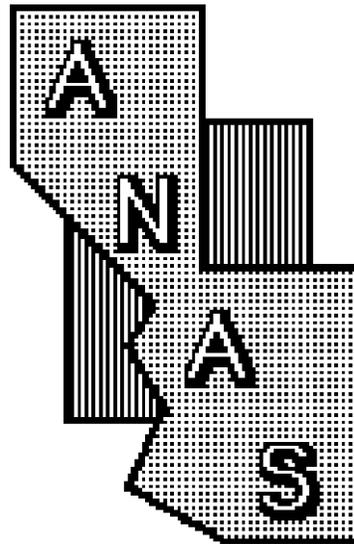


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**PROCEEDINGS
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SIXTY FIRST ANNUAL MEETING

April 1, 2017

**Glendale Community College
Glendale, AZ**

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**April 1, 2017
Glendale Community College
Glendale, Arizona**

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ABBREVIATED SCHEDULE AND ACTIVITIES LOCATIONS

Friday, March 31

Board of Governor's meeting:

6:00-8:00 PM

Glendale Community College: Life Science Building (LS) 273

Saturday, April 1

Section meetings on Saturday will take place in rooms in the Business Building (B 203) and Language Arts (LA 141) on the campus of Glendale Community College, Glendale, AZ. The Poster Session, coffee break and luncheon will take place in the Student Union (rooms A, B, C).

7:30-8:30	Registration: Student Union
8:30-9:30	Paper Sessions: See Section Schedule
9:30-11:00	Poster Sessions/Coffee Break: Student Union
11:00-12:00	Paper Sessions Continue
12:00-1:30	Annual ANAS Awards Luncheon/Guest Speaker/Annual Business Meeting: Student Union

SUMMARY OF SECTION MEETINGS

Section	Time	Room
Biology/Biotechnology	8:30-12:00	LA141
Biology/Geology	8:30-12:00	B 203

LUNCHEON SPEAKER

TESS NEAL

BIAS IN EXPERT JUDGMENT: WHY EXPERTS MIGHT BE EVEN MORE BIASED THAN THE REST OF US

Dr. Tess Neal is an Assistant Professor of Psychology in Arizona State University's New College of Interdisciplinary Arts & Sciences and is a founding faculty member of ASU's new Program on Law and Behavioral Science. She is both a researcher and a licensed psychologist.

Dr. Neal has published one edited book and more than two dozen peer-reviewed publications in such journals as *PLOS ONE*; *Psychology, Public Policy, and Law*; and *Criminal Justice and Behavior*. She is the recipient of the 2016 Saleem Shah Award for Early Career Excellence in Psychology and Law, co-awarded by the American Psychology-Law Society and the American Academy of Forensic Psychology. She was named a 2016 "Rising Star" by the Association for Psychological Science, a designation that recognizes outstanding psychological scientists in the earliest stages of their research career post-Ph.D. "whose innovative work has already advanced the field and signals great potential for their continued contributions."

In addition to teaching, she directs the Clinical and Legal Judgment Lab at Arizona State University.

BIOLOGY/BIOTECHNOLOGY SESSION

SESSION: 8:30

ROOM: LA 141

CHAIRPERSON: Paula Rivadeneira

8:30-8:45 *SCRUTINIZING THE EFFECTS OF UV-C RADIATION ON THE DEVELOPMENT AND MORPHOLOGY OF *DROSOPHILA MELANOGASTER*

Yesica J. Enciso, Audrie L. Santa Cruz, and Jennifer F. Hackney Price (Arizona State University West, Glendale, AZ)

Solar ultraviolet radiation (UVR) comes in three forms, UV-A (315-400 nm), UV-B (280-315 nm), and UV-C (100-280 nm). While UV-A and UV-B are associated with skin cancer, most solar UV-C is absorbed by the atmosphere without complications to human health. However, artificial UV-C radiation is becoming increasingly prevalent and is currently utilized in a variety of ways including as a germicide, pesticide, fungicide, and a catalyst to stimulate the degradation of toxic contaminants in water. While UV-C treatment is effective in killing eggs of common agricultural pests, the effects of UV-C on other developmental stages of arthropods remains incompletely understood. Here, we investigate phenotypic changes that occur during the development of the common fruit fly, *Drosophila melanogaster* when larvae are exposed to UV-C. Investigating the development of UV-C irradiated animals may help improve the efficacy of UV-C as a pesticide and increase knowledge of hazards associated with increasing UV-C exposure in humans.

8:45-9:00 *INVESTIGATING THE POTENTIAL OF *D. MELANOGASTER*'S UTILITY AS A MODEL ORGANISM FOR BURN INJURY

Teresa M. LuPone, Chaz Beckett, Annika Vannan, Madelaine Khosti, Jesus Contreras Rodriguez, and Jennifer Hackney Price (Arizona State University West, Glendale, AZ)

Approximately two million burn injuries in humans occur in the US annually. Burn injuries are associated with complex physiological responses that are incompletely understood but can drastically influence patient outcome. Current research into the local and systemic responses to burn injury utilizes mice, rats, or pigs; however these model organisms are expensive and often require relatively large burn areas to initiate a systemic effect. For this study, we assess the potential utility of the common fruit fly *Drosophila melanogaster*, as a model organism for burn research. *Drosophila* is well suited to burn injury research due to low economic costs, short life

cycle, and a multitude of readily available genetic and molecular tools. Here we present a relatively simple method for carrying out thermal burn injuries in flies and demonstrate the effectiveness of this method in modeling the systemic response to localized thermal injury.

**9:00-9:15 **IN SILICO* HOMOLOGY MODELLING, STRUCTURE PREDICTION
AND SEQUENCE ANALYSIS OF THE QUORUM QUENCHING
ENZYME AHL-LACTONASE IN *DEINOCOCCUS RADIODURANS***

Chad Albert and James Tuohy (Glendale Community College, Glendale, AZ)

AHL-lactonase (Quorum-quenching N-acyl-homoserine lactonase, EC 3.1.1.81) is an enzyme that degrades the lactone ring of N-Acyl homoserine lactone, a class of quorum signaling molecules found in gram negative bacteria. In this study, protein sequences theoretically derived from the DR_0172 gene of *Deinococcus radiodurans* R1 were analyzed. *In silico* analysis determined the instability index (II) to be 52.90 indicating an unstable protein species, while the *pI* (isoelectric point) was found to be 10.47. The overall predicted function of AHL-lactonase was derived from comparative homology modelling using SWISS-MODEL and iTASSER. The prediction of associated 3-D structure was inferred using multiple structural modelling predictors. This study discusses the iterative process of comparative homology modelling for the determination of *D. radiodurans* AHL-lactonase 3-D structure and function by comparison against known protein homologs. The similarity of 3-D structure and conservation of Zn²⁺ domain motifs among bacterial AHL-lactonases is highly suggestive of a uniformity of function.

9:30-11:00 POSTER SESSIONS/COFFEE BREAK: Student Union

**11:00-11:15 SCREAM OF DEATH: RESPONSES OF FEMALE COLUMBIAN
GROUND SQUIRRELS TO ANTI-INFANTICIDE PUP DISTRESS CALLS**

Theodore G. Manno (Catalina Foothills High School, Tucson, AZ)

Parents sometimes discriminate offspring from non-offspring while responding to vocalizations, ensuring that parental care is directed towards their progeny exclusively. This discrimination may result from differences in acoustic characteristics across individuals. However, recognition capabilities specific to individuals may not occur when parents differentiate offspring via location because litters are segregated spatially. Offspring discrimination is important during “distress calls” emitted by young-of-the-year for imminent danger because mothers that respond to non-offspring reduce the time available for protecting their litter, and failure to respond may result in offspring mortality. Columbian ground squirrel (*Urocitellus columbianus*) pups

sometimes emit a scream-like distress call near their mothers when attacked by marauding conspecifics. With field observations of infanticide and playback experiments that manipulated the identity and location of the caller, I examined whether a location-based rule or vocal recognition mediate female responses to distress calls. Mothers became vigilant and approached the speaker in response to playbacks of distress calls broadcast on their territory, regardless of whether the recording was an offspring or non-offspring. However, mothers approached distress call recordings originating on their territory more often than those occurring on adjacent territories. Thus, female Columbian ground squirrels respond to distress calls based on a location-based rule (*viz.*, on or off their territory) rather than vocal recognition *per se*. This strategy seems appropriate, since lactating females are territorial and pups rarely mix between litters during the 1-5 day period just after emergence from their natal burrow when they are susceptible to infanticide.

11:15-11:30 LANDSCAPE DISTRIBUTION AND GEOMORPHIC ADAPTATIONS OF *PARKINSONIA MICROPHYLLA*

Matt Haberkorn and Matt Hill (Phoenix College, Phoenix, AZ)

Parkinsonia microphylla, or foothill palo verde, is one of the most common tree species and well known nurse plants found throughout the Sonoran Desert. This desert tree is most commonly found on mountainsides below 4,000 feet, upper bajadas and along ephemeral stream banks. To explain this distribution, soil patterns of these locations, rooting habits and sprouting patterns of the plant were examined. Soils within these habitats were found to be characterized by calcic horizons, higher levels of rockiness and some degree of instability. Commonly, on the more unstable soil surfaces, numerous aerial stems were found to have sprout from relatively shallow rhizomes connected to larger more mature stems. This habit of sprouting from rhizomes was most common along unstable, rocky and calcified ephemeral stream banks. Suspected stems sprouting from rhizomes were found up to ten meters from the nearest tree. This phenomenon was more closely examined after a large ephemeral stream bank eroding flash flood event took place throughout western Maricopa County, Arizona. Eroded stream banks exposed in many locations rhizomes that connected several different aerial plant stems. It appeared that this adaptation allowed the plant to survive and exploit geomorphic instability, as well as aid in the protection of ephemeral stream banks from erosion and mass-wasting.

11:30-11:45 COMPARISON OF JACKRABBIT DENSITIES ON TWO GRASSLAND TYPES

David E. Brown , Maria Altemus , Randal D. Babb and Brett C. Blum (Arizona State University, Tempe, AZ, University of Arizona, Tucson, AZ, Arizona Game and Fish Department, Mesa, AZ)

We found antelope jackrabbit (*Lepus alleni*) densities to be lower in a Semidesert Grassland pasture protected from grazing when compared to a grazed pasture in Sonoran Savanna Grassland. While densities in the temperate Semidesert Grassland pasture generally declined after a fire, the antelope jackrabbit population in an unburned Sonoran Savanna Grassland pasture fluctuated annually at a greater density. We attribute these changes in density to the animal's preference for open annual grasslands having greater biodiversity when compared to grasslands composed of dense perennial bunch-grasses dominated by Lehmann's lovegrass (*Eragrostis lehmanniana*). Other factors that may have played a role in this difference were the proximity of a paved road and the absence of predator trapping in the Semidesert grassland pasture.

12:00-1:30 AWARDS LUNCHEON/GUEST SPEAKER/ANNUAL BUSINESS MEETING: Student Union, Room 104

BIOLOGY/GEOLOGY SESSION

SESSION: 8:30

ROOM: B 203

CHAIRPERSON: Robert McCord

8:30-8:45 *TEMPORAL AND SPATIAL VARIATION IN WILD BEE SPECIES RICHNESS AND ABUNDANCE WITHIN THE URBAN MATRIX

Samier J. Muhialdeen and Jennifer L. Foltz-Sweat (Arizona State University West, Glendale, AZ)

There are many drivers which have been found to contribute to the global pollinator decline, such as global climate change, habitat fragmentation, and pathogens; however, the effects of urban expansion on pollinator population dynamics is considered to be an influential catalyst to the decline in pollinators and has consequently taken historical precedence in research among urban ecologists. Efforts to evaluate bee species composition in response to urbanization have largely overlooked other potentially significant factors, such as temporal and spatial variation. In light of this, we measured changes in wild bee species richness, abundance and community composition of bee populations in semi-natural and urban sites across Phoenix city over a two-year period. Bees were pan-trapped and netted at four sites within the Phoenix area for four weeks over a two-year period. Of the four sites surveyed; two were located in dense, highly-degraded urban areas at Arizona State University West campus (ASUT1 and ASUT2) and two were located in a semi-natural habitat at Piestewa Peak (PP1 and PP2). Given the heterogeneity of urban habitats, we predicted that the urban sites would have greater spatial and temporal variability than the semi-natural sites. Our results show that the degraded urban sites had relatively higher species richness than the semi-natural sites over the two-year period; however, the relative abundance of bees was greater at the semi-natural site (PP1) for 2014 than any other site combined. As a component of the inter-annual site comparison (2014-2016), approximately 50% of the species were shared at the urban ASUT1 sites and ASUT2 sites over the two-year period suggesting moderate temporal variability (Bray-Curtis = 0.453 and 0.408 respectively) with regards to species composition as compared to the semi-natural PP1 site which showed less temporal variability (Bray-Curtis = 0.059). As part of the intra-annual comparison in 2016, the semi-natural sites (PP1 and PP2) exhibited high spatial variability with respect to species composition (Bray-Curtis 0.756), whereas the urban sites (ASUT1 and ASUT2) showed less (Bray-Curtis 0.572). Our results indicate that bee abundance has declined drastically between 2014 and 2016, possibly due shifts in floral resources; a feature attributed to surrounding habitat changes. This study begins to assess the fluctuation of bee abundance and species richness as it pertains to temporal and spatial variation within the urban matrix; however, this study will be

best served as part of a series of studies in a long-term effort to measure the effects of urbanization within our urban matrix.

8:45-9:00 *RESPONSE OF SWALLOWTAIL BUTTERFLIES TO PROJECTED CLIMATE CHANGE

Atticus W. Wolf (Northern Arizona University, Flagstaff, AZ)

Swallowtail Butterflies (*Papilio* spp.) are an important group of pollinators; many swallowtails are generalist pollinators that visit a wide range of plants, but some have fairly restricted distributions. However, with the advent of climate change many of these swallowtail habitats will be threatened. We wanted to understand how projected global warming would affect current Swallowtail habitats in order to see which species would be the most affected by large scale temperature change. We believe that swallowtails with small ranges that are already limited by strict temperature regimens will be the most affected by climate change. We performed ecological niche modeling (ENM) on all 46 species of swallowtails occurring in the United States to determine current suitable habitat based on 7 climatic variables as well as future suitable habitat. Most swallowtails are predicted to lose some of their habitat with an increase in global temperature. So far we have found that Swallowtails with limited ranges and who are more sensitive to warmer temperatures will experience reduced suitable habitat. This will more easily help develop conservation planning and prioritize which species should receive the highest priority in restoration planning.

9:00-9:15 ABUNDANCE OF POLLINATORS AND ANGIOSPERMS BETWEEN FOREST AND MEADOW HABITAT TYPE ALONG THE C. HART ELEVATION GRADIENT

Brittany Oxford, Lindsie McCabe and Neil Cobb (Northern Arizona University, Flagstaff, AZ)

Our research focused on species composition and abundance for insect pollinators and their floral resources along the C. Hart Merriam elevation gradient in two life zones (forest and meadow) on the San Francisco Peaks in Flagstaff, AZ. Using elevation in replacement with time, we can predict future conditions for pollinator and plant species as climate change occurs; we can then evaluate if these habitats will be suitable for pollinator species. Three sets of transects were laid down at each site in both forest and meadow habitats over four life zones: Pinyon/Juniper, Ponderosa Pine, Mixed Conifer, and Spruce/Fir. Insects observed pollinating, as well as flowering plants within our transects, were collected and/or documented. We observed that pollinator and angiosperm abundance was higher in the meadow habitat type than in the forest habitat type. This suggests that pollinators pass through forests and pollinate within meadows. This shows that habitat type strongly affects abundance of pollinators, and plant

species significantly contribute to the biodiversity of insects in ecosystems. This data on plant species abundance shows that different climates support different communities on an elevation gradient. This may help to model how these communities will adapt as climate change progresses.

9:15-9:30 * EARTH SCIENCE, CYCLES AND SYMMETRIES: A LOOK AT THE IMPLICATIONS OF ORBIT, TILT AND SPIN ON NATURAL SYSTEMS

Jeff Glessing (Prescott College, Prescott, AZ)

We have all heard stories about the way water going down a drain moves in clockwise or counterclockwise directions depending on which hemisphere you are in. But is that really true? And if so, what causes it? This presentation will help answer questions such as what is the climatological impetus for an ice age. What is the significance of the 23.5 degree axial tilt and the Tropic of Capricorn, and why will it be unimportant in the forthcoming millennia. How did the Earth's spin influence the African slave trade? Orbital parameters such as Milankovitch Cycles and precession of the equinoxes influence the way we navigate the planet. The intensity of seasonality differs in the Northern Hemisphere from the Southern Hemisphere. Looking at often overlooked aspects of the way our planet is configured in space, we will see how geographical distribution of land, water, biota and celestial bodies influence large scale phenomena found in the natural world across the globe and here in Arizona.

9:30-11:00 POSTER SESSIONS/COFFEE BREAK: Student Union

11:00-11:15 MAMMOTH (*MAMMUTHUS*) LOCALITIES FROM MARICOPA COUNTY, ARIZONA

Robert McCord (Arizona Museum of Natural History, Mesa, AZ)

Maricopa County, Arizona, has numerous *Mammuthus* localities, most of which have been covered to some detail by the news media. However, their formal documentation and publication have been woefully lacking. Chronologically by discovery these are: the Fort McDowell, prior to 1969, elements unknown, possibly in the UALP collection; the Nichols Site, published 1971, humerus, molar, fragmentary molar, scapula, ASU; the Chandler I site, innominate AzMNH, mandible and femur whereabouts unknown; the Chandler II site, tusk, tooth, pelvis, rib, whereabouts unknown; the North Phoenix Site, 1999, femur, whereabouts unknown; the Gilbert Site 2005, abstract published 2006, two tusks and an atlas, AzMNH; and the Estrella Site, 2016, limb bone, AzMNH. In addition, a possible *Mammuthus* site has been located (2017) in Sun City and is pending permitting and excavation by AzMNH. ¹⁴C dating has been attempted on a number of these sites, but has produced no results for Gilbert and Estrella, and a date of 8570 ±

130 on charcoal 4 inches above the site with an age estimate of 11,200 BP on the Nichols Site, and 9560 ± 80 on the Chandler I Site. In addition, the Estrella mammoth was found on the level of the Lehi Terrace possibly constraining its age. Additional fauna is known from three sites: with *Equus*, *Nothrotherium*, *Gopherus* and unionid from the Nichols Site; rodent and shell from the Chandler II Site, and cf. *Hemiauchenia*, *Equus*, *Stockoceros*, and *Gopherus* (*Gopherus*) from the Gilbert Site. The lack of formal description and, more seriously, the misplacing of material, hampered this review, and any future understanding of the late Pleistocene of Maricopa County. The fauna of Chandler I remains unanalyzed and its whereabouts are unknown. It is entirely possible that some of the other localities contained further faunal elements as well. Investigation of the whereabouts of this material continues.

11:15-11:30 PLANT-POLLINATOR INTERACTIONS: THE FIGHT BETWEEN NATIVE AND NON-NATIVE PLANT SPECIES

Brandon Clark (Northern Arizona University, Flagstaff, AZ)

Plant-pollinator interactions provide crucial ecosystem services. It is estimated that 86% of all angiosperms rely on animal pollination in order to reproduce. The invasion of non-native species into an ecosystem has astounding effects that can alter entire species communities. Modern globalization has resulted in the introduction of non-native species to native ecosystems. This is due to the increased global trade and travel. As society becomes more and more globalized the introduction of non-native species has increased exponentially. Since the 17th century there has been thousands of species introduced by humans. The effects that non-native plant species have on competing native plant species is relatively well known. But how do they affect plant-pollinator interactions? We predict that non-native plant species will harbor a greater number of pollinators than the native plant species in both richness and abundance. If this is true, the non-native plant species are competing with the native plants ability to reproduce. This increases the chances of the native plant species going extinct.

11:30-11:45 THE EXTRAORDINARY 111 RANCH FOSSIL BEDS OF GRAHAM COUNTY, ARIZONA.

Gavin McCullough, Robert McCord, Alison Stoltman (Arizona Museum of Natural History, Mesa, AZ), Larry Thrasher (Bureau of Land Management, Safford, AZ) and Paula Allen (Southwest Paleontological Society, Mesa, AZ)

The early Pleistocene (Late Blancan) deposits near Safford, Arizona, contain a record of a terrestrial ecosystem that housed a variety of faunas both familiar and seemingly exotic. A part of the Gila Conglomerate, the 111 Ranch beds are a sequence of approximately 2 million-year-old, mainly lacustrine and fluvial rocks that have been intensively yet intermittently explored since the early 20th Century. The Pliocene appearance of the Isthmus of Panama due to sea level

drop and regional uplift allowed migration of animals between North and South American continents, an event known as the Great American Biotic Interchange (GABI). 111 Ranch rocks have provided some of the most spectacular faunal results of the interchange. In addition to North American forms such as proboscideans, horses, camels, carnivorous mammals, tortoises, and rabbits, the GABI introduced Southern forms including porcupines, giant ground sloths, tapirs, capybaras, and glyptotheres. In recent years, research into the 111 Ranch and associated fauna has been active and made possible by the collaboration of the Bureau of Land Management, Arizona Museum of Natural History, International Wildlife Museum, and countless field volunteers. The richness of the 111 Ranch beds has provided volunteers with a constant stream of field and lab opportunities, all of which have potential to lead to enhanced understanding of the early Pleistocene of southeastern Arizona.

**12:00-1:30 AWARDS LUNCHEON/GUEST SPEAKER/ANNUAL BUSINESS
MEETING: Student Union, room 104**

POSTER SESSION

SESSION: 9:30-11:00

STUDENT UNION

CHAIRPERSON: Pamela Marshall

***MICROBIOTA OF THE GRASSLANDS AND RIPARIAN AREA OF THE SONORAN DESERT**

Nik Abrahamson, Abbey Bowser, Mark Buono, Angelina Davis, Leslie Evans, Nick Massoni, Melani Montgomery, Robert Myers, Maria Scaff, Gabriel Wachtel and Kari Durham (Cochise College, Sierra Vista, AZ)

The San Pedro River is one of the last undammed, free-flowing major rivers in the American Southwest and is of major importance to the health of the Madrean Archipelago ecoregion. The waters that fill the San Pedro flow from permanent and seasonal springs and creeks in the high altitude alpine conifer woodland. They pass through oak-pine forests, and Chihuahuan desert scrub/grassland, before reaching the rich riparian bottomlands of the San Pedro. This broad range of biomes and climate allows for a diverse floral environment, suggesting a complex and extensive microbial community must exist to support the regions biodiversity. In this study we examine and identify the bacterial communities that exist alongside the riparian flora of the San Pedro River. Samples were obtained just underneath the surface of the soil and near the base of the various trees, shrubs, and grasses. The samples were then incubated in petri-dishes and broths. After incubation, selective and differential media were used in the process of bacterial identification.

***THE CHEMOTHERAPEUTIC POTENTIAL OF REXINOIDS FOR ER α -POSITIVE BREAST CANCER**

Supreet Bains¹, Pritika Shahani¹, Carl Wagner¹, Pamela A. Marshall¹, Ichiro Kaneko^{1,2}, Michael Heck¹ and Peter W. Jurutka^{1,2} (¹Arizona State University, Glendale, AZ; ²University of Arizona College of Medicine, Phoenix, AZ)

Breast cancer tumorigenesis is spurred by the elevated expression of estrogen receptor alpha (ER α), a nuclear receptor responsible for cell metabolism and proliferation in the mammary gland. Previous experiments have shown that the FDA-approved drug bexarotene (Bex), used to treat cutaneous T-cell lymphoma (CTCL), possesses potential in attenuating estrogenic activity.

Bex binds with high affinity to the retinoid-X-receptor (RXR), another member of the nuclear receptor superfamily. RXR has the ability to both homodimerize and also to heterodimerize with a wide array of other nuclear receptors, implicating it in numerous biological pathways. Bex therefore has the potential to be effective against multiple cancers. The purpose of this study was to examine if Bex is able to suppress the proliferation of ER α -positive breast cancer cells. Novel drug analogs that achieve the same level of efficacy as Bex, but milder in their systemic side effects, were also evaluated. All experiments were carried out in the form of MTS assays and performed using human breast cancer cell models (MCF-7 and T-47D). Estradiol (E2) was used as a positive control; Bex and its analogs were evaluated both separately and in combination with E2. Results revealed that Bex significantly inhibited cell proliferation in both the MCF-7 and T-47D breast cancer cell models. In addition, most of the novel analogs tested were as or more effective than Bex at inhibiting proliferation. Bex and its novel RXR drug analogs are therefore implicated as ER α antagonists and possible novel breast cancer chemotherapeutics.

***LOCAL ADAPTATION IN LEECHES: ESTIMATING THE RELATIVE FITNESS OF THREE NORTHERN ARIZONA *HELOBDELLA MODESTA* POPULATIONS IN NATAL AND NON- NATAL WATER**

James C. Boothroyd, Cassidy A. Klovanih, Angela Rincon, Anneliese Martinez, Rebecca K. Beresic-Perrins and Stephen M. Shuster (Northern Arizona University, Flagstaff, AZ)

Helobdella modesta is a predaceous leech that is known to provide extensive post-zygotic parental care to offspring. To investigate whether natural populations are locally adapted, we conducted a fully-factorial, reciprocal water transfer experiment, in which pairs of leeches from each of 3 northern Arizona populations [Whitehorse Lake (WHL), JD Dam Lake (JDD), and Rio de Flag (RDF)] were maintained in natal, non-natal and filtered water (C). Each week for 12 weeks, we recorded three fitness proxies: (1) *survival*, (2) *reproduction*, and (3) *fecundity* within each cell replicate. We estimated the relative fitness of leeches in each cell and compared them using standardized difference tests. For all water treatments and all fitness proxies, relative fitness was not significantly different within leech populations, leading us to conclude that local adaptation is not present in these populations of *H. modesta*. There was, however, a significant difference in relative fitness between populations, indicating that some populations are hardier than others.

***ATTENTIVENESS ON AIRLINE QUALITY AS VIEWED BY THE DOMESTIC CONSUMER**

Brent D. Bowen, Erin E. Bowen, Mary M. Fink, Dean E. Headley, and Madeline S. Kuhn (Embry-Riddle Aeronautical University, Prescott, AZ)

This study examines the relationship between the quantitative model of the Airline Quality Rating (AQR), and the qualitative model of the Airline Passenger Survey (APS). Operational performance of the U.S. airline industry has been monitored for the past 27 years by the Airline Quality Rating. Qualitative performance has been monitored for the past 6 years by the Airline Passenger Survey. The AQR provides consumers and aviation industry professionals a means to compare performance quality among U.S. airlines using objective, performance-based data. No other airline study in the country is based on performance measures. The APS was added as a new feature of the AQR in 2008 following increased interest in the relationship between consumer perceptions and objective airline industry performance. Results from this study were retrieved from data between the periods of 2008-2016 from the April 2016 Airline Quality Rating Report and the Airline Passenger Survey.

***THE FUTURE OUTLOOK OF SOCIAL MEDIA USAGE FOR SCHOLARLY RESEARCH**

Brent D. Bowen, David A. Ehrensperger, Timothy B. Holt, Jacqueline R. Luedtke, and Hunter M. Watson (Embry-Riddle Aeronautical University, Prescott, AZ)

The initial method of this research was developed by Dr. Brent Bowen in leading the conceptual idea of social media and the impact it can have on scholarly research. This study concludes years of data compiled into a deliverable platform for universal use in academic research and serving as a common topic of interest. The Airline Quality Rating (AQR) was first developed and introduced in early 1991 as an objective method of comparing and rating airline performance on a multiplicity of factors that are combined, and shown to be important to consumers. Scores are calculated by the defining of 15 elements in four major areas focusing on airline performance and the significance to consumers of air travel in a given calendar year. The report is a summary of month-to-month ratings for U.S. airlines, which is required by the U.S. Department of Transportation in giving performance data on their domestic schedule. The general case study focus of this research is the AQR as it relates to the utilization of social media platforms, and thus having the ability to reach out to a broader worldwide presence. Future research will involve increasing the number of social media tools and platforms under consideration in order to obtain a more in-depth view of how scholarly research is used and disseminated via social media tools. Developing into scholarly platforms for future use including Mendeley, ResearchGate, Academia.edu, among others. In conclusion, the use of these tools to gain metrics of quantitative/qualitative analysis data the research can further develop into a more elaborate research base.

***A PRACTICAL APPLICATION OF MACHINE LEARNING-BASED CLASSIFICATION TECHNIQUES TO PROACTIVELY IDENTIFY INSIDER THREATS**

Joshua D. Bowen (Northern Arizona University, Prescott Valley, AZ)

Insider incidents are on the rise, just like the high-profile security breaches such as Snowden, thousands of insider-perpetrated security breaches occur in United States businesses every day. While current commercial software can monitor, log, and prevent access to designated files and directories, it remains difficult to predict and prevent unauthorized insider usage. Due to the gaps in research in this area, the focus of this study is to more accurately predict insider threats within a terminal environment. Linux was chosen specifically because of its ubiquity on commercial servers around the globe. Amazon's Machine Learning (AML) service has been selected to analyze the data, reduce the necessary computing power, and to minimize human factors considerations in the design of the machine learning architecture. AML uses multinomial logistic regression for multi-class classification and uses the stochastic gradient descent optimization technique. The method adapted is to utilize the AML software, it will be trained on a dataset comprised of normal user situations, crafted mistakes, and malicious activity. After providing the training dataset, the software will be instructed to make predictions against similar datasets to verify accuracy. It will then be tested against a human actor that will simulate multiple different roles, and test predictions in a high-fidelity simulation. In result, should it be demonstrated that ML software can accurately identify and predict insider threats, this research could be a foundation for future cyber security software architectures. Other opportunities for research in this area would include ML applications in intruder and malware detection.

***A MATHEMATICAL ANALYSIS OF AEROBIC GLYCOLYSIS TRIGGERED BY GLUCOSE UPTAKE IN CONES**

Danielle Brager (Arizona State University, Tempe, AZ)

The degenerative disease Retinitis Pigmentosa (RP) is typically categorized by loss of night vision due to rod degeneration and eventually progressing to daylight-blindness and cone death. Those afflicted with RP rely on aerobic glycolysis to supply the metabolites necessary for renewal and maintenance of the photoreceptors. In this work we mathematically model and investigate the biochemical processes in the retina triggered by glucose catabolism in cones. We develop a system of nonlinear ordinary differential equations that describe the experimental work of Le'veillard et al. with *Nxn11* ^{-/-} mice and the rod-derived cone viability factor (RdCVF). We utilize our mathematical model and resulting simulations to confirm the reliance of cones on rods. We investigate which processes contribute the most to the renewal of the cone photoreceptors by using Latin Hypercube Sampling and global sensitivity analysis. Through a series of simulations we are able to validate the model and confirm the laboratory results.

***THE ANTERIOR CRUCIATE LIGAMENT: NORMAL FUNCTION AND WHEN PROBLEMS OCCUR**

Anatasha Coleman, Hannah Hall, Chelsea Havill, Warren Pettitt and Eric vanSonnenberg (Arizona Christian University, Phoenix, AZ)

This poster will demonstrate various aspects of the anterior cruciate ligament (ACL). It will include the anatomy, the function, both normal images and images of injuries, and different types of therapy. The ACL is an essential ligament in the body, and is crucial for many sports activities. In high impact sports, the ACL can tear and end that athlete's season. There are degrees of tears associated with the ACL, and each tear has a distinct treatment. Treatment can be as simple as rehabilitation through physical therapy, while therapy can be highly invasive such as major reconstructive surgery.

***EFFECTIVENESS OF BLOOD DETECTING TECHNIQUES LEADING TO THE FURTHER ANALYSIS OF BLUESTAR® LUMINOL**

Catherine Craig and Kimberly Kobjek (Arizona State University, Phoenix, AZ)

Hemastix®, Phenolphthalein, and Bluestar® are all used as indicator tests for blood. In this study, the test reagents were used to detect blood on different substrates, after the blood was allowed to dry and was covered with different forms of paint: latex, oil, primer, and spray paint. The following study examines the ability of each of the three aforementioned testing reagents to positively detect blood on different substrates under different paint coatings. The data supports the continuing use of Hemastix®, Phenolphthalein, and Bluestar® in the field of Forensic science, it also demonstrated the limitations of these reagents. The study did not support the hypothesis of the more porous substrates hindering the blood detection process; however, there was a definitive observance of blood detection hindrance in the examinations of the paint coverings used on the substrates. The results demonstrate that on an overall consensus of positive blood detection, Bluestar® was the most effective; resulting in the continuance of this study in the form of testing the sensitivity of Bluestar® Luminol in presumptive blood detection. Bluestar® Luminol is used as a blood indicator test in the field of Forensic Science. In this study, the sensitivity of Bluestar® Luminol's blood detection ability was tested by covering five different dilutions of defibrinated sheep's blood with the same four forms of paint: oil, latex, spray, and primer. This continuation of the study examines the sensitivity of Bluestar® Luminol and develops a possible threshold of detection for this presumptive blood detection technique. In addition to a threshold of detection, the observance of blood detection hindrance, by use of differing paints, was made. Spray paint offers the least amount of blood detection hindrance to Bluestar® Luminol which has a possible blood detection threshold between 1/5 and 1/10 dilution of blood.

PATTERNS OF HOST SELECTION IN THE PARASITOID, *NASONIA VITRIPENNIS

Hannah Combs, Daniel Kollath, Byanca Hermosillo, Laura Blair, Zane Holditch, and Stephen M. Shuster (Northern Arizona University, Flagstaff, AZ)

Environmental factors, such as available nutrition, are assumed to explain observed patterns of sex ratio bias in many organisms. According to Charnov's host quality model, parasitoid wasps will bias their brood sex ratio in a manner that increases their offspring's survival, depending upon the relative mortality rate of male and female offspring. *Nasonia vitripennis*, a cosmopolitan species of parasitoid, provides a model system for testing assumptions embedded in Charnov's hypothesis, as female wasps appear to alter their brood sex ratios on the fly pupae they parasitize (*Sarcophaga bullata*). To determine whether host quality, estimated by host mass, influences the oviposition behavior and brood characteristics of *N. vitripennis*, we allowed females of two genetic backgrounds to oviposit on a pupa from one of 10 predetermined weights. After 12 days of development, we measured the total progeny and sex ratio of the resulting broods. We predicted that females ovipositing on larger hosts would produce larger clutches and increase the number of daughters in their brood, consistent with predictions made by Charnov's host quality model. We found that: 1. Host mass had no effect on the brood sex ratio. 2. Hosts >0.02 g had higher rates of parasitism and appeared to support larger broods. 3. Average mass of female offspring increased by 0.0035 g for every gram of host mass. Contrary to previous research, our results suggest that females do not bias their brood sex ratio according to host quality, despite appearing to adjust their clutch size.

***A COMPARISON OF GENETIC VARIATION IN TWO ENDEMIC THERMAL SPRING ISOPODS *THERMOSPHAEROMA THERMOPHILUM* AND *T. MILLERI* (CRUSTACEA: ISOPODA: SPHAEROMATIDAE)**

Autumn Dove, Viejo Jormalainen (University of Turku, Turku, Finland), and Stephen M. Shuster (Northern Arizona University, Flagstaff, AZ).

Using starch gel electrophoresis, we examined allozyme variation at 12 loci in two species of freshwater, sphaeromatid isopods. *Thermosphaeroma thermophilum*, an endangered species, inhabits a single thermal spring in central New Mexico, USA; *T. milleri* inhabits a more complex thermal spring system in northern Chihuahua, Mexico. We found no significant differences in allelic variation between the sexes within species. However, between species, electromorphs at each locus differed significantly in number and moiety, with *T. milleri* showing greater polymorphism and greater heterozygosity than *T. thermophilum*. Nei's unbiased genetic distance, calculated using the nine loci common to both populations ($D=0.75$), is consistent with morphological classification of *T. thermophilum* and *T. milleri* as separate species, as well as with molecular analyses suggesting that these populations have been separated since the late Cretaceous (88 myr). Moreover, consistent with the theoretical expectation that small, isolated

populations will exhibit reduced genetic variation our results show that *T. thermophilum*, an endangered species, exhibits significantly less genetic variation than the more numerous and less confined *T. milleri*.

***NATUROPATHIC AND CONVENTIONAL MEDICINE: THE INTERRELATIONSHIP**

Hannah Hall, Chelsea Havill, Anatasha Coleman, Warren Pettitt and Eric vanSonnenberg (Arizona Christian University, Phoenix, AZ)

This poster will demonstrate various aspects and history of medicine, and how over time the focus has changed. The initial understanding of medicine and how the innovations of today continue to reshape healthcare will be discussed in light of cultural understandings and Naturopathic Medicine. The role of commonly prescribed medications vis-à-vis natural methods and preventive measures will be discussed. The complexities and nuances of both types of medicine will be compared. Relevant topics will be analyzed with respect to the Hippocratic Oath, regarding the physician's goal of helping patients without causing harm to patients.

***THE ROTATOR CUFF: NORMAL FUNCTION AND WHAT CAN GO WRONG**

Chelsea Havill, Anatasha Coleman, Hannah Hall, Warren Pettitt and Eric vanSonnenberg (Arizona Christian University, Phoenix, AZ)

In this poster we will demonstrate the many facets of the rotator cuff including the anatomy, physiology, imaging, types of injuries, and therapy. The rotator cuff is a complex structure of the shoulder that is essential for athletes who use their arms. Rotator cuff injuries are common in athletes who put stress on their upper body and extremities. Each of the four components of the rotator cuff is important to the normal function, but may be injured. Images of the normal and abnormal rotator cuff will be demonstrated. Methods of prevention of injury as well as various treatment strategies will be discussed

***THE VULNERABILITIES OF HYPOXIC EVENTS WITHIN GENERAL AVIATION**

Timothy Holt, Jacqueline Luedtke, and Claire Schindler (Embry-Riddle Aeronautical University, Prescott, AZ)

It is a common misconception that the state of hypoxia is achieved only at high altitudes of flying, well above 10,000 feet. There are in fact four different types of hypoxia that can be achieved at any altitude. This common misconception can be hazardous to communities such as general aviation because most general aviation aircraft are not capable of such altitudes.

Unfortunately, this attitude is not the only hazard when factoring in all the dangers of the possibility of hypoxia occurring to a pilot. One must also consider the fact that the general aviation community is only required to discuss the causes, effects and corrective actions of hypoxia but no hands-on training is required, such as a hypobaric chamber where one could safely experience personal symptoms of hypoxia. The final factor to consider was the main focus of the study, in that most general aviation pilots do not report their experiences of hypoxia during normal, non-commercial flights. The reason for not reporting could range from a number of reasons, but without this critical information of how general aviation pilots are experiencing hypoxia, the community cannot make adjustments as to how hypoxia prevention is taught. The results of this study show how greatly the general aviation community may be impacted by hypoxic events, yet also how little support it puts toward training and reporting of such events.

***DETECTION OF *PSEUDOMONAS* IN WATER AND BIOFILM SAMPLES ON A COMMUNITY COLLEGE CAMPUS IN THE DESERT SOUTHWEST**

Schuyler Humes, Brant Pewonka, Jonah Mayers, Stephanie Mena Carrera, Barrierane 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)

Pseudomonas is a gram-negative, aerobic bacteria commonly found in soil and water. *Pseudomonas aeruginosa* produces a biofilm that can adhere to surfaces allowing it persist in a variety of environments. An opportunistic pathogen, *P. aeruginosa* can cause chronic lung disease, ocular, ear, wound, and acute respiratory infections in immunocompromised individuals. However, not all species of *Pseudomonas* are pathogenic. Therefore, the ability to identify species of *Pseudomonas* present in environmental samples isolated from public sources is of growing importance. The objective of this project is to determine whether or not *Pseudomonas* is present in water and biofilm sources collected from different zones on a community college campus. A total of fifty-seven samples (water and biofilm) were collected from zones A, C, D and E. The samples were concentrated via membrane filtration and cultured on *Pseudomonas* Isolation Agar (PIA) and *Pseudomonas* Fluorescence (PF) agar for selection of *Pseudomonas*. DNA extraction and Polymerase Chain Reaction (PCR) was performed on isolates using primers to amplify the *16S rRNA* gene specific to *Pseudomonas* and analyzed using agarose gel electrophoresis. DNA sequencing and BLAST analysis was used to confirm *Pseudomonas* species. From a total of fifty-seven samples surveyed, eleven tested positive for *Pseudomonas*.

***CIRRUS CLOUD MICROPHYSICS OVER DARWIN, AUSTRALIA**

Matthew David Johnson and Dorothea Ivanova (Embry-Riddle Aeronautical University, Prescott, AZ)

Ice clouds, crucial to the understanding of both short- and long-term climate trends, are poorly represented in global climate models (GCMs). Cirrus clouds, one of the largest uncertainties in the global radiation budget, have been inadequately studied at low latitudes. Parameterizations exist for mid-latitude and tropical cirrus (Ivanova et al. 2001; McFarquhar et al. 1997). Due to climate sensitivity in the GCM with respect to cloud input, without robust parameterizations of cirrus clouds, the GCM is inaccurate over most output fields, including radiative forcing, temperature, albedo, and heat flux (Yao and Del Genio 1999). Studies of the microphysical properties of tropical cirrus clouds may result in improved parameterizations for GCMs. Until ten years ago, there were no truly realistic cirrus clouds parameterizations for the different regions of the world in the global climate models (GCMs). A GCM requires information about ice particle diameter/maximum dimension (D), ice water content (IWC), and size distribution (SD) for small and large mode crystals. This study uses the latest tropical Atmospheric Radiative Measurements (ARM) data to analyze the small and large crystals in cirrus clouds over Darwin, Australia. The goal of the presented research is to better understand the cloud microphysics of cirrus in the tropics and help create better tropical parameterization with newer, more comprehensive datasets. The analyzed cirrus size distributions are consistent with the degree of bimodality typical for tropical cirrus clouds. Analyzing the sample distributions for the Darwin flight, we found that the best-fit line for the small mode crystals as well for the large mode is the gamma function. Furthermore, the data points to different mechanisms from which the mid-latitude and tropical cirrus clouds are generated.

***VITAMIN D AND ITS NUCLEAR RECEPTOR: ROLE IN DOPAMINE AND SEROTONIN REGULATION**

Sameera Khan¹, G. Kerr Whitfield², Mark R. Haussler², and Peter W. Jurutka^{1,2}
(¹Arizona State University West Campus, Phoenix, AZ, ²University of Arizona College of Medicine, Phoenix, AZ)

Vitamin D (1,25-dihydroxyvitamin D₃; 1,25D) plays a critical role in neural health and limits the severity of brain dysfunction. A clear correlation has been demonstrated between serum 1,25D levels and multiple neuropsychiatric diseases, including Alzheimer's, clinical depression, autism, and ADHD. However, the action(s) of 1,25D in the brain thus far have been relatively understudied and warrant a thorough investigation of the molecular mechanism by which this endocrine hormone can play a role in brain health. One such pathway for 1,25D action is to optimize synaptic levels of two essential neurotransmitters: dopamine and serotonin. Dopamine, a key driver of reward-motivated behavior, has been linked to neurodegenerative diseases, such

as Parkinson's, and neuropsychiatric illnesses, such as schizophrenia. The vitamin D receptor (VDR) is significantly expressed in dopamine-rich areas of the brain, alluding to the role of 1,25D in neurotransmitter regulation. Thus, we employed quantitative polymerase chain reaction (qPCR) to test if dopamine levels in the brain may be modulated by 1,25D via the upregulation of tyrosine hydroxylase (TH), the rate-limiting enzyme in dopamine synthesis. We also evaluated 1,25D-mediated downregulation of the synaptic cleft reuptake protein, dopamine active transporter (DAT), and dopamine degradation enzymes, monoamine oxidase A (MAOA) and B (MAOB), as well as catechol-O-methyl transferase (COMT). In a mechanistically similar manner to dopamine regulation, we assessed tryptophan hydroxylase 2 (TPH2), the rate-limiting enzyme in serotonin synthesis, for induction by 1,25D, and probed the reuptake protein serotonin transporter (SERT), as well as the serotonin degradation enzymes, MAOA and MAOB, for repression by 1,25D/VDR. Furthermore, the M1 and M4 functional isoforms (polymorphisms) of human (h)VDR may have differential effects on vitamin D signaling in the brain with regards to neurotransmitter optimization. The more transcriptionally potent M4 isoform of hVDR may be more active in TPH2/TH induction and/or more repressive in SERT/DAT and MAO/COMT genes than M1, therefore better optimizing neurotransmitter levels in the synapse. In order to examine this hypothesis, we tested both the M1 and M4 VDR for their ability to differentially activate TPH2 VDRE-mediated transcription. Taken together, our results expand previous findings on vitamin D regulation of serotonin and dopamine metabolic enzymes, demonstrate a differential effect of hVDR genetic polymorphisms on the transcription of a neurotransmitter biosynthetic enzyme, and further reveal the involvement of vitamin D in brain health as well as its impact in personalized medicine.

***ICE CRYSTAL PARAMETERIZATIONS IN ARCTIC CIRRUS – TOWARDS A BETTER REPRESENTATION IN GLOBAL CLIMATE MODELS**

Dick Lanman and Dorothea Ivanova (Embry-Riddle Aeronautical University, Prescott, AZ)

Cirrus clouds are one of the largest uncertainties in the radiative budget, crucial to understanding trends in climate. While parameterizations exist for cirrus in the tropical and mid-latitudes, high-latitude (arctic) cirrus are poorly represented in global climate models (GCMs). Ice and mixed-phase clouds also present a hazard in aircraft icing formed by non-classical formation mechanisms; i.e. freezing precipitation that forms without a melting layer. In-flight icing is a significant threat to aviation operations, resulting in loss of lift and reduced airspeed. The goal of this research is to analyze the newest microphysics data for arctic cirrus from Barrow, Alaska. Parameterizations of the size distributions, temperature, and ice water content (IWC) in ice and mixed-phase clouds will lead to a better understanding of their radiative properties and their role in the Earth's radiation budget as depicted by the GCMs. This study indicates that arctic ice clouds behave differently than their mid-latitude and tropical counterparts. The arctic cirrus clouds variations with temperature are more monomodal compared to both tropical and mid-

latitude size distributions from previous field campaigns. The two modes, small and large, are not clearly distinguished during the arctic flights; the large mode maximum is often missing, flattening the large mode ice crystal size distributions. This study may help improve airplane icing prediction through better understanding of the ice microphysical properties.

***THE URBAN HEAT ISLAND'S IMPACT ON ECDYSONE LEVELS THROUGHOUT DEVELOPMENT OF THE WESTERN BLACK WIDOW**

Claire E. Moen, Edgar Aragon Ruiz, Jennifer Hackney, and J. Chadwick Johnson (Arizona State University, Phoenix, AZ)

Ecdysone is a steroid hormone that controls molting in insects and other arthropods. While ecdysone is the direct initiator of molting, the actual timing of the molt is regulated by other hormones and environmental factors. For example, temperature increases often accelerate development in arthropods. Recent field studies of arthropod microclimates show average nighttime temperatures in urban Phoenix to be 33°C, which is drastically higher than the nighttime desert temperature of 27°C. The Western black widow spider, *Latrodectus hesperus*, thrives in the urban habitat; yet, our work shows that urban temperatures actually slow development, reduce body mass, and increase mortality of early stage spiderlings. Here we look at the relationship between ecdysone levels and development in spiderlings experiencing urban and desert temperature conditions. Developmental progress and ecdysone levels were recorded for four families of spiders from across the urban Phoenix area at 27°C and 33°C with data spanning from day 30 of development to the beginning of the third molting period. We found that elevated temperatures 1) led to a significantly higher production of 20E throughout development, 2) caused additional peaks of 20E unrelated to molting activity much like those of a stress response, and 3) that there was significant familial variation in 20E concentrations throughout development. These findings suggest that the increased temperatures of urban environments disrupt the molting and developmental systems of the Western black widow, resulting in the abnormal production of toxic levels of ecdysone leading to delayed development and mortality.

***DETECTION OF *LEGIONELLA PNEUMOPHILA* IN THE WATER SYSTEM OF AN EDUCATIONAL INSTITUTION IN THE DESERT SOUTHWEST**

Amber Neal, Daisy Rodriguez, Zaira Grijalva, David Reyes, Oliver Garcia, Anthony Gutierrez, Karissa Marquez, Matt Haberkorn, David Otto Schwake, Cori Leonetti and Robin Cotter (Phoenix College, Phoenix, AZ)

The *Legionella* genus contains pathogenic bacteria commonly found in sources of potable and non-potable water and biofilms. The presence of *Legionella* in water systems is of increasing

concern, particularly *Legionella pneumophila*, as it may result in respiratory illness, such as Legionnaires' disease. Little is known regarding the presence of *L. pneumophila* in public water sources and the risk of transmission through aerosol exposure. The objective of this project is to detect if *L. pneumophila* is present in water and biofilm samples collected from an educational institution in the Desert Southwest. A total of 70 samples (41 water and 29 biofilm) were collected from 19 sites organized within six zones based on usage by students, staff and community members. The samples were concentrated via membrane filtration and DNA was extracted and amplified using PCR primers specific for the *L. pneumophila macrophage infectivity potentiator (mip)* gene. The DNA was then analyzed by gel electrophoresis and DNA sequencing to confirm the presence of *L. pneumophila*. The presence of *L. pneumophila* was detected in initial screenings from the sites surveyed. These preliminary findings warrant additional sample analysis and highlight the importance of *Legionella* monitoring for public water systems due to the public health and environmental engineering implications

***THE EFFECT OF FLOWER COLOR ON BEE FORAGING**

Dustin Nguyen, Czarinabelle Perez, Basel Shaban, Kayla Suchoza, Jennifer Broatch, and Jennifer Foltz-Sweat (Arizona State University, Phoenix, AZ)

With over a thousand bee colonies lost each year, over 15 million dollars in crops are at risk, and more than twenty species have made the endangered list, the bee population is rapidly declining. In a survey conducted by *Bee Informed*, a website dedicated to bee conservation, a collective group of 5,756 beekeepers who are responsible for approximately 15% of the United States' bee population, reported losing 44.1% of their colonies between April 2015 and March 2016. It is increasingly evident that the bee population is on a rapid decline and the need to prevent this becomes a stronger and more urgent issue with each passing day. Particularly, in this study, the focus is if bee foraging is encouraged by the presence of specific colored flowers. It was hypothesized that the presence of specific color variants would optimize bee foraging and ultimately prevent the population from declining any further. In multiple studies, most notably from Karl Von Frisch, it has been shown that bees can see color and more recently that they only see wavelengths from 300-650 nm. In this preliminary study, pink and white variants of *Salvia Greggii*, commonly known as Autumn Sage, were observed to determine which color flower attracted the most bees. There were four replicates of each color and on each day of sampling they were randomly separated into pairs of low and high nectar. The nectar in each flower of the low pairs was extracted using a microcapillary pipette. Additionally, they were randomly placed in different locations in order to eliminate any confounding variables. The initial results show that the pink flowers do not encourage increased foraging. Testing more replicates, other plant species, and adding more color variants in the future may yield more information in their preferences with regards to, flower size, shape, color, and nectar production.

***ADOPTING UNMANNED FLIGHT OPERATIONS INTO CONTROLLED AIRSPACE**

Jannah C. Perry, Johnny L Young, Jacqueline R. Luedtke, Benjamin Cook, Holly Hughes, Allison Little, Anthony Velasco, and Kyle Wilkerson (Embry Riddle Aeronautical University, Prescott, AZ)

Unmanned aircraft activity is becoming more common within the National Airspace System (NAS) and is expected to dominate the NAS in the near future. Specific procedures for adopting unmanned aircraft into the National Airspace System (NAS), specifically into controlled airspace, have yet to be established. To accomplish simultaneous safe manned and unmanned aircraft operations in the NAS, the Joint UAS and ATC Team (JUAT) at Embry-Riddle Aeronautical University (ERAU) are developing a system that could be used to control UAS in conjunction with manned aircraft. The JUAT group is in the process of designing multiple simulated ATC scenarios in order to determine practical solutions for UAS integration. A variation of the Military Grid Reference System was developed and digitally overlaid onto the radar display. To incorporate this grid system, a customized flight plan database was created for the storage of operator submitted flight plans. Instead of verbal communication, a computer chat system is used for communication because of the low altitude operations in the field. The Federal Aviation Administration (FAA) has made UAS integration a top priority as they projected that the UAS market will reach 7 million systems by 2020. The JUAT is in the process of developing a conclusive solution that will help to safely adopt UAS into the NAS.

***INCORPORATING DIGITAL LEARNING TOOLS IN CONJUNCTION WITH AIR TRAFFIC CONTROL SIMULATION**

Jannah C. Perry, Jacqueline R. Luedtke, Allison Little, Kyle Wilkerson, Benjamin Cook and Holly Hughes (Embry Riddle Aeronautical University, Prescott, AZ)

Learning and applying complex information at a fast rate can be challenging for students within an air traffic control-training program. Incorporating digital learning tools into an air traffic control training programs may increase student learning and success rates. Swivl is a digital learning capture tool designed to enhance student learning by allowing students to refer back to their individual classroom lab training session videos via an online portal. Embry Riddle's air traffic program has started using Swivl in two separate ATC courses in order to determine if it is a viable solution to increasing learning. During our research, we have come to the formulation that Swivl is most useful in the air traffic control tower simulator, and has shown to be an effective learning tool thus far from the teacher's perspective. Additional student feedback and analysis is still forthcoming. Swivl has the potential to be an effective tool in ATC training and may enhance learning by allowing students to sharpen skills that are necessary to advance in the field of air traffic control. The air traffic control-training academy (used to train air traffic controllers hired by the federal government) has a high failure rate. Incorporating digital learning tools in that setting may increase success rates as well.

***PHYLOGENETIC ANALYSIS OF BIOFILM DERIVED *DEINOCOCCUS AQUATICUS* ISOLATES USING PROTEIN EXTRACTION MASS SPECTROMETRY**

Stacy Scholz-Ng, Chad Albert, Melinda Wall, Kurtis Born, Tyler Laird, Elaine Gilsdorf, Anthony Gutierrez¹, Elizabeth Leeman², James Tuohy, Sabrina Mueller-Spitz², Todd Sandrin¹ (Glendale Community College, Glendale, AZ, ¹Arizona State University West, Glendale, Arizona, ²University of Wisconsin, Oshkosh, WI)

Matrix-assisted laser desorption/ionization – Time of Flight (MALDI-TOF) mass spectrometry of whole cell protein extracts has been shown to produce a summary spectrum and a characteristic fingerprint for a given organism (1). We have recently used a derivative technique known as Protein Extraction Mass Spectrometry (PEMS) to quickly and reliably provide bacterial phylogenetic relationships between four species of *Deinococcus* (2). The present study further applies this technique to describe phylogenetic relationships and subpopulation variation between 14 isolates of *D. aquaticus*, a recently described species with a wide distribution in freshwater habitats. *D. aquaticus* samples were obtained from biofilms found on man-made and natural surfaces within the Fox River watershed of northeastern Wisconsin. Analysis of this isolate collection allows for a comprehensive comparison of the effectiveness, for phylogenetic purposes, of MALDI-TOF spectra analysis of whole cell protein extracts as compared to other more established methods, such as 16S rDNA gene identities and genomic fingerprinting by Box-AR1-PCR. This approach also permits conclusions to be drawn about the adaptive benefits of differential protein expression in related biofilm habitats.

***THE EFFECT OF HUMAN PRESENCE ON WILDLIFE ACTIVITY ALONG THE ARIZONAN U.S.-MEXICO BORDER**

Maria Scaff, Robert Myers, Nick Massoni, Gabriel Wachtel, Mark Buono, Melaani Montgomery, Abbey Bowser, Jasmine Riley and Edmund Priddis (Cochise College, Sierra Vista, AZ)

Southeastern Arizona is one of the most biodiverse areas in the United States of America and perhaps even all of North America. This is 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 uniqueness of this area is increased, as the region sits on the border between two countries. Many of the species found in this area are at the northernmost reach of their range. Within this region are a number of waterways that transverse the border and may act as an important corridor for species movements. This study compares the activity of species “captured” at three sites on federal conservation lands that lie within the border region, to the human activity also “captured” in these locations. High output covert infrared detecting camera traps were deployed at each of the sites. Pictures were gathered from March 2015 through December 2016. The relative abundance of species at each location, seasonal variations in species’ abundance, and species pair activity similarity was examined. The results indicated that there has been no distinctive correlation between human activity and wildlife transit in the locations studied. Future studies will include placing camera traps on the Mexican side of the

border. Pictures and scat will be analyzed to determine the effect of the Arizonan U.S.-Mexico border on animal migration patterns, and microevolution of wildlife species.

***VARIATION IN INTENSITY OF INFECTION BY *ECHINOSTOMA* METACERCARIA IN BULLFROG TADPOLES FROM FOUR NORTHERN ARIZONA WATER TREATMENTS**

Tiffany Tran, Lauren Marie Badertscher, Stephen Shuster, Tanya Sutton and Catherine Propper (Northern Arizona University, Flagstaff, AZ)

Echinostoma is a trematode genus known to encyst as metacercaria within the kidneys of amphibian larvae. The bullfrog, *Lithobates catesbianus* breeds throughout northern Arizona and is also an invasive species. This study examined the relationship between water source, *Lithobates* tadpole developmental stage, and the intensity of *Echinostoma* sp. trematode infection among four northern Arizona aquatic habitats [Rio de Flag (RDF), J.D. Dam Lake (JD), Frog Tank (FT), and Schultz Lake (SHL)]. Tadpoles were collected from each site, euthanized, and their kidneys were dissected and preserved for analysis of parasitic infections. Using a two-way ANOVA we found a significant relationship between the intensity of *Echinostoma* sp. and water source. This study substantiates a preliminary study from 2015 and suggests that tadpoles in the Rio de Flags are either more likely, or more susceptible, to suffer trematode infections than in other northern Arizona water treatment. Furthermore, new data has shown that there are no significant relationships between the average number of cysts in the tadpoles' kidneys and the developmental stages, suggesting that tadpoles maybe infected with *Echinostoma* sp. at an earlier stage, then progress into the later stages of tadpole development into adults.

ACADEMY BUSINESS AND ANNUAL REPORTS

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Paula Rivadeneira.....	Director at Large

APPOINTED

Robert McCord.....	Editor, Journal
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Robert McCord.....	Geology
Boris Poff.....	Hydrology
Shafiu Jibrin.....	Mathematics/Statistics
Pamela Marshall.....	Posters

PRESIDENT'S REPORT

This year's meeting is the culmination of another excellent year for the Arizona-Nevada Academy of Science (ANAS). Poster and talk sessions at Glendale Community College (GCC) provide a wonderful opportunity to promote STEM education at the Academy's progenitor institution. I want to thank my fellow board members for their work on the meeting and other initiatives, and special thanks are extended to GCC professors Karen Conzelman, Florence Slater, Robert Bowker, and Angela Schwendiman for organizing and hosting the annual meeting.

Our sixty-first meeting will mark the start of Brian Wainscott's term as ANAS President after his home institution, College of Southern Nevada (CSN), hosted our meeting last year. Brian inherits an innovative Academy, enhanced by an online presence that was recently improved by webmaster Rhett Michelson. I invite ANAS members to peruse www.aznvas.org and our Facebook page to keep abreast of the Academy's continued efforts, and to access our peer-reviewed journal (JANAS) via Bio One and JSTOR. And I look forward to bringing young scientists into our circle via these diverse modes of electronic communication.

Our poster and presentation sessions on April 1st remind us that the scientific process is not conducted in a vacuum—it is done with collegiality and community. The Academy therefore moves forward while maintaining the same core values we have held dear since our 1956 inception—equal opportunity and inclusion, constructive discourse between scientists of various backgrounds, informing the public via professional interaction with the media, and reverence for the peer-review system that holds us accountable as researchers. This worldwide free movement of ideas and openness among colleagues will position our members to approach the economic, environmental, and social challenges of contemporary America thoughtfully, and to generate complex solutions for dynamic and multifaceted problems.

From evaluating the effects of global climate change and finding sources of renewable energy, to advancing biomedical research and biotechnology, to the exploration of different galaxies, careers of the coming decades will demand STEM-related skills more than ever. As my presidency comes to end, the power and intricacy of scientific research continues. And so I hold great enthusiasm for this meeting of ANAS, hoping that it will serve to encourage the scientists of the future. Perhaps our sixty-first meeting will yield a prospective researcher who finds the cure for HIV, discovers a new planet, solves the planet's energy problems, or changes the way we think about our place in the universe. Or maybe, if nothing else, it will inspire an up-and-coming scientist to do something simple, but crucial, that will leave the world better than before.

Congratulations to the board and membership on another great year.

Theodore G. Manno
President

NOMINATING COMMITTEE REPORT

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

President-Elect (2017-2019): Paula Rivadeneira

Treasurer (2017-2018): Karen Conzelman

Membership Secretary (2017-2018): Angela Schwendiman

Recording Secretary (2017-2018): Robert Bowker

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

Director at Large (2017-2019): Pamela Marshall

MEMBERSHIP REPORT

We currently have a total of one hundred ANAS members that includes seventy two dues-paying members and twenty eight emeriti or life members. In addition, we have twenty two subscribing institutions.

Angela Schwendiman
Membership Secretary

MINUTES OF THE ANNUAL BUSINESS MEETING
AND AWARDS LUNCHEON
APRIL 16, 2016

Board members in attendance: Rob Bowker, Pedro Chavez, Karen Conzelman, Jennifer Hackney Price, Shafiu Jibrin, Bob McCord, Theo Manno, Rhett Michelson, Boris Poff, Paula Rivadeneira, Florence Slater, Aregai Tecele, and Brian Wainscott. Call to order and general introductory remarks: Theodore Manno, President

BUSINESS MEETING:

Proposed changes were approved by majority of membership in attendance.

ELECTION OF OFFICERS:

The members identified by the nominating committee (listed below) were re-elected for another term in office.

Recording Secretary: Robert Bowker (2016-2017)
Membership Secretary: Angela Schwendiman (2016-2017)
Treasurer: Karen Conzelman (2016-2017)
Director, Nevada: Boris Poff (2016-2018)
Director, Northern Arizona: Aregai Tecele (2016-2018)
Director, Central Arizona: Jennifer Hackney-Price (2016-2018)

AWARDS:

Best student posters:

Identification of Transcriptomic Biomarkers for Use in the Diagnosis of Irritable Bowel Syndrome (IBS)

Aleksandra Grozic¹, Christopher M. Dussik¹, Maryann Hockley¹, Lin Zhang¹, Connie Borrer¹, Jin Park³, Jie Wang³, Steven Yale⁴, Amy Foxx-Orenstein⁵, Todd Sandrin¹, and Peter W. Jurutka^{1,2} (¹Arizona State University, Phoenix, AZ; ²University of Arizona College of Medicine, Phoenix, AZ; ³Arizona State University, Tempe, AZ; ⁴North Florida Regional Medical Center, Gainesville, FL; ⁵Mayo Clinic College of Medicine, Scottsdale, AZ)

Competitive Outcome in *Tribolium* spp. Is Determined by Priority

Zane G. Holditch and Aaron D. Smith (Northern Arizona University, Flagstaff, AZ)

An Investigation into the Disruption of Bacterial Quorum Sensing By Algal Compounds

Anthony Gutierrez, Chad Albert, and James Tuohy (Glendale Community College, Glendale, AZ)

OUTSTANDING SERVICE AWARD:

Robert W. Bowker

OUTSTANDING LEADERSHIP IN SCIENCE EDUCATION:

Agripina Paluch

KEYNOTE SPEAKER:

Dr. Brenda J. Buck, University of Nevada, Las Vegas, Professor in Department of Geoscience spoke on “Naturally Occurring Asbestos in the Southern Nevada Region: Potential for Human Exposure”

CLOSING REMARKS:

Theo Manno thanked Brian Wainscott and his team for doing an outstanding job of organizing the meeting. Brian made some closing comments, thanking student presenters, College of Southern Nevada’s administration for their support and all those that helped make this conference successful. The meeting was adjourned at 1:30.

Robert Bowker

Recording Secretary

REPORT OF THE GRANT-IN-AID COMMITTEE

This year’s winners for the undergraduate grant-in-aid awards to pursue research at the undergraduate level are:

Hannah Combs, Northern Arizona University,

Offspring Mortality as a Function of Host Quality in *Nasonia vitripennis*, under the guidance of Stephen Shuster

Xavier Jenkins, Arizona State University,

Fossil excavation and collection from sites in Utah and Colorado, under guidance of Robert J. Gay, Curator of Museum Education in Museums of Western Colorado

Congratulations, Hannah and Xavier!

Aregai Tecele

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 4th at University of Nevada, Reno

Advanced Technology Academy, Las Vegas NV - coached by Kevin Chung

Carlin High School, Carlin NV - coached by Melissa Jones

Centennial High School, Las Vegas NV - coached by Alyson Darby

Clark High School, Las Vegas NV – coached by James Miller

Coral Academy of Science, Henderson NV - coached by Adem Akgedik

Green Valley High School, Henderson NV - coached by Shayna Segal

West Career and Technical Academy, Las Vegas NV - coached by Andrea McKinney

Congratulations to Clark High School whose A and B teams ranked 1st and 2nd in the state. Their A team will represent Nevada at the National Tournament at Wright State University in Dayton, Ohio in May.

OUTSTANDING SERVICE AWARD

GERALD GOTTFRIED

Jerry has been a very active participant and leader in the Arizona-Nevada Academy of Science Hydrology Section. He is a native of New York and received his B.S. degree in Biology from the City College of New York, his M.S. degree in forestry, hydrology, and soil science at Michigan State University and his Ph.D. from the University of Arizona in watershed management and soil science. He worked for the Rocky Mountain Research Station attached to research work units in Tempe, Flagstaff, and Phoenix from 1966 to 2015 as a research forester. Using his university training, he has been active in hydrological science and watershed management in the U.S. Forest Service, the Arizona Academy of Science, the University of Arizona, Northern Arizona University and Arizona State University. He has served as an Adjunct faculty member at all three universities. Jerry retired in 2014 after 48 years with the U.S. Forest Service. He worked on for 2 more years as an Emeritus Scientist, thus completing 50 years of service to the U.S. Forest Service and natural resources research in the Southwest. He authored or co-authored 191 publications. Jerry collaborated with scientists in Mexico, Israel, Japan, China, and France, and served on numerous graduate degree committees for international students. He was a primary contact and lead researcher at the Sierra Ancha Experimental Forest from 1980 until he retired, the Thomas Creek Watersheds in the White Mountains, and the Cascabel Watersheds in the Peloncillo Mountains of the Coronado National Forest. Jerry was well known for his expertise on watershed management in the Southwest, pinyon-juniper woodland silviculture, and encinal woodlands and savannas ecology. Jerry served as Chairperson or Co-chair of the Hydrology Section of ANAS numerous times and was an organizational leader of the section, encouraging land managers, federal scientists, university faculty, and students to make presentations. He was also instrumental in encouraging paper presenters to write up their work for *Hydrology and Water Resources in Arizona and the Southwest*, now working on its 49th issue.

BUD ELLIS SCHOLARSHIP AWARD

MARISSA CONN MINISTER

The Arizona - Nevada Academy of Science offers the Bud Ellis Scholarship of \$1,000 to a graduating senior in Arizona or Nevada High Schools or Preparatory Schools.

Marissa Conn Minister is the winner of the Bud Ellis Scholarship for 2017. Marissa ranks second in her high school class of 366 students at Flagstaff High School in Flagstaff, AZ. There Marissa has earned an un-weighted GPA of 4.0, a weighted GPA of 4.35, and has secured combined SAT scores of 1680, as well as a composite ACT score of 31. She has excelled in a wide range of AP courses at her school, she is involved in field research experiences unique to the Colorado Plateau, she is an officer in several honorary and community service societies, and does volunteer work in Central America. Somehow, Marissa also is a 4-year tennis letter winner at Flagstaff High.

Marissa has received the enthusiastic support of her instructors, counselors, coaches and community members. Marissa plans to attend the University of Arizona in Tucson to study Chemical Engineering.

Congratulations, Marissa!

Stephen M. Shuster

OUTSTANDING HIGH SCHOOL SCIENCE TEACHER AWARD

KRISTEN KAUS

Kristen Kaus is the 2017 Outstanding High School Science Teacher Award winner. Kristen is an Advanced Placement Biology, AIM II Biology and General Biology teacher at Cactus High School. In addition, she is the environmental club advisor, who engages students with the environment through diverse community service endeavors, including fruit gleaning and water cycle activities. She is also a dedicated educator, working with the Peoria Unified District on curriculum development and alignment with the Arizona State Standards. Kristen also mentors new teachers and is the department lead for science at Cactus High School. She is a sixteen year veteran and engages students in her classes through innovative curricula and engaging hands-on lessons. In addition, she is the Environmental Club advisor and, as such, engages student members with the environment through diverse community service endeavors including fruit gleaning and water cycle activities.

Kristen Kaus is an exceptional educator who has encouraged so many students and fellow teachers to be the best they can.

Congratulations Kristen!

OUTSTANDING LEADERSHIP IN SCIENCE EDUCATION AWARDS

DARRELL KIDD and MARTIN WESOLOWSKI

Two dedicated individuals are being recognized this year by the Academy for their outstanding leadership in science education.

Darrell Kidd has demonstrated exceptional leadership in science education in Arizona, making significant contributions toward improving STEM education well beyond his classroom. Darrell's commitment to designing a program to motivate students by treating them as working professionals and preparing them for post-secondary opportunities was crucial to the launch of the Peoria Unified MET Professional Academy in 2015.

Darrell is a secondary school teacher, certified in Career and Technical Education, math, physics, and earth science. Darrell was integral in formulating the values of MET, including its driving Mission Statement: Inspiring, empowering and shaping future leaders by providing college and professional opportunities through hands-on, real-world experiences to benefit our communities.

Darrell serves on engineering advisory boards for Grand Canyon University and the district CTE Department. He teaches dual enrollment courses through Glendale Community College. He is a leader in the CO+HOOTS Foundation and helps refine the SEED SPOT NEXT social entrepreneurship curriculum.

Martin Wesolowski served for fourteen years as an exhibit designer and builder for the Arizona Science Center before founding the Martin Arts Center and STEAMshop on the west side of Maricopa County in Glendale, Arizona five years ago. The STEAMshop combines traditional STEM fields with the arts to provide K-12 youth with auxiliary education, after-school programs and Maker Space opportunities to explore the creative symbiosis between the STE(A)M fields as well as employment opportunities within them.

During the past five years, Martin, as the STEAMshop's CEO, has passionately engaged with members of both public and private sectors to expand its reach. They have worked with over thirty educators through both on-site and outreach programming to impact well over 3500 K-12 students. Martin has developed key strategic partnerships to promote STEAM education, including an ongoing relationship with the City of Glendale, AZ for in-kind support through the use of space and utilities.

Another partnership with the Maricopa County Drug Enforcement Program, provides funding for the STEAMshop to stage after-school alternative activities for at-risk youth. Not one to slow down nor think small, Martin is in the process of negotiating a partnership to provide G.E.D. and High School Diploma training through his organization, as well.

Darrell Kidd and Martin Wesolowski are exceptional leaders who have made a significant impact in science education.

Congratulations Darrell and Martin!

**TREASURER'S REPORT-CORRECTED
2015**

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

Account Value on 12/31/14	\$27,022.18
Dividend Deposits	\$13.34
Account Value on 12/31/15	\$27,035.52

Goethe Educational Endowment Fund (Vanguard Index 500 Mutual Fund)

Account Value on 12/31/14	(246.435 shares at \$189.89/share)	\$46,795.54
Deposits (Contributions)	+0 shares Total: 241.712 shares	
Dividends	+5.228 shares Total: 251.663 shares	
Account Value on 12/31/15	(251.663 shares at \$188.48/share)	\$47,433.44

General Fund

December 31, 2014 Balance	\$36,034.21
Deposits	\$16,605.91
Expenses	(\$8,904.32)
December 31, 2015 Balance	\$43,735.80

Science Olympiad General Fund

December 31, 2014 Balance	\$95,125.74
Deposits	\$15,241.49
Expenses	(\$17,637.31)
December 31, 2015 Balance	\$92,729.92

Market Value of Assets (as of December 31, 2015)

\$210,934.68

General Funds Details

<u>Deposits</u>		<u>Expenses</u>
\$1,690.00	ANAS Membership dues	
	PayPal charges	44.86
	Postage	
	Journal:	
630.00	Subscriptions	
	PayPal charges	2.36
	Refunds	10.00
10,148.72	BioOne/JSTOR/CCC Royalties	
0.00	Sale of Back Issues	
690.00	Reprints/Page Charges	
	Printing	812.25
	Typing	750.00
	Postage	191.94
	Hydrology Proceedings	
	Other	
72.19	Royalties from book	
	Web hosting fee	219.63
	Scholarships:	
	Grants-in-Aid, High School:	
	Grants-in-Aid, Graduate	300.00
	Grants-in-Aid, Undergraduate	
	Science Olympiad awards	1,100.00
	Annual Meeting:	
3,340.00	Registration Fees	
	PayPal Charges	78.79
	Sponsor donations	
	Proceedings, Printing	752.69
	Proceedings, Postage	222.00
	Coffee Breaks/Luncheon	2,855.09
	Friday Reception	170.00
	Meeting Rooms/Equipment	708.53
	Awards	
	Outstanding Service	50.00
	Outstanding Teacher	100.00
	Outstanding Students	200.00
	Printing/Postage	
	Plaques	62.24
35.00	Goethe Endowment Fund Contributions	
	AZ Corporation Commission	10.00
	NAAS Dues	150.00
	Supplies	10.82
	Postage/Office	73.12
	Printing/Office	
	Board Meeting Refreshments	
	Bank Charges	30.00
	Interest	
	Other	
\$16,605.91	SUBTOTAL	\$8,904.32

<u>Deposits</u>		<u>Expenses</u>
	Science Olympiad	
\$12.48	Interest	
8,564.01	Sponsor donations	
6,026.00	Membership dues	2,160.00
	Tournament	
	Awards and Prizes	4,085.07
	Scholarships	
	Team Travel	2,617.66
50.00	T-shirts	4,817.60
	Supplies	198.34
589.00	Lunches	1,305.05
	Coaches gifts	
	Office Expenses	
	Copying and Postage	302.84
	Office supplies	
	Bank Charges	
	Outreach	
	Workshop stipends	1,220.00
	Seed money	600.00
	Brochures/PR	330.75
	Mileage	
	Travel to Nationals (State Director)	
	Other	
\$15,241.49	SUBTOTAL	\$17,637.31

\$31,847.40	TOTAL	\$26,541.63
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(Please note that the Science Olympiad is held in February or March of each year and this report is based on the calendar year. Some sponsorship dollars are received in the fall in anticipation of the upcoming year's tournament).

Karen Conzelman
Treasurer

**TREASURER'S REPORT
2016**

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

Account Value on 12/31/15	\$27,035.52
Dividend Deposits	\$98.39
Account Value on 12/31/16	\$27,133.91

Goethe Educational Endowment Fund (Vanguard Index 500 Mutual Fund)

Account Value on 12/31/15	(251.663 shares at \$188.48/share)	\$47,433.44
Deposits (Contributions)	+0 shares Total: 241.712 shares	
Dividends	+5.347 shares Total: 257.010 shares	
Account Value on 12/31/16	(257.010 shares at \$206.57/share)	\$53,090.56

General Fund

December 31, 2015 Balance	\$43,735.80
Deposits	\$16,618.71
Expenses	(\$6,622.02)
December 31, 2016 Balance	\$53,732.49

STEM Tournament Endowment Fund

December 31, 2015 Balance	\$92,729.92
Deposits	\$3,616.43
Expenses	(\$17,382.14)
December 31, 2016 Balance	\$78,964.21

Market Value of Assets (as of December 31, 2016) **\$212,921.17**

General Funds Details

<u>Deposits</u>		<u>Expenses</u>
\$1,015.00	ANAS Membership dues	
	PayPal charges	25.51
	Postage	
	Journal:	
80.00	Subscriptions	
	PayPal charges	1.18
	Refunds	
11,134.21	BioOne/JSTOR/CCC Royalties	
10.50	Sale of Back Issues	
105.00	Reprints/Page Charges	
	Printing	537.58
	Typing	750.00
	Postage	9.04
	Hydrology Proceedings	750.00
	Other	
	Royalties from book	
	Web hosting fee	315.51
	Scholarships:	
	Grants-in-Aid, High School:	
	Grants-in-Aid, Graduate	
	Grants-in-Aid, Undergraduate	200.00
	Science Olympiad awards	1,100.00
	Annual Meeting:	
4,274.00	Registration Fees	
	PayPal Charges	102.78
	Refund	45.00
	Sponsor donations	
	Proceedings, Printing	678.76
	Proceedings, Postage	136.86
	Coffee Breaks/Luncheon	407.30
	Friday Reception	161.08
	Meeting Rooms/Equipment	
	Awards	
	Outstanding Service	50.00
	Outstanding Teacher	50.00
	Outstanding Students	225.00
	Plaques	41.50
	Travel Grants	819.46
	Goethe Endowment Fund Contributions	
	AZ Corporation Commission	10.00
	NAAS Dues	
	Supplies	190.46
	Postage/Office	
	Printing/Office	
	Board Meeting Refreshments	
	Bank Charges	15.00
	Interest	
	Other	
\$16,618.71	SUBTOTAL	\$6,622.02

<u>Deposits</u>		<u>Expenses</u>
	STEM Tournament Endowment	
\$12.51	Interest	
46.42	Sponsor donations	
2,408.00	Membership dues	1,920.00
	Tournament	
	Awards and Prizes	4,569.70
	Scholarships	
	Team Travel	2,500.00
209.00	T-shirts	5,417.24
	Supplies	133.18
940.50	Lunches	1,516.57
	Coaches gifts	
	Office Expenses	
	Copying and Postage	325.45
	Office supplies	
	Bank Charges	
	Outreach	
	Workshop stipends	
	Seed money	1,000.00
	Brochures/PR	
	Mileage	
	Travel to Nationals (State Director)	
	Other	
\$3,616.43	SUBTOTAL	\$17,382.14

\$20,235.14

TOTAL

\$24,004.16

(Please note that the Science Olympiad is held in February or March of each year and this report is based on the calendar year. Some sponsorship dollars are received in the fall in anticipation of the upcoming year's tournament).

Karen Conzelman
Treasurer

