A Comparison of Coastal Sage Scrub Communities in California and the Effect of Environmental Aspects on Plant Adaptations

Danielle Amoroso and Barbara Collins, Ph.D.
Biology Department
California Lutheran University

This research aimed to shed new light on the composition of coastal sage scrub communities and how our changing environment has affected them. Three different areas were researched, including the north and south facing slopes of Mt. Clef in Thousand Oaks and the south-facing slope near Thornhill Broome beach. While little research has been done on the differences in this particular plant community, it is known that the south slope receives up to six times more sunlight than the northern slopes. This allows for great differences in species in the same community, within a few hundred meters of each other. Along with differences in overall sunlight, there is a marked difference in soil fertility and composition, bacterial levels within the soil, and temperatures on the surface. In order to analyze the plants themselves, the quadrat method was employed, allowing for two square meters of land to be studied at a given time. In addition to height measurements, density and dominance of species, and relative importance was calculated. Textures of plants were also studied using a dissecting microscope.

Preliminary results indicate great differences in the various areas that were studied. Although wild buckwheat was dominant on all three slopes studied, there was very little similarity of species on the various slopes. Heights also varied, with those on the north slope being the tallest, and those at Thornhill Broome being the shortest. Soil moisture was initially greatest on the southern slope of Mt. Clef, possibly a result of runoff after a recent rain. Leaf textures and sizes varied as well, those at the beach were greener, more succulent, and with fewer trichomes. The results of this study will continue to be compiled over the next year enabling analysis of seasonal differences as a result of environmental fluctuations.

This community is home to many threatened or endangered plant and animal species, and provides a corridor to other plant communities. This research aspires to understand the reasons why the community is at risk, as well as promote awareness to the public and society as a whole.

Research supported by the Swenson Summer Research Fellowship Program

Refugees and Access to Higher Education: A Case Study of Iraqis in Los Angeles

Erin Boettcher and Akiko Yasuike, Ph.D.
Global Studies Department
California Lutheran University

The purpose of this project is to examine refugees' access to institutions of higher education through the study of the Iraqi refugee population in the Los Angeles area. The Iraqi population was chosen because of their relatively high education levels and socioeconomic status upon arrival in the United States, making their chances for success in higher education much more likely.

Refugees are an important group to study because they have unique experiences that contribute to their unique needs in a new country that are not consistent with immigrant or international students. Iraqi refugees are an especially important group to study because the United States' military involvement in Iraq has led to the destabilization that has caused many individuals to flee the country. Further, education represents a positive opportunity for refugees that may not have been available to them in their home country that provides benefits for refugee students.

To examine this topic, the researcher conducted seven interviews and two site visits in order to gather data. Interviews were conducted with Iraqi refugees, employees of refugee assistance agencies, and employees of community colleges with a large number of refugee students, giving a variety of perspectives.

This study finds that despite the strengths of organizations, refugees still face many challenges in accessing higher education that have been further exacerbated by the recent economic recession. Employment tends to be a higher priority than receiving further education. Ethnic networks were seen to have both positive and negative effects upon refugees' ability to access higher education.

Research supported by the Pearson Scholars for Leadership and Engagement in Global Society

Isolation, Culturing, and Sequence Analysis of Feline Leukemia Virus

Courtney Burch and Dennis Revie, Ph.D.
Biology Department
California Lutheran University

Feline Leukemia Virus (FeLV) is known to cause many diseases that are usually fatal to cats. Felines can transmit the virus to another cat very easily. The virus can be transmitted through saliva, urine, feces, or mutual grooming. This study focuses on analyzing the DNA sequence of a known strain of the virus and using a cell culture system to compare with the known FeLV strain.

The DNA sequence gives an array of valuable information. It can tell us where genes are and where mutations are that code for drug resistance. Updating the virus genome is very important, because it has not been extensively studied for over 20 years. Cell culturing allows us to grow the virus in a controlled setting. By doing this we can learn about how the virus acts as if it was infecting cells within a cat. By growing the virus in a cell culture system, we can test to see what cell lines it can infect, which is important in understanding what and where the virus can infect.

We were able to successfully grow the virus in culture and infect HFF cells. This allowed us to further analyze and compare with the known FeLV strain, which will help us understand if the virus has changed over time. Sequencing the DNA of the virus allowed us to do these comparisons. Notable differences in the DNA sequences indicate that the virus has changed. This is very important because a more effective vaccine for cats can be made. The study of this virus is not only beneficial to cats but to humans too. It can help us understand other related human viruses, it can provide valuable information for others to use, such as in making better vaccines, and it can allow successful treatment and control of the virus.

Research supported by the Swenson Summer Research Fellowship Program

Pre-Raphaelite Painting Technique

Joseph Clarkson and Michael Pearce, Ph.D., MFA
Art Department
California Lutheran University

Background: The Pre-Raphaelite brotherhood had their own unique way of painting which created brilliant colors on the canvas and added a new brightness to their paintings. This Technique was almost completely lost in the 20th century. **Purpose:** The primary aim of this study was to reproduce the original style but using modern resources. **Methods:** I had 4 different panels gessoed in 2 ways, a traditional styled gesso and a modern acrylic gesso. On top of this, each painting was sealed with a different type of white, flake; foundation, zinc and silver, all have a different texture, feel, and look. I then painted everything in the same way using a special wet-white glazing technique, a very difficult process that takes patience and skill. **Results:** The Process produced two paintings that represent the Pre-Raphaelite style, while the two others did not have the same effect and were abandoned before the skin tone was applied. These two were abandoned because of the ineffective glazing properties that the particular white created on the surface of the piece. **Conclusions:** Using the wet white technique and a small striping brush I was able to closely reproduce Pre-Raphaelite style. Zinc and silver white were the best pigments to use due to the fact they had the proper transparency, texture and a slightly slick surface for glazing.

Research supported by Summer Undergraduate Research Fellowship (SURF) Program

Development of Neuroscience Lab Exercises Utilizing the SpikerBox and Biopac Data Acquisition System

Joe Crump and Kenneth Long, Ph.D.
Department of Biology
California Lutheran University

Effective demonstrations and laboratory investigations of physiological principles are valuable tools for students at different educational levels. We wish to expand the applications of the cockroach leg preparation for use in both secondary and undergraduate programs. To this end we employed both the SpikerBox system (Backyard Brains), which has been used in science outreach programs in secondary schools and the Biopac data acquisition system, which is commonly used in undergraduate physiology labs. The SpikerBox unit allows the easy demonstration of the neural responses generated by movement of tarsal joints and tibial spines of the cockroach leg. Simple pin electrodes fix the leg to a cork substrate and detect extracellular action potentials generated by sensory nerves in response to tactile stimulation. The unit amplifies the signals and converts them to an audio output. We connected the output of the SpikerBox to a Biopac MP36 system allowing the recording and measurement of the sensory responses. The low voltage stimulator of the Biopac MP36 was used to deliver stimuli of various durations (0.1 -1.5 ms) and the threshold voltage for each stimulus duration was determined by finding the lowest voltage that caused a visible twitch of the tarsus. Stimuli were delivered via needle electrodes or by attaching clip leads to the recording pins (allowing sensory and motor testing in the same preparation). This exercise readily produced a classic strength-duration curve. While the cockroach leg is not considered to be a preparation that is amenable to pharmacological experiments, we tested the effects of volatile anesthetics on both sensory and motor responses. Diethyl ether, chloroform, and FLyNap® severely depressed sensory and motor activity. The effects of chloroform and FLyNap® were not reversible; however, the effect of ether was readily reversible. The sensory and motor responses recovered at similar rates. The effect of ether on the motor response was assessed by generating strength-duration curves during and after exposure. Ether shifted the strength-duration curve to the right (rheobase and chronaxie were increased) indicating a loss of neural excitability.

Research supported by the Swenson Summer Research Fellowship Program

Correlation between Grain Dislocation Density and Orientation for Naturally Deformed Mantle Xenolith from the Jagersfontein Mine

Quinton Guerrero (Monmouth College) and Quinlan Smith (California Lutheran University)
UNLV Physics REU Advisor: Pamela Burnley
Dept. of Physics, University of Nevada Las Vegas, Las Vegas NV 89119

Determining the reaction of poly-crystalline structures to induced stress is an extremely difficult problem in contemporary engineering and geology. The main challenge lies in the inhomogeneity of the grains inside of the poly-crystalline structures. To predict the response of a certain polycrystalline structure to a specific stress, you must resort to one of two views on grain interaction, an orientation or propagation based model. For every material there may be certain correlations between the prediction model used and the actual deformation that occurred. Our work centers on describing the correlation of these prediction models with a sample of naturally deformed mantle xenolith from the Jagersfontein Mine in South Africa. In order to correlate the models with the sample, we needed to calculate the orientation and dislocation density of the individual grains. To measure the dislocation density, the ratio of the area of the dislocations to the total area of the grain itself, the sample needed to go through a decoration process. The sample was heated to accelerate oxidization and highlight the sample's dislocations. This "decorating" process allows us to easily discern the dislocations on the surface of the sample using a Scanning Electron Microscope (SEM). Dislocation density can then be calculated by using an open-source image analysis software called ImageJ on the image of the grain. Additionally, the other calculation, the orientation of the grain, is measured by an Electron Backscatter Diffraction (EBSD) analysis of the sample. The EBSD is a process of firing electrons at the sample and reading the diffractions produced. These diffractions create a "picture" of Kikuchi Bands, simply the diffraction lines produced by the electrons, which can be analyzed by proprietary software resulting in a calculation of the orientation of each grain. We were then able to look for correlations between the dislocation density and the orientation of each grain and identify which model describes the deformation results most accurately.

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Liberation, Resistance, & Rap: A Redefinition of Religion

Aminah Hassoun and Samuel Thomas, Ph.D.
Religion Department
California Lutheran University

This study analyzes the religious dimensions of underground rap music as lived religion. A study of rap in this way demonstrates a primary function of religion is to provide a means of resistance, social transformation, and spiritual liberation for the oppressed. Rap is a Black cultural art form that emerged from of the wastelands of ghettoized inner-cities across America into a creative tool to transmit ideas and messages to its audience. Rap is the response of young urban communities in the face of systemic oppression and lived experiences of marginalization. Through persistent self-reflection, redefinition, and subversive or alternative visions of reality, rap music is a conscious tradition of social resistance and spiritual liberation. Its lyrics form the corpus of an inter-textual tradition; its artists, the prophetic voices that speak on behalf of the voiceless. Through the vantage point of Liberation and Black Theology, particularly drawing from the works of Gustavo Gutierrez and James Cone, rap exhibits spiritual sensibilities and reveals its function as a religious modality. This study undertakes a preliminary interpretation of rap while recognizing the vast range of artistic expressions and uses of the music. Primary sources sample less-commercialized, "underground," and independent artists like Talib Kweli, Immortal Technique, Nas, and Little Brother whose music is imbued with the grassroots spirituality of its participants. Textual analysis of the discursive, ritual, contextual, and transcendent dimensions of rap music forms the basis of understanding hip-hop culture as a liberation movement for disenfranchised minority youth.

Research supported by Summer Undergraduate Research Fellowship (SURF) Program

Economic Impact of CLU Student-Athletes

Rachel Heagy and Kirk Lesh, M.B.A.
Economics Department
California Lutheran University

This study has been performed to look into the economic impact of California Lutheran University's student athletes and the effect of athletics on their academic performance. To get a full idea of the impact that the student athletes have on the school and community this project has been broken up into four different sections. The first section shows the economic impact that building the new athletic facilities had on the local economy. The next looks at the economic affect the student athletes have on the local economy. The third shows the economic impact that CLU's student athletes have on the school. The final part of the project compares student athletes' and non-athletes' performance in the classroom.

A program called IMPLAN was used to run the statistical analysis for this study. IMPLAN ran an analysis that identified and measured the economic impact of the CLU athletic facilities and the student athletes within the county. To see the effect that students bring to the local community we looked into a study previously done by Dr. Damooei. To compare academic performance, we first looked into athlete GPA's and majors and compared different athletic teams. Also, we looked into the academic performance of athletes compared to other students on CLU's campus. The data shows that CLU student athletes have a large financial impact on the school. Between the tuition that the students pay and the revenue that hosting sporting events brings to the community, CLU athletics generates a large portion of CLU's funding. Building the new athletic facilities generated over 85 million dollars for the community. Finally, athletic GPA's proved to be in line with non-athletes GPA's.

Research supported by Summer Undergraduate Research Fellowship (SURF) Program

Association of Nutrition and Physical Activity on Sarcopenia and Osteopenia in the Elderly

Emily Hnath and Louise A. Kelly, Ph.D.
Exercise Science Department
California Lutheran University

Background: With advancing age there are significant changes in body composition such as increased body fat, gradual loss of muscle mass and function (sarcopenia) and deterioration of bone (osteopenia). Research shows that a healthy diet and participating in physical activity may be the key to slowing down the process of aging, but research is conflicting. **Purpose:** To investigate the relationship of dietary intake, nutritional status, physical activity on sarcopenia and osteopenia in the elderly. **Methods:** 165 men and women (mean age 73.99$\pm$6.54 years) were recruited to participate in the study. Body Mass Index (BMI) was calculated by measuring height to the nearest 0.1cm and weight to the nearest 0.1kg using a beam and a medical scale. Body composition was measured by dual X-ray absorptiometry (DXA). A BMD t score below -1.0 defined Osteopenia and sarcopenia was defined as appendicular lean mass/total muscle mass. Dietary intake and physical activity were assessed over a 3-day period using diet recalls and the Actigraph GT1M accelerometer. Pearson correlation coefficients were used to examine the relationship between diet with Sarcopenia and Osteopenia, and Spearman's rank correlations were used to examine relationships between physical activity intensities with Sarcopenia and Osteopenia. All data was analyzed using SPSS version 18 (SPSS, Chicago, IL), with a significance set at $P< 0.05$. **Results:** Sarcopenia was positively correlated with light (rho = 0.30, P = 0.02) and vigorous physical activity (rho = 0.22, P = 0.03), total caloric intake (r=0.37, P<0.00), total carbohydrate intake (r=0.36, P<0.00), total protein intake (r=0.29, P=0.03), and total fat intake (r=0.41, P<0.00). Osteopenia was inversely correlated with sedentary behavior (rho = -0.20, P = 0.04) and was not correlated with any of the dietary variables (P>0.05). **Conclusions:** These data suggest the relationship between sarcopenia and osteopenia may indeed be mediated by physical activity and nutrition.

Research supported by the Swenson Summer Research Fellowship Program

Mapping a complex mutation in Drosophila: a Large Scale Deficiency Screen for Non-Complementation of the extra eye Mutation

James Hougen and David Marcey, Ph.D.
Biology Department
California Lutheran University

The genetics of a complex morphogenetic mutation, extra eye (ee), in Drosophila melanogaster has been difficult to decipher because of several unusual features of the mutation. The mutation displays incomplete penetrance, variable expressivity, and conditional dominance, all of which are enhanced by the presence of P transposable elements in the genome. Previous recombination mapping of the mutation showed that the extra eye gene is on the left arm of chromosome 2, near a P element inserted at chromosome band 26D1-2, but this mapping was imprecise because of complications due to the novel features of the mutation mentioned previously. We therefore undertook a complete deficiency mapping project of the entire second chromosome, screening for extra eye phenotypes in the F1 of of crosses of ee to over 200 second chromosome deficiency stocks. Interestingly, one deficiency, distal to the original ee map position, exhibited complete lethality over ee. We are now obtaining mutants for genes uncovered by this deficiency in order to conduct complementation tests with ee. This work may help explain some of the anomalous genetic results observed in previous experiments, and may shed light on the nature of the ee mutation. In a broader context, this work will help us understand some mechanisms by which genes coordinate tissue development.

Research supported by funds from the Fletcher Jones Chair and CLU Biology Department

Identification of genes in B cells and T Cells that Change Expression After Hepatitis C Virus Infection

Luis Jimenez and Dennis Revie, Ph.D.
Department of Biology
California Lutheran University

The Hepatitis C Virus (HCV) is an enveloped, positive, single stranded RNA virus. HCV infection may lead to cirrhosis of the liver and hepatocellular carcinoma. It is estimated that about 3.2 million people in the United States and about 200 million people worldwide are infected with the HCV. B cells and T cells are lymphocytes that are responsible for the immune response of the body. B lymphocytes are responsible for the humoral immune response and are precursors to antibodies. T lymphocytes are responsible for cell-mediated immunity in the body. The purpose of this study is to compare uninfected and HCV infected cells to identify differences in messenger RNA production.

Cultured B cells and T cells are infected with HCV. The infected cells are then isolated and the RNA is purified. RNA is converted to complementary DNA (cDNA) by reverse transcriptase (RT). The cDNA was then amplified using nested PCR, which results in specific copies of a DNA region. The resulting DNA then undergoes gel electrophoresis. If a high quality band of the right size is produced, real-time PCR is used to determine the concentration of DNA and thus the concentration of RNA. To culture HCV, serum from an infected patient is used to infect monocytes or macrophages, and the HCV which is produced is then used to infect B or T cells. Producing infected cultured cells has been difficult, but we have used RT-nested PCR to show that monocytes have been infected with HCV. We have also been able to replicate negative strands of the DNA, evidence that HCV is replicating. We will next-determine DNA concentrations using real-time PCR.

Research supported by the Swenson Summer Research Fellowship Program

A Comparison of Three Methods to Determine Critical Running Velocity in Healthy Adults

Neika Maryn and Jason T. Penry, Ph.D.
Exercise Science Department
California Lutheran University

Critical power describes the maximal sustainable power generated by aerobic metabolism during a given work modality, and is predictive of maximal endurance exercise performance lasting 15-30 minutes. Critical power has been widely studied in cyclists; however, little work has been conducted in runners. Due to the weight-bearing nature of running, maximal sustained velocity (critical velocity) is used in lieu of critical power. **Purpose**: This study was designed to (1) investigate the utility of a short duration, maximal-velocity field test of critical velocity in recreationally active individuals, and (2) to examine the criterion validity of a longer duration, submaximal-velocity field test across a range of fitness levels. **Methods**: Twenty subjects (mean age = 22.7 years ± 4.5) completed the criterion treadmill test of critical velocity (CRIT), the Endurance Capacity Test (ECT), and the 3-Minute All-Out Run (3MR). Data were analyzed using a repeated measures ANOVA (Greenhouse-Geiser correction). Bland-Altman plots were constructed to examine the agreement of the field tests with the criterion measure across fitness levels. **Results**: Post-hoc tests (Bonferroni correction) showed no differences in measured critical velocity among the three tests ($F(1.296, 38) = 1.384$, $P > 0.05$). Bland-Altman plots showed the 3MR to overestimate critical velocity in lesser aerobically fit individuals, while underestimating the same variable in individuals with greater aerobic fitness. A similar trend was observed when comparing the ECT to CRIT; however, the magnitude of this difference was reduced in all but the least fit individuals. **Conclusions**: These results suggest good criterion validity for the ECT and 3MR in recreationally active individuals. Nevertheless, test administrators must use care when using the ECT and 3MR due to an uneven bias across the range of fitness levels. In moderate- and high-fitness individuals, the ECT appears to be a more useful test due to a closer relationship with CRIT.

Research supported by the Swenson Summer Research Fellowship Program

High Resolution Atomic Force Microscopy Images of Porous Hydroxyapatite

Kao Tang Ying Moua and Michael Shaw, Ph.D.
Department of Bioengineering
California Lutheran University

The ability to image nanostructure materials is important in determining the high surface areas of specimen and recording interaction forces. Atomic Force Microscopy enables high resolution images by directly scanning specimens. The scanning surface area is monitored by reflecting a laser beam from the cantilever tip. The controlled interaction between the tip and sample surface can determine the force between a sample and its environment. This summer's project focused on creating a protocol in characterizing high resolution images in contact and tapping mode. In tapping mode, the cantilever tip rises near the sample surface and oscillates in high frequencies to create surface area images, it is commonly used for imaging lipid bilayers. In contact mode, the cantilever tip and surface specimen are kept in a constant deflective mode to record precise images of surface area. By applying different cantilever tips and mode methods, we were able to study and project images between the probe and hydroxyapatite surface area in: 1μm, 5μm, 20 μm, 50 μm, and 100 μm images. We successfully recorded topographical images, 3-dimensional profiles, and force data between the sample and tip. Our future plan, with the Atomic Force Microscope (AFM), is to characterize a 3-dimensional profile of the interactive forces between a custom hydroxyapatite cantilever tip and osteoblast cell sample.

Research supported by the Swenson Summer Research Fellowship Program

Identification and Characterization of Xenobiotic Metabolites using Gas Chromatography - Mass Spectrometry and Capillary Electrophoresis

Huong (Ivy) Thi Huynh Nguyen and Grady Hanrahan, Ph.D.
Department of Chemistry
California Lutheran University

Efficient and accurate analysis of xenobiotic metabolites in the environment is of great interest due to the possible risks that may arise from the exposure of humans and animals to such agents. A consideration of pesticide degradation products is also of interest as these products will often possess activities and lifetimes different from the parent compound. To address these concerns, accurate determination of low level metabolites is essential for structural elucidation and to assess toxicological potential. The purpose of this project was to further characterize and elucidate the chemical/physical mechanisms involved in degradation and metabolic processing of common xenobiotic materials. More specifically, determination of the unique chemical and structural properties of xenobiotic metabolites substances will lead to detailed information regarding cytotoxic effects and possibly lead to the development of new and improved environmental analysis and toxicological screening methods. Experiment methods centered on the use of Gas Chromatography-Mass Spectrometry (GC-MS) and Capillary Electrophoresis (CE). Pesticide and polycyclic aromatic hydrocarbon (PAH) degradation was examined and the metabolites characterized and quantified by structure-activity modeling. Such models will be used to represent and predict a wide variety of physical, chemical and biological properties. Overall, this project will lead to new and significant information regarding the degradation and metabolic processing of common xenobiotics found in complex environmental compartments.

Research supported by the Swenson Summer Research Fellowship Program

Laser-Induced Dissociation of O_2^+

Travis Severt[1,2], Mohammad Zohrabi[2], Utuq Ablikim[2], Kevin D. Carnes[2],
Brett D. Esry[2], and Itzik Ben-Itzhak[2]
[1]*Department of Physics, California Lutheran University*
[2]*J.R. Macdonald Laboratory, Department of Physics, Kansas State University*

The laser-induced dissociation of O_2^+ is studied via the $a\,^4\Pi_u \rightarrow f\,^4\Pi_g$ transition using ultrashort intense laser pulses of approximately 28 fs. Experimental kinetic energy release (KER) spectra are recorded using photons with energies of approximately 3.2 eV and 4.8 eV, created by second (390 nm) and third (263 nm) harmonic generation, respectively, of a 790 nm pulse. Theoretical calculations are performed using first-order time-dependent perturbation theory to determine transitional probabilities between the initial vibrational states of the $a\,^4\Pi_u$ state and the $f\,^4\Pi_g$ continuum. We are interested in the Cooper Minima effect, which describes the low rate of transitions between two electronic states at specific vibrational states. Specifically, the goal of this investigation is to demonstrate that the measured positions of the Cooper Minima can be used to identify dissociation pathways more effectively than by using other features in the KER spectrum.

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Applying Cubic Curves to Path Planning in a Gantry Robot

Randee Smith and Craig Reinhart, Ph.D.
Bioengineering and Mathematics Department
California Lutheran University

Approximately seven years ago Amgen donated a 3-axis gantry robot to the California Lutheran University Bioengineering department. The device is trained to perform a particular task (e.g. liquid aliquot operations) through use of either a pendant device or via custom designed software.

The system had the ability to move around the robot's space in linear paths, however one important aspect that was missing was the ability to travel in a curve in order to avoid obstacles. To address this, I began researching several cubic curves, specifically the Bezier, B-spline, and Hermite curves, and applied these to the custom designed software in order to figure out the optimal curve for the task. We successfully completed our initial proposal, and found the optimal curve and were able to apply it to the robot in order to avoid any set obstacle within the robot's space. While experimenting with the program designed to communicate with the robot, we tested the curves by attaching a marker to the robot's arm and allowed it to draw out the curves that were programmed.

Research supported by the Swenson Summer Research Fellowship Program

Quantitative Structure-Activity Relationship Studies of Humic Acid Substances via Multiplexed Capillary Electrophoresis and Related Techniques

Tracey Thompson and Grady Hanrahan, Ph.D.
Department of Chemistry
California Lutheran University

It has been shown that humic acids (HA), a group of substances with high molecular weights and a wide variety of molecular components (e.g., esters, carbonyls, lignins, etc.) exhibit pro-oxidant and cytotoxic effects in humans. For example, HA substances have been implicated as a factor that causes such conditions as goiters, certain types of cancer, and Blackfoot disease. Paradoxically, HA substances have been utilized in traditional Chinese medicine and are said to possess various pharmacological properties, including anti-inflammatory, anti-hypertensive, anti-neoplastic, and hemostatic activities. In order to characterize and assess these unique properties, determination of their abundance and source, along with their chemical and structural properties, is paramount. The purpose of this experiment was to optimize an extraction procedure and analyze the structure of humic acids. The experimental methods used included a manual acid-base extraction procedure, and analysis on Capillary Electrophoresis (CE), Gas Chromatography-Mass Spectrometry (GC-MS) and Nuclear Magnetic Resonance (NMR). The results showed distinct evidence of phenolic and carboxylic functional groups, which will help to explain the function of humic acids as it relates to the above medical conditions.

Research supported by the Swenson Summer Research Fellowship Program

Prevalence and Association of Sarcopenia and Osteopenia

Sam Van Gorder, Michele LeBlanc, Ph.D., and Steven Hawkins, Ph.D.
Exercise Science Department
California Lutheran University

Purpose: The aim of this study was to investigate the prevalence and interaction of sarcopenia and osteopenia in a sample of older adults. **Methods**: One hundred and five male (n=34) and female (n=71) participants over the age of 65 were tested for body composition and bone mineral density by DXA. Muscle strength was determined with a 1 RM leg press, handgrip test and pinch test. Functionality was established with a 6m Get-Up and Go test. Pearson correlations were used to examine relationships, and independent t-tests compared sarcopenic subjects to non-sarcopenic by gender ($p \leq 0.05$). **Results**: For the female participants, 23 were sarcopenic based on ASM/ht² (5.24 ± .33 vs. 6.45 ± .58, respectively, $p \leq 0.05$), whereas 12 were categorized as sarcopenic based on non-dominant hand grip values. For males, 9 were sarcopenic based on ASM/ht² values (6.94 ± .19 vs. 8.21 ± .70, respectively, $p \leq 0.05$), and three were sarcopenic based on their non-dominant hand grip strength. Based on hip BMD, 44 women were osteopenic and eight were osteoporotic, while 16 men were osteopenic and none were osteoporotic. Six men were sarcopenic and osteopenic. Twelve women were sarcopenic and osteopenic, and six were osteoporotic and sarcopenic. Group comparisons of those sarcopenic vs. not by ASM/ht^2 identified differences in leg press strength, right and left hand grip strength, lean body mass, fat mass and hip BMD ($p \leq 0.05$) for the females, whereas males differed only for lean body mass, total body BMD, forearm BMD, and age ($p \leq 0.05$). ASM/ht^2 correlated with leg press ($r = 0.74$, $p \leq 0.05$) and all measures of BMD ($r = 0.42 – 0.60$, $p \leq 0.05$). **Conclusions**: ASM/ht^2 appears the most definitive measure for identifying prevalence of sarcopenia, and there appears to be an interaction between osteopenia and sarcopenia.

Research supported by the Swenson Summer Research Fellowship Program

Site-Specific Relationships between Muscle and Bone in Younger and Older Women

Tracy White, Steven Hawkins, Ph.D. and Michele LeBlanc, Ph.D.
Exercise Science Department
California Lutheran University

The purpose of this study was to investigate relationships between muscle strength and mass with site-specific BMD and to determine if this relationship is age-dependent. Fifty young women (18-30 yrs) and fifty older women (65-81 yrs) with equivalent activity levels were tested for body composition and bone mineral density by DXA. Site-specific BMD was also determined for mid-femur, mid-shank, mid-humerus and mid-forearm. Muscle strength was determined by pinch test, hand grip, 1RM leg press, and isokinetic knee flexion and extension peak torque. Pearson correlations were used to examine relationships ($p < 0.05$). Grip strength correlated with values from the mid-femur ($r = 0.38$, $p = 0.009$), mid-humerus ($r = 0.45$, $p = 002$), and mid-radius ($r = 0.36$, $p = 0.016$) for the Young women. In contrast, for the Older women only the value from the mid-humerus correlated with the grip strength ($r = 0.39$, $p = 0.007$). For Young women, the peak extension torque correlated with mid-tibia and mid-radius ($r = 0.34$, $p = 0.023$ and $r = 0.31$, $p = 0.036$ respectively). There was a trend towards correlation with the mid-femur and mid-humerus. For Older women, peak extension torque correlated only with the mid-femur ($r = 0.43$, $p = 0.003$). Normalized leg press force did not correlate with any of the site-specific values for either group but there were some correlations between the absolute force for both groups. In conclusion, the relationships between site-specific BMD and muscle strength were different between the two groups with the Older women exhibiting more direct relationships while Young women exhibited more systemic relationships.

Research supported by the Swenson Summer Research Fellowship Program

The Use of Inexpensive Natural Organic Materials in Dye-Sensitized Solar Cells

Jacklyn Whitehead, Michael Shaw, Ph.D., and John Tannaci, Ph.D.
Bioengineering/ Physics and Chemistry Departments
California Lutheran University

Given our planet's growing energy crisis, sustainable energy research is of vital importance. A seemingly limitless resource that should be utilized to its fullest extent is solar energy. The Dye-Sensitized Solar Cell (DSSC) is a photovoltaic cell which utilizes organic material to produce a small voltage, between 0.4V to 0.5V, in a process similar to photosynthesis. Our research explores the effects of using all-natural organic materials, specifically blackberries, blueberries, raspberries, and acai berries as sources of dye for DSSCs. The acai berries were specifically selected based on their high levels of anthocyanidins, pigment molecules which adhere well to the titanium dioxide nanostructure of the DSSC; as well as their increased absorbency as compared to other berries. To date, we have developed and commissioned a novel experimental apparatus including a digital data-acquisition capability. Furthermore, we have measured and compared the optical absorbance of the dyes to investigate how absorbance relates to electrical output. Finally, we have synthesized 12 cells from various berries, and demonstrated an electrical output of 0.3V to 0.5V from a white light source with an average intensity of 38,900 lux.

Synthesizing Organic Electronic Materials by Direct Arylation Polymerization

Calvin Wiley, Shiloh Stone, Keenan Woods, Allyson Dorsey,
Robert Springer, and John Tannaci, Ph.D.[†],
Andrey Rudenko and Barry Thompson, Ph.D.[‡]
[†]*Chemistry Department, California Lutheran University*
[‡]*Chemistry Department, Loker Hydrocarbon Research Institute, and Center for Energy Nanoscience, University of Southern California*

Recently, direct arylation has emerged as a novel methodology that is on the verge of large-scale application. By eliminating pre-functionalization of one of the coupling partners, direct arylation offers a "greener" route to installing carbon-carbon bonds and it is being actively studied by pharmaceutical researchers. However, despite the benefits in terms of atom economy, direct arylation has not been incorporated into the toolkit for constructing organic electronic materials. To address this deficiency, we investigated small-molecule model systems to develop direct arylation polymerization conditions, which were then applied to the synthesis of regioregular poly(3-hexylthiophene). The polymerization conditions were optimized by monitoring both molecular weight and regioregularity using gel permeation chromatography and nuclear magnetic resonance spectroscopy, respectively. Direct arylation polymerization has the potential to lower production costs for organic electronic materials, which could facilitate their commercialization in field-effect transistors, solid-state lighting, and photovoltaics.