
2005-2006 FACULTY RESEARCH COMMITTEE

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Dr. Abbas Manafy (Humanities, Member at-large)
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2005-2006 NMHU SIGMA XI CHAPTER OFFICERS

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STUDENT POSTER SESSION SUBCOMMITTEE

Dr. Carol Linder
Dr. Jennifer Lindline (program designer)
Dr. Maureen Romine

**New Mexico Highlands University's
Faculty Research Committee and
Sigma Xi Chapter proudly present the**

**4th ANNUAL
FACULTY AND STUDENT
RESEARCH DAY**

**April 28, 2006
Kennedy Hall**

*Celebrating the research and scholarly accomplishments of
our faculty and students.*

Rene Palacios, Merritt Helvenston, Joe C'de Baca and Rodolfo A. Martinez
Converting Hydrazine Waste into Environmentally Useful Products

In collaboration with NASA, we have examined several classes of organic compounds that react rapidly and quantitatively with hydrazine to form stable organic products. There are several organic acids that react in near quantitative yield (based on Hz as the limiting reagent) to give high melting stable organic compounds. These organic compounds allow for the facile remediation of hydrazine under a variety of conditions. We have discovered that these compounds have an excellent potential to reduce the hazards associated with the handling and storage of hydrazine fuels. The reaction of hydrazine with 2-ketoglutaric acid (1) give a near quantitative yield of 6-oxo-1,4,5,6-tetrahydro-pyridazine-3-carbonic acid (2). This compound is currently being tested for several medical conditions such as mental disorder, digestive tract disease, muscular dystrophy, anti-Alzheimer's agents, antidepressants and cognition enhancers. Compound (2) is currently sold for \$10,000 / Kg. We have done extensive work on the reaction between Hz and these organic compounds. These reactions have been found to be very effective at converting technical grade hydrazine to less than ppm levels (none detected by Drager Tube Measurement). The hydrazine products formed have a HMIS Rating of Health:1, Flammability:1 and Reactivity: 1. The presentation will detail the synthesis of isotopically labeled 2-ketoglutaric acid (1) for the synthesis of labeled pyridazines (2).

Amina Sena, Michael L. Meyer, and David Shaul
Discharge Measurements Using Rhodamine WT Dye Tracer at Los Alamos National Laboratory

m flow measurements in arroyos of the arid regions of southwestern U.S. are complicated by the ephemeral nature of the arroyos, complex cross sectional geometry, and steep slopes. The short term duration of stream flow makes it difficult or impossible to use manual onsite stream/discharge measurements to develop stage-discharge relationships. Most sites require the application of the Manning equation or other mathematical modeling methods that often can not be verified. The purpose of this project was to develop stage-discharge rating curves using a dye tracer (Rhodamine WT). Sites were equipped with automated dye injection (40 mL/minute) and automated collection techniques that activated during a storm runoff event. Changing dye concentrations through a unit hydrograph were converted to discharge (cubic feet per second, cfs). One runoff event in Acid Canyon in August 2005 provided enough information to develop a rating curve with a discharge accuracy of +/- 10%. Methods developed as a result of this project will be expanded to other canyons in the Las Alamos area during the summer of 2006.

WELCOME

Jessica Levis, Christina Peterson, Mario Medina, Robert Mishler, and Susan Swan

Investigation of an Historic Archaeological Feature at New Mexico Highlands University: The Centennial Park Site

During an artificial turf landscaping project in September 2004, a stone-walled pit was discovered in Centennial Park on New Mexico Highlands University's campus. At the same time, several hundred historic artifacts of glass, metal, bone, and wood were recovered from the surface surrounding the pit. *What is the structure? When was it built? How does it relate to Las Vegas' past?* These questions are directing a current investigation by students, faculty, and a private consultant. This historical archaeology project is collecting a history of the property from archives and public records, oral histories from local citizens, and data through archaeological excavation to understand the feature's function and relationship to previously existing residences.

Robyn Madrid and Rolando Rael

The Antimicrobial Effects of Light Induced Surface Coating Compounds on Specific Bacterial and Fungal Strains

The viability of one fungal (yeast) and four bacterial strains was studied in the presence of visible light (400-750nm) and nine different photo-activated cytotoxic chemicals. The combination caused cell death in all microbial isolates tested; however, susceptibility varied between cultures. In the majority of test microorganisms, the minimum inhibitory concentration (MIC) was approximately 5.5µg/µl. However, some of the microbial strains tested had MIC levels less than 5.5 µg/µl. Ultimately the range of MICs was between 5.5µg/µl -0.0055µg/µl. These results suggest that susceptibility and resistance varies among different microbial isolates.

Angelo Ortiz and Hossein Tahani

Solaris Deployment at Los Alamos National Laboratory

The need for security is paramount in the type of computing environment found at Los Alamos National Laboratory. This research discusses suitable approaches for installing, patching, hardening, and verifying the configuration of a Solaris 10 workstation. A methodical, critical evaluation and testing of each part and of the whole procedure is also performed. Installation of a Solaris workstation can be accomplished from media, via a JumpStart (bootp and tftp) or a WANBoot server (http or https). All of these methods allow the deployment of preconfigured flash archive images that significantly reduce the install time. Installation of pre-verified patches can be done from a local NFS repository using the LANL Solaris UPDT package available on ESD. This speeds up the process by removing, from the Sun recommended patch clusters, the patches that are already installed on the system. The bulk of this research is concentrated on the secure configuration of the system. The hardening adheres to the Solaris LANL Configuration Cookbook that is based on the Solaris Benchmark published by the Center for Internet Security, and by local requirements specified in the Information Architecture standards. One major implementation in the hardening process is the use of the Service Management Facility (smf) and the ability to generate a hardened service profile in XML format suitable for each system. The LANL Solaris SHARK package, available on ESD, provides an automated reference implementation of the Solaris LANL Configuration Cookbook. Determining the compliance of the system configuration with the cookbook is accomplished with the LANL Solaris SAFE tool, also available on ESD. With the release of the CIS's Next Generation Verification Tool, further research will be needed to adapt the hardening and verification of Solaris 10 to the extensible configuration checklist description format (XCCDF) and open vulnerability assessment language (OVAL).

Welcome to the 4th Annual New Mexico Highlands University Faculty and Student Research Day! We are pleased to showcase a morning session of faculty oral presentations, followed by an afternoon session of student poster presentations. Most of the faculty research presented represents work funded through institutional Faculty Research Funds. Research and travel grants are awarded each term to faculty through a rigorous selection process. The Faculty Research Committee congratulates all grant recipients and encourages other faculty to apply for research support. The New Mexico Highlands University Sigma Xi chapter is sponsoring the student research presentations with additional support from the New Mexico-Idea Networks of Biomedical and Research Excellence and the Faculty Research Committee. We congratulate our student participants on their hard work and dedication to research and scholarly activity.

For more information about the Faculty Research Funds, contact one of the faculty representatives listed on the back of the program. You are also invited to visit the Faculty Research Committee's web page at <http://www.nmhu.edu/about/research/frc.html>.

Sigma Xi's mission is to enhance the health of the research enterprise, foster integrity in science, and promote the public's understanding of science for the purpose of improving the human condition. The society is a diverse, chapter-based organization dedicated to the advancement of science and engineering through outstanding programs and services delivered in a collegial and supportive environment. For more information about the NMHU chapter and its activities, visit the poster exhibit.

ACKNOWLEDGEMENTS

The Faculty Research Committee thanks New Mexico Highlands University for its continued recognition and support of the research and scholarly activity of its faculty and students. We especially thank the Office of Finance & Administrative Services and Vice Presidents Placido Gomez and Manilal Patel for their cooperation and support. We thank Dr. Joseph Sabutis, 2005-2006 Acting Chair of the Faculty Research Committee, for his lead role in organizing today's event. We also thank Ms. Generose Trujillo and Ms. Darlene Tapia for their administrative assistance and support of the Faculty Research Committee and its grant awardees.

The New Mexico Highlands University Sigma Xi Chapter thanks the following individuals for volunteering to serve as judges for the Student Poster Competition: Lisa Bentson, Daniel Griffith, W. David Hacker, Carol Linder, Jennifer Lindline, Edward Martinez, and Robert Mishler.

elucidation of biosynthetic pathways, pharmacokinetics, and drug metabolism. For many applications, site-specific ^{13}C or combined ^{13}C and ^2H -labeling are required. Carbon-13 is enriched from its lighter isotope by cryogenic distillation of carbon monoxide; thus, all labeled carbons must be derived ultimately from ^{13}CO . Because inefficiencies add greatly to the expense of isotope labeling, considerable effort was devoted to the preparation of efficient large-scale methods for the synthesis of single carbon synthons. Methyl phenyl sulfide has rich chemistry and if prepared with carbon and deuterium labels in the methyl group, can serve as a versatile labeled precursor. This presentation will outline a set of new labeled one-carbon synthons derived from [^{13}C]thioanisole.

Zac Karim, Bryce McIver, Mark Zydel, Warren Hill

Partial Functional Characterization of an Aquaporin 3 Ortholog from the European Eel, Anguilla anguilla

Human AQP3 belongs to the family of aquaglyceroporins which transport glycerol preferentially to water and are universally found basolaterally in mammalian epithelia. Thus it is tempting to speculate that the function of this protein in the FW eel may be to transport solutes other than water. It is possible that eel AQP3(eAQP3) may also transport urea across the gills. This correlates with observations showing that urea and water excretion appear to occur in parallel. It is also possible that NH_3 , an abundant nitrogenous waste product could be a transported substrate.

To begin to examine the substrate specificity and conductance properties, we expressed the eAQP3 ortholog in *Xenopus* oocytes. Optimal expression in oocytes was achieved by subcloning cDNA into a T7 RNA polymerase based vector that incorporates 5' and 3' untranslated sequences from the *X. laevis* globin gene. Once a sufficient expression period had passed, quantitative measurement of urea, glycerol and water swelling assays using video microscopy and time lapse photography were conducted.

Tiffany Kinnibrugh, Boris Averkiev, Youmei Lu, Francis Sena, Andrey Yakovenko, T. Timofeeva, and M. Antipin

Application of X-ray Diffraction Analysis for Solutions to Structural and Chemical Problems

Application of single crystal diffraction analysis at present technical and computational level can promote solutions for many problems connected to structure-properties relations. For instance, it may give rationale for synthesis of materials with acentric structure useful for nonlinear optical applications. It gives also information on absolute configuration of materials containing chiral center(s). This method is very important for evaluation of structure of intermediate products of catalytic reactions, etc.

Modern applications of X-ray diffractational analysis, sometimes referred as "experimental quantum chemistry", can provide information on charge redistribution inside polar molecules in crystals, molecular dipole and higher moments, electron density accumulation in intermolecular space, estimation of energy of hydrogen bonds, stacking interactions, and energy of crystal packing.

Structures of nonlinear optical and two-photon absorbing chromophores were studied to understand which conformation they have in crystal. It was shown that in spite of previous considerations derived from synthetic procedure they have *trans* conformation.

Products of catalytic Diels-Alder reaction in the presence of $(o\text{-C}_6\text{F}_4\text{-Hg})_2$ were studied by X-ray analysis to determine the reaction mechanism.

Electron density distribution to characterize stacking interactions in energetic materials was carried out by quantum chemical calculations and X-ray analysis. It was shown that these interactions are of the same magnitude as weak hydrogen bonds.

X-ray structural analysis of siloles was carried out to characterize their structure in crystal and the influence of structure on fluorescent/electroluminescent properties.

2006 NMHU RESEARCH DAY PROGRAM

FACULTY ORAL PRESENTATIONS

8:30 Breakfast service; coffee, juice, doughnuts, and fruit.

8:50 Opening remarks.

9:00 **Dr. Peter Linder**, Associate Professor of History
“Drumming Rebellion: Political & Social Violence in the Sur del Lago de Maracaibo on the eve of the Federal War, 1839-1858.”

In March of 1839, the black residents of the town of Gibraltar, south of Lake Maracaibo, attacked and routed the parish alcalde and the collector of municipal revenues. These individuals had been sent from Maracaibo to administer the area, but had proven unacceptable to the community's inhabitants. Some eighteen years later, the inhabitants of the nearby town of Bobures responded to a decree denying them the vote by invading the municipal palace, burning the decree, and marching through the city to the beat of chimbanguele drums, threatening the lives and property of the civil authorities and large landowners.

9:30 **Dr. Abbas Manafy**, Associate Professor of History
Islam and Democracy: Are the Two Compatible?

This study seeks empirical truth about validity or falsity of perceptions involving Islam and social justice. Since the Islamic world has been ruled mostly by kings, military rulers and dictators, western observers, scholarship and media most often see the world of Islam as undemocratic and violent. Hence, the attempt is to verify or falsify the compatibility thesis.

10:00 **Dr. Donna Woodford**, Assistant Professor of English
Cuban Appropriations of Shakespeare's Works: Romeo Y Julieta

Shakespeare's works, especially *Romeo and Juliet*, are well known in Havana and throughout Cuba. *Romeo and Juliet* is read by all students in the tenth grade. It has been performed in Havana, both as a play and as a ballet. Cinematic versions are frequently shown on Cuban television, and *Romeo Y Julieta* is even the brand name of a popular Cuban cigar. But just as the *Romeo Y Julieta* cigars and cigarettes are made of “100% tabaco Cubano,” so Cuban adaptations and appropriations of the play have become native Cuban products.

In this presentation, Dr. Woodford will look at two Cuban appropriations of *Romeo and Juliet*: a loose and overtly revolutionary adaptation entitled *Romeo Y Julieta en Luyanó*, and the most recent creation of Alicia Alonso and the National Ballet of Cuba, *Shakespeare Y Sus Mascaras*. Writing of her adaptation of another Shakespeare play, *Otra Tempestad*, Cuban director Raquel Carrió asks, “What can we do on this side of the world which wouldn't simply repeat the images of a playwright whose work has been staged thousands of times? How can we find a language which respects the beauty and profundity of the material but which does not simply translate the themes and forms of representation?” These appropriations of *Romeo and Juliet* offer an answer to this question. The works reflect the Cuban respect for and admiration of Shakespeare, but the directors, choreographers, and playwrights of these

precision, +/- 11% accuracy] to measure absolute values and percent changes in the left internal carotid artery [CQ, ml/min, an index of hemispheric cerebral blood flow]. We studied two age-matched cohorts: 1) 11 [6F] sedentary, healthy adults [22 +/- 3 yrs, VO2 max 33 +/- 3 ml/kg/min; and 2) 14 healthy, male, aerobically trained adults [23 +/- 3yrs, VO2 max 50 +/- 4 ml/kg/min] during rest and during 50% of maximal upright ergometer (bicycle) exercise. Resting CQ values between sedentary and trained cohorts were similar ($p>.05$): 317 +/- 110 ml/min and 334 +/- 53 ml/min, respectively. During submaximal exercise, CQ increased similarly ($p>.05$ unpaired T-test) in both cohorts: 12 +/-17% in the sedentary group, and 14 +/-14% in the endurance trained cohort. Heart rate, blood pressure, and respiration rate responses were consistent with previously published data. This cross-sectional and descriptive study suggests that aerobic exercise training does not significantly affect human hemispheric cerebral blood flow during rest and submaximal exercise.

Joseph H. Gallegos, Andrey A. Yakovenko, T. Timofeeva, and M. Antipin
Polymorphs of Organic and Inorganic Materials

In course of study of materials for biological applications with tosyl group, that, like other sulfonates, is a highly reactive leaving group, we investigated crystal structure of 3-oxa-1,5-pentanedyl bis(p-toluenesulfonate) (1) (Fig 1). It appeared that that material was already studied many years ago by Groth, 1985 at low temperature (LT), and later its structure was reinvestigated by Ferchaux et al., 1990, at room temperature (RT). Both authors reported that crystal (1) at RT and at LT crystallize from dichloroethane in monoclinic form, space group $C 2/c$, $Z=4$, with unit cell parameters $a = 23.772$ (8), $b = 5.472$ (5), $c = 15.284$ (6) Å, $\beta = 89.61$ (3)°, $V = 1987.9$ Å³ (RT) and $a=23.385$ (8) $b = 5.442$ (3) $c = 15.282$ (5), $\beta= 91.10$ (3)°, $V = 1944.45$ Å³ (LT). Our investigation (at 120 and 298 K, from methanol solution) has shown that in spite of similar unit cell parameters and similar topology with previously studied samples of (1) we obtained different crystalline modification that is described as orthorhombic, space group $P bcn$, $Z=4$.

It is known that polymorphism in crystalline materials may occur as a result of crystallization from different solvents, crystallization in presence of small and macromolecular additives, solid-solid phase transition, etc. In our previous investigations of polymorphs of organic materials we usually tried to assess the cause of coexisting of several phases of particular compound that is in many cases important for applications. Since unit cell parameters and relative molecular orientations in both polymorphs are similar, we decided to evaluate orthorhombic crystals of (1) in temperature interval from 100 to 296 K in search for possible solid phase transition.

Results of multitemperature evaluation of unit cell volume at temperatures range 150, 200, 250 K are presented in Fig. 2. On the same graph presented points corresponding to unit cell volumes for full structures investigations at 120 and 298 K for $P bcn$ phase, and at 143 and 294 K for $C 2/c$ phase. It is obvious that the unit cell volume reported for the monoclinic polymorph is somewhat higher than that found for the orthorhombic form. Therefore calculated densities of monoclinic form (1.416 gcm⁻³ (LT) and 1.385 g cm⁻³ (RT)) somewhat lower than for orthorhombic polymorph (1.438 gcm⁻³ (LT) and 1.391 gcm⁻³ (RT)). This suggests that the $P bcn$ form is thermodynamically more stable (Burger, 1979). Also this graph suggests that there is no phase transition between orthorhombic and monoclinic modification in temperature interval from 120 K to room temperature. So we can speculate that the major reason for obtaining these two polymorphs is a solvent from which crystals were grown.

Several other examples of polymorphs will also be considered.

David R. Glass, Rodolfo A. Martinez, David Wiedenfeld, Erick G. Ortiz, and Frank E. Anderson III
Chemistry of [¹³C]methyl phenyl Sulfide

Stable isotope labeled amino acids and nucleotides are required for structural and mechanistic studies of proteins and oligonucleotides. In addition, isotopically labeled biologically active compounds are required for many phases of drug discovery and development including

adaptations have done more than translate Shakespeare's play; they have changed it in ways that have made their adaptations uniquely Cuban.

10:30 Coffee Break

10:45 **Dr. Veronica Saunero-Ward**, Associate Professor of Spanish
The Literary Blog: The Resurgence of Authorship?

In this presentation, Dr. Saunero-Ward will discuss the convergence of information technology and contemporary literary theory and criticism as it relates to the concept of authorship. She will briefly comment on the Mexican writer Cristina Rivera Garza and her blog "There Is No Such Place: Contemporary U-Topics."

11:15 **Dr. Daniel Martinez**, Assistant Professor of English
Heretical Love Letters: Poems Inspired by the Life of "The Hermit"

Dr. Martinez will present a two part discussion: Part 1 – various accounts of The Hermit's life and Part 2 – drafts of poems on this subject.

11:45 **Dr. Edward Martinez**, Assistant Professor of Environmental Science
Morphological and Growth Responses in Chironomus Tentans to Arsenic Exposure

Laboratory bioassays consisting of sediments spiked with three concentrations (30, 130, and 260 $\mu\text{g g}^{-1}$ As dry wt.) of Arsenic (As^{+3}) were used to assess morphological responses and growth in *Chironomus tentans* larvae. Chironomid larvae were raised in contaminated sediments from egg-stage to emergence and mouthpart abnormalities, larval length, and larval head width were used as endpoints to determine differences between metal-spiked and control specimens. *Chironomus tentans* exhibited significantly higher mouthpart deformity proportions, smaller body sizes, smaller head widths, and slower development than Control larvae. Our results demonstrate a dose response relationship between As and mentum deformities in *C. tentans*. However, the proportion of deformed larvae did not increase through time in the treatment tanks. Results demonstrate that As induces mouthpart abnormalities at various concentrations. This research provides more support for the use of chironomid abnormalities as a tool for the assessment of heavy metal pollution in aquatic systems.

12:15 Catered Lunch and Student Poster Presentations.

1:45 Final Judging of Student Poster Presentations.

STUDENT POSTER PRESENTATIONS

(Note: New Mexico Highlands University student names are noted in bold)

N. Larry Agbor, V.A. Agbor, L. Yang, S. Sweeney, M. A. Handel, M. D. Griswold, and C. C. Linder
Developmental and Gene Expression Profiling During Spermatogenesis in a Chemically-Induced Genetic Mouse Model of Infertility (repro27)

Male infertility accounts for about half of fertility problems worldwide and about 45% of these cases have unknown causes. However, it is hypothesized that the majority of these cases are due to genetic defects. The ReproGenomics Program at the Jackson Laboratory (<http://reprogenomics.jax.org>) has generated over 20 mouse models of infertility by chemical mutagenesis using ethylnitrosourea. The objective of this study was to phenotypically characterize one of these infertility mutants (C3Fe; B6-repro27) and to ultimately isolate the candidate gene responsible for its phenotype. Initial repro27 analysis showed male specific infertility due to meiotic defects in spermatogenesis, low testis weight, abnormally shaped sperm heads without tails, low motility, and no IVF success. Preliminary mapping of repro27 places the mutation on chromosome 5 between 107.7 cM and 111.1 cM. This region contains 95 known genes (www.ensembl.org). Analysis was done in mice testis ages 2–10 weeks of age. Periodic Acid Schiff's reagent stained sections showed normal spermatogenesis in the control while in mutants, most germ cells undergoing meiosis failed to complete the process and die. The mean testis/body weight ratio at 2 weeks was 0.25% in the control and 0.27% in the mutant whereas at 3 weeks, it was 0.43% in the control and 0.33% in the mutant. This showed a significant reduction in the germ cell population in the mutant at 3 weeks of age with no variation at 2 weeks. Between 4 to 10 weeks, mutant mice continued to show a significant reduction in testicular germ cell population, yet controls were unaffected. There was no significant difference in seminal vesicle weights in both genotypes of various age groups. RNA expression patterns were analyzed in 18dpp mutant and controls using the Affymetrix's Gene chip Operating Software (GCOS) and the Gene spring 7.2 software (Agilent Technologies, Redwood City, CA). 417 transcripts were expressed at least 2-fold higher in controls compared to mutants. Further analyses showed 8 transcripts to be differentially expressed in the control mice, and falls within the repro27 candidate region (chromosome 5). We believe our data will be useful source for investigators studying the genetic basis of male infertility.

Cheryl Buford and Ian Williamson
Optimism and Lifestyle Factors

The purpose of our project was to examine the possible relationships between optimism and lifestyle factors, which include the following variables: Exercise, diet, alcohol use, sleep, hygiene, stress levels, goal achievement, energy levels, gender, ethnicity, and GPA. Optimism has already been shown to relate to positive health outcomes, increased immune response, and medical recovery (e.g. Seligman, 1990). We go beyond past work to include a larger range of healthy lifestyle choices. We expected that optimism would show a negative relationship to alcohol, drug abuse, and stress. We expected to find a positive relationship between optimism and exercise, energy levels, nightly sleep, and goal achievement. These relationships are currently being analyzed to determine if optimism has broader effects on lifestyle than previously documented.

Robert A. Castillo, Monica Marthell, Vanessa Salas, Katelin Engard, Rebecca Montoya, E.R. Greene
Human Cerebral Blood Flow during Exercise: Effects of Aerobic Training

Aerobic exercise training (ET) affects the control of human central and regional blood flows. Nevertheless, the effects of ET on cerebral blood flow has not been reported [Pubmed 2006]. Accordingly, we tested the hypothesis that aerobic exercise training would modulate the control of the cerebral circulation. We used non-invasive image-guided Doppler flowmetry [\pm 7%