

2010 Presentations at UCUR

BIOLOGY

Variable Plant Genotypes and their Response to Music

GARY BOSSHARDT, BRYCE CARTER, and TERRI HILDEBRAND

Plants, lacking a central processing system, should not vary in their growth or reproduction when exposed to musical stimuli. If this assumption is correct, plant genotypes should have no effect on growth and flowering. To examine this, 288 *Brassica rapa* (Brassicaceae) were selected and equally divided between groups that were true breeding dominant or recessive leaf and stem color (green/purple; yellow green/non-purple, respectively). Plants were further separated into three distinct groups; two of which were exposed to continuous heavy metal and classical music as well as a control group that was not exposed to music. The plants were grown under controlled light and moisture regimes for 45 days. Stem length and flower production was recorded weekly. Using SPSS, data were analyzed using linear regression and ANOVA. Statistical analyses did not find a significant relationship ($p=0.285$) among overall growth, genotype, and the type of music stimulus, although significant differences did occur for some time intervals (Days 7 & 35). Reproduction did vary significantly between genotypes ($p=0.047$) but not by music type. These results support our hypothesis that music stimuli have no effect on plant growth and reproduction, but genetic composition plays a significant role in fitness. Future studies will explore the effects of other traits, e.g. dwarf vs. non-dwarf, on reproduction.

Correlation between Antibiotic Resistance & Heavy Metal Tolerance in Bacteria

BRYCE CARTER and RON MARTIN

The frequency of antibiotic resistant microbes (ABRM) has grown dramatically over the past several decades. This poses a threat to humans and animals alike. ABRM are an increasing threat in hospitals and health related services around the world. Here in Southern Utah, we are affected as well. The surrounding mines located west of Cedar City have been found to have microbes living in a heavy metal environment. Previous research has demonstrated a linkage between antibiotic resistance and heavy metal tolerance (1). Our hypothesis is that there is a genetic correlation between antibiotic resistant microbes and heavy metal tolerance meaning that if a microbe is able to grow with metals such as lead or arsenic, it will have greater potential to be resistant to antibiotics as well. Our goal will be to prove or disprove that conjecture. To accomplish our task, the following has been completed or is in the process of being completed.

- 1) Taking water samples from the surrounding water filled mines; and culturing the microbes found therein on various amounts of nutrient broth mixed with various heavy metal concentrations.
- 2) Add the presence of various antibiotics and test the resistance to the antibiotics

by the microbes. For the controls of the experiment, we will compare the above results to a known freshwater source; we will culture various strains of commonly used antibiotic sensitive bacteria such as *Escherichia coli* to compare to the bacteria found in samples; and culture *Bacillus* and *Acinetobacter* isolates as controls for the metal tolerance testing. The data will then be compiled and presented with further research as a possibility.

The Effect of a Forearm Strength Trainer on Grip Strength, Grip Time-To-Fatigue and Electromyographic Activity

ANDREA DORSEY and PAUL PILLITTERI

There are currently a number of hand/forearm strengtheners on the market designed to increase athletic performance in various sports including golf, rock climbing, and baseball. However, these devices do not undergo physiological testing to demonstrate increased performance and most evidence of their efficacy is based on select customer testimonials. This project is part of an ongoing study, the purpose of which is to evaluate the effectiveness of various hand/forearm strengtheners, a popular hand/forearm strengthener. Twenty male subjects were pre-tested for maximal grip strength and grip time-to-fatigue. Electromyographic (EMG) activity of hand/forearm flexors was also measured during testing. Ten subjects were then given a Metolius GripSaver Plus and a progressive exercise protocol to follow for 4 weeks. Subjects were re-tested at one week intervals throughout the project. Control subjects completed the weekly testing but did not perform the exercise protocol. Data was analyzed for increases in maximal grip strength and grip time-to-fatigue and correlated with changes in EMG activity. The results of this study will be compared with the results of a previous and one future study looking at different devices. The independent physiological testing and reporting of the results will give consumers an unbiased knowledge base for choosing between various products on the market.

Skeletal Muscle Fiber Characteristics in Utah Desert Woodrats

TARAN HANSEN, AMBER NEIGHBOR, PAUL PILLITTERI, and RACHEL D. SMETANKA

Southern Utah is home to several species of woodrats, rodents native to much of the western United States. Due to southern Utah's uniquely diverse geography, woodrat species can be found at varying elevations and different terrains while still within limited geographical region. Study of Utah's woodrat species has demonstrated differences in behavioral patterns based on habitat distribution, but little is known about their physiological adaptations to habitat differences. Numerous studies in humans, rabbits, and several species of rodent have shown significant changes in skeletal muscle fiber type distribution due to differences in habitat. Muscle fiber distribution and muscle characteristics have not been examined in any woodrat species. The purpose of this project was to determine skeletal muscle characteristics and fiber type distribution in desert woodrats (*Neotoma lepida*). Desert woodrats, which live primarily in rocky terrain of lower elevation desert areas, were collected via live traps. The gastrocnemius muscles

were removed and skeletal muscle fiber type distribution was determined via immunohistochemistry. Muscle fibers were also evaluated for total cross sectional area, capillary density, mitochondrial content, and maximal force production. By analyzing other species of Utah woodrats, we can determine the extent of alterations in structure and function of skeletal muscle based on elevation and terrain.

The Effects of Wildfire Retardant on Survival Rate and Development in Xenopus Laevis

LOGAN VANCE, BRETT RICHE, DEREK POTTER, PATRICK BELL, DALLAS WRIGHT, JARED GARLICK, and RACHEL SMETANKA

The African Clawed Frog (*Xenopus Laevis*) is a species of South African aquatic frog found throughout Africa and in specifically introduced populations in North America, South America, and Europe. This species is commonly used as a model of developmental biology due to embryos which are large, easy to manipulate, and develop rapidly. Phos-Chek LC-95A is wildfire retardant commonly used in the western United States. Previous studies have demonstrated that fire retardant has no effect on survival rates in adult aquatic invertebrates. The purpose of the current project is to test the effects of Phos-Chek LC-95A on embryo survival rate and development in *Xenopus Laevis*. To test survival rate, various concentrations of fire retardant were introduced into controlled environments which simulated a common freshwater pond containing *Xenopus* larvae. Both concentrations of fire retardant were detrimental to survival rate. To test the effect of fire retardant on development rate, low doses were introduced into similar controlled pond environments containing various developmental stages of *Xenopus* larvae. It is anticipated that low doses of fire retardant will also be detrimental to the larvae development rate. These results will be used to support and further develop environmental regulations governing the use of wildfire retardant near freshwater sources.

BUSINESS & ECONOMICS

SUU Capture Rates for Iron County and the Factors which Affect Them

JOE BAKER and ALLEN BUTT

This study seeks to explain the trend fluctuations in SUU capture rates (number of students enrolling in SUU/number of students graduating) of Iron County high schools to determine policies to increase capture rates in the future. The study consisted of two parts. The first part was a focus group composed of Iron County HS guidance counselors and the Director of SUU Enrollment Management. From this focus group a number of possible capture rate determinants were developed, e.g., tuition changes, local economic activity, SUU's image, and increased high school diploma requirements. The second part of the study was to test these determinants

statistically. Using 1990-2008 data a multivariate model was estimated. The significant variables were the time trend variable, the high school the students attended, and the unemployment rate. The findings indicated Iron County taxable sales, SUU tuition rates, and the “Raising the Bar” program to be insignificant.

SUU & U: The Correlation between Outdoor Recreation and the Recruitment and Retention of Undergraduate Students

CHARLES BUSCH, KATIE ALVEY, SHARLENE WITT, and DEAN O’DRISCOLL

SUU & U was a research study to answer the question if there was a correlation between recruitment and retention of Southern Utah University undergraduate students and the outdoor recreational opportunities of Southern Utah. This information was to be used in deciding whether or not a promotional campaign featuring these outdoor recreational opportunities should be considered for recruiting students to SUU and what changes would need to be made if such a campaign were to be launched. The study consisted of a two-page survey, the first page being a qualitative gauge of the students’ attitudes towards SUU in general as well as things they liked to do in their free time. The second page consisted of quantitative measures of their outdoor activity levels, venues and activities they participated in, and their feelings about an outdoor recreational centered ad campaign for SUU.

DANCE

Waterfall: The Nature of Water

AMY HUPPI, TARA PRINCE, KARA JOHNSON, ASHTON OLSEN, ARIEL SMITH, KARYN ALLEN, KATIE HECKENBACH, ADREA CURTIS, JESSICA LARRSON, and PAUL OCAMPO

This choreographic work began as a study of balance. When I say balance I was looking at how far you can move a body in space before it falls over, in a kinesthetic sense, balance of the music, Steve Reich Ensemble, and the movement, and a visual sense of balance in the arrangement of the dancers on stage. As the choreography evolved so did the idea. I moved from an abstract idea of balance to water, a medium of natural balance. Water has the capacity to be fluid and continuous as well as sudden and harsh. This dual nature of water presents the essential balance of life to be both fluid and harsh in order to truly be beautiful. This is portrayed in my work through the convergence of streams into a river and concludes as the water descends a great waterfall.

The Caper: A Theatrical Portrayal of the Effect Women and Riches Have on the Male Perspective

KATELIN A. RUZZAMENTI, and SHAUNA T. MENDINI

My main focus when choreographing my dance routine was to convey the plot of a story through the art of dance and characterization. I have used musical theater, jazz, pointe, and tap movement along with theater performance elements to portray characters that produce a complete story for the audience. I have incorporated many themes in my choreography that relate the piece to society today. One idea that I wish to express is the battle of the sexes. The female dancers in my piece use their femininity, alluring movement, attractive looks, and charm to sway the male characters' judgment and distract them from their initial objectives. The male characters use their masculinity and authoritative nature to try not to let the female dancers divert them from their intentions. In the end, the male characters appear to have prevailed when from out of nowhere the female characters charm their way to success. Ultimately this portrays how the strength and power that male figures in society believe they possess can be easily influenced by a pretty face and the simplest of flirtatious looks. Another message I wish to convey with my piece is how society places value on materialism. There are three major personalities portrayed in my piece: a business man who puts his love and value on the jewels that he is selling, another of women who place value in gaining riches and getting their way, and a group of officers who objectify women and place them above their lawful duty. This shows how even though different groups in society place worth in varying sources, they all place greater value in materialistic things whenever they become available. I feel my choreography uses these themes to present a story both entertaining and relatable for the audience.

Alluring: A Study of Femininity

STEPHANIE TERRY, ALEXIS SMITH, KATELIN RUZZEMENTI, LEXIE WEEKS, MEGGAN FORSYTH, and KAY ANDERSEN

Imagine sailing on a ship for five months with no other human interaction except for the unshaven, ape-like physique of the fellow crew. In the distance, a faint hum of women singing overcomes the sound of the harsh waves clashing up against the ship. It becomes the most pleasing tone to the ears that within seconds, becomes more mesmerizing, more intriguing, and more intense. A silhouette of a feminine creature becomes visible as she lies upon a glacier of rocks. The physical characteristics of this creature, along with the sweet singing, become so indulging and so sensual that the ship is lured to its destruction. The tale of *The Sirens* is one of my favorite stories in Greek Mythology. The way these creatures are described as sensual beings and are capable of luring sailors to destruction, reminds me of how women, in reality, can use their physical features to attract men in an elegant way. I choreographed a piece to illustrate that the feminine body is artistically beautiful, and can naturally attract the opposite gender without any use of plastic enhancements. I created a small vocabulary of movement that is reused throughout the piece to emphasize the different features of the dancer's bodies mostly the legs, back, and hips. The slapping of hands to the floor symbolizes the singing of the sirens. I wanted the audience to feel as if they were being lured into the performance, so I created the beginning

and middle of the piece to have a hypnotic quality by using circular spatial patterns and diagonal formations to keep the eyes of the audience active. The ending of my piece is very strong with sharp, unison movement that indulges the audience with so much intensity that they cannot look away until it is over.

Pas de Deux for 9

KATIE WACKOWSKI and CHIEN-YING WANG

This piece is being created in an effort to represent a potentially abstract thought through movement. The piece deals with how we connect with one another on a soul to soul basis and how being part of such a community opens us up to give and receive support no matter where we are in the world or in our separate walks of life. The creation of this piece is also an experiment and observation on modern partnering as a dance style; the particulars of choreographing partnering and working with dancers on a piece that requires a heightened focus and sense of awareness.

EDUCATION

G.N.A.T.S. (Great Native American Teaching Strategies)

GENELL HARRIS, ANGELIA N. HANSEN, KIANA LIVINGSTON, and DARRELL MARKS

Although education has made significant changes towards multicultural learning over the past ten years (Doorlag, 2006) Native American students continue to have twice the drop-out rate of other middle class students (Reyhner, 2006). As future teachers we are extremely concerned about how this issue continues to impact Native Americans' ability to be academically successful (U.S Dept of Education, 1991). Our Question is: What are some effective teaching strategies that can be used to help Native American students'? As naturalistic researchers we describe and interpret human phenomenon: "to be clear about [their] biases, presuppositions, and interpretations so that others (stakeholders) can decide what they think about it all (Guba, 1990)." Our design is based upon a meta-analysis of extensive literature review and triangulation of common findings among two or more studies and interviews. According to O' Donoghue and Punch (2003), triangulation is a "method of cross-checking data from multiple sources to search for regularities in the research data. This meta-analysis approach (Marzano, 2003), will provide the basis for our interviews and teachers of native students, and tribal elders. The hope is that this research will lead to in-service training for current and future teachers, as well as a handbook for teaching Native American students in their classrooms. This research takes us on a journey of discovery of how best to teach Native American students. Knowing learning styles of Native American students and the best practices for teaching these students is important for current and

future educators. As education moves further into individualized instruction with mandates such as, No Child Left Behind, educators need adaptations and instructional strategies found to be successful with Native American students. Teachers deserve every tool possible to meet the needs of ALL students.

NUTRITION

Effect of Cinnamon on Postprandial Glucose

SARAH CALDER, LAURA HUMPHRIES, and CYNTHIA WRIGHT

Controlling blood glucose (BG) is important because type 2 diabetes is a common and increasing problem among Americans. Previous research on the impact of cinnamon on BG has produced conflicting results. The objective of the present study was to investigate the impact of cinnamon supplements on BG concentration among healthy young adults (mean age 22.6 ± 3.3 years). Baseline fasting BG was measured before participants consumed a meal containing 76.25 g of carbohydrate and cinnamon capsules (0, 2, 3, 4, or 5 g) each day of a five-day trial. BG was also measured 30 and 60 minutes post-meal. Cinnamon supplements decreased the peak concentration of the BG curve in males ($p=0.040$) and in those with a family history of diabetes ($p=0.026$). Additional research on the impact of cinnamon supplementation on postprandial BG among individuals diagnosed with type 2 diabetes is warranted before health claims are made.

Food Security among Students, Staff, and Faculty of Southern Utah University

HEATHER F. SANDALL, BROOKE N. NELSON, and CYNTHIA B. WRIGHT

Food security is the access by all people at all times to enough food for an active, healthy life. It is considered one of the requirements for a healthy, well-nourished population. In 2007, 89% of households in the United States were food secure. In light of the current economic environment, food security may now be a greater problem. This study was conducted to assess the current status of food security among students, faculty and staff at Southern Utah University (SUU) and how food security at SUU compares to food security in Utah and the United States. Data was collected using a survey developed by the Economic Research Service of the United States Department of Agriculture, the same survey used to gather data on the status of food security nationally. Results revealed food insecurity is more prevalent among SUU students and staff than in Utah and the United States. However, comparison of SUU data to Utah and U.S. data was made using the 2007 (most recently available) state and national data on food security. The state of Utah is in the process of gathering data on the current status of the food security of its residents. Future comparison of SUU data to new state data will provide a more accurate picture of how food security at SUU compares to the rest of Utah in the current economic environment.

Breathing Control and Oxygen Saturation in Collegiate Intermediate to Advanced Female Dancers

KATHERINE L. HECKENBACH and JULIE E. TAYLOR

Dancers often use breath control during training for various reasons. However, in the intermediate and advanced levels, dancers are no longer conscious of their breath. Upon observation, dancers appear to hold their breath while performing some of the most basic ballet barre exercises. The purpose of this study was to determine whether conscious breath control affects blood oxygen saturation in collegiate dancers of this level as compared to more natural breathing patterns. Fifteen female dancers, ages 18-25, of an intermediate to advanced level, were recruited for the study. Dancers were classified as intermediate or advanced if they had completed an intermediate level ballet class at Southern Utah University. During the study, they were asked to complete a series of ballet barre exercises under certain verbal cues. Their blood oxygen saturation was measured before and after the exercise bout using a non-invasive fingertip pulse oximeter. Oxygen saturation levels gave us an objective measure to discover how conscious breath control affected oxygen levels in the body. The use of verbal cues for dancers will be discussed along with the effect of these verbal cues on oxygen saturation. In the future, these methods could be further evaluated on other athletic populations; also, it may be beneficial to see how increased oxygen saturation affects rating of perceived exertion (RPE) and fatigue levels.

The Effect of Time Spent Doing Muscular Strengthening Activities on Body Age in Senior Athletes

LINDI A. MATTHEWS, JUDY HIGBEE, and JULIE E. TAYLOR

Muscular strength can be achieved in many ways. Muscular strengthening activities were defined as strength training, resistance training, push up, sit-up and other calisthenics. As age increase muscles mass decrease. For many seniors this causes problems such as falling and joint problems. This study looks at the time that senior athletes spend doing muscular strengthening activities per week and whether it reflects in their Body Age. Body Age is a calculation based upon fitness and health measures that represents chronological age relative to biological age. 80 Senior Athletes volunteered to participate in a health risk evaluation and fitness assessment to determine Body Age. Athletes were recruited for this study came from the 2009 Huntsman World Senior Games in St. George, Utah. The Huntsman Senior Athletes participated in a questionnaire and a Body Age Assessment. From this information discussions will include how much time they spent doing muscular strengthening activities and how this relates to their muscular strength that is given by the Body Age assessment. As well as how this reflects in their overall Body Age.

Does The Intensity of Physical Activity Effect Coronary Artery Disease Health Risks Among Active Senior Citizens?

RACHELLE WENDLER, JUDY HIGBEE, and JULIE E. TAYLOR

Previous studies indicate that the amount and type of physical activity has an effect on health risks across all ages. The intensity and duration of activity effects many aspects of individual health. The purpose of this study was to evaluate the relationship between the intensity of regular physical activity and coronary artery disease health risks including: cholesterol levels, blood pressure, height and weight, blood glucose levels, smoking habits, coronary artery disease signs, symptoms and family history of disease. Our goal is to answer the question, do senior athletes regularly participating in vigorous physical activity have fewer health risks compared to those participating in moderate physical activity and if so, how much time is required to see reductions in risk? Active seniors (n=80) participating in the Huntsman World Senior Games in St. George Utah in October 2009, participated in a survey of self-reported physical activity and health risks. These surveys allowed us to identify the athletes primary coronary artery disease risk factors and how much time they spent doing vigorous and moderate physical activity. Vigorous activity was stated to be jogging, swimming, brisk walking, etc. Moderate activity was said to be sports such as golf, yard work, bicycling on level ground, etc. The number of primary cardiovascular disease risk factors was compared to intensity and duration of physical activity among the senior athletes. Discussion will include how the intensity and duration of physical activity may influence health risk factors among seniors. Results could impact the exercise prescription designed to improve health among active seniors.

The Effect of Time Spent Participating in Moderate and Vigorous Activity on Body Age in Senior Athletes

HILLARY WHITE, JUDY HIGBEE, and JULIE E. TAYLOR

Body Age is a calculation based upon fitness and health measures that represents biological age as compared to chronological age. Differences in Body Age exist between senior athletes of different sports and even athletes of the same sport. Some possible explanations for these differences are the amounts of time athletes spend training per week and whether the activity was moderate or vigorous. The purpose of this study was to determine if self-reported physical activity is predictive of Body Age, and whether intensity or volume of activity is a better predictor of Body Age. Subjects for this study were recruited from the 2009 Huntsman World Senior Games in St. George, UT. Eighty subjects volunteered to participate in a health risk appraisal and fitness assessment including: blood pressure, resting heart rate, height, weight, body fat percentage, a bicep strength test, a modified sit and reach, and a submaximal cardiovascular fitness test. Based on these results, a Body Age was calculated for each subject. Subjects also completed a questionnaire where they reported the amount of time spent participating in vigorous and moderate activity per week. Self-reported physical activity was compared to Body Age results to determine the relationship between PA and Body Age, and whether intensity or volume of activity is a better predictor of Body Age. Past studies have concluded that there is a difference in Body Age between Huntsman Senior Games athletes and

non-athletes. Discussion of this study will include differences in Body Age in senior athletes based on amount and duration of physical activity.

PHYSICAL SCIENCE

Studying Solubility of Gases in a High Porous Polymer Using Positron Annihilation Spectroscopy

ZANE BAIRD, DYLAN GARY, WILLIAM TANNER, JAMES CHISHOLM, HUSSEIN SAMHA, and RENWU ZHANG

Solubility of gases in polymers is determined not only by its chemical structure, but also but its physical properties. This process is described by a so-called dual model, in which both Henry adsorption (determined by chemical structure) and Langmuir adsorption (determined by physical property) are considered. Since Langmuir adsorption is related to the trapping of gas molecules inside free volume holes, the solubility of gases must be related to fractional free volume of polymers. In this project, we try to use a high porous polymer, poly(trimethylsilyl-1-propyne) (PTMSP) as a the model sample and modify its free volume by using the chemically similar organic filler, trimethylsilylglucose (TMSG). By doing this, we may keep the same chemical environment but only change its physical property, fractional free volume. We will measure the free volume change in PTMSP upon the different load of filler by using positron annihilation lifetime spectroscopy (PALS). Meanwhile, we will utilize the reference data on the gas solubility in the same systems to correlate the solubility of gases to the free volume in the polymer. The relationship of Langmuir adsorption and the gas solubility versus fractional free volume in polymers will be explored.

Total Synthesis of the Alkaloid Siamenol through a Short Sequence of Reactions

DAVID BAUMANN and MACKAY STEFFENSEN

Siamenol is a carbazole alkaloid isolated from the tropical shrub, *Murraya simensis*, found to exhibit anti-HIV activity. The proposed total synthesis of siamenol involves the use of simple starting materials and easily manipulated reagents. The key step will utilize a Fischer indole synthesis to couple a properly derivatized aminophenol with a corresponding 4-methylcyclohexanol. Other key reactions include the aromatization of the resulting acyclic ring with tetrachlorobenzoquinone to form the carbazole skeleton. A Claisen rearrangement will be employed for rearrangement of the prenyl ether, to the prenyl phenol moiety. Preliminary test reactions show the proposed route is promising and efforts towards the total synthesis of siamenol will be presented.

Molecular Distribution Behavior of Cyanine Dyes in Aqueous Solution

JARED GARLICK, DAVID BAUMANN, BRYAN CLARK, and HUSSEIN SAMHA

The molecular distribution of the cyanine dye (5-chloro-2-[3-[5-chloro-3-(4-sulfobutyl)-2(3H)-benzothiazolylidene]-1-propenyl]-3-(4-sulfobutyl)-benzothiazolium hydroxide triethylamine salt, NK-3796) in aqueous solution was investigated using absorption and emission spectroscopy. Dimers of the dye are formed in concentrated solutions, while monomers dominate more diluted solutions. J aggregates are formed in solutions containing electrolytes such as sodium chloride, calcium chloride, and di-hydrogen ammonium phosphate. The dye readily forms J aggregates upon mixing with electrolyte. The J aggregates formation was followed spectroscopically by the appearance of a red-shifted narrow band centered at 653 nm in the absorption spectra. A similar shift is also observed in the emission spectra. The absorbance bandwidth is dependent on the charge of the cation of the electrolyte. This suggests different ground-state conformations for the J aggregates in solution.

Analysis of the Narayanaswamy Model for Relaxation Using Adam-Gibbs Theory

DYLAN GARY, ZANE BAIRD, WILLIAM TANNER, JAMES CHISHOLM, HUSSEIN SAMHA, and RENWU ZHANG

When temperature is reduced to a certain point, almost all polymeric materials will reach a glass state, in which the molecules are frozen in the liquid state but the material is exposed as a solid state. The glass state is a quasi-equilibrium state and tends to relax to its thermodynamic equilibrium state. This process is called physical aging. The aging process is determined not only by the characteristics of the material, but also by its thermal history. The widely accepted phenomenological model used to describe the aging process is called the Narayanaswamy model. This model, however, is contradictive to the general Vogel F T (VFT) equation describing the temperature dependence property of material within the glassy transition range. In order to solve this discrepancy, the Adam-Gibbs theory on the liquid cooling process was used to analyze and interpret the Narayanaswamy model. It is hypothesized that the activation energy parameter (ΔH) is not constant during the molecular rearrangement as expressed in the Narayanaswamy model. In addition, the relation between the glass transition temperature (T_g) and the Kauzmann temperature (T_z) (a characteristic temperature at which a polymer's molecules have zero configurational entropy) is also discussed in the presentation.

Heavy Mineral Provenance and Clay Mineralogy of a Devitrified Carbonatite Tuff from Southwestern Tanzania: Implications for the Initiation of the East African Rift System

TRENTON HASKELL and ERIC ROBERTS

Recent fieldwork in southwestern Tanzania has resulted in the discovery of a new Paleogene sequence of fluvial and lacustrine strata in the Rukwa Rift Basin. Within these rocks are a series of bizarre claystone beds with calcite pebbles. These claystones also contain an odd assortment of rare and unusual heavy minerals, which leads us to interpret these beds as volcanic tuffs of carbonatite origin. To test this hypothesis, we sampled one of these claystones for detailed clay and mineral analysis. The coarse fraction was first separated from the clay fraction. We then separated the coarse fraction into light and heavy fractions based on density and magnetic susceptibility. The identified heavy minerals include euhedral phlogopite, andradite garnet, titanite (sphene), and apatite; with a significant component of the light mineral sanadine; and minor amounts of magnetite, clinozoisite, ankerite, hematite, and pyrochlore. This unusual assemblage of minerals strongly supports an alkalic volcanic origin of unusual type (such as a carbonatite). Next, using settling velocities to separate the clay from the silt, the clay fraction was analyzed using x-ray diffraction, which identified montmorillinite as the dominant clay mineral. This result further supports our hypothesis of a volcanic origin. The confirmation of these units as carbonatite volcanic ash beds, coupled with a new radiometric age date of 24.9 Ma, makes these the oldest volcanics in the Western Branch of the East African Rift System. This pushes back the previous age of tectonism and development of this part of the rift by nearly 15 million years. These carbonatites are also significant in that they can help both geologists and paleontologists understand the formation and evolutionary history of the East African Rift System and its important vertebrate faunas.

Characterization of Storm Water Runoff in the Coal Creek Drainage Basin

SAMANTHA HUNTSMAN, SHANNON FORCE, DARREN DILLARD, LAUREN BUNKER, WHITNEY GREENHALGH, JORDAN LEACH, KIM WEAVER, and J. TY REDD

Coal Creek is a small, perennial stream, fed by mountain runoff, which is located in the Coal Creek Drainage Basin in the Cedar City, Utah area. The increasing urbanization of the Cedar City area raises concern about the water quality in the basin. This study focuses on characterizing pollutants from non-point sources and their impact on the water quality of Coal Creek and the organisms living within it. Analytes of interest include: common anions, mineral metals, pH, turbidity, conductivity and pesticides. The determination of pollutant concentrations in runoff and affected surface water will be beneficial to understand basic sources of non-point source pollution. It is hoped that this study will help to better understand the effects of population growth and urbanization on the water quality of Coal Creek and the organisms living within it.

Structural Studies of a Halophilic Archaeal Malate Synthase Enzyme

GEOFFREY THOMAS, KENNETH LAMLENN, and BRUCE HOWARD

Malate synthase is one of two enzymes unique to the glyoxylate cycle, the other being isocitrate lyase. This metabolic pathway has been identified in all three domains of life, and allows plants

to convert fatty acids to citric acid cycle intermediates, and allows microorganisms to survive on two-carbon compounds such as acetate for a sole carbon source. The glyoxylate cycle has been shown to be important for the virulence of pathogenic organisms such as *Mycobacterium tuberculosis* and *Candida albicans*, and is therefore a target for antibacterial and antifungal drug development efforts. Malate synthases found in cells of the halophilic Archaea constitute a third isoform of this important metabolic enzyme, in addition to the well characterized A and G isoforms. They are active in 3 M salt concentrations, and they share very little sequence similarity with these other two isoforms. Database searches using basic local alignments reveal relationships between isoforms A and G, but do not indicate a significant sequence relationship between members of this third isoform and those of isoform G, and only a distant relationship with members of isoform A. This third isoform, which we propose to call isoform H (Halophilic archaeal), is also significantly smaller in size: ~100 residues shorter than isoform A, and ~300 residues shorter than isoform G. Representatives of both isoform A and G have been structurally characterized, but no three-dimensional structural information exists for isoform H. Here we report the crystallization and preliminary X-ray diffraction from a crystal form of an H-isoform member, the malate synthase from the halophilic archaeon *Haloferax volcanii*, originally isolated from the mud of the Dead Sea. This crystal form diffracts well, and is amenable to single crystal X-ray analysis.

Dynamical Considerations of Clusters of Galaxies through a Simple N-Body Simulation

BRANDON K. WIGGINS and BRENT A. SORENSEN

As part of ongoing research intended to investigate the possibility of detecting transverse motion in extra-galactic systems, we aim to adequately simulate a large, spherically symmetric cluster of galaxies. Within this paper we propose a simple n-body code capable of modestly simulating the kinematics of a regular cluster of galaxies. We review basic methods of n-body simulation and explain the simple particle-to-particle algorithm utilized to produce viable velocity vectors representative of cluster members. Our discussion focuses primarily on the modeling of the intra-cluster medium (ICM), cold dark matter (CDM) and the initial distribution of galaxies along the cluster radius. Various elements of cluster dynamics are reviewed along with potential difficulties incident to n-body simulations. Discussion is provided on these points and on the methods utilized within the proposed code to account for these issues. We also present preliminary results of the n-body simulation.