson, Paula Rivadeneira, Florence Slater and Brian Wainscott,

Guests in attendance: Glendale City Councilman, Ray Malnar along with guests of the award winners

CALL TO ORDER AND GENERAL INTRODUCTORY REMARKS:

Theodore Manno, President called attention to the large numbers of people in attendance representing many colleges and universities, thanked everyone for their attendance and encouraged everyone to sign up for membership.

WELCOMES:

Fernando Camou, Dean of Academic Affairs at GCC welcomed the Academy to the campus and described GCC's commitment to STEM education by highlighting some of the college's activities and programs. Pamela Marshall, spoke about the importance of the Academy as a vehicle for students to present their research and interact with other scientists. She encouraged

students to consider submitting papers and/or short communications to *Journal of Arizona Nevada Academy of Science*.

KEYNOTE SPEAKER:
Pam also introduced the keynote speaker Tess Neal, Assistant Professor of Psychology in Arizona State University West, in the New College of Interdisciplinary Arts and Sciences, who spoke on: *Bias in Expert Judgment: Why Experts Might be Even More Biased than the Rest of Us*
REPORTS:

Minutes from 2016 Annual Meeting: Approved by majority of membership in attendance
Reports of officers**:** Approved by majority of Membership in attendance

AWARDS:

Bud Ellis Scholarship: introduced by Steve Shuster, NAU

Marissa Conn Minister is a senior at Flagstaff High School who plans to attend University of Arizona in the fall and major in Chemical Engineering.

Outstanding Service Award: introduced by Theo Manno

Gerald Gottfried, US Forest Service (Retired)

Outstanding High School Science Teacher: introduced by Pam Marshall

Kristen Kaus, Cactus High School, Glendale, Arizona

Outstanding Leadership in Science Education: introduced by Pam Marshall and George Gregg (GCC Chemistry faculty)

Darrell Kidd for his work on Peoria USD's MET Academy

Martin Wesolowski for his establishment of the innovative Arizona STEAMShop and Martin Center in Glendale, AZ

Each awardee spoke briefly about their programs.

Best Student Presentations: introduced by Biology/Geology Sessions Co-chair Paula Rivadeneira

Teresa M. LuPone, Chaz Beckett, Annika Vannan, Madelaine Khosti, Jesus Contreras Rodriguez, and Jennifer Hackney Price, ASU West, Glendale, AZ

Investigating the Potential of D. melanogaster's Utility as a Model Organism for Burn Injury (presented by Teresa LuPone)

Samier J. Muhialdeen and Jennifer L. Foltz-Sweat ASU West, Glendale, AZ

Temporal and Spatial Variation in Wild Bee Species Richness and Abundance within the Urban Matrix (presented by Samier Muhialdeen)

Outstanding Posters: introduced by Poster Session Chair Pam Marshall

Schuyler Humes, Brant Pewonka, Jonah Mayers, Stephanie Carrera, Barierane Akeeh, Alyssa Denning, Amber Neal, Oliver Garcia, Daisy Rodriguez, Jennifer Blan, Elizabeth Reese, Cinthia Gonzalez, Katie Hickey, Chaawpohdeey Melody,

Danny Scalf, Cori Leonetti, and Robin Cotter, Phoenix College, Phoenix, AZ
Detection of Legionella pneumophila in the Water System of an Educational Institution in the Desert Southwest (presented by Amber Neal)

Supreet Bains, Pritika Shahani, Carl Wagner, Pamela A. Marshall, Ichiro Kaneko, Michael Heck and Peter W. Jurutka from ASW West, Glendale, AZ and University of Arizona College of Medicine, Phoenix AZ
The Chemotherapeutic Potential of Retinoids for Erα-positive Breast Cancer (presented by Supreet Bains)

Hannah Combs, Daniel Kollath, Byanca Hermosillo, Laura Blair, Zane Holditch, and Stephen M. Shuster from NAU, Flagstaff, AZ
Patterns of Host Selection in the Parasitoid, Nasonia vitripennis (presented by Hannah Combs)

ELECTION OF OFFICERS:

The members identified by the nominating committee (listed below) were approved by the membership (without any additional nominations from the floor) for terms designated below.

President Elect: Paula Rivadeneira (2017-2019)

Recording Secretary: Robert Bowker (2017-2018)

Membership Secretary: Angela Schwendiman (2017-2018)

Treasurer: Karen Conzelman (2017-2018)

Director, at Large: Pam Marshall (2017-2019)

Director, Southern Arizona: Ty Ferre (2017-2019)

CLOSING REMARKS:

Theodore Manno passed the meeting to the new Academy President Brian Wainscott. Brian Wainscott thanked the GCC hosts and their team for doing an outstanding job of organizing the meeting. Brian made some closing comments, thanking student presenters, GCC's administration for their support, and all those that helped make this conference successful.

Robert Bowker
Recording Secretary

REPORT OF THE GRANT-IN-AID COMMITTEE

This year's winners for the grant–in-aid awards to pursue research at the high school level are:

Geethika Ameneni, Red Mountain High School, Mesa

Inducing Cell Dormancy in Human Breast Adenocarcinoma (MCF-7) Cells to Prevent Metastasis

Adrian Kwiatkowski, Red Mountain High School, Mesa

Transgenic Analysis of gld-1 as a Post-Transcriptional Mediator in the Y RNA Pathway Post Oogenesis through the Maintenance of an Embryonic Memory

Their advisor is Katy Gazda.

The winners at the undergraduate level are:

Benita Barnes and **Juana De Los Santos**, Glendale Community College, Glendale

Isolation, cloning and functional analysis of Lambda Bacteriophage R Endolysi.

Chad Albert, Glendale Community College, Glendale

An Investigation of Gene DR_0987 as a LuxR Type Transcriptional Regulator in the Gram-Negative Bacterium Deinococcus aquaticus

Their advisor is James Tuohy.

Congratulations to all!

Aregai Tecle
Grant-in aid Committee

TOURNAMENT TRAVEL GRANTS: NEVADA SCIENCE OLYMPIAD

Travel grants were awarded to the following schools to attend the Nevada Science Olympiad on March 10 at the University of Nevada.

Coral Academy of Science High School, Reno, NV – coached by Christopher Thomas

Carlin Combined School, Carlin NV – coached by Janie Kimble and Melissa Jones

OUTSTANDING SERVICE AWARD

RHETT MICHELSON

Rhett Michelson is on the faculty in the department of biological sciences at College of Southern Nevada. He has transformed the public face of the Arizona-Nevada Academy of Science while serving as Webmaster. He has not only given our website a contemporary facelift, but has made it more comprehensive reflecting the multi-faceted nature of our organization and more compliant with the diversity of browsers and devices utilized by our diverse membership. Rhett is an avid photographer and has contributed many amazing photographs to the Website. For these reasons, the Academy awards Rhett Michelson the Outstanding Service Award.

OUTSTANDING LEADERSHIP IN SCIENCE EDUCATION AWARDS

MARK GARNER

Dr. Mark Garner has served as a leader in science education in Nevada in several different ways. He oversees undergraduate chemistry research at the College of Southern Nevada and has done so for well over a decade. He oversees and guides the research of 3-8 students per semester. Six of his undergraduate research students have presented poster presentations at local scientific meetings including the 2016 ANAS Annual Meeting and 2016 ACS Local Section Undergraduate Poster Awards. At the ACS Local section meeting one group won second place award and another one honorable mention. What I find remarkable about Mark's service in this area is that it has been outside of his job responsibilities at our institution (our institution has extremely high teaching loads and has not considered research a normal part of its mission). His

leadership has been instrumental in helping to change the mission of our institution from one solely focused on teaching to one that embraces the benefits of undergraduate research. Without pioneers and leaders like Mark, such a transition would not have been possible. Mark served as Chair of the Department of Physical Sciences for nine years and managed, 22 FT faculty members, 30 PT Instructors, two Administrative Assistants, and two Staff Research Associates. During this time he developed course schedules for AST, CHEM, ENV, GEOG, GEOL, PHYS, CEE and ME resulting in over 200 sections per semester to meet student needs in Southern Nevada. He has also served as a Science Olympiad Event Coach at Hyde Park Middle School for 8 years and has served as American Chemical Society of Southern Nevada National Chemistry Olympiad Coordinator for ten years. For these reasons, and many more, Dr. Mark Garner has been chosen for the outstanding leadership in science education award.

MELISSA JONES

JANIE KIMBLE

Janie Kimble and Melissa Jones have been advisors for the STEM (Science, Technology, Engineering and Mathematics) club at Carlin Combined School in Carlin, NV for the past three years. Their goal is to introduce students to the world science through problem-based learning experiences.

They received a 2017 Voya's Unsung Heroes grant awarded to educators to honor innovative teaching methods, creative educational projects and the ability to positively influence students. Under their guidance participation continues to grow and students have done very well at competitions across the state including the Nevada State Science Olympiad and Math Counts competitions.

In 2017 the STEM club was selected to receive Finch robots from the Finch Loan program. These were used to increase understanding of computer coding using the Scratch program. After the students completed using the Finches, they taught the Junior High School STEM club students how to program the Finches with Scratch for their Junior High Recruiting Day.

Melissa and Janie have enabled students to see the relationship between science and real world jobs. STEMFEST brought over 25 businesses to the school. Their STEM students are now learning to use robotics, forensics and drones. The Academy is proud to continue supporting the STEM club with travel grants and congratulate Melissa and Janie for the wonderful job they have done making science such an enriching experience for the Carlin students.

TREASURER'S REPORT
2017

Operating and Short Term Reserve Fund (Vanguard Federal Money Market Fund)

Account Value on 12/31/16	$27,133.91
Dividend Deposits	$219.95
Account Value on 12/31/17	$27,353.86

Goethe Educational Endowment Fund (Vanguard Index 500 Mutual Fund)

Account Value on 12/31/16	(257.010 shares at $206.57/share)		$53,090.56
Deposits (Contributions)	+0 shares	Total: 241.712 shares	
Dividends	+4.949 shares	Total: 261.959 shares	
Account Value on 12/31/17	(261.959 shares at $246.82/share)		$64,656.72

General Fund

December 31, 2016 Balance	$53,532.49
Deposits	$14,998.88
Expenses	($8,279.30)
December 31, 2017 Balance	$60,252.07

STEM Tournament Endowment Fund

December 31, 2016 Balance	$78,964.21
Deposits	$17.49
Expenses	($5,400.00)
December 31, 2017 Balance	$73,581.70

Market Value of Assets (as of December 31, 2017) **$225,844.35**

General Funds Details

Deposits		Expenses
$865.00	ANAS Membership dues	
	PayPal charges	21.78
	Postage	
	Journal:	
400.00	Subscriptions	
	PayPal charges	3.24
	Refunds	
10,080.76	BioOne/JSTOR/CCC Royalties	
	Sale of Back Issues	
210.00	Reprints/Page Charges	4.74
	Printing	532.14
	Typing	750.00
	Postage	
	Hydrology Proceedings	750.00
	Other	
77.82	Royalties from book	
	Web hosting fee	358.61
	Scholarships:	1,000.00
	Grants-in-Aid, High School:	200.00
	Grants-in-Aid, Graduate	
	Grants-in-Aid, Undergraduate	611.90
	Science Olympiad awards	100.00
	Annual Meeting:	
3,335.00	Registration Fees	
	PayPal Charges	78.26
	Refund	
	Sponsor donations	
	Proceedings, Printing	673.32
	Proceedings, Postage	
	Coffee Breaks/Luncheon	2,320.41
	Friday Reception	133.32
	Meeting Rooms/Equipment	
	Awards	
	Outstanding Service	50.00
	Outstanding Teacher	150.00
	Outstanding Students	250.00
	Plaques	82.99
	Travel Grants	
	Goethe Endowment Fund Contributions	
	AZ Corporation Commission	10.00
	NAAS Dues	150.00
	Supplies	24.82
	Postage/Office	8.77
	Printing/Office	
	Bank Charges	15.00
30.30	Other	
$14,998.88	**SUBTOTAL**	$8,279.30

General Funds Details

(continued)

Deposits		Expenses
	STEM Tournament Endowment	
$12.49	Interest	
5.00	Sponsor donations	
0.00	Membership dues	
	Tournament	
	Awards and Prizes	150.00
	Scholarships	
	Team Travel	5,250.00
	T-shirts	
	Supplies	
	Lunches	
	Coaches gifts	
	Office Expenses	
	Copying and Postage	
	Office supplies	
	Bank Charges	
	Outreach	
	Workshop stipends	
	Seed money	
	Brochures/PR	
	Mileage	
	Travel to Nationals (State Director)	
	Other	
$17.49	**SUBTOTAL**	$5,400.00
$15,016.37	**TOTAL**	**$13,679.30**

Karen Conzelman
Treasurer