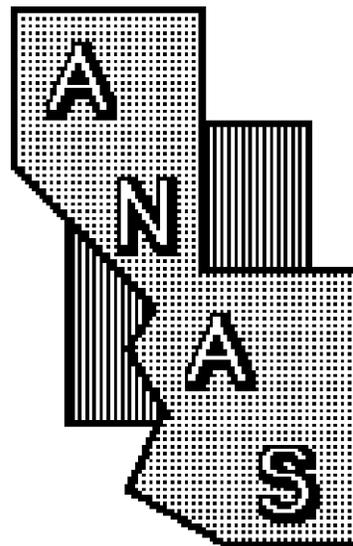


2013

VOLUME 48

**PROCEEDINGS
OF THE
ARIZONA-NEVADA
ACADEMY OF SCIENCE**



FIFTY SEVENTH ANNUAL MEETING

June 16-19, 2013

**Joint meeting with the Pacific Division of the American Association for the
Advancement of Science**

**University of Nevada at Las Vegas
Las Vegas, NV**

The 57th Annual Meeting of ANAS was held jointly with the 94th meeting of the American Association for the Advancement of Science-Pacific Division in Las Vegas, NV on June 16-19th. Although ANAS attendance at this meeting was rather low, the combined meeting afforded ANAS board members the opportunity to increase awareness of our organization and journal, particularly among individuals from AAAS-PD who live in Nevada, and hopefully boost JANAS manuscript submissions as well as participation and membership in the Academy.

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PRESENTATIONS

The following papers were presented at the joint meeting of ANAS and Pacific division of AAAS

THE PUTATIVE ROLE OF RESVERATROL IN SIRT-1-MEDIATED MODULATION OF THE VITAMIN D PATHWAY

Angelika Dampf Stone¹, Shane F. Batie¹, G. Kerr Whitfield², Mark R. Haussler² and Peter W. Jurutka^{1,2} (¹ Arizona State University, Glendale, AZ, ²University of Arizona College of Medicine, Phoenix, AZ)

The nuclear vitamin D receptor (VDR) modulates gene transcription in 1,25-dihydroxyvitamin D (1,25D) target tissues such as kidney, colon, and bone. The 1,25D hormone is derived from vitamin D in the skin or from the diet, and binds to and activates the VDR. We have previously shown that resveratrol, an antioxidant found in the skin of red grapes, activates the VDR signaling pathway. Cells treated with resveratrol and 1,25D showed synergistic stimulation of VDR-mediated transcription. When hormone treatments were applied to wild-type and single-point VDR mutants, 1,25D displayed a significant drop in activity caused by these ligand-binding pocket mutations, while the ability of resveratrol to activate VDR was only modestly attenuated. These results suggest that resveratrol affects VDR activity indirectly, perhaps by activating SIRT1, an enzyme known to deacetylate other nuclear receptors. Radiolabeled 1,25D displacement assays supported this hypothesis, suggesting that direct binding of resveratrol to the VDR is unlikely. Additionally, we observed increased transactivation in response to resveratrol in other nuclear receptors, including the liver X receptor, which is closely related to the VDR and is known to be deacetylated by SIRT1. We tested receptor-mediated transcriptional activity in a system containing VDR in the absence and presence of over expressed SIRT1. VDR activity was higher in cells expressing SIRT1, and synergistic activity of 1,25D combined with resveratrol was observed. We are currently employing this VDR/SIRT1 assay in multiple cellular contexts. In conclusion, this study elucidates a potential novel pathway for "crosstalk" between two nutritionally derived lipids, vitamin D and resveratrol.

EVALUATION OF RESVERATROL AS A NOVEL MODULATOR OF THE FOXO AND VITAMIN D PATHWAYS IN COLON CANCER

Marya S. Sabir¹, Angelika Dampf Stone¹, Shane F. Batie¹, G. Kerr Whitfield², Mark R. Haussler², and Peter W. Jurutka^{1,2} (¹ Arizona State University, Glendale, AZ, ²University of Arizona College of Medicine, Phoenix, AZ)

Acquired from dietary sources or synthesized via sun exposure, vitamin D is converted to the active metabolite, 1,25D-dihydroxyvitamin D (1,25D) which functions as the primary ligand for the nuclear vitamin D receptor (VDR). The activated hormone-receptor complex mediates a

myriad of bioactivities (i.e., cell proliferation/differentiation and chemoprevention of epithelial cancers) by modulating gene transcription in VDR target tissues, including colon and kidney. Resveratrol, a plant-derived polyphenol, functions as a chemo preventative agent and potent activator of NAD-dependent deacetylase sirtuin-1 (SIRT1). The current study employed mammalian-two-hybrid (M2H) and VDRE-based transcriptional assays to probe effects of resveratrol on VDR signaling. Resveratrol potentiated 1,25D-dependent heterodimerization between VDR and RXR, as well as VDRE-driven transcription. 1,25D displacement assays revealed an increase in VDR-bound radiolabeled 1,25D only in the presence of resveratrol, suggesting that resveratrol may *indirectly* increase VDR transactivation by stimulating SIRT1 (a deacetylase protein and known target of resveratrol) and FOXO3, a transcription factor which has been shown to regulate common VDR target genes. Initial studies reveal that FOXO3 activity diminishes when at least one component of a putative trimeric complex of VDR, SIRT1, and FOXO3 is eliminated. Additionally, the upregulation of *p21*, a human tumor suppressor gene, was induced by FOXO3 and VDR in colon cancer cells when treated with both 1,25D and resveratrol. We propose that 1,25D-VDR associates directly with resveratrol-activated SIRT1 and FOXO3 to form a trimeric complex resulting in SIRT1 deacetylation of FOXO3 and VDR, thus leading to enhanced transactivation of tumor suppressor genes by VDR/FOXO3 to attenuate colonocyte proliferation.

IDENTIFICATION OF DIFFERENTIALLY EXPRESSED GENES AS BIOMARKERS FOR DIAGNOSIS OF IRRITABLE BOWEL SYNDROME (IBS): A PILOT GENE DISCOVERY HYPOTHESIS GENERATING STUDY

Maryam M. Hockley¹, Michael A. Galligan¹, Lin Zhang¹, Todd R. Sandrin¹, and Peter W. Jurutka^{1,2} (¹ Arizona State University, Glendale, AZ , ²University of Arizona College of Medicine, Phoenix, AZ)

The diagnosis of irritable bowel syndrome (IBS) is currently based on symptomatic criteria that exclude other conditions affecting the gastrointestinal tract, such as celiac disease, food allergies, and infections. The absence of appropriate diagnostic and therapeutic approaches for IBS places a significant burden on the patient and the health care system due to direct and indirect costs of care. Limitations associated with the application of symptomatic criteria include inappropriate use and/or intrinsic restrictions such as the population to which these criteria are applied. The lack of biomarkers specific for IBS, non-specific abdominal symptoms, and considerable variability in the disease course creates additional uncertainty during diagnosis. This project involves screening colonic tissue samples from patients with verified IBS to identify gene expression-based biomarkers associated with the disease. The current results obtained from two gene chip microarray analyses from a total of 16 tissue biopsy samples have revealed a number of up-regulated and/or down-regulated genes when compared to the genetic profile of matched control non-IBS tissue samples. A select number of genes were further analyzed using bioinformatics to determine their function in biological pathways in the body. This analysis suggested that some of the genes could not only be participants in pathways leading to the inflammatory symptoms that are characteristic of IBS, but that multiple genes working in tandem

may create a genetic "fingerprint" responsible for IBS, and that these gene-expression patterns could serve as a reliable diagnostic tool for IBS.

ANALYSIS OF VOLUTIN FORMATION IN SACCHAROMYCES CEREVISIAE

Pamela A. Marshall, David B. De La Rosa, Lorenzo G. Sanchez, and Matthew L. Starr (Arizona State University, Glendale, AZ)

The budding yeast *Saccharomyces cerevisiae* serves as an effective model organism for many cellular pathways including phosphate transport, accumulation, and storage. In *S. cerevisiae*, phosphate is actively transported across the plasma membrane via several phosphate carriers and is then transported into the acidic vacuole (roughly equivalent to the mammalian lysosome with degradative functions but with additional storage functions, such as calcium) where it is synthesized into volutin, a storage form of polyphosphate, found in many organisms. We have been studying volutin granule formation in wild type cells to determine the physiological requirements for formation and in mutants to determine the pathway by which the volutin biosynthetic proteins are transported to the vacuole. Undertaking an analysis of volutin formation in yeast vacuoles by blocking vacuole function with pharmacological agents, such as ionomycin and CCCP, we see that vacuole pH as well as vacuolar calcium seems critical for volutin formation. Different blocks in vacuolar protein sorting have differential effects on volutin granule accumulation, with volutin granule formation seen in all mutant strains thus far tested, except for *vps33*, a mutant cell strain lacking all vacuolar structure. Our data are consistent with trafficking of the volutin biosynthetic enzymes through either the cytoplasm to vacuole trafficking pathway (CVT) or through the direct Golgi to vacuole vesicle-mediated pathway that sorts alkaline phosphatase to the vacuole (ALP pathway). Our work to determine physiological requirements for volutin granule formation will continue in the future with a new fluorometric method for quantification of volutin in yeast.

INHIBITION OF THE SACCHAROMYCES CEREVISIAE LOW AFFINITY CALCIUM CHANNEL

Lorenzo G. Sanchez, Jennifer Muir, Jennifer L. Kepler and Pamela A. Marshall (Arizona State University, Glendale, AZ)

The budding yeast, *Saccharomyces cerevisiae*, has at least two inwardly rectifying plasma membrane calcium channel systems: the high affinity calcium channel (HACS), the heterodimer of Cch1p/Mid1p, and the uncloned low affinity calcium channel (LACS). To assay the LACS channel activity, we assessed the amount of cytosolic calcium after a 100mM (final

concentration) calcium pulse in untreated wild type cells (BY4742) or cells treated with potential inhibitors of the channel. We treated *S. cerevisiae* cells expressing a cytosolic aequorin with potential inhibitors or a media only control and then placed the cells in a luminometer. Cells were then pulsed with 100mM calcium chloride and cytosolic calcium was assessed by following luminosity given off by the aequorin protein. In the absence of treatment, cells responded to this extracellular pulse with a single peak of aequorin luminosity, corresponding to a cytosolic calcium peak of about 25 μ M, lasting approximately 2 seconds. After this peak, cytosolic calcium returned to approximately baseline. We treated the cells singly with 100mM magnesium chloride, 100mM magnesium sulfate, 100mM nickel chloride, 100mM cadmium chloride, or 10mM gadolinium chloride. Only the magnesium treatments partially inhibit the LACS channel, as indicated by a decrease of the cytosolic calcium spike to about 5 μ M after the calcium pulse in cells treated with magnesium chloride or magnesium sulfate. These data indicate that the LACS channel is potentially a novel type channel, as most calcium channels are either inhibited by nickel (L, N, P, Q, and R) or by cadmium (T and Q).

SOCIAL NETWORKING IN THE COLUMBIAN GROUND SQUIRREL

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

When animals aggregate, they form complex relationships and structures via social interaction. Networks consisting of individuals connected through these interactions may potentially behave as interconnected systems. Indeed, my field observations on a colony of 65 free-ranging Columbian ground squirrels suggest that their society exhibits characteristics of a “small-world” network through social interactions like kissing and sniffing. In addition, the ground squirrel social network displays many of the same characteristics as human networks. Squirrels associate, and often mate with, the “friends of their friends”. On average, any pair of squirrels can be connected via three intermediates, just as non-obviously connected people may be able to reach each other in a relatively “small world” via e-mail or social acquaintances. And squirrels with many interaction partners who are “popular” form cliques by associating with other well-connected squirrels, while “transient” squirrels associate with other transients. Thus, certain individuals appear to play more central roles than others in the cohesion of the network, and simulated removal of individuals that are connected to many other squirrels fragments the network into smaller clusters. Taken together with comparisons from the literature, my results suggest that some general principles that govern social life in apparently simple rodent societies, particularly the maintenance of a social network, have extensions to human social evolution.

CAMPANIAN DINOSAURS OF THE SOUTHERN BASIN AND RANGE PROVINCE

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

Although not as famous or as spectacular as Campanian Age faunas of the northern Western Interior, a remarkable, diverse, and little known record of Campanian dinosaurs is preserved in the Fort Crittenden Formation of Arizona, the Ringbone Formation of New Mexico, and the Corral de Enmedio Formation of Sonora. Study of these faunas is hampered by spotty exposures and generally disarticulated remains making even generic identifications difficult. Despite these issues, continued work is being rewarded by increasing knowledge of a surprisingly diverse fauna. Taxa known to date include: ?allosauroid, small ?dromaeosaur, large dromaeosaur, tyrannosaur, ?titanosaur, hadrosaur, chasmosaur, centrosaur, and ankylosaur *sensu stricto*. Dinosaur track ways, skin impressions, and eggshell are also known as well as pollen, wood, invertebrates, fish, turtle, lizard, and crocodylian remains. Although likely separate sedimentary basins these deposits represent similar intermontane lacustrine, deltaic and riparian systems created by early Laramide uplift with similar source areas. Geochemical evidence suggests seasonal aridity and frequent wildfires. This area represents a productive, unique snapshot of southern, upland dinosaurs of Laramidia.

PRESIDENT'S REPORT

The joint meeting of the ANAS and the Pacific Division of the AAAS was a success, with several students and members presenting posters and talks at the meeting. The setting at University of Nevada at Las Vegas helped to spark enlightening discussions and gave us the opportunity to connect with many individuals from Nevada, Idaho and California. Thank you for helping to make this meeting a success.

I would like to remind you that the Academy has scholarship and grant opportunities. The information can be found at <https://Arizona Nevada academy of science. org/grants.html>.

The Bud Ellis Scholarship of \$1000 is awarded to an Arizona or Nevada high school senior who will be attending an Arizona or Nevada college or university with plans study science or engineering. Applications are due January 15. Three opportunities for grants are available: one for high school students, one each for undergraduate and graduate students. High school grant applications are due December 15 and undergraduate and graduate applications are due November 15 and March 15 respectively. We also accept nominations for an outstanding teacher award.

Pamela Marshall

OUTSTANDING SERVICE AWARD

DR. PETER FFOLIOTT

Dr. Peter Ffolliott has been selected by the ANAS Board of Directors to receive the ANAS Outstanding Service Award for 2013. He has both a distinguished service record to ANAS and to his profession to deserve the award. He was president of the ANAS in 2005-2006 and its recording secretary in 2004-2005. He spear-headed the publications of the annual ANAS Hydrology section meetings proceedings for many years. Without his leadership and material support that publication would not have been as successful as it has been during the last 40 years.

In the area of research, Dr. Ffolliott has a distinguished record in the fields of forestry and forest watershed management in the southwestern United States and in many other arid regions around the world. His research has especially concentrated on the impacts of forest and woodland management on water yield, water quality, snowpack characteristics, erosion and sedimentation. In addition, Dr. Ffolliott's research work has spanned the full array of watershed resources including ecology, tree over stories, herbaceous vegetation, fire effects, numerous wildlife species and their habitats. He has conducted research in these areas for more than 40 years advancing our knowledge of southwestern ponderosa pine forest ecosystems, pinyon- juniper woodlands, and the encinal oak woodlands and savannas. Dr. Ffolliott has collaborated closely with scientists from many universities and the U.S. Forest Service's Rocky Mountain Research Station on numerous studies. He was one of the lead scientists on the Beaver Creek Program in central Arizona that studied the impacts of numerous land management options on multiple natural resources. His research and insights have been published in more than 620 authored and co-authored books, journal articles, Forest Service research papers and proceedings to the benefit

of public and private land managers and university and other researchers. His sustained activities in the advancement of forest science and forestry education have resulted in his election as a Fellow of the Society of American Foresters and the Arizona-Nevada Academy of Sciences.

Academically, Dr. Ffolliott is well-recognized as a skilled teacher who has mentored many undergraduate and graduate students who are now leaders in forestry and watershed management in the United States and many countries around the world. He has conducted international training classes sponsored by the USDA Forest Service, the Food and Agriculture Organization of the United Nations, and other international programs. Dr. Ffolliott has participated in numerous United States government activities, the International Arid Land Consortium, and other international consultations, and was elected a Fellow of the Indian Association of Hydrologists.

Peter Ffolliott has a distinguished career advancing forest biological science by his research and transferring the information gained to students, researchers and forest resources managers in the United States and throughout the world. The ANAS Board of Director's congratulates Dr. Ffolliott and is very pleased to give him its Outstanding Service Award for the year 2013.

Aregai Tecele
Florence Slater
Karen Conzelman

FELLOWS

The following two past and present Presidents of ANAS were selected as Fellows of the Academy:

Shafiu Jibrin

Shafiu is currently Associate Professor of Mathematics at Northern Arizona University. He has been a member of the academy since 2006 and has served as Director for Northern Arizona and President from 2011-2013. In addition, he has been active in the Academy's annual meeting as a session chair for mathematics. He is the author of over a dozen peer-reviewed publications as well as the book, *Redundancy in Semidefinite Programming: Detection and Elimination of Redundant Linear Matrix Inequalities*. He teaches and actively supervises numerous research projects, with both graduate and undergraduate students.

Pamela Marshall

Pamela is currently Associate Professor of Eukaryotic Genetics at Arizona State University, West. She has been a member of the ANAS since 2008 and has served the Academy as Membership Secretary and Poster session chair. She is now President of the Academy. She has authored over 30 peer-reviewed publications, and has received several patents and significant research grants.

Robert McCord

NECROLOGY

The Arizona-Nevada Academy of Science has lost the following members during the past several years. Obituaries are provided where available.

Eleanor E. Davey

Mrs. Davey was the author/co-author of fourteen science books and a contributor to scientific journals and magazines. She was selected as Arizona's Environmental Conservation Teacher of the Year (1973-74) and Outstanding Biology Teacher of the Year (1975). Palmer High School inducted her into its Alumni Hall of Fame in 1987.

Henry Dobyns

David Emerson

Dr. Emerson served as Dean of the College of Science, Math, and Engineering at UNLV, a position he held until 1988. He then served as Dean of the College of Sciences from 1988-1989. Known as a tireless advocate for the sciences, Emerson influenced many students as a chemistry professor. Even after being granted emeritus status, he stayed involved on campus, volunteering, teaching, and conducting research.

Lorenzo K. Lisonbee

Charles H. Lowe, Jr.

Chuck, as he was known by many, who knew him best, was an intense and colorful herpetologist who for many years was a leading southwestern naturalist and ecologist. He directed the development of a herpetological collection, now totaling over 50,000 specimens that is an indispensable resource for systematics, ecology, and conservation in Arizona and Sonora. In 1964, he edited "The Vertebrates of Arizona," a landmark book that also included, under his authorship, detailed descriptions of all of Arizona's natural environments.

Harold Edwin Malde

Hal received the USGS Meritorious Service Award in 1979, with the citation particularly honoring his work with hazards and reclamation. He was active in a number of the dozen scientific organizations to which he belonged. He was a fellow of both GSA and the American Association for the Advancement of Science. GSA activities included associate editorship of the Geological Society of America Bulletin and chairmanship of the Quaternary Geology and Geomorphology division, and he was a councilor of the American Quaternary Association.

Paul S. Martin

Paul's impact on science was deep and transformative, cutting across many disciplines including ecology, paleontology, anthropology, and biodiversity conservation. He is best known for his work on the loss of America's charismatic megafauna, from mastodons and mammoths to saber-toothed cats and sloths. The mystery of the Pleistocene extinction fascinated the naturalists of the 18th and 19th century, including Darwin, Wallace, Lyell, Owen, and Cuvier. Martin first

published on the subject in 1958, formulated a much debated human“overkill” hypothesis in 1966, and later authored seminal works on the subject. Paul’s 50-year journey studying Pleistocene extinction is documented in his memoir *Twilight of the Mammoths*.

Charles “Chuck” Mason

Chuck was a longtime curator of the University of Arizona Herbarium. During his years at the UA Herbarium, Dr. Mason expanded the collection from 105,000 specimens to nearly 300,000. Notable accessions included the Howard Gentry collection of agaves and Homer Shantz' photographic plates. With his wife Patricia, he wrote *A Handbook of Mexican Roadside Flora* (UA Press, 1987), a traveler's guide to Mexican plants. When Pat induced him to travel beyond North America, one of his greatest pleasures was visiting his former students in their countries around the world.

Allan Matthias

Professor Matthias was employed as a faculty member at the Department of Soil, Water and Environmental Science at the University of Arizona for 31 years.

Albert Mead

Achatina, a genus of giant African land snail, was the life's study of Albert R. Mead. For more than 60 years, he was the world's leading authority on the exotic and destructive creature. In 1961, he published the first of two books on Achatina. The second book was published in 1979, and Mead had published at least 85 articles in scientific journals and popular magazines, including *Reader's Digest* and *Atlantic Monthly*.

James Doyle Sell

His early passion for geology eventually took Jim to many places around the world as an exploration geologist specializing in porphyry copper deposits. He retired after 32 years with ASARCO. As an active member of the Arizona Geologic Society and AIME, Jim coordinated and spoke at many geology field trips, explorations, tours, and events in the Southwest.

SCIENCE OLYMPIAD/SCIENCE BOWL LIAISON'S REPORT

In support of our mission to "... stimulate scientific research and education and promote fraternal relationships among those engaged in scientific work ...," the Academy is affiliated with the regional tournaments of two high school academic programs: the Science Olympiad and the Science Bowl.

Science Olympiad (<http://www.gccaz.edu/biology/so>).

The Science Olympiad annually brings together bright minds from high schools across Arizona and prepares them for the opportunities ahead in STEM fields. Since its inception in 1989, this statewide competition has celebrated the accomplishments of young people in the sciences and mathematics, and challenged them to reach beyond the scope of typical school curricula and achieve new heights in content knowledge, skills, problem solving, and innovation.

At the 2013 state tournament held on March 2 in Glendale Community College, the participants' commitment and desire to be the best in their chosen events was evident. At the awards ceremony, their accomplishments were recognized with medallions and ribbons presented to the 1st through 7th place finishing teams in the 25 different events. (Descriptions of the events can be found at:

<http://www.gccaz.edu/biology/so/tournament13.html>)

Even in such a competitive atmosphere, good sportsmanship and a spirit of camaraderie and collaboration dominate the program. As is typical of "real world" science, the students worked together as teams of up to 15 per school to prepare for the tournament, and their support and encouragement of one another as well as other competitors was apparent as they rooted for one another during the day.

All the individual scores were in turn combined to rank the top tiered teams overall out of the 35 competing. (Score sheets can be found at:

<http://www.gccaz.edu/biology/so/images/olympiad2013scores.pdf>).

Catalina Foothills High School from Tucson repeated as the State Champions and represented Arizona at the National Tournament on May 18th at Wright State University in Dayton Ohio.



Catalina Foothill High School SO teams, Tucson, 2013
Blue team (1st place overall) and White (4th place) teams

As we have the last six years, the Academy donated special prizes in memory and honor of Dr. Bud Ellis to top placing teams in two events (<http://www.gccaz.edu/biology/so/specialAwards.html#Ellis>) as well as supply money to the club accounts of ten teams. In addition, several ANAS members joined an army of other community volunteers to help to run the tournament. The 2014 tournament is planned for the first Saturday in March. Anyone interested in assisting next year should contact Karen Conzelman, State Site Director.

Arizona Regional Science Bowl (<http://www.wapa.gov/dsw/scibowl/>)

Science Bowl is a fast-paced, verbal competition where students answer questions at random from the following subject areas: astronomy, biology, physics, chemistry, mathematics, as well as earth and general sciences. Teams of five students compete in this "college bowl" double elimination tournament that gradually whittles all the entrants down to a single first place team. The Science Bowl program is overseen by the Department of Energy and locally by the Western Area Power Authority.



Winning team from BASIS High School, Scottsdale
Arizona Regional Science Bowl, 2013

A total of 31 teams competed in the 2013 tournament, representing 28 different high schools from throughout the state of Arizona. Teams range from those that practice rigorously for this year's event to those fine-tuning their skills for next year. Competition was fierce, but BASIS Scottsdale ultimately won top bragging rights. The Scottsdale Basis team received an all-expense paid trip to Washington, DC, to represent Arizona in the National Science Bowl, at the end of April.

Science Bowl is a proven tool that encourages high school students to excel in math and science and to pursue careers in those fields. By raising the visibility of academic achievement in the sciences, the program has been successful in placing these young people on a par with their peers who excel in athletics.

Agripina Paluch, State Director, Arizona Science Olympiad

Karen Conzelman, State Site Director, Arizona Science Olympiad

Cathy Castle, Asst. Regional Manager for Mgmt Services, AZ Regional Science Bowl