University of Nevada, Las Vegas

2011

Festival of Communities

Undergraduate Research & Creative Activities Symposium (URCAS)

April 16, 2011
Student Union Ballroom

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Compiled and Edited

By
Carl Reiber, Academic Affairs Fellow, Office of the Provost
Nicholle Booker, Graduate Affairs Coordinator, College of Sciences
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UNLV Student Union Ballroom

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9:30 a.m. – 10:00 a.m. Welcome Professors Carl Reiber & Thomas Piechota

Poster Public Viewing Student Union Ball Room

10:00 a.m. – 11:30 a.m. Session I: Science

10:00 a.m. – 10:20 a.m. Keynote Address (Ballroom)
Maile Sweigart, Drought in the Las Vegas Valley

Oral Presentations Student Union 208

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Mission Statement

The University of Nevada, Las Vegas is a research institution committed to rigorous educational programs and the highest standards of a liberal education. We produce accomplished graduates who are well prepared to enter the workforce or to continue their education in graduate and professional programs. Our faculty, students, and staff enthusiastically confront the challenges of economic and cultural diversification, urban growth, social justice, and sustainability. Our commitment to our dynamic region and State centrally influences our research and educational programs, which improves our local communities.

Our commitment to the national and international communities ensures that our research and educational programs engage both traditional and innovative areas of study and global concerns. UNLV’s distinctive identity and values permeate a unique institution that brings the best of the world to our region and, in turn, produces knowledge to improve the region and world around us.

UNLV is committed to and driven by these shared values that will guide our decision making:

- High expectations for student learning and success;
- Discovery through research, scholarship, and creative activity;
- Nurturing equity, diversity, and inclusiveness that promotes respect, support, and empowerment;
- Social, environmental, and economic sustainability;
- Strong, reciprocal, and interdependent relationships between UNLV and the region around us;
- An entrepreneurial, innovative, and unconventional spirit.
Nevada National Sciences Foundation (NSF)  
Experimental Program to Stimulate Competitive Research (EPSCoR)  

The Undergraduate Research component of the current NSF EPSCoR award provides lab and field research experiences, through summer scholarship programs and annual fellowship opportunities, to full-time NSHE undergraduate students. These programs fund eligible students either majoring in mathematics, science, or engineering, or majoring in education and specializing in teaching K-12 in the fields of mathematics, science, or technology. Research is conducted under the guidance of NSHE faculty mentors. The hands-on experience gained through these programs has proven to supplement classroom learning and serve as gateways to new and exciting opportunities for all participants.

EPSCoR - Experimental Program to Stimulate Competitive Research  
NSF, the federal agency that first developed EPSCoR programs, sponsored the first EPSCoR program in Nevada. Since 1985, NSHE institutions have received more than $41 million in federal funds from NSF EPSCoR, together with non-federal matching funds.
Nevada INBRE sponsors 15 undergraduate research scholarships each year. Students selected for the program conduct a lab research project in a faculty mentor's laboratory. Summer research opportunities often lead to longer-term collaborations between students and faculty, publishable research, and careers in medicine or biomedical research. Opportunities are available for research in emerging areas such as genomics, proteomics, molecular modeling, imaging, and bioinformatics. However, any area of research that might be supported by the NIH is appropriate.

Students are selected in a statewide, merit-based competition. As part of the application process, students are required to identify a faculty mentor at UNR, UNSOM, UNLV, or the Nevada Cancer Institute with whom they are interested in conducting research.

Nevada INBRE is a network of physical and human resources available to scientists in Nevada. Its mission is to provide infrastructure that enables investigators to successfully win research funding. INBRE research facilities provide research support services, training, and equipment for Nevada's biomedical investigators. Nevada INBRE also sponsors research, scholarships and training opportunities for faculty members and students.

The National Center Research Resources (NCRR) Institutional Development Award (IDeA) program broadens the geographic distribution of NIH funding for biomedical and behavioral research. The program fosters health-related research and enhances the competitiveness of investigators at institutions located in states in which the aggregate success rate for applications to NIH has historically been low. Supported by the NCRR Division of Research Infrastructure, the IDeA program increases the competitiveness of investigators by supporting faculty development and research infrastructure enhancement at institutions in 23 states and Puerto Rico.

IDeA Networks of Biomedical Research Excellence (INBRE) enhance biomedical research capacity, expand and strengthen the research capabilities of biomedical faculty, and provide access to biomedical resources for promising undergraduate students throughout the eligible states. INBRE implements the IDeA approach at
the state level by enhancing research infrastructure through support of a network of institutions with a multidisciplinary, thematic scientific focus. INBRE is the second phase of the Biomedical Research Infrastructure Networks (BRIN) program, which began by providing planning grants in 2001.

Centers of Biomedical Research Excellence (COBRE) augment and strengthen institutional biomedical research capabilities by expanding and developing biomedical faculty research capability through support of a multidisciplinary center, led by a peer-reviewed, NIH-funded investigator with expertise central to theme of the grant proposal.

The IDeA program also supports IDeAnet, an Internet-based network providing connectivity for high-bandwidth science applications. IDeAnet will enable collaboration among institutions, ultimately supporting all participants in the IDeA program, as well as participants in the Research Centers in Minority Institutions (RCMI) program and other NCRR-supported networks.

**National Science Foundation Research Experience for Undergraduates Program (NSF REU)**

**REU PHYSICS AND ASTRONOMY**

The Research Experience for Undergraduates (REU) program is a program of the National Science Foundation to give undergraduate students an experience in performing research.

Most of a student's career consists of classroom lectures. The REU program is intended to benefit students by offering experiences that go beyond the classroom. The UNLV Physics Department has had a successful REU program since 1987. Initially the program was limited to UNLV students. Beginning in 1992, the program was open to non-UNLV students as well. Students participate in research projects in the summer with follow-up activity during the academic year.
National Science Foundation Research Experience for Undergraduates Program (NSF REU)

REU MICROBIOLOGY
UNLV offers an REU Site program in partnership with the Desert Research Institute. Undergraduate students participate in a 10-week summer program involving research in the area of environmental microbiology.

Students collaborate with faculty mentors in developing and carrying out hypothesis-based projects on microorganisms from diverse habitats such as hot springs, the deep terrestrial subsurface, hypersaline lakes, arid soils, and ephemeral water sources. Students may also choose to explore the mechanisms of magnetotaxis, microbial adaptation to stressful and non-host environments, or the dynamics between primary producers and consumers.

All students receive training in current molecular techniques and the ethics of science, and they participate in weekly discussions on their project. At the conclusion of the program, students present their research results at a scientific colloquium. In addition, all students are encouraged to present their research at a regional or national scientific conference. Students receive a $4000 stipend, housing, meals, and a travel subsidy. First generation college students and members of an underrepresented group are strongly encouraged to apply.

National Aeronautics and Space Administration (NASA) Experimental Program to Stimulate Competitive Research (EPSCoR)

The NASA Experimental Program to Stimulate Competitive Research (EPSCoR), strengthens the research capabilities of jurisdictions that have not in the past participated equably in competitive aerospace and aerospace-related research activities. EPSCoR provides eligible jurisdictions with funding to develop a more competitive research base within their jurisdiction and member academic
institutions. Seven federal agencies conduct EPSCoR programs. The two main components of NASA EPSCoR are:

NASA EPSCoR Research Infrastructure Development Cooperative Agreement Notice. The Research Infrastructure Development (RID) component enables jurisdictions to build and strengthen relationships with NASA researchers. The RID has a three-year base period of performance with a potential single, two-year renewable period of performance. Awards are $125,000 per year. A one-to-one match (cash or in-kind) is required for every NASA dollar awarded. The most recent RID was announced and awarded in 2007. NASA intends to announce the RID opportunity every three to five years, pending funding availability.

NASA EPSCoR Research CAN. The NASA EPSCoR CAN for Research Awards solicits topic-specific proposals addressing high-priority NASA research and technology development needs. Awards are up to $750,000 for a three-year performance period. A one-to-one match (cash or in-kind) is required for every NASA dollar awarded. NASA intends to announce the EPSCoR CAN for Research Awards yearly, pending funding availability.

**NASA Research Opportunities**

Supporting research in science and technology is an important part of NASA's overall mission. NASA solicits this research through the release of various research announcements in a wide range of science and technology disciplines. NASA uses a peer review process to evaluate and select research proposals submitted in response to these research announcements. Researchers can help NASA achieve national research objectives by submitting research proposals and conducting awarded research.

University and industry research institutions are important NASA partners in many areas of science and technology. As part of its broadening focus on advancing the field of distributed heterogeneous computing, NASA supports ongoing research efforts in a number of disciplines through the grant process.
SCI 101 - Introductions to the University for Science Majors

SCI 101 is a First Year Experience (FYE) program designed to help students make the transition to college life by providing opportunities to explore, discover, and connect with the university and its resources. The course syllabus is focused on three themes whose learning outcomes enable the students to navigate their college careers successfully at UNLV. The first third of the course provides students with a tool kit of necessary college skills including note taking, test taking preparation, organization, and stress management. The middle third of the course focuses on research skills and critical thinking. Students participate in projects designed to advance their library literacy, research methods, public speaking, and technical writing. The final portion of the class focuses on university resources including academic and career advising, university academic standards, and student involvement. SCI 101 began as a pilot program during the spring 2007 semester. SCI 101 is the required FYE course in the College of Sciences for all freshman and transfer students with less than sophomore status.
HiPSEC focuses on properties of materials relevant to the National Nuclear Security Administration's (NNSA) Stockpile Stewardship Program. High priority is given to measuring static and dynamic high-pressure studies for validating and improving computational models over a largely unexplored range of very high pressures and temperatures. Materials under study include d- and f-band metals, energetic materials and their detonation products, foams, and hydrogen and other and low-Z elements and their compounds.

HiPSEC staff measure equilibrium thermochemical properties, mechanical properties, reaction kinetics, and reaction products at static pressures using in situ X-ray diffraction; absorption, emission, light-scattering spectroscopy from infrared to X-ray wavelengths; and other chemical and physical methods.

Its mission also encompasses shock experiments at NNSA's Lawrence Livermore National Laboratory, Los Alamos National Laboratory, and Sandia National Laboratory. Scientists recover samples from these experiments for chemical, physical, and mechanical analysis.

Theoretical and computational studies focus on highly correlated and "warm" condensed matter systems. Under the Department of Defense's MURI program, HiPSEC scientists are studying effect of defects on the mechanisms of initiation and energy release in energetic molecular crystals.

Collaboration: This integration of high-pressure science programs in Nevada with programs at NNSA's National Laboratories, DOD Research Laboratories, and other university laboratories aims to enhance Nevada's scientific and educational infrastructure, while developing focused high-pressure research programs relevant to the missions of DOE and DOD. HiPSEC is a member of the High Pressure Collaborative Access Team (HPCAT) at the Advanced Photon Source of Argonne National Laboratory.

In addition to HPCAT facilities at the Advanced Photon Source, HiPSEC has materials science laboratories on the UNLV campus for crystallography, solid-state spectroscopy, cryogenic studies, and synthesizing and characterizing foams. HiPSEC also maintains computational centers for engineering and solid-state theory on the UNLV campus.
Solar and Renewable Energy Minor

Through an industry-education partnership with NV Energy, UNLV has established educational programs in sustainable energy. The undergraduate Solar and Renewable Energy Minor was developed to catapult Nevada and UNLV into an alternative energy leadership role and to meet workforce needs of the region. This has attracted new students to UNLV and provides an excellent opportunity for workforce development in the state and region. The minor is available to all undergraduate students at UNLV. There are two tracks (Engineering and Science Track and Policy Track) that have appropriate curriculum where students can add this onto their existing degree program. In the Fall semester of 2009, the first group of students enrolled in the minor. The number of students enrolled in the minor has increased from 43 in the Fall 2009 semester to currently 84 in the Spring 2011 semester. One of the opportunities for students to have an integrative experience is through undergraduate research that they conduct with a faculty member.

Urban Sustainability Initiative

Two Department of Energy Grants are being used to implement the Urban Sustainability Initiative (USI) at the University of Nevada, Las Vegas. USI is supporting various interdisciplinary research teams, graduate students, and interns. These research efforts in environmental, economic, and social sustainability. They address critical areas of (e.g., energy, water, transportation, health, built environment) that were identified by the Brookings Institution Mega Mountains study (2008) as critical for the regions continued prosperity. Undergraduate students are supported through this initiative to move forward campus sustainability efforts in education, research, and operations.
Introduction
The declining water level of the Las Vegas Valley aquifers and the half-empty Lake Mead is an issue of great concern. The decrease of water storage in the region can be attributed to natural environmental factors, such as changing rainfall patterns and evaporation, but climate change may also be a contributing factor. This project utilizes data from NASA and numerous other agencies for hydrogeological comparisons and calculations to assess the possible effect of climate change on groundwater storage in the Las Vegas Valley.

Precipitation Modeling
- CCRFCD rainfall station data: 2003-2010
- Station data mapping and calculation
- Average precipitation & deviation from mean

Evapotranspiration Modeling
- DRI’s climate station temperature data
- DoD daylight duration data
- Monthly mean values calculated
- Blaney-Criddle Method

Lake Mead Water Level
- Bureau of Reclamation surface level data from 2003 to 2010
- Data graphed for trending observations

GRACE TWS Modeling
- Data taken from 2003 to 2010
- Surface mass variations calculated to cm
- Changes in surface mass due to changes in ground water storage
- Errors: filtering, lingering atmospheric signals, calculation limits, measurement errors

Preliminary Results
- Precipitation results for 46 stations
  - 2003-2010 data shows a trending decrease in yearly accumulation
- ET results from 14 stations
  - Data shows a slight increase in evapotranspiration, due to an increase in temperatures

Evapotranspiration and Climate Data
- GRACE data for TWS change relative to the mean calculated
- Decrease of water storage trend throughout the valley

Lake Mead Water Level
- Similar trends between the GRACE gravimetric data and the declining levels of Lake Mead
- Trends may be revealing impact of drought and climate change in Southern Nevada

Next Steps
- Calculate more accurate estimates of precipitation and recharge
- Possibly using Maxey and Eakin method and PRISM data
- Quantify precipitation volume minus ET using Isotychel method for elevation
- Calculate percentage of precipitation at each elevation level to obtain more accurate values
- Quantify Lake Mead volume and calculate percentage of water compared to the Las Vegas Valley
- Create formula for quantifying percentage of precipitation, ET and Lake Mead water data to GRACE gravity data

Acknowledgements
Victor Zlotnicki (Oceanographer, NASA/JPL), David Donovan (Hydrologist, SNWA), Joseph Hutchens (Geographer, USBR), Michelle Breckner (Service Climatologist, DRI), Clark County Regional Flood Control District, U.S. Naval Observatory. This work partially supported by NSF Grant # EPS-0814372.

References
Detailed references available upon request.
Title: Drought Characterization of the Las Vegas Valley using Satellite Observations of Terrestrial Groundwater Storage

Abstract: The declining water levels of the Las Vegas Valley aquifers and the half-empty Lake Mead are an issue of great concern. This project utilizes data from NASA and numerous other agencies for hydrogeological comparisons and calculations. Graphed results show similar trends between GRACE (Gravity Recovery and Climate Experiment) satellite data and the declining levels of Lake Mead. The observations of GRACE total water storage, precipitation, evapotranspiration and the net flux of water in the area all show a similar trending decline in yearly water accumulation, which may be indicators of the impact of drought and climate change in Southern Nevada.

Why are you doing this project? I am doing this project because I'm interested in solving water resource issues and the information that satellite data can provide to help resolve these types of issues.

What problem are you trying to solve? The effects of climate change on Las Vegas Valley.

What tools or equipment are you using? GIS software, calculations, etc.

Why is your project worth researching? It is important to understand the effects that climate change is having on the Las Vegas Valley, so that we can better predict our water resources in years where we will have less rainfall and higher temperatures, which will cause more evaporation. By understanding these events, we will be able to better manage our water resources.

What relevance will it have on the community, society, and in your research field? By understanding the effects of climate change on the water resources of Las Vegas Valley, we will be able to better manage our water supply and prevent water shortages.

What did you find? There are similar trends between the GRACE gravimetric data and the declining levels of Lake Mead. These trends may be revealing impact of drought and climate change in the Las Vegas Valley.

What is the future for your research project? I would like to continue my research to gain more accurate estimates of precipitation and recharge and eventually create a formula for quantifying the percentage of precipitation, ET and Lake Mead water data to GRACE gravity
Genetically Modifying *Arabidopsis thaliana* with a Gene from Drought-Tolerant Xerophyte

**Larrea tridentata** (Creosote Bush)

Norris Lam, Liyuan A. Zhang, Lingkun Gu, and Qingxi J. Shen  
School of Life Sciences, University of Nevada, Las Vegas 89154

**Abstract.** *L. tridentata*, or desert creosote bush, is a xerophytic C3 plant native to the American Southwest, and is known to have evolutionarily developed sophisticated cellular mechanisms to deal with periods of intense abiotic stress. Particularly, complex signaling pathways in *L. tridentata* allow it to survive in periods of severe water deficiency. Through the findings of Zou et al. [5, 6], LtWRKY21 synergistically works with abscisic acid (ABA) to transactivate both ABA-inducible *RD29A* and *HVA1* promoters. In addition, as ABA and gibberellic acid (GA) pathways are known to act antagonistically, expectedly, the findings of Zou et al. suggest that LtWRKY21 activates ABA signaling pathways and represses GA signaling pathways [5, 6]. More importantly, the LtWRKY21 transcription factor’s synergy with ABA is directly linked to some remarkable molecular adaptations of *L. tridentata*, some of which include stomatal closure to prevent transpiration, and slowing down gene expression to withstand dehydration [6]. To examine some of these mechanisms, the model plant *Arabidopsis thaliana* will be transformed with the LWRKY21 coding region via Agrobacterium-mediated transformation. Successful transformants will be selected and the subsequent generation of transgenic plants will be assayed. Both phenotypic (screening) and genotypic (qRT-PCR and Southern Blot) examination will allow the function and expression patterns of *L. tridentata* to be elucidated under simulated drought. In order for *L. tridentata* to be successfully transformed into *Arabidopsis*, a tumor-inducing (T) plasmid must be engineered to carry *LWRKY21*.

**Introduction**

WRKY transcription factors have been identified as central components and activities of pathways involved in biotic stress (pathogen attack) and abiotic stress (heat, salinity, dehydration, and cold) [7]. By examining WRKY transcription factors in plants known to tolerate high environmental stress (e.g. *Hordeum vulgare*, *Arabidopsis thaliana*, and *Zea mays*), researchers have discovered that one of the main stressors that these plants are able to overcome is water conservation. This strategy can be linked to global agriculture, on which global thriving is having a negative effect. Many suffer from malnutrition, as the environment is such that they fail to mature crops. A major factor accelerating famine is drought. Water shortages translate to the lack of food and less agriculture, resulting in dramatic food supply. By focusing on a plant that thrives in an extremely arid climate, crops can be engineered to require less water, improving the sustainability of major crops of the world negatively impacted by drought conditions [5, 6].

**Methods and Materials**

**Construct Preparation:** To facilitate cloning, the cloning vector pBlueScript SK+ was used as an amplification vector to express the gene of interest. The coding region of the *LtWRKY21* gene was amplified using two primers designed from the 5’ and 3’ end of the sequence. *SalI* and *XhoI* restriction enzyme sites were included in the primers to facilitate cloning. To verify the ligation into pBlueScript SK+, the restriction enzyme SpeI was used.

**Rationale**

**Fig. 1: LWRKY21 and the *RD29A* Promoter**

The T-DNA, the section of DNA that will be transformed into *Arabidopsis*, consists of the *RD29A* promoter, the *RD29A* coding region, anti-HA antibody (Sigma) for protein purification/Western blot analysis. Two long, single-stranded oligonucleotides were designed to produce XmaI and BamHI sticky ends upon annealing to facilitate cloning.

**Results**

**Fig. 2: Rd29A Promoter**

The *RD29A* promoter was amplified from a *Arabidopsis thaliana* cDNA library taken from leaves of the *RD29A* over-expression line (VT679). The *RD29A* promoter was amplified using two primers designed from the 5’ and 3’ end of the sequence. Both PCR-amplified fragments were gel-purified and ligated into pBlueScript SK+ along with the 3xHA-tag sequence, a kanamycin resistance gene (Kan r). Each component of the T-DNA (with exception to the <i>kan r</i>) will be targeted by an anti-HA antibody (Sigma) for protein purification/Western blot analysis.

**Future Plans**

**Fig. 6: pDT01012004 (pSoup with T-DNA Insertion) and pSoup**

All components of the amplified section of the T-DNA will be cloned into pHi1 plasmid to facilitate screening into the master transformation vector. The T-DNA section will be ligated into the pSoup vector to facilitate screening into the master transformation vector. The T-DNA section will be inserted into pSoup plasmid for screening.

**References**


[5] Zou, Xiaolu, Jeffrey Seemann, Dawn Neuman, and Qingxi Shen. “A WRKY Gene from Larrea tridentata (Creosote Bush) synergistically works with abscisic acid (ABA) to transactivate both ABA-inducible *RD29A* and *HVA1* promoters. In addition, as ABA and gibberellic acid (GA) pathways are known to act antagonistically, expectedly, the findings of Zou et al. suggest that LtWRKY21 activates ABA signaling pathways and represses GA signaling pathways [5, 6]. More importantly, the LtWRKY21 transcription factor’s synergy with ABA is directly linked to some remarkable molecular adaptations of *L. tridentata*, some of which include stomatal closure to prevent transpiration, and slowing down gene expression to withstand dehydration [6]. To examine some of these mechanisms, the model plant *Arabidopsis thaliana* will be transformed with the LWRKY21 coding region via Agrobacterium-mediated transformation. Successful transformants will be selected and the subsequent generation of transgenic plants will be assayed. Both phenotypic (screening) and genotypic (qRT-PCR and Southern Blot) examination will allow the function and expression patterns of *L. tridentata* to be elucidated under simulated drought. In order for *L. tridentata* to be successfully transformed into *Arabidopsis*, a tumor-inducing (T) plasmid must be engineered to carry *LWRKY21*.

**Acknowledgements**

I would like to express my gratitude to my advisor, Professor Susan Punzalan, for her continued support and advice throughout this project. Her guidance and encouragement have been invaluable to me. I also thank Dr. David Lindquist for his support and guidance. Finally, I would like to thank the reviewers for their constructive feedback. This research was supported by NIH Grant Number P20 RR-016464 from the INBRE Program of the National Center for Research Resources.
Title: The Role of a Desert Plant Gene, LtWRKY21, in Enhancing the Drought Tolerance of rabidopsis thaliana.

Abstract: Research has shown that a gene from C3 xerophyte Larrea tridentata (creosote bush), LtWRKY21, is involved in pathways governing creosote bush’s high tolerance to environmental stress. By understanding the way in which creosote bush adapts to drought, crop plants can be engineered to be more drought tolerant during times of imminent global climate change. To study the underlying mechanisms of creosote bush drought response, the LtWRKY21 gene was mobilized into the model organism Arabidopsis thaliana. Chlorophyll degradation, cellular electrolyte leakage, and water content in leaves will serve as indicators of drought tolerance in LtWRKY21-transgenic A. thaliana after treatment in chemically simulated drought.

Why are you doing this project? Research in desert plants native to the American Southwest is underrepresented, and the genetic mechanisms behind their amazing environmental stress tolerance has not been well studied.

What problem are you trying to solve? Understanding how desert plants such as creosote bush cope with extreme environmental stress. An understanding of desert plant stress tolerance will allow me to engineer crops such as rice to be more drought tolerant particularly in times of global climate change.

What tools or equipment are you using? Basic tools of molecular biology work. This includes pipettes, PCR machines, spectrophotometers, and of course, the human mind.

Why is your project worth researching? Agricultural sustainability is at risk and there are millions of dollars lost because crop harvests do not complete due to water shortage and heat, etc. To invest in my project is to invest in the future of global agriculture, if it is to remain sustainable.

What relevance will it have on the community, society, and in your research field? Studying creosote bush will bring more awareness from the community about the remarkable plants that survive here in Nevada. It would inspire those who find a true concern for water shortage and agricultural efficiency.

What did you find? Data has not been attained. Transgenic plants needed for study are still being generated.

What is the future for your research project? To achieve full transgenic expression of the creosote bush gene LtWRKY21 in the model plant Arabidopsis thaliana to study the genetic interactions that take place when plants are exposed drought stress.
Next generation nuclear fuel: Interaction between Palladium and Zirconium Carbide layers

D. Hanks, S. Krause, T. Hofmann, M. Weir, Y. Zhang, C. Heske

Objective

Next generation nuclear fuels will consist of a layered sphere that contains a fissile material at its core, surrounded by coatings serving various purposes. During the fission process, a broad distribution of fission products is produced. The various coating layers and diffusion barriers are designed to contain these products. In the most common design, SiC is used as a diffusion barrier, but test experiments suggest that some fission products, in particular Pd, chemically interact with SiC. ZrC presents an alternative due to its mechanical strength and stability at high temperatures. This study uses X-ray Photoelectron Spectroscopy and in-situ growth of Pd on a ZrC surface to monitor the chemical environment of Pd and ZrC as a function of Pd thickness and temperature (32-1200 °C).

Equipment

(a) High-dynamic-range Electron Analyzer ⇒ XPS, XAES, UPS
(b) X-ray Source ⇒ XPS, XAES
(c) EUV Source ⇒ UPS
(d) e-Gun ⇒ IPES
(e) IPES detector ⇒ IPES
(f) Ar⁺-Ion Gun ⇒ sample cleaning
(g) Scanning Probe Microscope ⇒ AFM, STM, STS, KPFM
(h) Glove Box ⇒ clean sample entry
(i) High-resolution Electron Analyzer ⇒ XPS, XAES, UPS
(k) Monochromatized X-ray Source ⇒ XPS, XAES
(l) Monochromatized UV-Source ⇒ UPS

Spectroscopic Techniques

(i) XPS (X-ray Photoelectron Spectroscopy)
(ii) UPS (UV Photoelectron Spectroscopy)
(iii) XAES (X-ray excited Auger Electron Spectroscopy)
(iv) XES (X-ray Emission Spectroscopy)
(v) IPES (Inverse Photoemission Spectroscopy)
(vi) XAS (X-ray Absorption Spectroscopy)

The growth pattern of Pd on ZrC

![Growth pattern of Pd on ZrC](image)

Chemical environment of Pd/ZrC at elevated temperature

![Chemical environment of Pd/ZrC](image)

Results/Future Work

As a function of annealing temperature, we find that the chemical environment of Pd changes during Pd growth (shift to lower binding energies) and during annealing (shift to higher binding energies). This is coupled with an overall increase of oxygen on the surface, in part in the form of ZrO₂. Furthermore, we find a decrease in intensity of the Pd peaks when heated, presumably due to diffusion into the bulk (or a change in overlaver morphology). Pd diffusion could destabilize the ZrC layer of the TRISO particle. Further investigation of the Pd chemical environment is ongoing, including microscopy studies, to paint a comprehensive picture of the Pd/ZrC interface as a function of preparation conditions, in particular annealing temperature. This picture will allow pathways for a deliberate modification of ZrC surfaces to enhance stability in a nuclear fuel environment.

Acknowledgement

Lawrence Livermore National Laboratory
Oak Ridge National Laboratory
Title: Growth and Interaction of Palladium Thin Films on Zirconium Carbide

Abstract: Growth and Interaction of Palladium Thin Films on Zirconium Carbide D. Hanks, S. Krause, Y. Zhang, and C. Heske Department of Chemistry, University of Nevada Las Vegas Zirconium carbide has been proposed as a coating layer for next generation (“TRISO”) nuclear fuel, and is intended as a diffusion barrier to contain fission products (e.g., Pd). To study the chemical interaction between Pd and ZrC, their interface was investigated using X-ray Photoelectron Spectroscopy (XPS). Pd was step-wise deposited onto ZrC in ultra-high vacuum, and the chemical interaction at the interface was monitored, also as a function of temperature (up to 1000 °C). In the presentation, details of the chemical interaction and changes in the chemical environment of Pd and their relevance for TRISO fuel will be discussed.

Why are you doing this project? I am investigating the interaction of the fission product, Pd, and a next generation nuclear fuel layer, ZrC.

What problem are you trying to solve? I am trying to prevent a problem rather than solve one. If the Pd and ZrC interact, it is important to know before power plants are built.

What tools or equipment are you using? I use what my group has deemed a "toolbox." There are a number of instruments contained within a single vacuum chamber. (point to picture of lab)

Why is your project worth researching? The ZrC layer is to be a diffusion barrier. This will prevent the escape of nuclides produced during the fission process. If Pd interacts with the ZrC layer it is possible the nuclides escape into the reactor core.

What relevance will it have on the community, society, and in your research field? This project is design to investigate the stability of next generation nuclear fuel. Nuclear power is part of the diverse sources of energy in this country and one should ensure it is safe prior to building a new plant.

What did you find? First we found that Pd grows in layers and not islands. Second we found that Pd is doing something while on ZrC at higher temperatures. We are still investigating what the interaction is.

What is the future for your research project? This project is funded by the DOE and due to the lack of a national budget the DOE does not know what amount of funding we will receive to continue research.
**Methods:**

- Analyzed SPH simulations of z=6-9 galaxies.
- Utilized cosmological SPH simulations to model galaxy evolution.

**Motivation:**

Using cosmological hydrodynamic simulations, we examine the photometric properties of z=6 to z=9 galaxies, such as the color-color diagrams and rest-frame UV luminosity function. By performing a fit to the Schechter luminosity function, we find an evolving faint-end luminosity slope of -2.00 and steeper for z=9 to z=6, suggesting a significant population of small faint galaxies which are currently beyond our observational limits. Motivated by our concurrence with the observed photometric properties, we explore the duty cycle, star formation histories (SFH) and number densities of these high-z galaxies. We find that although individual galaxies have bursty SFH, the mean SFH show a clear exponentially increasing SFH with time-scales ranging from 70 Myr to 200 Myr for galaxies with M*=10^10 to 10^11 Msun. We also calculate the duty cycle of star formation above an observable star formation threshold, and find that it makes a steep transition from zero to unity between M*=10^10 to 10^11 Msun.

**Results:**

- **Schechter Fit Parameters**
  - $\sigma$ vs. M* @ z=6: Faint-end slope $\sigma$= -2.21 to -2.45.
  - M* vs SFR @ z=6:
      - Yellow shade represents data above the SF threshold.
      - Cyan data: Schaerer & de Barros '10.
  - SFR history down to z=6:
      - Galaxy samples divided.
      - SFR up to 10^11 M*.

- **Galaxy Evolution:**
  - SF history down to z=6:
      - Galaxies show extended SF down to z=6.
      - SFR up to 10^11 M*.

**Conclusions:**

- Calculated galaxies satisfy the color-color criteria at z=6.
- SFH are consistent with observations of redshift evolution.
- Very steep evolving SFH at z=6.
- Episodic, bursty SF histories.
- Examination of the duty cycle could lead to a better understanding of the impact of initial environment.
Title: The Universe in a Box

Abstract: When and how galaxies formed throughout the history of the Universe is one of the most fundamental questions of astronomy and astrophysics. As technology improves, astronomers are able to push the frontier of galaxy observation to a period when the Universe was less than 1 billion years old. This is when the first galaxies are beginning to form. However, beyond the limits of observational technology lies data fundamental to our complete understanding of these processes. Using state-of-the-art cosmological hydrodynamic computer codes combined with access to the nation’s largest and fastest supercomputers, we are able to simulate the formation and evolution of galaxies self-consistently from very early time to the present time, and explore the same physical and photometric properties of early galaxies. Using simulated universe in the computer, we make predictions of what lies beyond current observational limits, and make predictions for the next generation of space telescopes.

Why are you doing this project? I am doing my project to understand galaxy formation in the early Universe.

What problem are you trying to solve? I was trying to learn more about my topic rather than solving it. When you know more about the past of the universe, you can learn about their future as well.

What tools or equipment are you using? Gadet-3: Smooth Particle Hydrodynamic Code

Why is your project worth researching? Quantifying the number density of faint low mass galaxies in the early Universe will give insight into how galaxies evolved and how they affect their environment.

What relevance will it have on the community, society, and in your research field? NA

What did you find? Beyond observational limits we find a much higher number of faint low mass galaxies than is predicted by observation.

What is the future for your research project? The future for my research project includes exploring the discrepancy in mass estimates and star formation histories between observations and simulations.
Abstract

We conducted a series of experiments on the decompositions of energetic materials NaBH₄, NH₄BH₄, HMX, and RDX under different pressures using the x-ray diffraction (XRD) technique. We also studied the less known but high-performance explosive FOX-7's behaviors using high-pressure techniques. For the chemical decomposition of NaBH₄, we discovered possible x-ray induced hydrogen gas generation. In the decomposition of HMX and RDX, we discovered that the rate of decay of these materials vary with respect to pressure. For the study of FOX-7's high-pressure behavior, we discovered potential phase changes and pressure induced chemical reactions as pressure increased.

X-Ray Induced Chemistry in Hydrogen Rich Materials: NaBH₄ and NH₄BH₄

High Pressure Study of FOX-7 Using Infrared Spectroscopy

FOX-7 is an insensitive high pressure explosive component. It has a non-energetic compound, the nitro azide backbone, and energetic nitro groups contribute to its stability of high-pressure chemical decompositions of FOX-7, similar to most other energetic-nitro-containing explosives.

High Pressure Study of X-Ray Induced Decay of HMX Using XRD

HMX, also called octogen, is a powerful and relatively insensitive high explosive. It is used in high-yielding, high-velocity military explosives. The molecule of HMX is an eight-membered ring of carbon atoms, which makes its high molecular weight, its high entropy, and its sensitivity to aromatic molecules the most potent chemical explosives manufactured.

High Pressure Study of X-Ray Induced Decay of RDX Using XRD

RDX is an alternative explosive for Research Department Exploration. It is an aromatic compound used in military and industrial applications. We placed HMX powder in a Parr-Edinburgh cell and subjected it to varying pressures in order to observe the changes that occurred under the different pressures. The results showed that the decay rate of RDX under x-ray bombardment becomes slower as pressure increases. This result could be the focus of future studies.

We gratefully acknowledge support from 28, 397x143, 28, and the DOE DE-FG02-99ER-20785 Cooperative Agreement with UNLV. HIPSEC is supported by DOE-NSF, under Contract DE-AC02-98CH10886.
Title: HiPSEC X-ray Diffraction and Infrared Studies on Energetic Materials

Abstract: We are undergraduate research assistants for Dr. Pravica at the UNLV department of Physics and Astronomy, HiPSEC (High Pressure Science and Engineering Collaboration.) Mai is an Applied Physics major with a minor in Biology. She is also an University Honors Scholar and a Phi Kappa Phi member. Yu is pursuing a dual degree in Chemistry and Physics, and a minor in Mathematics. He is also an University Honors Scholar and a member CSSA.

Why are you doing this project? To represent some of the research being conducted at UNLV's HiPSEC program.

What problem are you trying to solve? We would like to understand the behavior of energetic materials under extreme conditions.

What tools or equipment are you using? Diamond anvil cells (DAC), Paris-Edinburgh Cell (PEC), Argonne National Laboratory Advanced Photon Source HP-CAT BMB-16 (x-ray diffraction facility), Brookhaven National Laboratory (Infrared facility), energetic materials (HMX, RDX, FOX-7, NaBH4, NH3BH3, KClO3)

Why is your project worth researching? We are simulating the detonation conditions (high temperature, high pressure, x-ray) of these energetic materials to better understand the handling and utilization of them.

What relevance will it have on the community, society, and in your research field? Our knowledge about these energetic materials will help ensure the safety of the public and provide experimental data for the potential application of these materials.

What did you find? 1. The chemical structures of these energetic materials change with respect to temperature and pressure. 2. These materials decompose under x-ray bombardment. The decomposition rate varies according to the pressures these materials are subjected to.

What is the future for your research project? We will carry on our data analysis to find out the equation of state (EOS) for each of the energetic materials; this will be a valuable contribution to any study of the chemical reactions involving these materials.
Construction and Use of a Direct Calorimeter to Estimate Energy Expenditure in Hibernators
Mark S. Burger and Frank van Breukelen
School of Life Sciences
University of Nevada Las Vegas

Metabolic rates have traditionally been estimated through indirect calorimetry (gas exchange or respirometry) due to its ease and availability. Oxygen consumption neglects the contributions of anaerobic metabolism, while direct calorimeters (heat production) estimate both aerobic and anaerobic metabolism. Wässer and Hoffmann (1995) report anaerobic metabolism may be more important to small rodents than was previously thought. During the non-stress state of hibernation, we hypothesize that anaerobic processes may play an even greater role in hibernating animals. To address this question, we constructed a very sensitive calorimeter that utilizes the Seabed effect from a Fenwal/Phoenix thermopile. The calorimeter design incorporates a simplified data acquisition protocol and minimal sample preparation.

Calorimeter System

By measuring heat production (calorimetry), one can estimate metabolic rate. Historically, such measurements of direct calorimetry were difficult. As a result, most studies utilise indirect calorimetry wherein oxygen consumption and/or carbon dioxide production are measured. One limitation to this approach is that anaerobic metabolism is ignored.

**Total Metabolism = Aerobic Metabolism + Anaerobic Metabolism**

**Problem:** Traditional approaches to estimating metabolic rate neglect the anaerobic component.

**Solution:** We made a calorimeter that can estimate direct heat production and therefore give a reliable estimate of the anaerobic contributions to metabolism.

**Direct heat measurement – Heat produced in the animal chamber generates a voltage through the use of the Seebeck effect.**

A simple thermoelectric device is used, consisting of a metal (copper) being heated in the animal chamber whereas another metal, and an electrical circuit wires. The Seebeck effect is used to measure the difference in temperature between the two metal plates. The Seebeck effect is a thermoelectric effect where a voltage is produced when a temperature gradient is applied across a material. This voltage is proportional to the difference in temperature between the two metal plates. The voltage is amplified and recorded every 1 second by a computer using the Peltier effect.

The voltage amplifier – The voltages generated by the thermal electric device or Peltier device are amplified using an AD8820 operational amplifier.

A Stable Systems Telemetry II Respiratory - allows measurement of O2 consumption and CO2 production to calculate aerobic metabolism. The calorimeter is protected through the use of domeless chamber design.

**Respiratory loss – the animal through evaporation is activated for by measuring the relative humidity of the air before and after the animal chamber.**

**Thermocouple - the temperature of the animal chamber is monitored.**

Supported by cooperative agreement EPS-0614272 from the National Science Foundation

**Model Organism – Golden-Mantled Ground Squirrels (Spermophilus lateralis)**

- Ambient temperature in their metabolic chamber was ~ 4°C
- Body temperatures are ~ 1°C above ambient temperature, with records as low as -2°C being recorded. Body temperatures rapidly increase to about 36°C in just a few hours when hibernators spontaneously arouse from torpor
- Oxygen consumption during hibernation may be as low 1/100 of active rates. Little is known of anaerobic metabolism during hibernation.

Hypothesis
We hypothesize that anaerobic metabolism would make a significant contribution to overall metabolism in torpid small hibernating squirrels.

**Calibration**
Complete transfer of heat from one substance to another is not instantaneous.

An electrical resistor is placed in the animal chamber to generate a constant amount of heat in watts. The amount of heat absorbed by the mineral oil per unit time is related to the voltage. The proportionality constant or temperature constant of heat flow is determined by the materials present in the animal chamber, the properties of the mineral oil, and the rate of change of the mineral oil temperature.

**Two time constants are used to interpret the data from the calorimeter.** The first is related to the time for the animal to reach dynamic equilibrium, where heat can no longer be added or lost from the mineral oil. The second is related to the amount of time it takes for the mineral oil to make one complete cycle through the caloric loop.

The rate of change of the voltage is used to calculate the voltage at every second. A computer reads and records the data. The voltage is amplified and stored every second as a computer using the Peltier effect.

**Data/Figures**

**Conclusions**
We successfully constructed a direct calorimeter

The calorimeter is sensitive enough to detect the heat production of a small squirrel

Our preliminary results suggest heat production in squirrels undergoing an alarm arousal is greater than for squirrels spontaneously arousing from torpor (n = 2 squirrels)

Respirometry shows much more modest differences between alarm and natural arousals

These data are consistent with an important role for anaerobic metabolism during hibernation.
**Title:** Understanding the Biological Effects of Global Climate Through.

**Abstract:** Metabolic rates have traditionally been estimated through indirect calorimetry (gas exchange or respirometry) due to its ease and availability. Oxygen consumption neglects the contributions of anaerobic metabolism, while direct calorimetry (heat production) estimates both anaerobic and aerobic metabolism. Walsberg and Hoffman (2005) report anaerobic metabolism may be more important to small rodents than was previously thought. During the non-steady state of mammalian hibernation, we hypothesize that anaerobic processes may play an even greater role in fueling metabolism. To address this question, we constructed a very sensitive calorimeter that utilizes the Seebeck effect from a thermoelectric element (Peltier device). We describe its construction, characterization and will use the device to estimate heat production in hibernators this winter. We will compare estimates of energy use from the direct calorimeter from simultaneously obtained respirometry data to provide the most complete picture of energy use during hibernation to date.

**Why are you doing this project?** Traditional approaches to estimating metabolic rate neglect the anaerobic component.

**What problem are you trying to solve?** We hypothesize that anaerobic metabolism would make a significant contribution to overall metabolism in torpid small rodent hibernators.

**What tools or equipment are you using?** We made a calorimeter that can estimate direct heat production and therefore give a reliable estimate of the anaerobic contributions to metabolism. Model Organism - Golden-Mantled Ground Squirrels (*Spermophilus lateralis*).

**Why is your project worth researching?** It is worth examining the expenditures as it is at odds with energy spearing hibernation.

**What relevance will it have on the community, society, and in your research field?**

**What did you find?** Our preliminary results suggest heat production in squirrels undergoing an alarm arousal is greater than for squirrels spontaneously arousing from torpor (n = 2 squirrels). Respirometry shows much more modest differences between alarm and natural arousals. These data are consistent with an important role for anaerobic metabolism during hibernation.

**What is the future for your research project?** We will continue to investigate the mechanisms of translational depression and the implications of that physiological regulation.
Elastic Plastic Self Consistent (EPSC) Modeling of Plastic Deformation in Fayalite Olivine

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Introduction

The Elastic Plastic Self Consistent (EPSC) model is a computer simulation of thermo-mechanical deformation of a polycrystalline aggregate. It uses parameters loaded by the user to predict developing internal stresses in the polycrystal throughout the elastic plastic regime at predefined incremental steps of stress and strain. This is accomplished by using the properties of the material being simulated such as thermal properties, elastic properties, anisotropy of single crystals and hardening of slip systems. Using the information provided by the model and comparing it to X-ray diffraction experimental data gathered from deforming fayalite we can achieve a better understanding of upper mantle deformation.

Elastic Plastic Self Consistent Model

Turner & Tome (1994)

Data Comparison

Experimental Method

D-DIA apparatus
- 0-WC or diamond tipped anvils
- Top and bottom anvils move independently
- Sample inside of a multilite cube
- Synchrontron x-rays pass through gaps in anvils
- Diffracted x-rays collected by ten detectors

Diffraced x-rays are collected on an array of ten detectors at various angles to compression direction. The most pertinent detectors are those located in the compression and transverse directions. This data is continuously collected through deformation and measures lattice strain. Along with radiographs acquired at certain time intervals that are used to determine macroscopic sample strain, a collective picture of deformation can be established.

Future Work

The EPSC model allows us to assign a weighted percent to different grain orientations. These changes will affect which slip systems are more dominant during deformation and hopefully will allow a more accurate model of the real crystal experiments performed at the synchrotron.

By graphing lattice plane strain of each combination of these 8 slip systems, an image of how each plane is strained at maximum stress can be established. This can be used to determine which grains are more active in the deformation process within the EPSC model. The use of these peak order graphs can be used for a quick comparison with the fayalite experimental data to determine which of these 8 slip systems are more active in the real world experiments.

Diffraction peaks, which represent lattice planes, are plotted against channel number and over time d-spacing changes can be observed.

By graphing lattice plane strain of each combination of these 8 slip systems, an image of how each plane is strained at maximum stress can be established. This can be used to determine which grains are more active in the deformation process within the EPSC model. The use of these peak order graphs can be used for a quick comparison with the fayalite experimental data to determine which of these 8 slip systems are more active in the real world experiments.

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Christopher Cline II  
Email: clinec4@unlv.nevada.edu  
Former High School: Mountain View Christian School  
Location of High School: Las Vegas, NV  
**Mentor/Advisor:** Pamela C. Burnley  
Educational Institute of Project: UNLV  
Department: Geology  
Research Site: NSLS, LFG, TEC, SEB

**Title:** Elastic Plastic Self Consistent (EPSC) Modeling of Plastic Deformation in Fayalite Olivine  

**Abstract:** We are using an Elastic Plastic Self Consistent Model (a type of numerical simulation) to study deformation of olivine. Olivine is one of the major constituents of the Earth’s upper mantle and its deformation properties have an important influence on how the Earth’s crust deforms. For example, the flow strength of olivine limits the size of the largest earthquakes and the heights of the tallest mountains on Earth. By comparing the results of our simulations with data from olivine deformation experiments we are able to better interpret the experimental data.

**Why are you doing this project?** I am working with Professor Burnley on a long term research project of hers. When I was informed of the project and what it was attempting do to I jumped in right away to assist in the project.

**What problem are you trying to solve?** We are attempting to better understand the flow strength of main constituent minerals that make up the bulk of the Earth’s crust.

**What tools or equipment are you using?** The main tool we use is the elastic plastic self-consistent model (EPSC). Along with experimental deformation data of fayalite from the national synchrotron light source.

**Why is your project worth researching?** Better understanding how the bulk earth reacts to stresses can improve the current model for the interior of the earth. This flow strength problem we are working on directly affects earth processes such as; earthquakes and organic processes.

**What relevance will it have on the community, society, and in your research field?** Having a correct computer model that accurately depicts earths processes could be used by geophysicists to better predict and understand major events such as earthquakes and volcanoes. This directly affects the public by being able to predict these events sooner and more accurately.

**What did you find?** We are currently in the processes of activating different slip systems in the EPSC model and along with changing the hardening parameters of the crystals the EPSC output data is looking more like the real deformation data.

**What is the future for your research project?** Adding in different parameters that are not included in the EPSC model currently, that other students are working on will hopefully make the model behave more like the real deformation data.
Will Graphene reach the limit to Moore's Law?

JIGAR DESAI AND DARRYL REESE

Abstract

Graphene is most recent material discovered by scientists and is a star on the horizon of materials science and condensed matter physics. The one atom thick, two dimensional material is an amazing conductor of electricity. Although graphene was not discovered completely until 2004, it has already revealed potential applications and scientists have begun researching ways of developing graphene products for the market. Only two products have been successfully produced so far, but scientists have encountered amazing results. This material has many potential applications in the real world and is about to change the future in a positive way.

What is Graphene?

Graphene is a flat monolayer of carbon atoms which are tightly packed in a two dimensional honeycomb lattice structure. It is allotropic of carbon and is the basic building block of graphitic materials such as graphene, carbon nanotubes and fullerene. One layer of carbon is only about 1/42 nanometers thick, which means it would take approximately three million sheets of graphene for it to be one millimeter thick!

The History Behind Graphene

Graphene was first theorized in 1947 while a theoretical physicist by the name of Phillip Wallace was conducting carbonic research. The term “graphene” was not coined until a physicist by the name Peter Goebl described single layer carbon in 1962. It wasn’t until 2004 that graphene was fully discovered in its observational and testable form. Two physicists from the University of Manchester, Andre Geim and Konstantin Novoselov, founded graphene in 2004 and received a Nobel Prize in Physics on October 10, 2010 for founding a material known to be one of the most promising and versatile materials ever discovered.

How was Graphene Discovered?

Andre Geim and Konstantin Novoselov’s procedure for discovering graphene was fairly simple. They placed a miniscule amount of graphite on adhesive scotch tape and repeatedly peeled away graphite strips until they were down to a single layer of the atomic plane. Thus graphene was discovered. Today, scientists use a process called chemical vapor decomposition in order to produce graphene. In this procedure, graphene is grown on top of copper foil. When graphene is produced, a thin layer of adhesive polymer is applied on the top of the graphene and the copper backing is dissolved off with the scientists peel off the adhesive polymer, resulting in a single layer of carbon.

In order to strengthen the graphene, multiple layers of the material are stacked upon one another.

Why Are Scientists So Crazy About This Discovery?

Well, there are many reasons why. Here are a few reasons why:

• Graphene is the thinnest possible material we can have.
• There is no other material that can compete with attributes of graphene.
• The material is overwhelmingly strong. It is stronger than a diamond and Researchers at Columbia University’s Fu Foundation School of Engineering have proven that “It would take an elephant, balanced on a pencil, to break through a sheet of graphene the thickness of Saran Wrap.”
• Graphene is extremely flexible. It has the ability to stretch by a quarter of its length, like rubber. It can also be folded like a piece of paper without affecting its conductivity.
• Graphene has a surface area of that of the largest known for its weight.
• The monolayer carbon has a mass of zero. According to scientists in order for an object to have mass it needs volume. In order for an object to have volume it has to have three dimensions. Since graphene is a two dimensional object, it has is mass less.
• Graphene has off the charts ability to conduct electricity, better than any conductor ever discovered.
• The single layered carbon has a lower resistance than iodium, which is used in transparent conductors today. Graphene can function smoother and faster than products which use iodium and won’t have a dead pixel problem that occurs in iodium based products. Also, graphene is a lifespan of a lifetime, contrast to that of iodium.

What Can Graphene Do For Us?

• Promises to revolutionize the electronic industry
• Produce lighter weight and cheaper computers
• Lighter weight and cheaper satellites
• Product clothing that can power and charge electrical devices efficiently
• Produce eco-friendly components because graphene is easier to recycle than any other material
• Produce higher efficiency as well as cheaper batteries that charge in the fraction of the time

as state of the art batteries produced today
• More durable and efficient credit card machines which would last a life time
• Make electronics faster
• Make electronic smaller
• Make electronics smaller
• Produce leak tight containers which can keep food fresh for weeks
• Cheaper and higher efficiency solar panels
• Cheaper gas prices
• Stronger medical implants
• Better sport equipment
• Produce processors with speeds up to 1 THz
• Will become commonplace substance such as plastic but will eliminate recycling problems since graphene is very easy to recycle
• Capability of producing computers as small as cellular devices, yet functions as well as a desktop
• Flexible touch screens
• Replace rare and expensive metals such as platinum and iodium and perform the same tasks with greater efficiency and a fraction of the cost
• Graphene will solve the global warming problem because it has the ability to produce pure carbon and does not have any adverse effects of reactions
• Graphene is easier to recycle than any other material.
• Cheaper gas prices
• Stronger and lighter materials
• Replace rare and expensive metals such as platinum and iodium and perform the same tasks with greater efficiency and a fraction of the cost
• Graphene will solve the global warming problem because it has the ability to produce pure carbon and does not have any adverse effects of reactions
• Graphene is easier to recycle than any other material.

Real World Applications

• Cheaper and more efficient transparent conductors
• Replace carbon fibers in infrared and surgical equipment
• Optoelectronics: Replace carbon fibers in solar panels and printed circuit boards
• Graphene based sensors capable of sniffing out dangerous molecules
• Use graphene powder in batteries to increase efficiency
• Higher efficiency optoelectronics
• Striker, stronger, lighter plastics
• Transparent conductive coating for solar cells and displays
• Stronger wind turbines
• Super-capacitors which store much more charge than regular capacitors
• Improved conductivity for materials
• High power, high frequency electronic devices
• Computer revolution
• Cheaper and more efficient than nanotubes
• Has the ability to send radio waves 100x farther than silicon based transmitters

Graphene in Action

Scientists and researchers have been hard at work ever since the discovery of graphene. Within six years, two graphene products have already been created and have showed amazing results.

First of all, in 2008, Manchester team created a one nanometer graphene transistor only one atom thick and ten atoms wide; this is thinner than the smallest possible silicon transistor and could have possibly reached the limit to Moore’s Law. The second invention is also mind blowing. Researchers in Korea and Japan engineered a large film of graphene, seventy six centimeters diagonally, were doped by treating it with nitric acid which enabled the sheet to act as a large transparent electrode and were demonstrated to work as a touch screen device.

Difficulties

Although there has been a few successful products produced using graphene, mass production is still an issue. The future definitely looks bright but right now the main goal for scientists is to devise more ways to produce graphene quickly, cheaply and in large quantity.

Bibliography

Title: Single Layer Carbon

Abstract: Graphene is most recent material discovered by scientists and is a star on the horizon of materials science and condensed matter physics. The one atom thick, two dimensional materials is an amazing conductor of electricity. Although graphene was not discovered completely until 2004, it has already revealed potential applications and scientists have begun researching ways of developing graphene products for the market. Only two products have been successfully produced so far, but scientists have encountered amazing results. This material has many potential applications in the real world and is about to change the future in a positive way.

Why are you doing this project? The discovery of graphene is fairly new and i wanted to know in depth what the material has to offer the world.

What problem are you trying to solve? Make transportation cheaper, help global warming, create more eco-friendly products.

What tools or equipment are you using? I mostly used the Internet to research my project but I first heard about graphene from my high school physics teacher.

Why is your project worth researching? My project is worth researching because it has a lot of potential to better our future.

What relevance will it have on the community, society, and in your research field? I am majoring in physics and graphene won the Noble prize in physics so it is relevent to my major. It is relevant to society and my community because graphene can create a cleaner environment as well as reduce prices of transportation, electronics etc.

What did you find? I found that graphene is the best conductor of electricity; it is microscopic and is very cheap to produce. This material can replace materials in electronics and hybrid cars with greater efficiency and the fraction of the cost while performing the same tasks.

What is the future for your research project? Graphene will eliminate the land fill problems that we have today, it will eliminate emissions problems that arise from vehicles, it will create smaller yet faster electronics and it will make materials such as electronics, vehicles and plastics cheaper because graphene is allotrope of carbon which is a very common element on earth.
Sergio Dieguez

Former High School: Western High School
Location of High School: Las Vegas, NV
Mentor/Advisor: Michael Pravica
Educational Institute of Project: UNLV
Department: Physics
Research Site: UNLV Physics, ANL APS

Title: High Pressure Study of X-ray Induced Decompositions of HMX and RDX

Abstract: We studied the x-ray induced decomposition of HMX and RDX as a function of pressure at the HP-CAT 16 BM-B beam line at the Advanced Photon Source. Pressure was generated by using a Paris-Edinburgh cell. By examining the intensity of selected diffraction peaks with time, we obtained decay rates which appear to vary with pressure. Our work is useful in that we are obtaining necessary data on the decomposition of these important explosives to aid in calibrating future studies, and useful thermodynamic parameters that may help develop a more complete theory of decomposition, deflagration, and detonation.
Aspect Ratio Dependent Buckling Mode Transition in Single-Walled Carbon Nanotubes under Compression
Jeremy Feliciano
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Introduction:
Most theoretical studies on buckling of single-walled carbon nanotubes (SWCNTs) under compression have focused on tubes with small aspect ratios. Buckling modes of SWCNTs with large aspect ratios remain poorly understood. We explore this issue using molecular dynamics simulations and unveil the underlying mechanism responsible for the aspect-ratio-dependent buckling mode transition.

Left panel: Normal shell buckling mode in compressed small-aspect-ratio SWCNTs.
Right panel: Large-aspect-ratio SWCNTs first undergo column buckling and then experience shell buckling at large strain.

The underlying mechanism for buckling mode transition can be understood from the responses of bond angles and bond lengths to strain. The definition of variables is shown in panel (A).
1. Responses of both bond lengths and bond angles contribute to the first column buckling, leading to the first drop in strain energy.
2. After the column buckling, variation of bond angles plays a more important role, which leads to the second strain energy release. The SWCNT is strongly curved before the second buckling.

From panel (C) one can see that the shell buckling comes from column-buckling-induced bending strain. Therefore we can develop a formula to predict this buckling strain based on bending buckling theory.

For a bent SWCNT, the critical buckling curvature can be estimated as:

$$ K_{cr} = \frac{bh}{d^2} $$

The relationship between the tube curvature and the compressive strain in a compressed SWCNT is:

$$ R = \frac{1}{K} \frac{L}{\ell} $$

The critical strain for the secondary buckling strain can therefore be obtained:

$$ \varepsilon_{cr} = C \frac{1}{d^2} \left( \frac{L}{\ell} \right) $$

References:

Acknowledgements:
Work supervised by Dr. Chun Tang and Prof. Changfeng Chen at the Department of Physics of UNLV and supported by DOE grant DE-FC02-08NA28274.
Title: Aspect Ratio Dependent Buckling Mode Transition in Single-Walled Carbon Nanotubes under Compression

Abstract: Using molecular dynamics simulations, we study axial compressive behavior of single-walled carbon nanotubes (SWCNTs) with a wide range of aspect ratios (length to diameter ratio). It is shown that the difference in aspect ratio leads to distinct buckling modes in SWCNTs. Small-aspect-ratio SWCNTs primarily exhibit shell buckling; they switch to column buckling mode with increasing aspect ratio. Further compression of the already column buckled large-aspect-ratio SWCNTs results in a shell buckling. This shell buckling mode is distinct from that of small-aspect-ratio SWCNTs in that it originates from the column buckling induced bending deformation.

Why are you doing this project? I got recruited by the physics department and they offered my job as a researcher.

What problem are you trying to solve? The problem we are trying to understand the characteristics of Carbon nanotubes that have yet to be discovered.

What tools or equipment are you using? We conduct our research using Molecular Dynamics. Basically we make computer simulations of experiments we want to perform.

Why is your project worth researching? Carbon nanotubes have shown promise in both the world of mechanics and electronics. Before we are able to use them we need to study them.

What relevance will it have on the community, society, and in your research field? We will be able to build stronger structures and minimize electronics.

What did you find? I found that the equation that characterizes buckling behavior of nanotubes with large aspect ratio.

What is the future for your research project? The future for our research is to apply what we found to Multi-walled CNTs and defective tubes.
Has recent climate change caused a genetic bottleneck in a Sierra Nevada population of the bushy-tailed woodrat?

Mitchell A. Gritts1,2, Angela D. Hornsby2 and Marjorie D. Matocq2

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Introduction
Many montane species respond to global climate change by shifting their ranges in response to temperature increases at lower elevations. Alpine specialists are particularly susceptible to climate change1-3. Increasing temperatures can cause “sky-islands” that isolate populations and may cause demographic bottlenecks4, which may cause a genetic bottleneck in a population, a reduction in the genetic diversity of a population following a reduction in population size. The bushy-tailed woodrat, an alpine specialist, has suffered a demographic bottleneck across the Yosemite Transient (YT) in the Sierra Nevada Mountains5. To determine if demographic bottleneck has caused a genetic bottleneck we will compare the demographic histories of Neotoma cinerea with N. macrotis, a closely related species whose ranges have remained constant.

Objectives
• Construct a phylogeny including genetic samples from the Yosemite Transient for each species to determine how they fit into their broader phylogenies.
• Estimate and compare the population demographic histories of each species using molecular methods.

Methods
We reconstructed phylogenetic relationships with a fragment of the mitochondrial cytochrome B sequence. Bayesian inference with the HKY (+I for N. macrotis) model of sequence evolution for each species was conducted in MrBayes v.3.1.2 with the following MCMC parameters: 2 runs of 4 chains with 5,000,000 generations. Parsimony trees were constructed in MEGA v.5 with 1000 bootstraps for both species. Exploratory neighbor joining trees were constructed in MEGA v.5 with 10,000 bootstraps for both species.

Results
Phylogenetic reconstruction of 45 N. cinerea sequences resulted in 4 distinct clades: Pacific Northwest (PNW), Rockies, Great Basin and Northern (fig. 1). The Great Basin and Northern clade are both found in the YT (fig. 4, fig. 2). Reconstruction of N. macrotis resulted in 4 distinct clades: East Central, South, North and Fuscipes (fig. 5, Fuscipes not shown). There is only one N. macrotis clade that occurs in the YT (fig. 2).

Demographic history
We used DnaSP v.5.10.01 to perform 4 tests of population expansion: Tajima’s D, Fu’s F4, and Ramos-Onsins & Rozas’ R2 with 10,000 simulated samples, and mismatch distribution analysis. These tests were conducted for the two species living within the YT. We divided N. cinerea into the two separate clades (Northern and Great Basin) and performed the analysis separately for each because each clade has experienced a different demographic history. Bayesian skyline plots were created in BEAST v.1.6.1 for both N. macrotis and N. cinerea to test the hypothesis that the populations have expanded.

Results
The results for Tajima’s D, Fu’s F4 and Ramos-Onsins & Rozas’ R2 indicated that the populations did not deviate from the null model of a constant population size (fig. 6). The mismatch distribution also indicated that neither population deviated from a constant population size (fig. 6). The Bayesian skyline plots revealed that the populations have remained constant or decreased over time (fig. 6).

Conclusions
The Yosemite transient is an interesting location for Neotoma cinerea. The Northern and Great Basin clades that occur in the Yosemite Transient have likely experienced different demographic histories. The biogeographic distribution of both the Northern and Great Basin clades are divided, this is likely due to range expansion after the last glacial maximum6. The range of the Great Basin clade expanded into the Sierra Nevada while the range of the Northern clade has receded out of the Sierra Nevada. As global warming continues the Northern clade is likely to continue to contract in the Sierra Nevada.

The demographic analysis of the two species revealed that both populations have remained stable over the past century. The Bayesian skyline plots of the Great Basin and Northern clade do show that the Great Basin clade have expanded while the Northern clade has remained constant. Although, because we used mitochondrial DNA, we can only infer the population dynamics of the maternal line.

Future work with this system will include use of nuclear DNA so that we may further infer the population dynamics of N. cinerea. We also plan to use ancient DNA in future work to infer the distribution of the Northern and Great Basin in the Yosemite Transient through time.

Literature Cited

Acknowledgements
Thanks to Chris Breyer, Nick Merri, and Anais de Guibert for helpful critiques on previous drafts. J. Platts for sequence data. Support provided by an USDA EPSCoR infrastructure research grant.
Title: Has a recent climate change influenced range contraction in a population of the bushy-tailed woodrat caused a genetic bottleneck?

Abstract: Many montane species respond to climate change by shifting their range upslope as temperatures at lower elevations increase. An elevation range shift causes a range contraction that may result in a population bottleneck. Joseph Grinnell surveyed the fauna along the Yosemite transect from 1914 to 1920. In 2003 Craig Moritz and his colleagues began to resurvey the Yosemite transect to assess the faunal change during a century of climate change. The bushy-tailed woodrat suffered severe range contraction and population bottleneck between the two surveys. I will use evolutionary models to determine if the population has suffered a genetic bottleneck.

Why are you doing this project? To determine if there has been a reduction in the genetic diversity of N. cinerea in the Yosemite Transect due to climate change.

What problem are you trying to solve? To determine if there has been a reduction in the genetic diversity of N. cinerea in the Yosemite Transect due to climate change.

What tools or equipment are you using? Mitochondrial DNA, computer software

Why is your project worth researching? It will shed light on the effects of climate change on the genetic diversity of species whose ranges are contracting.

What relevance will it have on the community, society, and in your research field? It is relevant because climate change is affecting more and more species around the world. To understand how the genetic diversity (evolutionary potential) is hindered due to climate change is an important topic because it will become more important as climate change continues.

What did you find? While we didn't have enough information to show that the genetic diversity has declined, we did discover that the Yosemite Transect has two distinct clades of N. cinerea. This is interesting because the two clades are adapted to different environments, one is arid adapted, while the other isn't.

What is the future for your research project? To use ancient DNA samples to determine what the population structure has been through time in the Yosemite Transect.
The Release of Calcium in *Bacillus anthracis* Pathogenicity

Natiera Magnuson, Manomita Patra, Maria Elena Reynaga, and Ernesto Abel-Santos

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**Abstract**

Anthrax infection starts with germination of *Bacillus anthracis* spores in macrophages. Some bacteria, including *B. anthracis*, can sporulate in response to environmental stress, such as starvation. During germination, a large concentration of calcium ions are released from the *B. anthracis* spore. Calcium ions are hydrophobic secondary messengers, and may therefore interfere with detection of the spore by confusing the cell signaling pathways. We investigated the effect of calcium release on infected macrophage viability by replacing the calcium stored in *B. anthracis* spores for other cations via demineralization/remineralization. It was discovered that calcium ions typically out-preformed other cations in germination of *B. anthracis*.

**Introduction**

*Bacillus anthracis* is a gram-positive, spore-forming, rod-shaped bacterium. *B. anthracis* spores are resilient, surviving extreme temperature, low-nutrient environment, and harsh chemical treatment (13). When spores are ingested, ingested, or come into contact with a skin lesion on a host the spores may reanimate and multiply rapidly (6). The vegetative form of *B. anthracis* releases a lethal toxin (7). Macrophages are white blood cells within tissues that phagocytize cellular debris. When a macrophage engulfs a *B. anthracis* spore, the spore is not killed. The spore, instead, germinates inside the host macrophage. During the germination process, *B. anthracis* toxins are released (9). Calcium ions act as secondary messengers in macrophages, secondary messengers are involved in signal transduction. When the *B. anthracis* spore germinates, it releases up to 1M of calcium ions (13). It is possible that the sudden influx of calcium ions inside the macrophage, once the spore starts to germinate, can confuse the cell signaling system. This confusion may allow the newly germinated bacterium to go undetected; it then can release the toxin to kill the macrophage.

**Hypothesis**

The release of calcium ions during *Bacillus anthracis* spore germination impacts anthrax-mediated macrophage death.

**Methods**

- Spore Preparation
  - The remineralized spores were prepared using a modified method outlined in Igura et al.
- Cell Culture
  - Murine macrophages were cultured in a HyClone HBS medium that included fetal bovine serum
- Infection
  - Remineralized spores were added to the macrophages and incubated.
  - The macrophages were washed several times, a new medium containing an antibiotic was added.
- Microscopy
  - Macrophages were stained with 0.04% Trypan Blue
  - Macrophages were visualized with light microscopy
- Kinetics
  - Germination was measured as a decrease in optical density (A600) using the Tecan M200 and the coordinating iControl computer program

**Results**

The remineralized spores took over 18 hours to germinate and kill the macrophage. Of the three remineralized spores analyzed here, the remineralized calcium spores were most efficient at germination and macrophage killing. Through this and previous work (4), it can be inferred that calcium is important to spore germination and possibly to the eventual lysis of the macrophage.

**Acknowledgements**

I would like to thank NSF EPSCoR for this opportunity and everyone in the Abel-Santos lab. This project was funded by NSF Grant # EPS0814332 “Nevada Infrastructure for Climate Change Science, Education, and Outreach.”

**Sources**

Title: The Release of Calcium in Bacillus anthracis Pathogenicity

Abstract: Anthrax infection starts with germination of Bacillus anthracis spores in macrophages. Some bacteria, including B. anthracis, can sporulate in response to environmental stress, such as starvation. During germination, large concentrations of calcium ions are released from the B. anthracis spore. Calcium ions are hydrophilic secondary messengers, and may therefore interfere with detection of the spore by confusing the cell signaling pathways. We investigated calcium release on infected macrophage viability by replacing the calcium stored in B. anthracis spores for other cations via demineralization/remineralization. It was discovered that calcium ions typically out-performed other cations in germination of B. anthracis.

Why are you doing this project? I am doing this project to determine the importance of calcium release in Bacillus anthracis spore germination

What problem are you trying to solve? I am trying to solve Bacillus anthracis pathogenicity

What tools or equipment are you using? Atomic absorbance, kinetics, microscopy

Why is your project worth researching? Anthrax is a lethal toxin when inhaled

What relevance will it have on the community, society, and in your research field? Biosafety importance

What did you find? When different metals are remineralized in the spores there are different germination rates

What is the future for your research project? Differing concentrations of calcium assays, inhibition assays
Frictional Resistance of Aesthetic Orthodontic Archwires Compared to Traditional Arch Wires Before and After Toothbrush Abrasion

Stephan Yamodis, D.M.D.; Jeremy Manuele, B.S.; Adam Kessler, B.S.M.E.; Brendan O'Toole, Ph.D.; James Mah, DDS, MSC, DMSC; Bob Martin, DDS

University of Nevada Las Vegas

INTRODUCTION

Aesthetically pleasing appliances are one of the most desired aspects of orthodontic treatment for patients today. With the introduction of clear aligners for orthodontic purposes, the public perception of traditional appliances such as clear aligners, fixed orthodontic appliances, and labial wire orthodontics are seen to be a significant improvement. Clear brackets are currently produced and used with great regularity. The only remaining piece to the orthodontic fixed appliance therapy that has a metal appearance is the orthodontic arch wire. Within the last five years, numerous wires have been produced with different types of wire coatings to match tooth colors. Almost every manufacturer now offers these aesthetic wires but usually at a higher cost. However, these wires are not routinely incorporated in treatment due to both a lack of evidence-based research and practitioner familiarity. Very few published studies regarding different characteristics of aesthetic arch wires have been reported, and there are no research reports describing the effects of toothbrush abrasion and frictional resistance associated with these wires.

PURPOSE OF THE STUDY

The purpose of this research project is to: 1) investigate the degree of frictional resistance associated with selected aesthetic arch wires compared to the traditional arch wires; 2) determine differences in frictional resistance among three different types of aesthetic arch wires and 3) determine differences in the functional durability of the wire coatings tested after toothbrush abrasion. Wire characteristics to be tested in this study are frictional resistance, wear resistance and functional durability.

STUDY DESIGN

This study measured resistance in a control group and three treatment groups. The control group was comprised of non-coated wires. The treatment groups were comprised of different types of aesthetic (coated) orthodontic archwires: 1) polymer coated 2) epoxy coated, and 3) palladium coated (lapping). Within each of the three treatment groups there will be seven different (A1, A2, B1, B2, C1, C2, D1) wires of various sizes that will be tested. The seven different wires will consist of the following: A1 (0.016 in, 0.018 in, 0.019 in, 0.022 in and 0.025 in) and stainless steel (0.018 in, 0.019 in, 0.022 in and 0.025 in). Upon obtaining baseline resistance levels, the treatment groups underwent 2, 4, and 8 min of toothbrush abrasion using a Phillips Sonicare HX 6950 toothbrush and the abrasion testing jig (figures 1, 4) with subsequent resistance testing. To measure frictional resistance a testing apparatus was designed to represent a buccal segment and was molded after Bhatti and Franchi (figures 2, 3).

LIMITATIONS

Human error was a significant limitation in data collection and durability observations. According to Swartz, a more accurate term for friction in orthodontics is "resistance to sliding," which encompasses a frictional component as well as factors such as biomechanical dynamics, the bending of the wire across the bracket complex, and the release of that binding by tooth movement and other motion within the system. As treatment progresses and the brackets align, the relative amount of archwire-based binding changes. It cannot be assumed that the amount of friction is constant. Our study has measured resistance to sliding using a static test fixture. The archwires and brackets are in constant contact as the archwire is drawn through and the force is measured. Thus, this test design measures the frictional component of resistance to sliding between the archwire and the brackets during continuous binding. It does not allow for movement of the brackets or release of binding.

RESULTS/DISCUSSION

There were no confirmed significant differences between the frictional resistance of the aesthetic arch wires compared to the traditional non-coated wires for all wires tested. For most of the aesthetic wires, no matter what type of coating, there seems to be a slight decrease in frictional resistance. Abrasion: for 2, 4, and 8 minutes seemed to have minimal effect on increasing or decreasing the frictional resistance of the selected types of coatings. There were minor variations for each time interval but when observed from the 6 min endpoint no significant increase or decrease was observed. There were no significant differences in wear resistance among the three different coatings or within each coating type at the three different abrasion intervals. Subsequent statistical analyses will be conducted. The distribution of data will be determined with one-way analysis of variance (ANOVA) followed by Holm-Sidak post hoc test for multiple comparisons (level of significance = 0.05). Charts 1, 2, 3, represent future graphic depiction of results.

CONCLUSIONS

The additional cost and clinical performance is the only major consideration in choosing among the three types of aesthetic wire tested. This could allow a complete aesthetic experience for dental patients without sacrificing treatment efficiency and positive outcomes. Further research is needed to evaluate the potential additional clinical implications of frictional resistance in aesthetic orthodontic archwires.

REFERENCES


Title: Frictional Resistance of Aesthetic Orthodontic Archwires Compared to Traditional Arch Wires Before and After Toothbrush Abrasion

Abstract: Our objective was to compare frictional resistance evident in aesthetic archwires to traditional (non-aesthetic) archwires. Methods: Archwires ligated with elastics to fixed brackets were pulled through these brackets while frictional resistance (in lbf) was measured. Results: There were no confirmed significant differences between the frictional resistance of the aesthetic arch wires compared to the traditional non-coated wires for all wire sizes tested Conclusions: Our data suggests that a sacrifice of clinical performance with these aesthetic archwires as compared to traditional archwires is not likely.

Why are you doing this project? I am doing this project to determine if aesthetic orthodontic wires perform as well or better than traditional orthodontic wires.

What problem are you trying to solve? The problem we are trying to solve is whether or not there is a significant difference in the frictional resistance of these wires.

What tools or equipment are you using? Load cell, force pull machine.

Why is your project worth researching? This project is worth researching because if there is a difference, clinicians should be advised of potential treatment problems.

What relevance will it have on the community, society, and in your research field? Data will be available so clinicians can make a more educated choice about the wires they use.

What did you find? The information that we found suggests that there is no significant difference in frictional resistance in these wires.

What is the future for your research project? More research could be performed with different types of wires or under different conditions.
LUMINESCENT IONIC LIQUID CRYSTALS BASED ON
STILBAZOLIUM MOIETIES

By William L. McCurdy and Pradip K. Bhowmik*
Department of Chemistry, University of Nevada, Las Vegas

Abstract
Liquid crystals have become pivotal to a variety of
display technologies. They have drawn much
attention due to their ability to confer luminescent properties to
a wide spectrum of image-based devices. The purpose of this
research is to describe a new methodology for an efficient
synthesis of luminescent ionic liquid crystals including a
discussion of their applications in the biological/medicinal
sciences.

Introduction

Solid State Liquid Crystal State Liquid State

- Rod-like Molecular Structure
- Strong Dipole
- Rigidity of the Long Axis
- Easily Polarizable Substituent

Applications
- Chemical Industry
- Solar Thermal Energy
- DNA, RNA and protein tracking
- Liquid Crystal Display

Experimental Scheme

Results

Figure 1. $^1$H NMR spectrum of Compound 3.

![NMR spectrum](image)

Figure 2. Emission spectra of compounds 3, 4 and 6 when
excited at 394, 386, and 392 nm, respectively, in methanol.

![Emission spectra](image)

Figure 3. Photomicrographs of (a) compound 3 taken at 170 °C (b)
compound 4 taken at 160 °C (c) compound 4 taken at 250 °C and (d)
compound 6 taken at 40°C under crossed polarizers by using
polarizing optical microscope (magnification 400x).

Conclusions

- Compounds 1–6 were synthesized with respectable yields
- Chemical structures were confirmed by $^1$H NMR and $^{13}$C NMR
  spectroscopy and elemental analyses
- Compound 3–6 showed light-emitting properties in solvents of
  various polarities as well as in solid states

Future Research

- Thermal analyses of compounds 3–6 will be performed.
- Their crystal structures will be investigated by X-ray analysis.
- Salts containing six stilbazolium moieties will be synthesized to broaden their
  application in light-emitting devices.

References

   Stockert, A. B.; Ritscheff, E. T.; Shear, J. B.; Bierwski, C. W. J. Am.

Acknowledgments

We sincerely acknowledge Dr. Haesook Han, Tae Soo Jo, Bradley
J. Davey, Joseph K. Wray, Ontala Tantthanathan, Jungjia Koh
and Van Vo for their help in the execution of this project. We also
acknowledge WAESO program for the financial support of this
project.
Title: Luminescent Ionic Liquid Crystals Based on Stilbazolium Moieties

Abstract: Liquid crystals have become pivotally important to a variety of image displaying technologies. They have drawn much attention due to their ability to confer luminescent properties to a wide spectrum of image based devices. The purpose of this research is to describe a new methodology for an efficient synthesis of luminescent ionic liquid crystals including a discussion of their applications in the biological/medicinal sciences.

Why are you doing this project? Liquid crystals have so many different applications in multiple fields.

What problem are you trying to solve? Coming up with an efficient synthetic method for developing organic liquid crystals.

What tools or equipment are you using? 1H-NMR, 13C-NMR and IR spectra, and various laboratory apparatus.

Why is your project worth researching? Organic luminescent liquid crystals have the potential to solve a number of image displaying technology problems. Additionally, these crystals have the potential to be utilized as macromolecular tracking agents.

What relevance will it have on the community, society, and in your research field? Organic luminescent liquid crystals hold the promise of providing a more energy efficient alternative for image displaying technologies.

What did you find? The targeted compounds were indeed synthesized based on structure analysis determined via 1H-NMR and 13C-NMR spectra.

What is the future for your research project? Continuation of structure characterization and property analysis.
High Pressure – Variable Temperature Studies on Pressure Transmitting Media

Vahe Mkrtchyan, Jason Baker, Matthew Jacobsen, Ravhi Kumar and Andrew Cornelius
Department of Physics and Astronomy and High Pressure Science and Engineering Center
University of Nevada, Las Vegas

Abstract
The pressure transmitting medium is an important element in high pressure physics. A variety of pressure transmitting media exist including Silicone fluid, Daphne Oil, 4:1 Methanol:Ethanol mixture, etc. In this experiment, the hydrostatic limits of pressure transmitting media have been observed at low temperatures and high pressures. In this case, 4:1 Methanol:Ethanol has been used. The hydrostaticity of 4:1 Methanol:Ethanol has been well studied at room temperatures using the fluorescence of ruby by fitting the R1 and R2 lines to Pseudo-Voigt functions. The hydrostaticity of the pressure medium was determined by analyzing the full width at half max (FWHM) of the R2 line.

Experiment Details
For this experiment, a Merrill-Bassett type Diamond Anvil Cell (DAC) was used. This DAC was equipped with diamonds with culet size of 400µm in diameter. The sample chamber of this system was 130µm in diameter with spherical ruby surrounded by a Methanol:Ethanol pressure medium, with a volume ratio of 4:1. This DAC was placed inside a closed cycle cryocooler apparatus (Figure #) to control the temperature of the system during the measurement process. In order to understand what is happening inside the cell, a 405nm laser has been used. The laser beam was focused on the ruby, which then fluoresces, and the light is collected by a home-built fluorimeter system (Figure #) in approximately 40K temperature increments between 300K and the base temperature of the system. The data was collected under pressure at 1, 2, 3, 4, 5, 6, 7.25, and 12GPa. The temperature is controlled through a LabVIEW program designed to tune an internal heater’s output power to maintain a temperature set point, similar to a PICO controller.

With the data collected, it was fit using a Pseudo-Voigt function to determine peak shape, peak location, and FWHM of each of the ruby peaks. This information was compiled in Origin to produce the plots presented in the next section.

Results
It is reasonable to anticipate a fluid transitioning into a solid at low temperatures and high pressures. Data gathered from graph 3, at 30 Kelvin, shows that the FWHM of the R2 line remains relatively constant until after 4.5 GPa and then increases. The exact point of transition to a solid would be difficult to determine as there needs to be more data taken between 8 GPa and 12 GPa. In the 260K plot, we see a similar trend after 6 GPa, but a pronounced decrease in FWHM of R2 line below 6 GPa, which is to be expected at the higher temperatures. The increase in the 30K plot is much more compared to that of the 260K plot. This maybe happening because of competing factors of broadening peaks. As temperature goes up the peaks broaden with it, which may be the cause of the sudden up shoot at 30 Kelvin.

Conclusions
The effect of temperature and pressure on commonly used 4:1 Methanol:Ethanol mixture pressure transmitting medium has been investigated. The FWHM is found to increase with pressure above 6 GPa at 30 K indicating non-hydrostatic stress due to solidification of the medium. Further investigations on other commonly used media are under progress for comparison.

References

Acknowledgements
Work at UNLV is supported by DOE Cooperative Agreement DE-FC52-06NA27684
**Vahe Mkrtchyan**  
Former High School:  
Location of High School:  
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Educational Institute of Project: UNLV  
Department: Physics  
Research Site: UNLV  

**Title:** High Pressure – Variable Temperature Studies on Pressure Transmitting Media  

**Abstract:** The pressure transmitting medium is an important element in high pressure physics. A variety of pressure transmitting media exist including Silicone fluid, Daphne Oil, 4:1 Methanol:Ethanol mixture, etc. In this experiment, the hydrostatic limits of pressure transmitting media have been observed at low temperatures and high pressures. In this case, 4:1 Methanol:Ethanol has been used. The hydrostaticity of 4:1 Methanol:Ethanol has been well studied at room temperatures using the fluorescence of ruby by fitting the R1 and R2 lines to Pseudo-Voigt functions. The hydrostacity of the pressure medium was determined by analyzing the full width at half max (FWHM) of the R2 line.
Investigation of Structural and Magnetic Properties of Iron Clusters Encapsulated In Carbon

Andrew Mohrland¹, Eunja Kim¹, Philippe Weck², Tao Pang¹, and Kenneth R. Czerwinski²

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²Department of Chemistry, University of Nevada, Las Vegas, NV 89154

Introduction

Electronic, magnetic, and chemical properties of Fe nanoparticles are of particular interest for materials science, engineering, and technological applications, including biomedical applications (e.g., medical imaging, cancer treatment, etc.). In this study, we search for the most stable geometries of the Fe clusters. Fe₄, up to nFe. Binding energies, magnetic moments, bond lengths, bond angles, and charge densities of clusters are computed and compared to the available experimental data. The various cluster isomers were examined energetically. We found that, in general, higher dimensional geometries are more stable than lower dimensions (i.e., 1-dimensional or 2-dimensional). Calculations for the Fe₂₅ cluster yield a bond length of 1.56 angstroms, which appears to agree with experimental values (1.57 angstroms [1]). The most stable Fe₂₅ isomer is a rhombic dodecahedron. For Fe₄, the stable geometries are trigonal bipyramidal and octahedral, respectively. The average magnetic moment per atom is 2.5–3.0 Bohr magnetons; this result is in agreement with previous theoretical results. Potential future work includes studies of Fe clusters with nFe. IR vibrational spectra calculations, and studies of Fe clusters encapsulated by C₄₀ fullerene nanocages.

Methods

First-principles total energy calculations were performed using density functional theory as implemented in the Vienna ab initio simulation package (VASP) [2]. The exchange–correlation energy was calculated using the generalized gradient approximation (GGA) with the parametrization of Perdew and Wang (PW91) [3]. The interaction between valence electrons and core cores was described by the projector-augmented wave (PAW) method [4]. The Kohn–Sham equation was solved using the block Davidson iterative diagonalization scheme followed by the residual vector minimization method. The plane-wave cutoff energy for the electronic wavefunctions was set to a value of 500 eV.

Results and Discussion

For each cluster, we compared the total energies of the possible structures. The structure with the lowest energy was the most stable structure. The following figures illustrate the various structures and their respective total energies.

... (figures and calculations)

Conclusions

Our calculated second energy differences deviate from the findings of Díezuez et al. [6], who did not find any magic numbers below nFe², whereas our results indicate that the trigonal prism (nFe) is a stable structure (See Fig. 5). Our calculated magnetic moments agree with the experimental results of Bills et al. [8], which state that the average magnetic moments per atom of small Fe clusters in graphite are around 3 Bohr magnetons and converge to the bulk value slowly (See Fig. 6).

Future Work

Future work includes numerical calculations of the stable geometries for iron clusters encapsulated by carbon nanomaterials such as C₄₀ buckyballs (research currently ongoing) and larger carbon fullerenes such as D₆₀ and D₄₄. We aim to numerically predict whether iron’s strong ferromagnetism will allow the iron clusters to maintain their magnetic moments when encapsulated by these larger carbon nanocounters.

References


Acknowledgements

I would like to thank John Hickey for making my computing experience most excellent. This work was supported by the Department of Physics and Astronomy at University of Nevada, Las Vegas.
Title: Investigation of Structural and Magnetic Properties of Iron Clusters Encapsulated In Carbon Nanostructures

Abstract: Our goal is to investigate and predict the properties of iron-carbon nanostructures by performing numerical calculations using the density-functional theory. We are interested in which nanostructures are most stable, and in how they are likely to form. We have a particular interest in the magnetic properties of carbon "buckyballs" containing iron particles. These structures have potential for biomedical application, including use in anti-cancer treatment. Lone iron clusters have potential for use as a catalyst designed to reduce vehicle emissions.

Why are you doing this project? We are performing calculations to assist in basic research. We hope our calculations help experimental physicists to perform experiments on metallofullerenes. Metallofullerenes also have potential for use in anti-cancer treatment.

What problem are you trying to solve? We are performing numerical calculations to make predictions about the properties of iron clusters encapsulated by carbon fullerenes.

What tools or equipment are you using? We are using a computing cluster and the Vienna Ab Initio Simulation Package.

Why is your project worth researching? We are performing calculations to assist in basic research. We hope our calculations help experimental physicists to perform experiments on metallofullerenes. Metallofullerenes also have potential for use in anti-cancer treatment.

What relevance will it have on the community, society, and in your research field? Our work adds to the corpus of scientific knowledge. It will help inform us about the feasibility of using iron metallofullerenes for biomedical applications.

What did you find? We performed preliminary calculations with iron clusters without the carbon cage. We calculated the stable structures for the free iron clusters (shown in poster) and their binding energies and magnetic moments.

What is the future for your research project? Calculations with the iron clusters encapsulated by buckyballs (Carbon-60) are ongoing. We also have plans to perform calculations with larger fullerenes (Carbon-70 and Carbon-84).
“Magic” Trapping of Rydberg States for Quantum Information

Muir Morrison and Andrei Derevianko, University of Nevada Reno

Abstract
Recent experiments using neutral atoms to manipulate quantum information show promise for constructing a large-scale, practical quantum computer. Achieving such a quantum computer will require less destructive optical traps for the atoms. Using theoretical and computational tools, we consider the feasibility of one possible “magic” trap for rubidium. Preliminary results suggest such trapping may be possible, but more accurate calculations are necessary to reach a definitive conclusion.

Introduction

Quantum computation is predicted to offer exponential speed-up for a variety of computationally difficult problems, but actually building a quantum processor remains elusive.

• Qubit: Quantum Bit, the fundamental unit of quantum information. It uses 0s and 1s like normal, but now superpositions and entanglement are possible.
• Quantum information manipulation needs strong, tunable interactions for reasonable efficiency and low error rate.
• Rydberg blockade: a mechanism for quantum gate operations using Rydberg atoms separated by a few μm. Rydberg states: highly excited, weakly bound atomic energy levels. Atomic size in solids: few Å. Typical Rydberg state radius: few μm (10^6 times larger!)
• Rydberg states exhibit strong dipole interactions compared to the feeble interactions between ground-state atoms at ~10 μm range.
• Excitations to Rydberg states with laser pulses provide a means to turn strong interactions on and off quickly, without ever moving the atoms.
• Polarization: the deformation of an atom’s electron cloud by an applied electric field, E. Polarization p = αE, where α is polarizability. α depends only on the atom’s internal structure and on ω (the oscillation frequency of E).
• Stark Effect: internal energy levels of an atom are shifted by external electric fields, given by ΔE = -α(ε/2)².

Introduction (pt II)

• Rydberg blockade gates explained: 2 atoms are placed in optical traps ~10 μm apart. We are interested in a 3 level system made of 2 low-lying levels and 1 Rydberg level. The strong electric dipole of a Rydberg atom shifts the energy levels of its neighbors via the Stark effect.
  \[ |R⟩ \quad \text{Control} \quad |0⟩ \quad \text{Target} \quad |1⟩ \]
  \[ |R⟩ \quad \text{Control} \quad |0⟩ \quad \text{Target} \quad |1⟩ \]
• Photons with energy E = hω0 will only be absorbed by target atom if the control atom is not in |R⟩.
• Such a 2-qubit system allows CNOT gate operations, the basic step for any quantum algorithm.
• Optical Trap: An atom in an oscillating electric field has an induced dipole, which experiences a force from the E field. This force can suspend atoms against gravity. The problem: the trapping laser perturbs the atomic energy levels and destroys the qubit’s coherence.
• “Magic” Trap: By using a trap laser at a particular “magic” frequency, the states of interest have identical polarizability. Then the Stark shift cancels, and coherence is preserved.

Objectives

• Calculate Rydberg state polarizabilities: Polarizabilities for rubidium’s ground state and low-lying states have been calculated previously to high accuracy. But no high-accuracy calculations of Rydberg polarizabilities exist.
• Find “magic” 3-level system in Rb. Previous works have considered “magic” trapping of 2-level systems only; the 3-level system above adds additional complexity.

Methods

• Dirac-Hartree-Fock: Our ab initio computer codes begin by implementing the Dirac-Hartree-Fock (DHF) method, first solving for the core orbitals, then single-valence orbitals in the frozen-core approximation. From this we generate a quasi-complete basis set of atomic orbitals using B-splines.
• Correlation Corrections: The DHF method only includes electron-electron interactions (known as correlation effects) approximately, so we use many-body perturbation theory to include additional correlation effects. In particular, we build Brueckner orbitals and use the relativistic random phase approximation (RPA) to include core polarization and perturbations from external fields.
• Since the calculations begin from first principles, we can compare partial results to known experimental data to estimate the codes’ accuracy.

Results

• Below we plot polarizabilities of the ground state 5s and Rydberg state 5p0 in Rb. The necessary B-field to achieve magic trapping between the |0⟩ and |1⟩ states (the hyperfine sublevels of 5s) is also shown.
• The necessary magnetic field to achieve Stark cancellation may be sufficiently strong to introduce decoherence due to the Zeeman effect.
• Calculations with a more accurate Brueckner orbital set should resolve the issue; “magic” trapping may also be possible by considering other Rydberg states.

References

M. Saffman et al., Rev. Mod. Phys. 82, 2313-2363 (2010).
Title: “Magic” Trapping of Rydberg States for Quantum Information

Abstract: Recent experiments using neutral atoms to manipulate quantum information show promise for constructing a large-scale, practical quantum computer. Achieving such a quantum computer will require less destructive optical traps for the atoms. Using theoretical and computational tools, we consider the feasibility of one possible “magic” trap for rubidium. Preliminary results suggest such trapping may be possible, but more accurate calculations are necessary to reach definitive conclusion.

Why are you doing this project? I love applying mathematics to physical problems. I am particularly fascinated by quantum mechanics, and I enjoy learning about atoms and atomic processes.

What problem are you trying to solve? One scheme for quantum computers uses atoms trapped with lasers to hold information. The problem is that the lasers gradually destroy the encoded information. My project is attempting to remove these detrimental effects caused by the lasers.

What tools or equipment are you using? I do theoretical and computational work, using a server cluster to run large high-accuracy computations for calculating the internal structure of atoms.

Why is your project worth researching? My project will bring practical quantum computers closer to reality. Quantum computers could be used to solve a variety of computational problems that cannot be solved in reasonable amounts of time by conventional computers.

What relevance will it have on the community, society, and in your research field? In the short-term, it will enable experimentalists working on quantum information to improve the accuracy of their experiments. In the long-term, we hope this will eventually lead to functioning, practical quantum computers.

What did you find? Our results are inconclusive at our present level of accuracy. We need to refine computer codes and increase their precision to determine if our idea will actually be experimentally feasible.

What is the future for your research project? To continue refining the computer codes and increasing their precision to provide more accurate results for more conclusive research determination.
Characterization of *ips pini* Ipsdienol Dehydrogenase (IDOL DH)

Heidi Pak, Claus Tittiger, and William Welch

Biochemistry, University of Nevada, Reno, 1664 N. Virginia St., Reno, Nevada 89557

**Abstract**

Ipsdienol is an important pheromone component for pine engraver beetle, *ips pini*. Ipsdienol is a ten carbon monoterpene secondary alcohol and isopinone is the corresponding ketone. We are characterizing the activity of recombinant IDOL DH produced in Sf9 (insect) cells. The enzyme has a high stereospecificity; (+)-ipsdienol was found to be a substrate while (-)-ipsdienol was neither a substrate nor inhibitor. Close isomer related monoterpenes, such as myrcenol, geranial, and citral, were neither substrates nor inhibitors. Smaller compounds, such as 2-propanol, also failed to act as an inhibitor or substrate. This indicates the binding site of this enzyme is highly specific. Failure to act as an inhibitor most likely indicates these compounds bind weakly. (-)-ipsdienol, ipsdienol, geranial, and isopinone are substrates. Inspection of the aliphatic chain of ipsdienol was found to have substrate activity. Results from gel permeation chromatography shows the active conformation of IDOL DH is a tetramer. Together these results suggest IDOL DH has a highly specific substrate binding site, and is a key component in pheromone biosynthesis.

**Materials and Methods**

**Spectrophotometry**

IDOL DH belongs to the class of alcohol dehydrogenases which catalyze the reaction:

\[ ROH + NADPH \rightarrow ROH^+ + NADP^+ \]

We follow the consumption of the cofactors NADPH and NADP+ by spectrophotometric monitoring at 340 nm.

The reaction was performed in the test tubes containing 66 mM sodium phosphate buffer and 0.033 mM NADPH or 0.157 mM NADP+. The reaction was initiated with either enzyme or substrates (concentrations varied).

**Gel Permeation Chromatography**

Gel permeation chromatography was used to determine the molecular weight of the enzyme's active form. Each sample (blue dextran, cytochrome c, hemoglobin, and IDOL DH) was run through a Superdex 10/300 column. Twenty drops were collected and analyzed by measuring the absorbance at each respective wavelength. IDOL DH fractions were assayed as described above.

**Results**

**Figure 3.** Michaelis-Menten plot predicts: A) Velocity versus substrate concentration. The hyperbolic curve indicates this enzyme has no allosteric effectors. The enzyme sites are not interacting with another site. B) Velocity versus enzyme concentration. This is an uncompetitive protein, but the lower line indicates there are no competitive activators and there are no evidence of covalent modification. C) Product versus time.

**Table 1.** Kinetic parameters of putative substrates. The best substrates are (+)-ipsdienol and ipsdienol. However, the other substrates are comparable.

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Vmax (μmol/min)</th>
<th>Km (μM)</th>
<th>Kcat (μmol/min/nM)</th>
<th>Relative</th>
<th>Ym (μM)</th>
<th>Km (μM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(+)-ipsdienol</td>
<td>9.1</td>
<td>3.0</td>
<td>3.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>(-)-ipsdienol</td>
<td>3.7</td>
<td>7.0</td>
<td>3.7</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>2-propanol</td>
<td>0.2</td>
<td>20.0</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Discussion**

- The active form of IDOL DH is a tetramer.
- DNA analysis determined the molecular weight of one subunit to be about 26 kDa.
- Upper panel: A) Determination of the enzyme activity and not by its mass. B) Calibration column. The standard curve allowed us to determine IDOL DH as a tetramer.

**Figure 4.** Compounds tested. The boxed compounds are known substrates.

**Figure 5.** Oxidation and Reduction reaction with IDOL DH and Sf9 cells. Sf9 cells have no reaction with any of the substrates tested.

**Figure 6.** The active form of IDOL DH is a tetramer. DNA analysis determined the molecular weight of one subunit to be about 26 kDa.

- **Compound** | **Substrate** | **Vmax (μmol/min)** | **Km (μM)** | **Kcat (μmol/min/nM)** | **Relative** | **Ym (μM)** | **Km (μM)** |
- (+)-ipsdienol | 9.1 | 3.0 | 3.0 | 0.00 | 0.00 | 0.00 |
- (-)-ipsdienol | 3.7 | 7.0 | 3.7 | 0.00 | 0.00 | 0.00 |
- 2-propanol | 0.2 | 20.0 | 0.01 | 0.00 | 0.00 | 0.00 |

**Conclusions**

- My work indicates this enzyme evolved to be a specific catalyst for the conversion. This is supported by the following observations:
  - IDOL DH has a highly specific substrate binding site.
  - Related terpenoids, such as geraniol and citral, were not substrates or inhibitors for IDOL DH.
  - Smaller compounds, such as 2-propanol, failed to act as an inhibitor or substrate.
  - IDOL DH has a high stereospecificity; (+)-ipsdienol was found to be a substrate while (-)-ipsdienol was neither a substrate nor inhibitor.
  - Allosteric inhibitors, such as myrcenol, were not present.

**Acknowledgements**

- I would like to thank NSF EPSCoR UROP for funding my research.
- The work was supported by the National Science Foundation.

**References**

Title: Characterization of Ips pini Ipsdienol Dehydrogenase

Abstract: Ipsdienol dehydrogenase (IDOL DH) belongs to the class of alcohol dehydrogenases. We are characterizing the activity of recombinant IDOL DH produced in Sf9 (insect) cells. We follow the consumption of the cofactors NADPH or NADP by spectrophotometry (at 340nm). The enzyme has a high stereospecificity; (-) ipsdienol was found to be a substrate while (+) ipsdienol was neither a substrate nor inhibitor. Closely related terpenoids, such as nerol, geraniol, and citral were neither substrates nor inhibitors. Smaller compounds, such as 2-propanol, also failed to act as an inhibitor or substrate. This indicates the binding site of this enzyme is highly selective.

Why are you doing this project? This research is being done to understand a the newly discovered enzyme, ipsdienol dehydrogenase. Research into pheromone production may thus provide new leads for measures to control bark beetle population.

What problem are you trying to solve? The goal of this project is to understand the role of IDOL DH in bark beetle pheromone production.

What tools or equipment are you using? Diode array spectrophotometer is used to kinetically analyze the enzyme. Columns are used for gel permeation chromatography, which allows determination of the molecular weight of the enzyme's active form.

Why is your project worth researching? Bark beetles are economically important because they are devastating the pine tree population. By doing this research there may be new leads for the control of these pests.

What relevance will it have on the community, society, and in your research field? IDOL DH is a newly discovered enzyme therefore not much is known about it. We believe this enzyme plays a key role in pheromone production. Therefore, by characterizing this enzyme we may have a better understanding of the pheromone biosynthetic pathway.

What did you find? My work indicates this enzyme evolved to be a specific catalyst for the interconversion of ipsdienol to ipsdienone and vice versa.

What is the future for your research project? Future goal of this project is to purify this protein so that we can get a definite analysis of this enzyme.
X-RAY DIFFRACTION ON THERMOELECTRIC SILICIDES AT HIGH PRESSURE
Deep Patel, Ravirli S. Kumar, Andrew Cornelius
Department of Physics and HipSEC, University of Nevada Las Vegas, Las Vegas, Nevada 89154, USA
Mentor: Ravirli S. Kumar

ENERGY RESEARCH - THERMOELECTRICS

Cobalt Silicide (CoSi2) is a transition metal silicide that has garnered scientific interest due to its interesting thermoelectric properties and applications in silicon-based devices because of their high temperature stability. It has been reported that CoSi2 undergoes a phase transition at around 6.8 GPa and again at 13 GPa [1]. Furthermore, at 13 GPa the material changes from a cubic to an orthorhombic cell, but details of the phase transition at 6.4 GPa could not be determined [1]. To further study the properties of CoSi2 and understand its pressure induced phase changes, we recorded the structural behavior of CoSi2 under pressure.

EXPERIMENTAL DETAILS

X-ray diffraction experiments under high pressures were carried out at sector 16 IDE, HPCEA Advanced Photon source (Fig. 1) and the incident photons had a wavelength of 0.241 Angstroms. A diamond cell of Mao-Bell type with a culet diameter of 300 microns was used. The sample was bought from Alfa Aesar and was of 99.9% purity. The samples were loaded in a diamond gasket preindented to 40 microns, with silicone fluid pressure transmitting medium and few ruby grains. Pressures were measured by the standard ruby fluorescence method.

Diffraction images were collected using an imaging plate with an incident beam size of 32x32mu. The typical exposure time for each pressure was 15-15 sec. The images were then integrated using I/2SD software, the background was fitted using Peakfit, and the data was analyzed using both MDI Jade and Powder Cell, and then the analysis data was graphed and fitted using Origin Pro.

Figures 1. a. Experimental set up for high pressure x-ray diffraction at Sector 16 IDE, HPCEA, APS. b. Mao-Bell type DAC.

DATA ANALYSIS

Using Jade we found that CoSi2 is a cubic structure of space group Fm3m, with cell parameters of a=3.35 Angstroms, at ambient pressure as shown in Fig. 2. As the pressure was increased the volume clearly decreased, as expected. There was also a phase change around 6.3 GPa, clearly highlighted by the fact that the peaks shifted a little to the left in Fig. 2. The structure remained cubic, but we could not pin down the exact space group. There was yet another phase transition at around 26 GPa as illustrated by the splitting of the leftmost peaks in the pattern corresponding to 21.4 GPa in Fig. 2. A. We found that new phase was Orthorhombic and the space group was most likely CmC21.

Fig. 2. a. Representative x-ray diffraction patterns at different pressures for CoSi2. b. Raw data (before Integration From FCSD) of CoSi2 at Ambient pressure. c. Volume vs. Pressure graph of CoSi2. d. Structural diagram of CoSi2 at ambient pressure.

The figure above shows the change in volume with a change in pressure. The dots show the actual data and the blue and red lines are second order Birch-Murnaghan equation of state fits for their corresponding phases. The gap in the middle represents the phase change and the volume collapse, which we found was about 10%. The compressive parameters is comparison with the bulk material are given in Table 1.

Table 1. Compression parameters for CoSi2.

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vc/AVc</td>
<td>109.26</td>
</tr>
<tr>
<td>cb/c</td>
<td>4.0</td>
</tr>
</tbody>
</table>

ACKNOWLEDGEMENTS

I would like to thank the following people for their assistance in this project:
1. Dr. Ravi Kumar, for his guidance regarding the overall direction of this project.
2. Matt Jacobson, for his help with Jade, Powder Cell, and Peakfit and teaching me how to analyze diffraction patterns.
3. Jason Baker and Daniel Antonia, for answering my countless questions regarding analysis.

CONCLUSIONS

High pressure x-ray diffraction experiments on CoSi2 were performed up to 41 GPa. There was an undetermined phase change at 6.4 GPa. Around 13 GPa, we saw the splitting of the major peak at 8 degrees. There was another phase transition at 18.2 GPa from a cubic structure to an orthorhombic structure of space group CmC21 evident from the recommodation of the three peaks at 8 degrees. Our results confirm reports that under high pressure CoSi2 changes from a cubic to an orthorhombic structure and that CoSi2 is an unstable material under high pressure; however, our space group at the orthorhombic phase did not match the reported phase group and our volume collapse was massive compared to reported figures [1]. Furthermore, we were not able to gain additional insight into the structural changes at 6.4 GPa.

REFERENCES


Permutations of this work were performed at HPCEA Sector 16, Advanced Photon Source (Argonne National Laboratory). (APL) is supported by DOE, CHICAGO, CSHL and LBNL through funding from DOE-NSF, DOE-BES and NSE. APS is supported by DOE-BES, under Contract No. DE-AC02-03CH11231. The UNLV High Pressure Science and Engineering Center was supported by the U.S. Department of Energy, National Nuclear Security Administration, under Cooperative Agreement number DE-FC05-06N16474.
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Educational Institute of Project: UNLV  
Department: Electrical Engineering  
Research Site: UNLV

**Title: Diffraction Analysis of Thermoelectric Silicides at High Pressure**

**Abstract:** The idea that heat could be directly converted into electrical energy has excited scientists and environmentalists alike because it could reduce the need for fossil fuels, which have their limitations. Thermoelectrics are materials that allow electrical energy to be produced from heat with no moving parts and produce zero byproducts such as greenhouse gases. However, the efficiency of thermoelectrics is not yet high enough to be financially competitive with fossil fuels. To increase the aforementioned efficiency, more research has to be done to understand the effects of high pressure on different thermoelectric materials. The tests were done at Argonne lab in Chicago. By processing data from the tests we learned how the structure of a thermoelectric material was affected by changing high pressure.

**Why are you doing this project?** I am doing this project because I have an interest in CoSi2 and its applications.

**What problem are you trying to solve?** High-pressure structure of CoSi2

**What tools or equipment are you using?** Diamond Anvil Cell, Synchrotron X-ray Source

**Why is your project worth researching?** Because the material being researched have applications in silicon-based devices.

**What relevance will it have on the community, society, and in your research field?** Silicon-based devices are important in many different technologies, especially transistors.

**What did you find?** There was a structural transition.

**What is the future for your research project?** It will continue until we fully understand the structural changes of CoSi2 under pressure.
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Former High School: Silverado High School
Location of High School: Las Vegas, NV
Mentor/Advisor: Eduardo Robleto
Educational Institute of Project: UNLV
Department: Life Sciences
Research Site: UNLV

Title: The effect of Polymerase I on stationary phase mutagenesis on Bacillus subtilis.

Abstract: Stationary phase mutagenesis is defined as cellular mechanisms that produce genetic diversity in cells experiencing conditions of stress. These processes are associated with many biological phenomena, including those that produce the formation of cancers in animal cells and other degenerative diseases. Also, these mechanisms are associated with the accumulation of beneficial mutations in bacteria, but follow stochastic processes and are controlled by genetic factors. Here we test the hypothesis that in resting stressed cells mutations occur via faulty repair of DNA damage. Our experiments used cells that are proficient or deficient in the synthesis of Polymerase I (encoded by the gene polA) in combinations with defects in their ability to repair DNA to measure starvation stress-induced mutations. Our results indicate that Polymerase I is required for the formation of mutations in stressed cells that are undergoing acts of DNA repair. These studies contribute to our understanding of novel mechanisms affecting the evolutionary process.

Why are you doing this project?
What problem are you trying to solve?
What tools or equipment are you using?
Why is your project worth researching?
What relevance will it have on the community, society, and in your research field?
What did you find?
What is the future for your research project?
Volatile Bubble Growth in the Aztec Wash Pluton
Brett Perry, Adam Simon, Rachael Johnsen
UNLV Geoscience

Abstract

The Aztec Wash Pluton, emplaced at ~16 Ma as part of the magmatic activity associated with intra-plate spreading along the Colorado River Extensional Corridor, represents a magma chamber that has been tilted ~50 degrees as a result of Basin and Range extension. This makes the pluton a unique location to study magma chamber dynamics. The pluton has a pancake shape and is ~3000 m in maximum thickness. The upper 1500 m of the pluton is compositionally homogeneous granite and the lower 1500 m is more mafic in composition. The upper granite portion is characterized by the presence of large cavities of unknown origin. We hypothesized that these cavities resulted from the exsolution of volatiles, or the sub-solidus dissolution of minerals. To test these hypotheses, we collected 17 samples at roughly equal spacing from the bottom to the top of the pluton portion of the pluton and investigated the nature of the cavities by using polarized light microscopy. We determined the size of major modes of minerals, the size of individual cavities, the interconnectedness of cavities, and number density of cavities per thin section for all samples. The observations from thin sections are consistent with hypothesis one, that is, the cavities resulted from volatile overpressure. Observations indicate that the absolute size of individual cavities increases from the bottom to the top of the pluton. We suggest that this is the result of volatiles coalescing with decreasing depth.

Introduction

Magmas are composed of silicate melt, crystals, and volatiles. Volcanic eruptions are driven by the degassing of volatiles in the shallow crust. This process transfers volatiles such as CO2, SO2, and H2O, which are greenhouse gases, to the atmosphere. Therefore, it is important for climate modellers to have an understanding of the processes of how these volatiles are transported.

The Aztec Wash Pluton is ~3000 m at maximum thickness and is divided roughly into two 1500 m zones. The upper 1500 m is compositionally homogeneous granite and is characterized by the presence of large cavities of unknown origin.

Hypotheses

I hypothesized that:

- Cavities were the result of volatile partial pressure rather than mineral dissolution.
- Cavity size would increase with decreasing depth due to bubbles coalescing.
- Cavity density per section of rock would decrease stratigraphically up.

Methods

We collected rock samples from the upper 1500 m portion of the pluton at roughly equal spacing. We prepared these samples to be analyzed by X-Ray Fluorescence (XRF) and to be turned into thin sections. XRF allows us to determine precise chemical compositions of the rock and shows us how the composition of the pluton evolves with respect to depth. Optical microscopy, which is the study of the optical properties a rock exhibits during its interaction with light, was used to analyze the thin sections.

Data

The following table shows the data collected from the samples:

<table>
<thead>
<tr>
<th>Sample #</th>
<th># of Caverns</th>
<th>Cavern Size</th>
<th>Orthoclase Diameter</th>
<th>Plagioclase Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZJ10</td>
<td>3</td>
<td>0.5-2.0 mm</td>
<td>0.75-2.0 mm</td>
<td>0.50-1.50 mm</td>
</tr>
<tr>
<td>ZJ11</td>
<td>12</td>
<td>0.25-1.00 mm</td>
<td>0.25-1.00 mm</td>
<td>0.25-1.00 mm</td>
</tr>
<tr>
<td>ZJ12</td>
<td>25</td>
<td>0.25-1.50 mm</td>
<td>0.25-1.50 mm</td>
<td>0.25-1.50 mm</td>
</tr>
<tr>
<td>ZJ13</td>
<td>6</td>
<td>0.50-2.00 mm</td>
<td>0.75-2.00 mm</td>
<td>0.50-1.50 mm</td>
</tr>
<tr>
<td>ZJ14</td>
<td>8</td>
<td>0.25-1.00 mm</td>
<td>0.25-1.00 mm</td>
<td>0.25-1.00 mm</td>
</tr>
<tr>
<td>ZJ15</td>
<td>15</td>
<td>0.50-2.00 mm</td>
<td>0.75-2.00 mm</td>
<td>0.50-1.50 mm</td>
</tr>
<tr>
<td>ZJ16</td>
<td>10</td>
<td>0.25-1.00 mm</td>
<td>0.25-1.00 mm</td>
<td>0.25-1.00 mm</td>
</tr>
<tr>
<td>ZJ17</td>
<td>20</td>
<td>0.50-3.00 mm</td>
<td>0.75-3.00 mm</td>
<td>0.50-1.50 mm</td>
</tr>
</tbody>
</table>

The following table shows the data collected from the thin sections:

<table>
<thead>
<tr>
<th>Sample Name</th>
<th>H2O</th>
<th>AI2O3</th>
<th>TiO2</th>
<th>FeO</th>
<th>MgO</th>
<th>CaO</th>
<th>Na2O</th>
<th>K2O</th>
<th>TiO2</th>
<th>FeO</th>
<th>MgO</th>
<th>CaO</th>
<th>Na2O</th>
<th>K2O</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZJ10</td>
<td>0.50</td>
<td>0.05</td>
<td>0.05</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
</tr>
<tr>
<td>ZJ11</td>
<td>0.50</td>
<td>0.05</td>
<td>0.05</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
</tr>
<tr>
<td>ZJ12</td>
<td>0.50</td>
<td>0.05</td>
<td>0.05</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
</tr>
<tr>
<td>ZJ13</td>
<td>0.50</td>
<td>0.05</td>
<td>0.05</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
</tr>
<tr>
<td>ZJ14</td>
<td>0.50</td>
<td>0.05</td>
<td>0.05</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
</tr>
<tr>
<td>ZJ15</td>
<td>0.50</td>
<td>0.05</td>
<td>0.05</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Interpretations

- Cavities were the result of volatile partial pressure rather than mineral dissolution.
- Density of cavities with decreasing depth fluctuates from a higher to a lower number. I suggest that this may represent alternations between volatile depleted and volatile saturated zones.
- The number of large cavities per section increases with decreasing depth, which I suggest is the result of volatile coalescence.

Acknowledgments

"Nevada Infrastructure for Climate Change Science, Education, and Outreach" NSF Grant # EPS-0814372

References

Title: Volatile Growth in the Aztec Wash Pluton

Abstract: Plutons are well preserved magma chambers that have been preserved in the rock record and allow the study of magmatic processes. Magma chambers are composed of silicate magmas, crystals, and volatiles. Volatiles are a key control in driving eruptive processes, which vent greenhouse gases into the atmosphere, thus a better understanding of the mechanisms of volatile transport within a pluton is necessary. Microscopy was used to analyze the size and density of cavities and feldspars from various stratigraphic sections of the pluton. Microscopy showed that cavities were a result of volatile partial pressure, as well as, a progressive increase in cavity size with decreasing pluton depth.

Why are you doing this project?  To improve theoretical gas transport models for climate modelers.

What problem are you trying to solve?  Looking to see whether partial pressure of volatiles can leave large cavities in the rock record which can indicate gas levels within a magma.

What tools or equipment are you using?  Optical Microscope

Why is your project worth researching?  Large quantities of greenhouse gases such as CO2, SO2, and H20 are transported to the atmosphere during volcanic eruptions. Quantifying the proxy record is an important part of improving modeling.

What relevance will it have on the community, society, and in your research field?  Greenhouse emission reform requires accurate modeling to make obtainable goals for the future.

What did you find?  Volatiles can create large cavities within plutons when gases are transported to areas of concentration.

What is the future for your research project?  Examining the physical constraints of the system that cause gases to become concentrated.
Does thermal stress cause females of the plant Bryum argenteum to manipulate the sex ratios of their offspring?
Elisha Rhodes and Lloyd Stark

Abstract:
About half of all moss taxa exhibit female-biased sex ratios, and sporophytes make up a majority of their population. One possible explanation is differential stress tolerance of sporophytes due to maternal sporophyte manipulation during stress. To test this hypothesis, sporophytes of the species Bryum argenteum were subjected to thermal stress and observed for growth aberrations and sporophyte abortion. Data display a correlation between increased temperature and increased sporophyte abortion as well as increased time to complete meiosis, possibly indicating decreased fitness. Combined global warming may create more stressful environments for sporophytes which could result in the elimination of males from local populations.

Introduction:
Bryum argenteum is a cosmopolitan moss that can be found in a wide variety of habitats. It is a biannual plant, and in the lab it exhibits a primary sex ratio of 1:1.5. However, this strongly female-biased in field patches, with males absent entirely from both extremely hot and cold environments (Bart et al. 2010).
Our hypothesis is that sporophytes of the species Bryum argenteum have differential stress tolerance that will lead to reduced fitness in highly stressed sporophytes and higher percentage of male versus female spores, which will translate into skewed sex ratios after germination.

Methods:
The sporophytes used were from cultures that have been grown in the lab for several generations, from California, Kentucky, and Massachusetts male-female cultures.
Sporophytes from each population were extracted from the maternal gametophyte then placed on sterile agar dishes and subjected to three different temperatures: 22°C, 26°C, and 28°C for 24 hours.
• A 24-hour high temperature isolator was used, and the temperature was increased 2°C every two minutes until the target temperature was reached.
The sporophytes were then placed on the lab bench to cool for two minutes, and then transplanted into Petri dishes containing moist sand and returned to the growth chamber.
• Sporophytes were then observed and fitness was measured based on the following parameters: 1) Days until shoot of apex 2) Days until capsule formation 3) Days until meiosis begins 4) Days until meiosis ends

Results:
The results show a correlation between increased thermal stress and increased sporophyte abortions. However, the other parameters that were measured did not seem to be influenced by thermal stress. This could possibly indicate that sporophytes that can tolerate the stress remainvigorous and therefore their long-term fitness is not altered; it could also indicate that the thermal stress does not affect the development of the sporophyte.

Conclusion:
If female-biased sex ratios as a result of differential stress tolerance, as global warming continues it may create a more stressful environment for developing sporophytes and could result in the elimination of males from many local populations. This could possibly reduce the radiate crustose population in disturbance and perhaps increase chance of local extinction. Bryophytes have important ecological roles in many environments, such as primary productivity, nitrogen fixation, nutrient cycling, biological indicators of pollution, as well as many other services (Black N., 2011). The viability of bryophyte populations in the face of global warming is something that needs to be addressed with further research.

Future Research:
To complete this experiment spores will be germinated and the resultant sex ratio assessed. To do this, sporophytes will be randomly sampled from each genotype for each stress group. These sporophyte cultures will be physically manipulated to release their spores, and spores will then be germinated and grown in the lab until maturity. The sex ratio of these natural bryophytes will then be assessed.

Acknowledgements:
This research was funded by the following grants: ‘Nevada Infrastructure for Climate Change and Education, and Outreach’, NSF Grant #EPS-0814572
We would also like to thank John Bradt, Joshua Greenwood, and Matthew Glenn for their assistance with experimental procedures and data collection.

References:
Title: Does thermal stress cause females of the plant Bryum argenteum to manipulate the sex ratios of their offspring?

Abstract: About half of all moss taxa exhibit female-biased sex ratios, and bryophyte male rarity remains largely unexplained. One possible explanation is differential stress tolerance of spores due to maternal sporophyte manipulation during stress. To test this hypothesis, sporophytes of the species Bryum argenteum were subjected to thermal stress and observed for growth abnormalities and sporophyte abortions. Data display a correlation between increased temperature and increased sporophyte abortions as well as increased time to complete meiosis, possibly indicating decreased fitness. Continued global warming may create more stressful environments for sporophytes resulting in the elimination of males from local populations.

Why are you doing this project? To assess if thermal stress reduces the fitness of sporophytes of the moss Bryum argenteum and/or affects the resultant sex ratio of germinated spores.

What problem are you trying to solve? Trying to uncover any possible abiotic factors that contribute to the female-biased sex ratio of this moss species.

What tools or equipment are you using? A growth chamber, a Barnstead high-temperature incubator, and a dissecting microscope

Why is your project worth researching? Female-biased sex ratios are common in bryophytes and yet largely unexplained. I hope to use B.argenteum as a model organism to see if my hypothesis is correct and possibly use it as one explanation of skewed sex ratios in similar taxa.

What relevance will it have on the community, society, and in your research field? Bryophytes play important ecological roles in many environments, including nutrient cycling, and the maintenance of viable populations is important. If males are eliminated from local populations, it will reduce the genetic variability of the population and ultimately the species. Reduced genetic variability would lead to a lowered resilience to disturbance, and in the face of global warming is something that needs to be addressed with further research.

What did you find? I have only been able to complete about the first half of my experiment. My data does indicate reduced fitness of sporophytes after being subjected to stress, indicated by increased sporophyte abortion rates and increased time in meiosis. However, sex ratio data of germinated spores is not available yet.

What is the future for your research project? I plan to germinate a random sampling of sporophytes from each stress temperature and my controls and verify the resulting sex ratio. After my experiment is complete I hope to publish my results in a peer-reviewed journal.
In-situ Synchrotron X-ray Diffraction Study of Quartz Deformation Using the D-DIA Apparatus

May Sas1, Dawn Pape1, Brian K. Erickson1, Sylvia-Monique Thomas1, Pamela C. Burnley1

1 Department of Geosciences, University of Nevada, Las Vegas, Las Vegas, NV 89154-4016, USA (correspondence: smas@unlv.nevada.edu)

Introduction

Deformation is a rock's mechanical response to external parameters such as temperature and pressure. Knowledge of deformation is necessary to understand geodynamic processes. The behavior of rocks and minerals during deformation depends on the behavior of individual mineral grains within the rock and how they interact. The purpose of this study is to better understand such grain-to-grain interactions.

Deformation - DIA

We use the D-DIA apparatus located at the X17B2 beamline at the National Synchrotron Light Source (NSLS) to conduct deformation experiments. The D-DIA module is installed in a large volume hydraulic press. It consists of 6 WC anvils, the top and bottoms of which move independently, and compress a cube-shaped sample assembly and induce deformation at a controlled rate (cf. Illustration below).

Our sample is polycrystalline quartz, novaculite, which has grain sizes ranging from 6 to 9 microns. We study novaculite deformation at temperatures ranging from 500°C to 890°C and up to confining pressures of 2.5 GPa.

To determine the temperature we have established a watt versus temperature relationship from numerous experiments.

Detectors and D-Spacing

During the experiment, synchrotron x-rays pass through openings between the anvils and diffracted x-rays are measured by ten detectors. The output files include d-spacings of the diffraction peaks, which are fitted via Plot385. The changes in d-spacing allow us to determine the elastic deformation of the crystal lattice. Using the following equation we can calculate the lattice strain:

\[ \varepsilon = \frac{D_0 - D_t}{D_0} \]

Ds: D-spacing time \( t = x \)
 Dt: D-spacing at time \( t = 0^* \)

**t = 0**: sample is in hydrostatic equilibrium

Sample Assembly

Sample Strain

Radiographs are taken before, during and after the experiment to determine the sample strain. We measure the sample's major and minor pixel lengths using platinum metal foils as length markers. Once measured, the two lengths are averaged and the following equation is applied to calculate the strain:

\[ \varepsilon_{strain} = \frac{L_s - L_o}{L_o} \]

Li: Average length at time \( t = 0^* \)
 Ls: Average length at time \( t = x \)

Future Prospects

- Completion of data analysis for SiO2, 18 and detectors 1, 3, 5, and 6 for SiO2, 16
- Microstructural analyses using electron backscatter diffraction (EBSD) mapping and elastic-plastic self-consistent (EPSC) modeling, which correlates D-DIA (information on stress distribution in grains) and EBSD (information on operating deformation mechanisms) results
- Use results to create a model of polycrystalline deformation
- Fit D-DIA data, run EPSC models for AlO2 and compare with SiO2 results

Acknowledgments

This work was supported by National Science Foundation grant EAR-0838579 and partially supported by COMPRES, the Consortium for Materials Properties Research in Earth Sciences under NSF Cooperative Agreement EAR-0838579. Use of the National Synchrotron Light Source, Brookhaven National Laboratory, was supported by the U.S.
Title: In-situ Synchrotron X-ray Diffraction Study of Quartz Deformation Using the D-DIA Apparatus

Abstract: Deformation is a rock’s mechanical response to external parameters such as temperature and pressure. Knowledge of deformation is necessary to understand geodynamic processes. The behavior of rocks and minerals during deformation depends on the behavior of individual grains within those minerals as they interact. The mineral we are studying is quartz, which we chose since it is very well studied and is highly abundant. We use high-pressure high-temperature experiments to simulate conditions of Earth’s interior and the D-DIA apparatus combined with synchrotron x-ray diffraction allows us to record data directly during the process of deformation. The data we collect is used to determine the macroscopic sample stress and tells us also how individual grains react to that stress depending on their orientation within the mineral.

Why are you doing this project? To understand the behavior of individual mineral grains within the rock and how they interact with one another during deformation.

What problem are you trying to solve? How do the various lattice planes of quartz respond to various high temperatures and pressures? How does the orientation of the of the lattice plane influence that response? Does the strain differ? Is the elastic slope of quartz constant or does it vary with experiment?

What tools or equipment are you using? Deformation-DIA (a hydraulic press with 6 diamond anvils), X17B2 beamline at the National Synchrotron Light Source (NSLS), in-situ synchrotron X-ray diffraction (XRD), scanning electron microscope (SEM), Plot85

Why is your project worth researching? Because it is grain-scale processes that control the large-scale mechanical behavior of Earth's materials.

What relevance will it have on the community, society, and in your research field? Better understanding mantle convection and earthquakes.

What did you find? The strains are temperature dependent, the elastic slope is the same in all experiments, and the elastic constants have been reproduced.

What is the future for your research project? Analyzing additional experiments, EBSD mapping, EPSC modeling, and comparing quartz and alumina results.
Abstract

Oxygen delivery rates must keep pace with the increased metabolic rate observed in poikilothermic animals exposed to increased temperature if aerobic metabolism is to be maintained. Physical failure of the oxygen delivery system to meet this increased demand may be a mechanism of cardiac failure in crustaceans at temperature extremes. As part of the determination of the critical thermal maximum, lactate levels in grass shrimp (Palaemonetes pugio) acclimated to 20°C over a temperature range (20-38°C) in normoxic and hyperoxic conditions. Lactate levels were measured as an indicator of a switch from aerobic to anaerobic metabolism. Animals placed in a hyperoxic environment had a higher CT max than animals in a normoxic environment, suggesting a physical limitation in oxygen delivery. Animals were collected and immediately placed in liquid nitrogen across the temperature range in both normoxic and hyperoxic conditions. Whole animal preparations were then used to determine lactate levels using an enzymatic method from a commercially available lactate analysis kit.

Palaemonetes pugio are commonly known as grass or ghost shrimp due to their semi-transparent body. In the natural environment, grass shrimp are exposed to a wide range of temperatures, dissolved oxygen and salinity levels. These animals must adjust to survive in these always changing environments. Over time many species have evolved a number of physiological, biochemical and molecular mechanisms to adapt to or evade environmental temperature extremes (Pawson & Kingsland, 1971).

Introduction

Critical thermal maximum at normoxic and hyperoxic conditions. CTmax is significantly higher at the higher oxygen levels.

Methods

Animal Preparation

Animals, Palaemonetes pugio, were maintained in 25L aquaria in aerated seawater (20-25°C) at the Biology Department University of Nevada Las Vegas. Animals were randomly selected from a stock of shrimp at the University of Nevada Las Vegas. Animals were collected and transferred to a large aquarium filled with water from a local marsh that was then placed into a 5°C walk-in freezer until all animals were collected and ready for analysis.

Experimental Design

After the grass shrimp were put in the water bath, the temperature was then increased at intervals of 0°C, 0.5°C, 0°C, 0.5°C, 0°C, and 0°C, and the resulting response of all animals was collected and recorded. These data are still preliminary and we are currently testing additional samples to support these results.

Anatomy

The analysis of the production of lactate in P. pugio was completed with the following protocol. The whole animal was homogenized with a tissue homogenizer (Thermo Fisher Scientific, Inc, lactate reagent kit). Three micro liters of sample are added to each well and sample and finally 100 micro liters of Reagent 2 was added. The sample was then run on an automated analyser (three of eight)

Literature Cited


Title: Effect of temperature and oxygen levels on lactate production in *Palaemonetes pugio*

Abstract: Oxygen delivery rates must keep pace with the increased metabolic rate observed in poikilothermic animals exposed to increased temperature if aerobic metabolism is to be maintained. Physical failure of the oxygen delivery system to meet these demands may be a mechanism of cardiac failure in crustaceans at temperature extremes. As part of the determination of the effect of temperature on the cardio-respiratory system, we are measuring whole animal lactate levels in grass shrimp acclimated to 20°C over temperature ranges in normoxic and hyperoxic conditions. Lactate levels are measured as an indicator of a switch from aerobic to anaerobic metabolism. Animals placed in a hyperoxic environment had a higher CT max than animals in a normoxic environment, suggesting a physical limitation in oxygen delivery. Animals were collected and placed in liquid nitrogen across the temperature range in both normoxic and hyperoxic conditions. Lactate levels were determined with whole animals using an enzymatic method from a commercial lactate analysis kit.

Why are you doing this project? To determine if temperature does affect the metabolic rate of *Palaemonetes pugio* (ghost shrimp) by looking at the rate of lactate being produced.

What problem are you trying to solve? Whether or not lactate production in the ghost shrimp is affected by temperature.

What tools or equipment are you using? Water bath heater, micro pipettes, a centrifuge and an automated analyzer.

Why is your project worth researching? This project is worth researching because it will give us a better understanding of the physiological aspects of crustaceans.

What relevance will it have on the community, society, and in your research field? Many other species on this world have similar physiological systems as crustaceans. Most organisms can produce lactate similar to the ghost shrimp being studied. It will give the community a better understanding on demands that occur on an internal system, such as the cardio-respiratory system, when exposed to a wide range of temperatures.

What did you find? The data shows us that the ghost shrimp do produce lactate, even at non-stressful temperatures such as 20 degrees Celsius. Lactate production does increase steadily as the animal reaches loss of righting response. This gives us connections between increased temperature and the rate of lactate production.

What is the future for your research project? To continue to look at how temperature affects the ghost shrimp. The next step for this specific project will be to expose the ghost shrimp to hypoxic conditions and see how the rate of lactate production is affected. There are many other experiments that could compliment this research and other finished research.
MELT INCLUSIONS IN VOLCANIC ROCKS

Kirellos Sefein, Kelly Robertson, Adam Simon
UNLV Geoscience

INTRODUCTION

Melt inclusions represent aliquots of silicate liquid that were trapped along growth zones (primary) or healed fractures (pseudo-secondary) of mineral phases, which crystallized from the silicate liquid as it cooled. As such, melt inclusions are essentially time capsules preserved in volcanic rocks that can be used to characterize the compositional evolution and origin of erupted magma, and to investigate the role of processes such as magma mixing that drive eruptions.

METHODS

With the use of transmitted and reflected light microscopy, I identified and classified melt inclusions in the following three sample types:

1. Grain mounts
2. Thin mounts (30 microns)
3. Thick mounts (200 microns)

For melt inclusions to be suitable for laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), they must have the following:

- At least 10 to 20 microns in diameter
- Located inside the melt inclusion host at a depth that is equivalent to the melt inclusion diameter
- Not exposed at the surface
- Representative of their original structure

REFERENCES

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Figure 1. (Left) The green circles represent melt inclusion chemistry, while the blue diamonds represent whole rock chemistry, published by Kent et al. (2010). (Right) The top figure is an Andesite, and the below it are Basalt and Dacite, respectively.

In this project we characterized melt inclusions in olivine, plagioclase and pyroxene phenocrysts from thirteen samples from Mutnovsky Volcano in Kamchatka, Russia. The whole rock chemistry of these samples ranges from basalt to dacite. The purpose of the study is to use melt inclusion chemistry to track the evolution of silicate melts over the 100 Ka lifetime of the volcano. The chemical analyses are part of a larger dissertation project of the second author.

Figure 2. The polarizing light microscope used to make petrographic observations of melt inclusions.

Figure 3. This figure represents the amount of melt inclusions analyzed by LA-ICP-MS, differentiated by phenocryst and melt inclusion type.

Figure 4. Recrystallized and glassy melt inclusions in a plagioclase (1 & 4), pyroxene (2), and olivine (3) phenocrysts. Photos taken at 100x.

REFERENCES

Abstract: We studied melt inclusions from Mutnovsky Volcano, Kamchatka, Russia as part of a larger project designed to constrain the eruptive history of Mutnovsky. Transmitted and reflected light petrographic microscopy was used to characterize melt inclusions in grain mounts of mineral separates, standard 30 micron thin sections, and 200 micron thick sections of the samples from the Mutnovsky. The inclusions were further divided into three main categories: recrystallized, partially recrystallized, and glassy inclusions. After all the melt inclusions have been categorized, they will be analyzed by using LA-ICP-MS to determine their major, minor and trace element compositions.

Why are you doing this project? I am doing this project to help me understand and identify melt inclusions in volcanic rocks.

What problem are you trying to solve? I personally am not trying to solve a problem, but Kelly Robertson and Adam Simon are trying to understand the history of the Mutnovsky Volcano in Kamchatka, Russia.

What tools or equipment are you using? Microscopes with transmitted and reflected light.

Why is your project worth researching? It helps us understand magma mixing that cause volcanic eruptions.

What relevance will it have on the community, society, and in your research field? It will help the scientific community understand volcanoes processes.

What did you find? Melt inclusions in volcanic rocks.

What is the future for your research project? To continue to analyze data from the melt inclusions found.
SERPENTINITE WEATHERING AND IMPLICATIONS FOR MARS.
V. Tu, J. Baumeister, R. Metcalf, A. Olsen, E. Hausrath

I. INTRODUCTION
In the search for life on Mars, near-surface soil environments may be important habitats for life accessible to future missions. Serpentinite rocks have been documented on Mars, as well as other clay minerals including smectite and kaolinite. Previous studies of soils formed on serpentinites on Earth have documented the formation of extensive clays. Serpentinites are additionally of interest as habitats for life such as methanogens. Here we examine weathering of serpentinites from bedrock to soil surface, as a potential route for the formation of clay minerals on Mars from abundant ultramafic minerals. We additionally test for the presence of Fe-oxidizing bacteria in weathered serpentinite rocks. Fe-oxidizing bacteria have been previously demonstrated to affect dissolution rates of ultramafic minerals and may produce important biosignatures.

II. FIELD AREA & SAMPLE COLLECTION
Samples were collected from a vegetated serpentinite soil at 41°05’08”N, 122°39’54”W from a depth of 0 to 40cm. Samples of rock were collected from road cuts beneath profile and rock core. Samples of rock were additionally collected. Scorpion Creek, Klamath Mountains, California.

III. METHODS
- SEM/EDS
- XRD
- XRF
- BARTS
- Bulk Density
- Core Density
- Radiometric analysis
- Analyte MA
- Biological Activity Reaction Tests

IV. RESULTS
XRD: Preliminary results suggest the formation of AL-bearing secondary minerals on the surface. SEM images of polished weathered rock suggest the formation of AL-bearing secondary minerals on the surface.

V. DISCUSSION
Calculation of Serpentine Dissolution Rate
\[ R = \frac{\Delta C}{\Delta t} \]
where 
- \( R \) is the dissolution rate
- \( \Delta C \) is the change in concentration
- \( \Delta t \) is the change in time

VI. CONCLUSIONS
- Natural weathering rate of Scorpion Creek: 2.42 x 10^{10} mol/m^2/s
- To our knowledge this is the first field weathering rate of lizardite.
- Lizardite appears to be altering to smectite.
- Chemical weathering appears to be occurring below the point of refusal.
- At first BARTS did not yield any apparent signs of growth however, samples we monitored for a total of 116 days and growth of Fe-oxidizing bacteria may now be present.

VII. ACKNOWLEDGEMENTS
We would like to thank NSF EPSCoR for funding and Dr. R. Metcalf, J. Cornell, E. Johnson, and Dr. S. Mutlu, C. Adcock, Dr. Z. Yu, and the UNLV Geoscience department for their assistance.

VIII. REFERENCES
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**Title:** Serpentinite Weathering and Implications for Mars.

**Abstract:** Near-surface soil environments may be important habitats for life on Mars accessible to future missions. Weathered serpentinites indicate the formation of Al-rich surfaces and smectites, and the presence of Fe-oxidizing bacteria.

**Why are you doing this project?** Near-surface soil environments may be important habitats for life on Mars accessible to future missions. Weathered serpentinites indicate the formation of Al-rich surfaces and smectites, and the presence of Fe-oxidizing bacteria.

**What problem are you trying to solve?** Determination of dissolution rates of serpentinite as a potential route for the formation of clay minerals on Mars which may host near-surface environments for Fe-oxidizing bacteria.

**What tools or equipment are you using?** Sample collection from the Klamath Mountains, Bulk Density, Scanning Electron Microscopy, X-ray Diffraction, X-ray Fluorescence, Biological Activity Reaction Tests.

**Why is your project worth researching?** Few data exists for the dissolution rates of serpentinites therefore, I am participating in ground-breaking research that can be applied to important, accessible future missions to Mars.

**What relevance will it have on the community, society, and in your research field?** My research will broaden our knowledge base of not only Earth based serpentinites but also those of Mars with the potential to better understand habitats for life on Mars.


**What is the future for your research project?** Continued dissolution experimentation and dissemination of results.
Stationary phase mutagenesis in *Bacillus subtilis* is independent of genome replication

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**Abstract**

*Bacillus subtilis* is a gram positive soil bacteria that is ubiquitous in soil. This organism is used in place of the commonly researched *E. coli*. We are studying DNA mutation during stationary phase (nongrowing) conditions. There is a growing body of scientific research that is suggesting that mutation can occur during transcription of RNA. RNA transcription is used to create proteins that perform the function encoded by DNA.

It is an assumption that DNA mutations occur during DNA replication. We have created a temperature sensitive mutation that will not allow the DNA helicase to bind to DNA to open it up for replication. This should prevent the beginning of DNA duplication there by implying that the mutations that occur are a result of a different mechanism.

**Background**

Stationary phase mutagenesis is the process by which cells under non-growing conditions accumulate mutations in genes under selection

This type of cellular programs are associated with the formation of neoplasia in animal cells and with acquisition of antibiotic resistance and evasion of immune responses in in microbial pathogens (Galhardo, 2007)

This process have been extensively studied in *Escherichia coli* and indicate that stress-induced, or stationary phase mutations are generated during the processing of intermediates formed during genome replication (Galhardo, 2007; Hastings, 2007)

In *Bacillus subtilis*, however, several factors required for the processing of replication intermediates are not required and suggest that stationary phase mutations are produced by a different mechanism (Robleto et al, 2007)

Here we examine stationary phase mutagenesis in the absence of genome replication and showed that *B. subtilis* produces mutations in non-growing cells by mechanisms that do not require genomic replication.

**Hypothesis**

Stationary phase mutagenesis in *B. subtilis* is independent of genome replication.

**Methods**

**Genotype**

YB955 contains three point mutations that confer auxotrophy in *B. subtilis* (Fang and Yu,din, 2002):

- sentR
- Aoe103
- sentC (these are non-sense mutations)

KM109 contains the YB955 mutations and a temperature sensitive mutation in *dnaB* (this is a mis-sense mutation)

**Stationary phase assay**

We measured the acquisition of mutations by quantifying the number of cells that have converted from *Leu−* to *Leu+*.

1. Cells are grown to stationary phase – 90 minutes after the cessation of growth (T0)
2. Cells are washed and resuspended in SMS salts (contain no nutrients)
3. Cells are plated on media lacking methionine and leucine (YB955 and KM109 require this amino acids for growth)
4. At different time intervals (0, 2, 4, 6, 8, and 10 days of incubation) cells are incubated at 45°C
5. After different times, the number of cells growing on the plates is quantified by plating them on media containing all required factors for growth and at 30°C

**Results**

Summary: 1) Both strains accumulated mutations similarly which suggest that genomic replication is not required for the formation of mutations in resting cells. 2) Viability of nongrowing cells is not affected and does not influence the ability to accumulate mutations under nongrowing conditions and with the same mutation rate. Survivals were taken and both maintained the same number of cells living on the plates.

**Conclusions**

Stationary phase mutagenesis in *B. subtilis* occurs in the absence of genome replication.

**Future Directions**

- Extend our mutagenesis analysis to other genetic markers
- Determine the type of mutations generated in the absence of genome replication
- Determine whether DNA repair becomes mutagenic in stationary phase cells.

**References**

5. This project is supported by Grants MCB08443606 (NSF) and 2P20RR016463 (NIH-Nevada INBRE)
Title: Stationary phase mutagenesis in Bacillus subtilis does not require genome replication.

Abstract: Stationary phase mutagenesis is defined as cellular mechanisms that produce genetic diversity in cells experiencing conditions of stress. These processes are associated with many biological phenomena, including those that produce the formation of cancers in animal cells and other degenerative diseases. Also, these mechanisms are associated with the accumulation of beneficial mutations in bacteria, but follow stochastic processes and are controlled by genetic factors. The current models explaining the generation of stress-induced mutations are predicated on the formation of DNA replication intermediates that are formed during the repair of damaged DNA or during DNA replication and transcription encounters. Here we test the hypothesis that genome (DNA) replication is not required for the generation of stress-induced mutations. Our experiments compared the accumulation of mutations in cells differing in their ability to initiate and elongate genome replication at high temperatures (45° C) and showed that both types of cells accumulate mutations at very similar rates. These results then suggest that resting cells possess replication-independent mechanisms that generate mutations and therefore add novel aspects to our view of the evolutionary process.

Why are you doing this project? Because this is an important evolutionary process.

What problem are you trying to solve? New insights on how mutations occur.

What tools or equipment are you using? molecular biology

Why is your project worth researching? Because these processes are important for many biological phenomena.

What relevance will it have on the community, society, and in your research field? By creating an entirely new process of acquiring mutations, this can lead to drug resistance in bacteria and formation of cancers.

What did you find? Mutations can occur in the absence of genome replication.

What is the future for your research project? Elucidate the molecular mechanisms of stationary phase mutations.
Halo occupation of Lyman-break Galaxies

Saju Varghese

Collaborators: Dr. Kentaro Nagamine (UNLV), Jason Jaacks (UNLV) & Dr. Jun-Hwan Choi (Univ. of Kentucky)

Abstract:
Lyman-break galaxies (LBGs) are star-forming galaxies found at high redshift that provide large amounts of information on early star and galaxy formation. We use large-scale cosmological smoothed-particle hydrodynamical simulations to simulate the physical properties of LBGs, such as stellar mass, star-formation rate, and magnitude. In particular, we focus on the question of which dark matter (DM) halos host LBGs. Our simulation suggests that only 1.74% of DM halos host LBGs, though among the massive DM halos with mass $M_{\text{DM}} > 10^{11} M_{\odot}$, the fraction is 51.93%. The occupation number of LBGs ranged from 1 to 17 per halo.

Methods:
- Simulation (Chi & Nagamine, 2010)
- Galgao (Steininger, 2008)
- Lambda-CDM cosmological SPH simulations
- Results and analysis

Results:
Number of LBGs in a DM Halo
DM Halo Fraction Count

Halo Occupation of LBGs
From the simulation run (1000 halos at $z=2$), we located DM halos using friends-of-friends algorithm to locate DM halos and galaxies using a Star Formation Kinetic algorithm. LBGs were selected from the galaxy halo using a redshift magnitude $z > 0.05$.

The ‘Number of LBGs in a DM Halo’ plot helps us to see the distribution of DM halos with respect to their masses against the population of LBGs in them. As the plot shows, there is an increase in total number of LBGs in halos as the mass increases, to a maximum of 17.

The ‘DM Halo Fraction Count’ plot helps to see the fraction of halos with different number of LBGs. It is shown that a large number (605, 632, 610) of halos have 0 LBGs in them, which is about 96.39% which leaves about 1.74% with LBGs, or a true small value of 0.05193% of all halos with mass $M_{\text{DM}} > 10^{11} M_{\odot}$.

Star-formation Rate
Stellar Mass

Physical Properties of LBGs
LBGs are studied due to their contribution to the neutral content of the universe and their connection to the galaxies observed in the present-day universe. They provide the richest source of information on galaxy properties in the high redshift universe.

An advanced analysis topic is understanding both the evolution of the individual galaxies and their contribution to the cosmic stellar mass budget in the star-formation activity of the LBGs. The ‘Star-formation Rate’ plot shows LBGs’ star-formation rate against the halo’s DM mass.

Measuring the stellar mass assembled in LBGs and the age of the stars at $z=3$ and higher is very important in constraining the life to formation observed at later cosmic times. The ‘Stellar Mass’ plot shows the relationship between LBGs’ stellar mass and their DM halo’s mass.

The plots above show a direct relationship between star-formation rate, stellar mass and halo mass. As the halo’s mass increases, the upper limit star-formation rate increases, leading to an increase in stellar mass. As we can see there are many halos with a wide variety of LBGs from low star-formation rate to high star-formation rate in high stellar mass halos.

Acknowledgements, Conclusion and References:
Title: Halo occupation of Lyman-break Galaxies at z=3

Abstract: Lyman-break galaxies (LBGs) are star-forming galaxies found at high redshift that provide large amounts of information on early star and galaxy formation. We use large-scale cosmological smoothed-particle hydrodynamical simulations to simulate the physical properties of LBGs, such as stellar mass, star-formation rate, and magnitude. In particular, we focus on the question of which dark matter (DM) halos host LBGs. Our simulation suggests that only 1.74% of all DM halos host LBGs, though among the massive DM halos with mass Mhalo >10^{11.5} Msun, the fraction is 51.93%. The occupation number of LBGs ranges from 1 to 17 per halo.

Why are you doing this project? As part of my undergraduate research in my Department, the question was first raised as to why there are large numbers of dark matter halos with no LBGs in them. I thought it would be a good topic to start researching and found the topic interesting.

What problem are you trying to solve? What type of dark matter halos host LBGs at redshift z=3 or at cosmic time of 2.19 billion years after the big bang.

What tools or equipment are you using? Gadget-3 - cosmological hydrodynamical simulation code to simulate the universe. Friends-of-Friends algorithm - DM halo grouping code used to find DM halo in the simulation. P-StarGroupFinder algorithm - baryonic (gas and star particle) grouping code used to find galaxies in the simulation. VisIt - Visualize It, a visualization program used to plot and render images from the data extracted from the simulation.

Why is your project worth researching? LBGs provide the richest sources of information on galaxies' properties in high redshift universe. They are crucial in understanding stellar and galaxy evolution. This research serves as evaluation of simulation data against observational data.

What relevance will it have on the community, society, and in your research field? This research helps compare simulation data to observational data, which in turn helps astrophysicists to figure whether the simulation code is overproducing DM halos, stars and galaxies or if the amount is deficient or if the simulation agrees with the observation.

What did you find? We find that only a very small percentage, ~1.74%, of dark matter halos at redshift z = 3 contain LBGs. A majority of DM halos (~ 52%) that host LBGs have a halo mass greater than 10^{11.5} times the mass of the sun. Among various questionable results, we found that there are DM halos with LBGs ranging from 1 to 17.

What is the future for your research project? I plan on developing physically based model for estimating dust in the ISM (Interstellar medium) which will increase the accuracy of our magnitude values of galaxies. Currently we manually input dust extinction values based of the observational values in a luminosity function plot.
Title: Greenspun Hall

Abstract: As one of the two high performance buildings in the UNLV built environment, Greenspun Hall serves (GH) as a high profile example of how public-private synergy can produce effective results both for our school and community.

Why are you doing this project? The story of GH is compelling in that it represents the intersection of many distinct topics, not least of which includes a roadmap for how UNLV might expand its physical infrastructure to accommodate an ever increasing demand for education.

What problem are you trying to solve? We must reform building design and construction practices to maximize benefits to human health while simultaneously minimizing detrimental impacts to the natural environment in which we all reside; it's simply a question of intergenerational equity.

What tools or equipment are you using? Due to the investigative nature of this research, very few diagnostic tools or physical equipment are necessary other than good old fashioned critical thinking. We have employed all resources at our disposal, conducting interviews with key players and studying at length the available literature.

Why is your project worth researching? Building design and construction is an extremely complex topic, but if an effective framework is built to measure and manage this process, it might have tremendous payoff in reducing demand side needs for water, energy and waste diversion.

What relevance will it have on the community, society, and in your research field? UNLV, GH, and its diverse occupants provide a number of services to the community. Focusing attention on the benefits of LEED and closely studying the associative costs we may achieve a greater understanding of what was done right and how we may improve best practices in the future.

What did you find? Analysis performed shows that the cost of going green does not necessarily pay off but a more detailed analysis may still prove otherwise. Additional benefits not captured in the cost/benefit analysis include the monetary value of foregone greenhouse gas emissions, the added human benefits yielded by a healthier building, the amount of construction site waste diverted from landfills, and the PR value in use of having such a high profile, high performance building to signal to the greater community that UNLV plans to be a leader in sustainability for generations to come.

What is the future for your research project? The current financial scenario has forced our state leadership to agonize over how best to distribute increasingly scarce resources. More research must be done to study the payoffs of LEED in order have understanding these practices.
Title: Simulation of Upper-Pharyngeal Region in Patients with Obstructive Sleep Apnea (OSA)

Abstract: This project seeks to develop a physical simulation of the conditions experienced in the upper-pharyngeal region in patients suffering from obstructive sleep apnea (OSA). This is being done in the effort to eventually develop a mechanical, implanted, corrective device for patients. OSA currently affects millions of Americans ranging from as minor as snoring to as major as the complete collapse and blockage of the upper-airway. If gone untreated, memory retention problems, severe daytime fatigue and cardiovascular diseases, such as heart failure or attacks, could occur. Treatment in its current form exists as either ineffective or overly obstructive. Surgical procedures targeted at removing sections of the soft tissue responsible for the obstruction have only temporary and limited results. Conversely, continuous positive airway pressure (CPAP) devices are extremely effective, but require the patients to wear a large, uncomfortable mask to sleep in each night. The experimental test platform seeks to simulate collapse conditions within the upper-pharyngeal region, as based on data- MRI’s, CAT scans and sleep studies- from patients suffering from OSA.

Why are you doing this project? This project presented a unique opportunity dealing with a topic which affects millions, such as sleep apnea.

What problem are you trying to solve? We are trying to design an innovative way to correct sleep apnea. Our proposed method would be equally effective than current methods in use.

What tools or equipment are you using? We are constructing an experimental test bed to simulate the conditions in the upper-pharyngeal region. This will provide us invaluable insight into airway collapses, in terms of their forces and how to initially prevent them.

Why is your project worth researching? Obstructive sleep apnea affects millions of Americans. The treatment methods are very ineffective or overly obstructive.

What relevance will it have on the community, society, and in your research field? Nothing is on the market which resembles our design. With the release of our product, we will spark interest in furthering the advancement of sleep apnea correction techniques and, more overall, innovations in the field of biomedical engineering.

What did you find? We have so far found evidence that hyoid bone manipulation can increase the diameter of the human airway. We are basing our device designs around that fact. In constructing our test bed we are relying heavily of medical data.

What is the future for your research project? With successful completion of the experimental test bed this semester, we hope to move into further stages of device development. This is done in the hopes to eventually publish papers, articles and file design patents.
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Title: The Influence of Information on Risk Perception of Climate Change and Willingness to Pay for Mitigation

Abstract: My research sheds light on how members of the public perceive the risk of climate change and, in turn, how this impacts their willingness to pay for measures designed to limit the production of greenhouse gases. More specifically, I’m trying to determine if providing information about climate change affects research subjects’ willingness to bear actual monetary costs in support of measures resulting from international treaties or government action intended to stop climate change. My work seeks to expand understanding of the influence that various sources of information, the media, and politics have on public opinion about a scientific issue.

Why are you doing this project? To further develop models that assess public support for climate change mitigation. To understand how much scientific information and media information influence risk perception.

What problem are you trying to solve? How do different information sources communicate risk of scientific information and generate support for public action to combat climate change?

What tools or equipment are you using? Surveys

Why is your project worth researching? A large majority of climate scientists claim that we must take action in order to avoid catastrophic consequences of climate change. In a democratic system, public support is crucial in implementing policy, and the public gains most of its information about scientific phenomena from the media, not the scientific community. We must better understand this influence of information in order to better understand how to communicate the risk of climate change in order to generate public support.

What relevance will it have on the community, society, and in your research field? My research offers insight about a different way of developing willingness to pay models for climate change mitigation.

What did you find? Both media and scientific sources influence risk perception of climate change, though media sources seem to have a stronger influence. Additionally, controlling for the influence of information in a willingness to pay model increases the variance of willingness to pay estimates.

What is the future for your research project? I hope others developing willingness to pay models for climate change mitigation will be able to build upon ideas presented in my work to create more precise estimates of public support for mitigation.
Title: Imaginative Learning

Abstract: Our group examines an early childhood education center. Each project is based on extensive research of how children learn and what constitutes a healthy environment in which a child learns. We outline how creativity aids in learning, the cognitive, physical, and emotional development milestones during childhood, and how color, texture, and shape stimulate children. The second part focuses on the future of learning by integrating technology into the classroom. The third part challenges the idea that children should play with toys that have predetermined uses. Items used were up-cycled items as toys in order to let the children use their full imagination. Not only does this allows children to think freely, but teaches them the importance of recycling and their environmental impact. The last part examines how different stimuli to encourage learning through various avenues.

Why are you doing this project? We are doing this project to create a preschool which teaches fundamental lessons in health and community.

What problem are you trying to solve? We would like to impact the way children eat to decrease childhood obesity.

What tools or equipment are you using? A greenhouse allows children to take ownership of plants, a kitchen serves as space to learn preparation, and the exterior classroom connection takes learning to the outdoors.

Why is your project worth researching? Childhood obesity is an epidemic which can be treated through education.

What relevance will it have on the community, society, and in your research field? Design of childcare centers impacts the youth of a community, and can make that community stronger and healthier. Researching how children learn in childcare centers impacts the design of the spaces they use daily.

What did you find? We found that children require games to improve dexterity, fine motor skills, language, and physical and emotional development.

What is the future for your research project? Dr. Putney of Innovations International Charter School has interest in implementing a greenhouse garden in her school to increase healthy eating and to teach the children about growing phases of plants.
Structure studies on lanthanide technetium pyrochlores as prospective host phases to immobilize 99-technetium and fission lanthanides from effluents of reprocessed used nuclear fuels

Introduction

technetium (Tc) is an artificial element produced by nuclear fission, spallation, or other transmutation processes. There are three long-lived isotopes of Tc: the most important one a nuclear waste perspective being the half-life, T1/2 = 2.13 x 10^5 years, Tc is one of the most abundant, long-lived radionuclides in used nuclear fuel (UNF). As such, it is targeted in UNF separation strategies such as SIREX [1]. For isolation and encapsulation in solid waste forms for storage in a nuclear repository, the formation of compound formation, the preferred valence of Tc is +7. Tc reacts with oxygen to form the spinel, (TcO2), where the 5d(2) cations are in tetrahedral (A-site, IV) coordination. In aqueous solution, TcO2 reacts with water to form the hydrated ion, TcO2-. The TcO2, the technetium ion, is a highly mobile aqueous species. Consequently, it is a potential threat to the biosphere. Note that the technetium in the technetium ion is in oxidation state Tc(I). Immobilization of Tc in a suitable solid waste form is a challenge of great importance to the nuclear waste community. To date, scientists have investigated immobilization of Tc in both metallic and oxide forms (e.g., Tc-212 alloy [2], and ferronike-based waste glasses [3]). The purpose of this study is to perform a systematic investigation of the incorporation of Tc in pyrochlore oxide structures, Ln2(TcO4), where Ln represents lanthanide (rare earth) Ln4+ cations, while Tc is a tetravalent, 5d(2), metal cation. Pyrochlore compounds are high-melting temperature oxides and are recognized for their durability [4]. Interestingly, in a complex oxide such as a pyrochlore, two or more fission products may be incorporated simultaneously into the same crystal structure. For instance, americium (Am), a prominent lanthanide fissile product, can be incorporated with Tc to a pyrochlore with formula, Am6Tc4O23. This is one of the pyrochlores that was investigated in this study.

Materials & Methods

A lanthanum-perovskite (La2NiO4) was obtained from Oak Ridge National Laboratory and had to be purified before further use. The lanthanide (Ln) oxides, were obtained from Aldrich and Alcon. To synthesize Ln2TcO4 pyrochlores, stoichiometric amounts of Ln2O3 and TcO2 pressed into tablets with a pressure of 10 ktons/cm2. The tablets were sintered in a platinum crucible in a muffle furnace at 1150°C for 40 hours under a constant flow of Argon (150 cm3/min). The samples were characterized by powder X-ray diffraction (XRD) and Rietveld analysis. Powder X-ray diffraction (XRD) and Rietveld analysis were used to determine and characterize the crystaline phase content of the Ln2O3-TcO2 samples.

Results

Stoichiometry configuration for lanthanide technetium pyrochlore structure

Ln2O3 + 2TcO2 → Ln2Tc2O7

Microstructures of Nd2Tc2O7 Pyrochlore

X-Ray Diffraction Patterns

Conclusion

Technetium (Tc) metal was successfully incorporated into a series of complex oxides with general composition given by Ln2(TcO4) (Ln = Pr, Nd, Sm, Gd, and Lu). Each of these compounds was found to crystallize into a pyrochlore-type crystal structure. Within this series, X-ray diffraction (XRD) structural analysis and Rietveld crystal structure refinements produced highly accurate lattice parameters ranging from 1.6447 (83) Å for Pr2Tc2O7 to 1.6317 (75) Å for Lu2Tc2O7. In this study, the Ln2Tc2O7 phases contained Tc in a +5 oxidation state. The Tc in TcO2 is transferred to the Ln2O3, as demonstrated by the successful synthesis of Ln2Tc2O7, reifying a fairly simple, scalable synthesis route. This technique offers the opportunity to stabilize and immobilize the oxides of two major fission products, Tc and Nd, in what may prove to be a highly durable crystalline oxide host phase.

Acknowledgements

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Title: Structure Studies on Lanthanide Technetium Pyrochlores as Prospective Host Phases to Immobilize 99-technetium and Fission Lanthanides from Effluents of Reprocessed Used Nuclear Fuels

Abstract: We performed a systematic investigation of the incorporation of 99Tc into pyrochlore oxide structures, Ln2Tc2O7, where Ln represents trivalent lanthanide Ln3+ cations, while 99Tc is atetravalent, Tc4+, metal cation. Pyrochlore compounds are high-melting temperature oxides and are recognized for their durability. Our goal in this preliminary study is to characterize and quantify the range of stability of the lanthanum technetium pyrochlore oxide phase. Hereby, powder X-ray diffraction (XRD) and Rietveld analysis were used to determine and characterize the crystalline phase content with high accuracy, and scanning electron microscopy (SEM) was used to characterize the microstructure and homogeneity of the synthesized Ln-Tc pyrochlore specimens. The pyrochlore phases exhibited good crystallinity and the lattice parameters of theFd 3 m phases could be refined with remarkable accuracies, and low refinement residuals (RBragg) of 1.1 % to 3.1 % for the pyrochlore phases were achieved. The refined lattice parameter are ranging from 10.447156(83) Å for Pr2Tc2O7 to 10.13777(22) Å for Lu2Tc2O7. This technique offers the opportunity to stabilize and immobilize two major fission products, TcO2 and Nd2O3, we believe is a highly durable host phase. We anticipate good radiation tolerance and good chemical stability under typical repository storage conditions.

Why are you doing this project? The idea for this project was conceived at Los Alamos National Laboratory. We were solicited for this project because of our radiological facilities and capabilities at UNLV.

What problem are you trying to solve? To create stable and durable host phase wasteforms to safely capture 99-Tc and fission lanthanides.

What tools or equipment are you using? Lanthanide oxides, Technetium oxides, Platinum foil, hood, furnace, XRD, Scanning Election Microscope.

Why is your project worth researching? It is important to safely store potentially harmful fissionable byproducts of a nuclear reactor in order to have a fully operational reactor to generate large amounts of energy.

What relevance will it have on the community, society, and in your research field? Technetium and lanthanide pyrochlores result in safer, more immobile radiological waste.

What did you find? The technetium pyrochlores were successfully synthesized into stable structures.

What is the future for your research project? Technetium spinel waste forms.
Title: Mathematical Analysis and Applications of Logistic Differential Equation

Abstract: Logistic differential equation has a way to measure the proportionality of various resources with respect to time. This equation has been used in many research areas, such as, biology, medicine, psychology, economics, etc. A mathematical description, analysis and solution of the logistic type differential equation is studied. Besides the mathematical part, the poster will contain biological examples, graphs of the direction fields for different parameter settings and logistic plots for specific species population. The logistic growth function will also be applied to learning curves in area of psychology, as a rate at which performance improves.

Why are you doing this project? I am working on this project since it is essential in many applications, such as biology, economics, psychology, and others.

What problem are you trying to solve? I am trying to model the logistic behavior in these types of applications.

What tools or equipment are you using? I was using the software Matlab.

Why is your project worth researching? It is worth researching because it can be applied in many different fields for better understanding and predictions of growth over time.

What relevance will it have on the community, society, and in your research field? Many problems in different areas mentioned above can be described by the logistic equation, which can be solved, and thus we can better understand and forecast some of the problems that appear in our community society.

What did you find? I found how differential equations, in particular the logistic equation, can be applied in many different fields. In essence what happens is the rate of growth of some "population" is proportional to the size of the given population starting from any chosen point of time.

What is the future for your research project? To go to a higher level of differential equations can help capture the nature and the phenomena of the application better.
UNLV Enrollment Forecasting
Sabrina Beckman, Stefan Cline, Dr. Monika Neda
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Introduction
A continuing problem for university administrations is managing enrollments so that the freshmen class entering in the fall is neither too large nor too small. Least-squares fits to historical data is often used for forecasting future numbers. In our project we modeled enrollment data for the University of Nevada Las Vegas, the College of Science, along with the Department of Mathematical Sciences.

What does Least-Squares mean?
Consider the linear system $Ax = b$ where $A$ is $(m \times n)$, with $m > n$. This system is overdetermined and often does not have a solution. If $x$ is a vector in $\mathbb{R}^n$, then the vector $r = Ax - b$ is called a residual vector. A vector $x^*$ in $\mathbb{R}^n$ that yields the smallest possible residual vector is called a least-squares solution to $Ax = b$. More precisely, $x^*$ is a least-squares solution to $Ax = b$ if $\|Ax - b\|_2 = \min \{\|Ax - b\|_2 : x \in \mathbb{R}^n\}$.

Least-Squares Theorem, [(1)].
Consider the $(m \times n)$ system $Ax = b$.
(a) the associated system $A^TAx = Ab$ is always consistent;
(b) The least-squares solutions of $Ax = b$ are precisely the solutions of $A^TAx = Ab$;
(c) The least-squares solution is unique if and only if $A$ has rank $n$.

The least-squares method rule is: "The degree of the least-squares fit should be about half the number of data points." Our data consists of 15 points, ranging from year 1996 to 2010. Each graph, from the Numerical Results section, will show the linear approximation, and then the 7th degree polynomial approximation (because that is about half the number of data points).

Investigation of Numerical Error
We used the given data up until year 2008 and then tried to predict the UNLV enrollment for 2009 and 2010 using linear approximation and then the 6th degree polynomial approximation (since we were now only working with 12 data points). Our actual 2009 enrollment was 22,700 students. The 6th order polynomial approximation predicted it at 22,608 students, a 0.45 percent error. The linear approximation predicted it at 23,749 students, a 4.85 percent error. Our actual 2010 enrollment was 22,538 students. The 6th order polynomial approximation predicted it at 23,940 students, a 5.29 percent error. The linear approximation predicted it at 24,235 students, a 3.04 percent error. For both years, the 6th order polynomial approximation is more accurate.

Conclusions and Future Directions
Our results show an overall increase in the undergraduate student enrollments. The investigation of the numerical error shows that the higher order approximation gives a better prediction for the near future. Future studies will be connected to other data fitting methods, their comparison, and applied to other data sets.

References

Acknowledgements
We thank Janet Reiber, Director of College of Sciences Advising Center, and the Office of Institutional Analysis and Planning (OAP) for help with the enrollment data. We also thank the Department of Mathematical Sciences for the provided funds.
Title: UNLV Enrollment Forecast

Abstract: Our project investigates the future enrollment of undergraduates at UNLV in the entire university, the College of Science, and the Department of Mathematical Sciences. The method used for the forecast is the well-known least-squares method, for which a mathematical description will be presented. Studies for the numerical error are pursued too. The study will include graphs that describe the past and future behavior for different parameter settings. Mathematical results obtained show that the university will continue to grow given the current trends of enrollment.

Why are you doing this project? To further our understanding of what we are learning in MATH 365

What problem are you trying to solve? How much more accurate is the least squares method

What tools or equipment are you using? MATLAB

Why is your project worth researching? Because it can predict how fast UNLV will grow

What relevance will it have on the community, society, and in your research field? It will help show that it is beneficial to invest in UNLV because of its growth rate.

What did you find? The least squares method is better for predicting short term data but not long term because it grows too fast.

What is the future for your research project? Discover a more accurate method for far future enrollments.
Exploring the Potential of *Agave* as a Biofuel Crop on Arid Land

Rhea Conlu, Diana Ha, and Jeffery Shen

School of Life Sciences, University of Nevada, Las Vegas

**Introduction**

As residents of a desert environment, the main concern stemming from climate change is the future availability of water. Decreasing water levels force us not to consider only conservation, but also the smarter use of the resulting wastewater. The genus *Agave* comprises over 200 species of plants, many of which are capable of growing in very harsh, arid environments, including the Nevada desert. The plant has adapted to various ways to a lack of hydration, including the storage of water throughout its tissues and a Crassulacean Acid Metabolism (CAM), where its sugar production and carbon fixation are done mainly at night [2]. This allows the stromata to remain intact during the day and reduces the amount of water lost through transpiration. Because of its drought tolerance, it can be cultivated on the 38% of the state’s lands which is semi-arid land, much of which is no longer being used for agricultural production [3]. Global warming coupled the expansion of desertification has shifted the focus of alternative energy toward the production of biofuels.

Throughout its history, the *Agave* has been grown and harvested as a source of alcohol and as a sugar substitute because of its high concentration of fructose, which are oligomers of fructose units bound to a sucrose. The pits, or leaves, of these plants contain a high amount of fructan polymers such as inulin, which can be hydrolyzed to free fructose [4]. Because the sugars can thereafter be fermented, *Agave* is considered an economically important plant. It is estimated that the *Agave* can yield 3,000-10,000 liters of alcohol, which is more than other potential sources of biofuels such as corn, sugarcane, and potato [3]. These predictions, combined with a higher projected productivity than corn and the plant’s ability to flourish with less water and nitrogen requirements, makes a compelling argument for further research in the *Agave*.

**What makes *Agave* an ideal biofuel crop?**

- **High total sugar density and content**
- **High genetic diversity**
- **Does not compete with agricultural land**
- **Is not a food crop**

**How do other biofuel crops compare?**

<table>
<thead>
<tr>
<th>Product</th>
<th>Process</th>
<th>Corn</th>
<th>Agave (Walley)</th>
<th>Sugar Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>3 kg</td>
<td>6 kg</td>
<td>13.6 kg</td>
<td></td>
</tr>
<tr>
<td>Ethanol</td>
<td>12 kg</td>
<td>110</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>120%</td>
<td>125</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Field</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Environmental impact (Biofuel, bioenergy)</td>
<td>Very high</td>
<td>Very low</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Agricultural value</td>
<td>Very high</td>
<td>Very low</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Demand for food</td>
<td>Very high</td>
<td>None</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Sugar content</td>
<td>5%</td>
<td>10%</td>
<td>16%</td>
<td></td>
</tr>
</tbody>
</table>

**Hypotheses**

At the beginning of the experiment, it is hypothesized that:
1. growth of *Agave neomexicana* would remain consistent between a control group and a group exposed to waste water, and
2. growth of *Agave neomexicana* would remain consistent between a control group and a group exposed to drought conditions.

**Materials and Methods**

Fifteen plants were separated into three groups and grown over a period of 8 weeks. To understand how *Agave neomexicana* responds to increasing water, which may still contain microbes, run-off, and sorbed materials, 5-10% of plants were treated with treated water available at a UNLV’s SEB building. They were watered at the same rate as the control group, which was about every 10-14 days. Because the required amount of water for optimal plant growth was known, the amount watered began with 3 L but gradually increased to 10 L because peripheral leaves of plants from all groups seemed to droop and wilt. The drought-treated group was watered every 15-20 days with the same amount of water. Because the required amount of water for optimal plant growth was known, the amount watered began with 3 L but gradually increased to 10 L because peripheral leaves of plants from all groups seemed to droop and wilt. The drought-treated group was watered every 15-20 days with the same amount of water. The plants were kept in a constant greenhouse environment and repeatedly monitored to reduce their exposure to mutations.

To better gauge the water needs of the plants, an apparatus called the HH2 Moisture Meter with a Theta Probe attachment was used to measure the amount of moisture found by the roots of the plant (see Fig. 2). The probe sends an electrical impulse down the stainless steel probe, and the amount of time it takes for the impulse to jump between the probes reflects the percentage of water in the soil available for the roots.

**Future Research**

1. **Flow Cytometry**
   - Application: Cellular analysis
2. **Chromatin Staining**
   - Application: Cell cycle analysis

**References**


**Acknowledgements**

Dr. Jeffrey Shen & Shen Genomics Lab

Nevada Infrastructure for Climate Change Science, Education, and Outreach

NSF Grant # EPS-0814372
Title: Exploring the Potential of Agave as a Biofuel Crop on Arid Land

Abstract: Worldwide awareness of global warming and depleting fossil fuel sources has made research into alternative resources, such as plant fuels imperative. Since groundwater irrigation is unsustainable, especially in desert climates, plants that are drought resistant or can utilize otherwise unusable water are more viable sources of future biofuel production. Agave nevadensis, a species belonging to the family Agavaceae are succulent plants native to Las Vegas. This experiment aims to expose A. nevadensis to both wastewater and drought conditions and observe its response. The results can help define Agave as a water-resourceful biofuel both tolerant of drought and capable of utilizing urban water.

Why are you doing this project? I am interested in the future of alternative fuels. When I think of climate change, one of our biggest problems to face will be the consumption of fossil fuels for energy. Research into solutions for this problem is imperative.

What problem are you trying to solve? The lack of a sustainable, clean energy source that can be produced in an area such as Nevada. These areas are already hot and dry, and future climate changes may further stress these extreme systems. My research focuses on Agave, a potential biofuel crop, and its ability to survive in stressful conditions.

What tools or equipment are you using? Sugar refractometer, climate controlled greenhouse, moisture meter.

Why is your project worth researching? All projects gathering information for future energy research are vital to industry, and future scientific research can be performed building upon the research performed on Agave.

What relevance will it have on the community, society, and in your research field? Nevada is a large, arid state, and research into viable future energy production options in these areas is a necessity for the economy of the area. Future research can also be performed testing other aspects of the Agave plant.

What did you find? Agaves are particularly resistant to drought, and this genus of plants has characteristics that make it very favorable as a future biofuel pending additional research. These characteristics include large genetic diversity, high sugar density, and a metabolism specifically adapted to potential climate changes.

What is the future for your research project? Further research can be done on the Agave plant usage as a biofuel crop with new potential enzymes to degrade the normally unused material into products that can be utilized for ethanol production.
Sustainable Alternative to Non-biological Nitrogen Fixation to Nitrates for Fertilizers

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Abstract

Sustainable practices in food production are at the forefront of global concern. Industrial methods of nitrogen fixation for use in fertilizers constitute nearly 3% of the total fossil fuel energy used, and contribute to climate change and other environmental issues. One alternative approach uses the Haber-Bosch process, which involves a heterogeneous catalyst, a chemical reactor, and a high pressure and temperature. This approach is energy-intensive and requires significant infrastructure. This research explores the use of a sustainable method of nitrogen fixation using the titanium dioxide (TiO2) photocatalytic process. The method involves the use of sunlight and TiO2 to produce nitrogen gas from atmospheric nitrogen and water. The process is environmentally friendly and does not require high pressure or temperature, making it a promising alternative to current methods. The results of the study suggest that this method has the potential to contribute to sustainable food production.

Methodology

Preparation of the Titanium Dioxide (TiO2)

Titanium dioxide (TiO2) was used as the photocatalyst in this study. It was prepared by dissolving titanium tetra-isopropoxide in isopropanol and then calcining the resulting precipitate at 450°C for 2 hours. The resulting TiO2 was then characterized using X-ray diffraction and UV-visible spectroscopy.

Results

Figure 1: Effect of contact time on nitrogen production (mg/kg) for TiO2 with different pH levels. The highest nitrogen production was observed at pH 7, with a peak of 5 mg/kg.

Conclusions

The results of this study suggest that the use of TiO2 for nitrogen fixation is a promising method for sustainable food production. The high nitrogen production observed at pH 7 suggests that this method could be used to produce nitrogen for use in fertilizers in a more environmentally friendly and sustainable manner. Further research is needed to optimize the conditions for nitrogen production and to investigate the potential of this method for use in large-scale applications.

References


Title: Sustainable Alternative to Non-biological Nitrogen Fixation to Nitrate for Fertilizers

Abstract: Currently, the industrial method of nitrogen fixation for use in fertilizers (Haber-Bosch process \[\text{N}_2 (\text{g}) + 3 \text{H}_2 (\text{g}) \rightleftharpoons 2 \text{NH}_3 (\text{g})\]) is our main source of non-biological conversion of atmospheric nitrogen to ammonia. The proposed research experiment utilizes the catalytic mechanism of titanium dioxide which, in the presence of heat or sunlight, undergoes fixation of atmospheric nitrogen. This method of nitrate production could serve as a sustainable source of nitrogen for fertilizers. Variables in the experiment included the manipulation of thermal pressure, heat, and base addition to counteract hydrochloric acid production, a self-limiting byproduct.

Why are you doing this project? It is important to find sustainable alternatives to current methods of mass production, given the population projected to increase to 9 billion by 2050.

What problem are you trying to solve? I am trying to bypass the need for a carbon-based energy source for the production of nitrates used in fertilizer production. If this method proves feasible, it could substantially decrease global carbon dioxide emissions.

What tools or equipment are you using? 1 liter pressure reactor chamber, standard laboratory heating oven, petri dishes for holding samples, syringes and .45 micron filters for filtering the samples post-treatment, and a Dionex Ion Chromatograph for processing the samples.

Why is your project worth researching? The current method of fertilizer production will only increase carbon dioxide emissions and future separate us from a sustainable method of nitrate production. If a viable method is put into place now, future generations will benefit from a cleaner atmosphere, but also a sustainable production of fertilizer to satisfy global food demands.

What relevance will it have on the community, society, and in your research field? This research will help open new avenues of scientific interest with my university; as for the ranchers, they can benefit from cheaper and more economic fertilizers during food production for livestock. And as for society, the greatest benefit will know that we have curbed a large portion of carbon emissions and have, in effect, created a truly "green" method of food production.

What did you find? Titanium dioxide will produce nitrates, most successfully in the presence of heat or pressure, and mixed with sodium hydroxide. The base addition counteracts the acid production which is a self-limiting mechanism of the catalytic process.

What is the future for your research project? Production of nitrates using titanium dioxide is dependent on surface area and titanium dioxide can be reused multiple times, a key part of "sustainable" fertilizer production. Since titanium dioxide has photo catalytic properties as well, it would worth researching the production of titanium dioxide coated surfaces and if their ability to oxidize nitrates in the presence of sunlight.
The Effects of Climate Change on a Basic Animal-Cell Function
Michelle B. Fulbright and Andrew J. Andres
School of Life Sciences, University of Nevada Las Vegas

Abstract:
Increasing global temperatures during the 21st century may have detrimental effects on basic cell functions within eukaryotic animals. This project aims to systematically examine the effects of climate change on secretory cargo transport through the use of Rab proteins. Rab proteins are found in the endoplasmic Drosophila melanogaster and play an essential role in vesicular transport within the cell and can be genetically manipulated to monitor the biological consequences of global warming.

Introduction:
Although an increase in climate temperature will have significant ecological effects, it is important not to overlook the physiological consequences at the cellular level. The fruit fly, Drosophila melanogaster, is an excellent model organism for monitoring the physiological consequences of climate change. These ectothermic creatures have well-characterized genotypes that can be experimentally manipulated. This research aims to investigate the impact of climate change on a basic characteristic of all eukaryotic cells: vesicular trafficking mediated by Rab GTPases. These proteins function in molecular zip codes needed to target vesicles to specific cells for transport across the plasma membrane via exocytosis or vice versa. Understanding this process is essential for the production of increased climate temperature. RNAi is a major tool used by organisms to protect against viral and bacterial infections. This mechanism may be severely affected at elevated temperatures in ectothermic organisms, which may lead to unforeseen stressing that the animals may not be able to cope with.

Materials and Methods:
The technology used in these experiments is outlined in Figures 3 and 5. It requires the preparation of an assay stock and uses the Genesilqus Binary System to allow for the creation of transgenic flies with Rab GTPase, the endoplasmic Drosophila melanogaster, and the laboratory of Matthew Scott. The experiment can be completed in three versions in which a well-characterized, Rab-GTPase is inserted into the laboratory of Matthew Scott. The GUS-Rab was purified in three versions in which a well-characterized, Rab-GTPase is inserted into the laboratory of Matthew Scott. The experiment can be completed in three versions in which a well-characterized, Rab-GTPase is inserted into the laboratory of Matthew Scott. The experiment can be completed in three versions in which a well-characterized, Rab-GTPase is inserted into the laboratory of Matthew Scott. The experiment can be completed in three versions in which a well-characterized, Rab-GTPase is inserted into the laboratory of Matthew Scott.

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I would like to thank Andrew J. Andres and his graduate students, Katie Larkins and Elise Palenik, for their guidance and assistance with this project. I would also like to thank my colleagues, Richard Keen, Mary Jane Scott, and Matthew Scott, for their technical assistance with this project involving the Rab screen. I am grateful for the Bloomberg Center for Cancer Research, Center, and NSF-IPY (Japan) for providing Drosophila stocks. This project was funded by an NSF "Neuroinfrastructure for Climate Change Science, Education, and Outreach" Undergraduate Research Fellowship (Grant # EPS-0814372).

References:
Title: The Effects of Climate Change on Basic Animal Cell Functions

Abstract: Increasing global temperatures during the 21st century may have detrimental effects on basic cell functions within ectothermal animals. This project aims to systematically examine the effects of climate change on secretory cargo localization through the analysis of Rab Proteins found in the model organism Drosophila melanogaster. Rab Proteins play an essential role in vesicular transport within the cell and can be genetically manipulated to monitor the biological consequences of global warming.

Why are you doing this project? To see how climate change will affect the animals that inhabit our environment. There is little information about this topic thus far.

What problem are you trying to solve? How climate change affects vesicular transport within an animal cell

What tools or equipment are you using? General microscope/fluorescence microscopy/dissecting tools

Why is your project worth researching? Most information on the subject of climate change is geared towards plants and the environment as a whole. We rarely hear how about how these climate changes will affect animals that live in the environment.

What relevance will it have on the community, society, and in your research field? It will give the community a better understanding of the broad effects that our Earth’s changing climate will have on our animals in the future.

What did you find? I am still currently obtaining data on my topic, but so far I have found out where certain proteins that assist with vesicular transport within a cell localize.

What is the future for your research project? I plan to further investigate the localizations of these vesicular transport proteins within a cell to determine their specific functions.
Entangling the Lattice Clock with Rydberg Gates
Frank Greenhalgh
University of Nevada, Reno Physics Department

Introduction
Modern atomic clocks measure time by counting oscillations of a local oscillator whose frequency is set by the transitions of atoms in a linear optical lattice. The local oscillator's (laser) frequency, \( \omega \), may be found by measuring the probability that the atoms make a transition when a laser is shone on them. When the probability of transition is a maximum, the resonant frequency has been found.

When \( N \) unentangled atoms are measured, the signal to noise ratio goes up as \( \sqrt{N} \). When these atoms are entangled the signal to noise ratio goes up proportional to \( N \).

The modern atomic clock's shortcoming is that the electron movement is random in the atoms that are responsible for the time measurements. Entangling the atoms increases the sensitivity of the measurement.

Problem
Using the following cluster states as qubits, the Greenberger–Horne–Zeilinger (GHZ) state will be created.

These cluster states will be represented in a lattice as shown below. The Rydberg state qubit is "shown blocking" the others from being promoted to the Rydberg state.

Methodology

\[ |\psi\rangle = |000\rangle \]
\[ |\psi\rangle = |1(\frac{\tau}{2})\rangle_0 + |00\rangle \]
\[ |\psi\rangle = |1(\frac{\tau}{2})\rangle_0 + |01\rangle_0 \]
\[ |\psi\rangle = |1(\frac{\tau}{2})\rangle_0 + |10\rangle_0 \]
\[ |\psi\rangle = |1(\frac{\tau}{2})\rangle_0 + |11\rangle_0 \]

In this way, we get the state with all the qubits in a GHZ-like state.

\[ |\psi\rangle = |\frac{\tau}{2}\rangle_{1110} + |1010\rangle \]

Every other qubit must be flipped to get an entangled state with different energies:

\[ |\psi\rangle = |\frac{\tau}{2}\rangle_{1110} + |1010\rangle \]

Flipping every other qubit we get,

\[ |\psi\rangle = |\frac{\tau}{2}\rangle_0_{1000} + |1111\rangle \]

Conclusions
An entanglement scheme has been given. This entanglement scheme shall be used in an atomic clock as discussed below.

First, the GHZ will be produced by the process given. Then the state will be allowed to evolve on its own for a set amount of time. The \( |1111\rangle \) part of the state evolves faster since it has more energy and thus a higher frequency. This will create an overall complex phase difference between the two states. After the set evolution time, this phase difference can be mapped into measurement probabilities by applying the GHZ scheme in reverse order. This final state is measured.

References
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Research Site: UNR Leifson Physics  

Title: Entangling the Lattice Clock with Rydberg Gates  

Abstract: Knowledge of the exact time is critical to many engineers and planetary experts; unfortunately atomic clocks can't have infinite accuracy by Heisenberg's uncertainty principle. To attain accuracy past the limit we have achieved today, we will design a critical improvement of the atomic clock via the Rydberg gates method. Rydberg gates synchronize the atomic states so that they are more sensitive which will greatly increase the accuracy. This project will introduce fast acting Rydberg gates to an existing atomic clock layout. The Rydberg gates will allow the clock to entangle atoms in less time, thus decreasing decoherence effects on the atoms whose entanglement is needed for more precise time measurements.

Why are you doing this project? Atomic clocks are used for accurate timekeeping and global positioning. The more accurately the atomic clock can tell time, the more accurately your cellphone can know where you are.

What problem are you trying to solve? The atomic clock can benefit from quantum entanglement of many atoms. So far entanglement schemes take so long that a good measurement cannot be performed due to the so-called Dick Effect. We use Rydberg gates and ideas from quantum computing to decrease the time it takes for the entanglement process.

What tools or equipment are you using? This project uses mostly computers and pencils. It is a theoretical project with hopes of becoming the new atomic clock protocol.

Why is your project worth researching? The GPS can currently track your position to within a few meters. A more accurate atomic clock can pin your position even more accurately. More accurate atomic clocks will also benefit other areas of science including tests of Einstein's Theory of Relativity.

What relevance will it have on the community, society, and in your research field? Currently much research is being done to increase the accuracy of optical lattice clocks. This scheme could draw more attention to the quantum entanglement approach in which all atoms are made to be optimally entangled in only two quantum states.

What did you find? We have found a scheme to entangle atoms quickly and reliably in short time.

What is the future for your research project? Still required are numbers to decide how the so called Rydberg blockade might negatively affect the accuracy and stability of the atomic clock over time.
Title: Adaptation of the Nevada Climate Change Data Portal Web Interface to Small-Screen Mobile Devices

Abstract: Robust and convenient access to the Nevada Climate Change Data Portal is vital for the project’s success, because of the researchers’ need to gather and analyze large volumes of data with minimal effort. However, the current version of the data portal web interface is not optimized for small-screen mobile devices such as mobile phones, PDAs, iPads, NetBooks, and others. The proposed research will address this issue by exploring the current methods for creating a client-aware web interface adaptable to the variety of small-screen devices, designing and implementing the most appropriate solution, and finally, user testing of the implemented solution.

Why are you doing this project? I am working on my project, because I find it a great way to conduct research on an interesting topic, contribute to the climate research initiative, and learn quite a bit in the process.

What problem are you trying to solve? The goal of my project is to enable users to conveniently access the web interface of the Nevada Climate Change Portal with handheld devices such as smartphones.

What tools or equipment are you using? I use the most recent technologies in the web-design field, including the latest standards of HTML5 and CSS3. Additionally, two smartphones and one tablet are used as testing platforms.

Why is your project worth researching? The project is worth researching, because even though accessing websites through small-screen devices is not yet commonplace, in the future this practice might become the primary way of accessing web content. There are many challenges still unsolved in providing mobile web users with a good experience, and the research in this area has the potential to bring many benefits in this regard.

What relevance will it have on the community, society, and in your research field? The research makes the information provided by the Nevada Climate Change Portal more accessible, which translates to a larger number of people finding out about the current climate issues. The research is applicable to mobile web-sites in general, which makes it widely reusable.

What did you find? I found a couple of techniques to reduce to optimize websites for small-screen devices, in order to make the website more responsive.

What is the future for your research project? I look forward to continuing my collaboration with the designers of the climate portal.
Global Warming

At what point does atmospheric greenhouse gas release become unethical?

Luke Good & Gladys Lopez

Abstract

In recent decades, the concept of global warming has developed into an increasing concern among the scientific community and general public alike. The first indication of warming was reported by James P. Jones in 1968, but it wasn’t until the 1970s when the issue of global warming began to be seriously considered by many countries on the planet. Global warming is often defined as the gradual increase in temperature of the Earth’s surface and the lower atmosphere, primarily caused by the increased absorption of solar radiation by greenhouse gases. These gases contribute to the greenhouse effect by trapping radiation that would otherwise escape into space, thereby increasing the Earth’s temperature. The primary greenhouse gases responsible for this effect are carbon dioxide, methane, and water vapor. These gases trap heat in the atmosphere, leading to a rise in global temperatures. The rise in temperature is expected to cause significant changes in the climate system, including rising sea levels, more extreme weather events, and changes in precipitation patterns. These changes could have severe impacts on human and natural systems worldwide.

Atmospheric Carbon Dioxide

While carbon dioxide is the primary greenhouse gas responsible for global warming, it is not the only one. Other greenhouse gases, such as methane, nitrous oxide, and CFCs, also contribute to the greenhouse effect. Methane is a potent greenhouse gas, with a global warming potential 25 times that of CO2 over a 100-year period. Nitrous oxide has a global warming potential 298 times that of CO2 over a 100-year period. CFCs, or chlorofluorocarbons, are also potent greenhouse gases, with a global warming potential of 25,000 times that of CO2 over a 100-year period. The concentration of these gases in the atmosphere has increased significantly over the past century, leading to a rise in global temperatures.

Mechanism

The greenhouse effect is caused by the absorption of infrared radiation by greenhouse gases in the atmosphere. These gases, such as water vapor, carbon dioxide, and methane, absorb and re-emit infrared radiation, which warms the Earth’s surface. The greenhouse effect is crucial for maintaining a habitable climate on Earth, as it helps to regulate the Earth’s temperature and prevent it from becoming too hot or too cold. However, when the concentration of greenhouse gases in the atmosphere increases, the greenhouse effect becomes stronger, leading to a rise in global temperatures.

Conclusion

The observations and research clearly imply a gradual increase in global temperatures and the potential for a rapid increase in human emissions in the years to come. With the advent of the industrial revolution, we have unknowingly caused an increase in air and water pollution due to the burning of fossil fuels and the production of large quantities of industrial waste. This has led to a rise in air and water pollution, which contributes to the greenhouse effect. The rise in temperatures has led to a rise in sea levels, more extreme weather events, and changes in precipitation patterns. These changes could have severe impacts on human and natural systems worldwide.

References


[2] Integrated Assessment Model (IAM) of the Global Scenario Model (GSM), Global Climate Change Project, University of Maryland, College Park, MD, USA.


Fig. 1 - Mount Everest 1968 VS. 2007

Fig. 2 - Glacier National Park

Fig. 3 - Mauna Loa Observatory CO2 Measurements

Fig. 4 - Forest Fire Emissions

Fig. 5 - Carbon Dioxide Concentration and Time

Fig. 6 - Concentration of Greenhouse Gases

Fig. 7 - CO2 Concentration in Atmosphere

Fig. 8 - Global Land-Ocean Temperature Index

Fig. 9 - Global Mean Temperature

Fig. 10 - Diagram of the Greenhouse Effect
Title: Global Warming

Abstract: In recent decades, the concept of global warming has developed increasing concern among the scientific community and general public alike. What was initially dismissed as little more than unlikely has now become a severe warning for global climate crisis threatening not only our way of life but ultimate future existence on this planet? Global warming is defined as the steady mean increase in atmospheric temperature, the primary asserted cause thereof being increased emissions and inherent atmospheric concentrations of “greenhouse gases” – carbon dioxide in particular. These gases contribute to the greenhouse effect by trapping radiation (from the sun) in the atmosphere. The largest contributor of man-made carbon dioxide is the burning of fossil fuels, especially in regards to energy production and transportation vehicles. As a result, the manufacture and utilization of cars in today’s society is not only perhaps the greatest contributor to human induced global warming but also the single major aspect that everyone can do something about. With present knowledge and considering the potential environmental influence of our collective actions, it's the obligation of human society to restrict its climate change inducing actions if it wishes to persist and thrive as a species.

Why are you doing this project? We did this project because global warming is an important topic to research for the future of all mankind.

What problem are you trying to solve? Our ethical question was: At what point does greenhouse gas release become unethical? We investigated greenhouse gases and its effect on earth.

What tools or equipment are you using? We investigated many different websites as well as searched for graphs to back up our data/information.

Why is your project worth researching? This project is worth researching because we might be able to get new findings on the topic of global warming which will affect not only the United States, but all of mankind.

What relevance will it have on the community, society, and in your research field? Global Warming affects everyone not us America. It is a catastrophe that we human beings are creating and we are not doing much to stop the process.

What did you find? We found in our research that Co2 emissions have dramatically increased since the industrial revolution due to ice core sample found scientist have been able to go back millions of years ago and see into that time periods atmospheric conditions.

What is the future for your research project? We hope that we can help others be aware about global warming and the conditions it has put on the Earth as well as contribute to stopping it in some of their own ways.
Accumulation of Polonium-210 in different species of fish in Lake Mead
Dr. Vernon F Hodge, Suraj Ghevarghese John and Shunmugam Nallaperumal
University of Nevada Las Vegas
College of Sciences

ABSTRACT
Discovered by Pierre Curie and Marie Sklodowska-Curie in 1898, Polonium is a chemical element with an atomic number of 84. This rare naturally occurring radioactive element is chemically similar to bismuth and tellurium, and forms in uranium ores. Polonium-210 is an naturally occurring radioactive element with a half-life of 138.376 days. This element is found in trace amounts in most organisms. Our research is focused on the accumulation of polonium-210 in fish that occupy in Lake Mead.

The sample species is chosen based on varying lake stratification (layers of the lake). This gives us a good idea of the difference in polonium-210 amounts, based on diet since it tends to change with lake stratification. This research will be based on a previous research that concluded that the polonium 210 is found generally in the internal organs especially the Gastro-intestinal tract of the fish and 97% of polonium acquired by fish is from food intake. The results from our research will help identify the causes for accumulation and compare the level of polonium 210 accumulation in different species based on the strata they are found in.

INTRODUCTION
Research on marine organisms, especially in fishes have shown that the internal organs retain different chemical compounds of nature that are not particularly utilized by the organism. Naturally occurring radioactive materials are retained in the internal organs of fishes (2). Among several naturally occurring radioactive elements, Polonium 210 is the fifteenth nuclide in the chain produced from the decay of U工程施工es found in earth. The decay of uranium produces different radioactive elements. Among several of those include Polonium 210.

Previous research has shown that polonium accumulates in higher levels in the GI tract of the fish indicating that the polonium 210 came from their diet. Our research will focus on difference in polonium-210 accumulation between species and why the organs retain Polonium-210. The results will be useful in trying to find ways to eliminate polonium-210 from our system (which is accumulated from pollution and smoking). It has been identified that polonium 208-210 is an ingredient of tobacco and that human lungs retain traces of different radioactive elements which might be a contributing cause to lung cancer (4). If polonium 210 can be removed from organisms early in the food chain, its propagation and accumulation in the higher order organisms will be avoided.

METHODS ADMINISTERED
It is important to test different species from the lake. Different habitat and feeding habits affect the retention of polonium 210. Fishes are captured from different location and strata. Once captured, the internal organs of the captured fishes are removed and stored separately in pre-weighted and numbered beakers. The organs are placed on hot plates to dry after the wet weights of each of the organs are noted. Then the dry weight of the samples is noted. The samples are then dissolved in nitric acid. They are then spiked with 1 piccurie of polonium-209 to act as a reference tracer for the polonium 210. Once the sample is dissolved by the nitric acid along with the tracer, we then dilute it with Hydrochloric acid. A silver disc is then brought in contact with the solution which causes all the radioactive material from the sample to transfer to the silver plate. The silver disc is placed in an alpha spectrometer and left overnight. There will be spikes at two different areas in the scale, one for polonium-210 and one for the tracer polonium-209. The data will show the proper energy and the number of counts on each sample. This is then divided by the deterioration per minute after correcting for efficiency of the detector. The result is then divided by the dry sample weight. The answer is then compared with the results from the polonium-209 spike to check for flaws when we plugged in the numbers.

DISCUSSION
This alpha particle (two protons and two neutrons) emitting element contributes ionizing radiation to many organisms on earth. Since alpha particles are much slower than beta particles, giving rise to greater impulses (6). The penetration depth of alpha particles is very small compared to the other radiations. In minute amounts, the radiation is harmless to organisms. But in high amounts, the energy released by the decay can potentially cause irreversible damage to the organism. 0.03-0.04 microCi is the maximum amount of polonium a human body can endure before damage is introduced.

RESULTS
Since there is not enough data yet on the research, we are not able to provide any concrete results, rather we hypothesize on what can be expected. The initial finding from the research will be the concentration of polonium-210 in fishes from different species and strata. This will help us focus our efforts on a particular strata and then the species found in those strata. For example: If the results show that the fishes found in the Hypollumion have a higher accumulation of polonium-210, the bottom feeding species found in lake mead such as carp, bass and catfish will be looked at for further research on the cause of the retention of polonium-210 in their system.

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MATERIALS
Alpha Spectrometer – Measures the alpha particles emitted from polonium-210 and polonium-209 (7).

Polonium -209 – It is an isotope of polonium and in this case is spiked into the solution in a known quantity. This is done to be the tracer, used as a reference point to compare the sample’s polonium 210 levels

Reagents- Nitric acid and Hydrochloric acid, these reagents dissolve the sample, so it can be spiked with a radioactive tracer.

Fishes - Local fishes used for the research include Black Bullhead, Crapie, bluegill, Channel Catfish, Largemouth Bass, Striped Bass, Rainbow trout, Smallmouth Bass and green sunfish.

REFERENCES
7. QuantumRelativists/Penetrations/QuantumRelativityPenetrationandShielding.html
**Title: Polonium 210 in Lake Mead Marine Organisms**

**Abstract:** Under the guidance of the Chemistry Department we are conducting research with a team studying Polonium 210, a naturally occurring radioactive isotope. Previously collected data have shown that certain species retain polonium in their tissues. Our goal is to find out why fishes retain the Polonium 210 in the GI tract. We also want to know if there is any relation between humans retaining Polonium 210 in their lungs with their use of cigarette smoking.

**Why are you doing this project?** We are doing this project in order to apply skill and knowledge to what we learn as undergraduate student.

**What problem are you trying to solve?** We would like to find out whether fishes retain the polonium 210 in their GI tract.

**What tools or equipment are you using?** Radioisotope counter, Alpha/Gamma particle counter, fishing rod and boat.

**Why is your project worth researching?** Polonium 210 is a main ingredient of cigarette and we are examining why the tissue retains this element.

**What relevance will it have on the community, society, and in your research field?** With the research, we can warn people not to consume fish located in Lake Mead.

**What did you find?** Our results show that Polonium 210 was retained by fish most commonly found bottom feeder’s fish.

**What is the future for your research project?** We hope to locate and examine more species that may retain Polonium 210 to address how this may impact human and the species themselves.
Energy Densification via Hydrothermal Carbonization

Keri Noack

Introduction

A process called hydrothermal carbonization (HTC), also known as wet torrefaction, involves treatment of raw biomass in hot, pressurized water. HTC of woody biomass has been shown to significantly increase the energy density of the feedstock, producing a biochar, similar to coal, having up to 40% higher calorific energy content. Feedstocks investigated include Tahoe chips, Pinion/Juniper chips, Rice hulls, and Corn Stover pellets pre-treated at 215 °C, 255 °C, and 295 °C. Chemical analyses were conducted on the gaseous, aqueous, and solid HTC products. Energy contents of the solid biochar products were measured by calorimetry, and mass balances were determined.

Product Characterization

The noncondensable gases collected in the Tedlar bag were analyzed using a gas chromatograph. The aqueous products were sent out for lab analysis of total organic carbon, sugars (Fig. 3), and organic acids (Fig. 4). The solid char was air dried and weighed. The calorific energy content of oven-dried char was measured with a calorimeter, shown in Figure 7.

Biomass Pre-Treatment

Lignocellulosic biomass is increasingly regarded as a promising, renewable feedstock for the production of heat, chemicals, fuels, and electrical power. Another advantage of HTC is homogenization of many different feedstocks, which leads to improved handling, transportation, and storage of thermochemical feedstocks.

Properties of HTC Char Products

Figure 7: Effect of reaction temperature on the energy content of several feedstocks.

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Temperature (°C)</th>
<th>Mass Yield (%)</th>
<th>Energy Densification</th>
<th>Atomic O/C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tahoe Chips</td>
<td>215</td>
<td>69.07</td>
<td>1.11</td>
<td>0.639</td>
</tr>
<tr>
<td></td>
<td>255</td>
<td>50.69</td>
<td>1.28</td>
<td>0.931</td>
</tr>
<tr>
<td></td>
<td>295</td>
<td>59.10</td>
<td>1.45</td>
<td>0.727</td>
</tr>
<tr>
<td>Pinyon-Juniper</td>
<td>215</td>
<td>71.45</td>
<td>1.13</td>
<td>0.608</td>
</tr>
<tr>
<td></td>
<td>255</td>
<td>50.58</td>
<td>1.38</td>
<td>0.316</td>
</tr>
<tr>
<td></td>
<td>295</td>
<td>48.45</td>
<td>1.36</td>
<td>0.287</td>
</tr>
<tr>
<td>Rice Hulls</td>
<td>215</td>
<td>72.57</td>
<td>1.68</td>
<td>0.763</td>
</tr>
<tr>
<td></td>
<td>255</td>
<td>55.44</td>
<td>1.18</td>
<td>0.373</td>
</tr>
<tr>
<td></td>
<td>295</td>
<td>53.63</td>
<td>1.36</td>
<td>0.289</td>
</tr>
<tr>
<td>Corn Stover</td>
<td>215</td>
<td>72.20</td>
<td>1.55</td>
<td>0.499</td>
</tr>
<tr>
<td></td>
<td>255</td>
<td>61.91</td>
<td>1.16</td>
<td>0.268</td>
</tr>
<tr>
<td></td>
<td>295</td>
<td>58.68</td>
<td>1.11</td>
<td>0.157</td>
</tr>
</tbody>
</table>

Conclusion

HTC has been shown to produce a solid char product having considerably higher energy density compared to the raw feedstock. The woody biomass has a more energy dense feedstock and shows a higher increase in energy density than the grasses, as expected. As shown in Figures 5 and 6, along with the oxygen to carbon ratio in Table 1, the relative carbon content increases with temperature and the relative oxygen content decreases. This is ideal to achieve a more coal-like product.

Acknowledgement

Funding support from the National Science Foundation (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR) under the award EPS-0814372 for $3900 October to May 2011 and from DOE under the awards DE0000272 and DE-FG36-01G01082 is gratefully acknowledged.

DRI Project Mentors

Keri Hoekman – Research Professor
Amber Broch – Assistant Research Engineer

Figure 1: Schematic of 2 L Parr stirred reactor system used for the HTC process.
Title: Energy Densification via Hydrothermal Carbonization (HTC) of Cellulosic Biomass

Abstract: A process called hydrothermal carbonization (HTC), also known as wet torrefaction involves treatment of raw biomass in hot, pressurized water. HTC of woody biomass has been shown to significantly increase the energy density of the feedstock, producing a biochar, similar to coal, having up to 40% higher calorific energy content. Feedstocks investigated include Tahoe chips, Pinion/Juniper chips, Rice hulls, and Corn Stover pellets pre-treated at 215 °C, 255 °C, and 295 °C. Chemical analyses were conducted on the gaseous, aqueous, and solid HTC products. Energy contents of the solid biochar products were measured by calorimetry, and mass balances were determined.

Why are you doing this project? Research experience and interesting topic

What problem are you trying to solve? Helping reduce carbon footprint by researching alternative energy options

What tools or equipment are you using? A parr reactor and calorimeter and gas chromatography equipment

Why is your project worth researching? My project is worth researching because it is important to find alternative and renewable energy sources

What relevance will it have on the community, society, and in your research field? Reducing carbon footprint and advancing technology in alternative energy field

What did you find? Hydrothermal carbonization increases the energy density of biomass, some feedstocks more than others

What is the future for your research project? Designing and constructing a larger and continuous process for hydrothermal carbonization of many different feedstocks of biomass
Predicting HOMO and LUMO Energy Gaps for Organic Semi-Conductor: A Theoretical Study

Padnya Pukpayat
Department of Chemistry
University of Nevada Las Vegas

Abstract

This poster presents a theoretical approach for characterizing the electronic properties of novel electron-deficient organic semiconductors containing various groups of electron donor substituents. In testing these compounds, the following questions will be addressed:

- What is the bandgap between the HOMO and LUMO levels?
- Which substituents lower the bandgap to the desired range for solar cell applications (~2.0 eV)?
- Can we use the current, inexpensive and unreliable computational methods as a predictive tool for guiding future experimental design of organic based solar cells, rather than depending solely on experimental procedures?

Introduction

Global warming is becoming one of the most serious problems of our generation. The average temperature of the Earth's surface, air, and oceans is increasing as a result of an increased concentration of carbon dioxide and other greenhouse gases. Solar cells are devices that capture sunlight and convert this radiant energy into electricity. Unlike fossil fuels which release carbon dioxide and greenhouse gases into the atmosphere, solar power is clean, renewable, and sustainable, helping to protect our environment. Currently, inorganic semiconductor-based solar cells are prevalent in the market place. These devices are typically expensive and rigid. Conversely, organic molecules offer a cheaper and more flexible alternative for solar cell applications. Organic-based solar cells can be created using organic molecular design processes. One of the critical aspects for achieving high power conversion efficiency is to enhance light harvesting. To support effective light harvesting, molecules are required to have small bandgaps (~2.0 eV). Computationally, the bandgap is defined as the difference between the HOMO (highest occupied molecular orbitals) and LUMO (lowest unoccupied molecular orbitals).

Experiment Data

HOMO and LUMO energies can be calculated using Density Functional Theory (DFT) coupled with the 6-31+G* basis set. These results are then compared with experimentally measured values to assess which substituent will yield the lowest possible bandgap. The results of computational predictions can be compared with the experimentally observed values to assess which substituent will yield the lowest possible bandgap.

Figure 1: Open Ring System
Figure 2: Close Ring System
Structure of new light-harvesting organic semiconductors

Results

Several organic compounds are selected for computational and experimental analysis. The compounds are designed to have small HOMO-LUMO gaps, which are ideal for solar cell applications. The results of computational predictions are compared with experimentally measured values to assess which substituent will yield the lowest possible bandgap.

Conclusion

Our ultimate goal is to understand how, electron-rich substituents on an electron-deficiency moiety core affect electronic properties such as bandgap, HOMO, and LUMO values.

After obtaining the projected values of both the closed and open ring systems, we have seen that both systems follow the same general trend. The compounds triphenylene and carbazole, both in systems, have the best values indicated by their low HOMO and LUMO open ring systems however, also has a lower eV. We are still investigating if GO's values are consistent. It is also worth noting that all attained values are overestimated by 0.2 - 0.3 eV, so in an actual experimental procedure these values are expected to drop.

Future Plan

Since my passion and interest is in chemistry, I will continue to give my dedication to this project and attain the actual experimental values to further prove my thesis.

Reference

The author would like to thank Dr. Kathleen Robins and Dr. Dong-Chan Lee for their helpful suggestions and continuous support. This work was funded by NSF LPSGCR.
Title: Predicting molecular band gaps for organic solar cell application: A Theoretical Study.

Abstract: This poster presents a theoretical approach for characterizing the electronic properties of novel electron-deficient organic semiconductors containing variety of electron donor substituents. In treating these compounds, the following questions will be addressed: What effects to the bandgap will each substituent have? Will any of the substituents lower the band gap to the desired range for solar cell applications(<2.0eV)? Can we use the current, inexpensive and tractable computational methods as a predictive tool for guiding future experimental design of organic based solar cells, rather than depending solely on experimental procedures?

Why are you doing this project? Since I have learned Organic Chemistry, it has been my passion to learn as much as possible and conduct hand-on research experiences toward this subject.

What problem are you trying to solve? Can we use the current, inexpensive and tractable computational methods as a predictive tool for guiding future experimental design of organic based solar cells, rather than depending solely on experimental procedures?

What tools or equipment are you using? Gaussian’09 computational method

Why is your project worth researching? Because the current experimental procedures are expensive and time consuming, we can work to eliminate the cost and shorten the time by doing computational methods for guiding practical and efficient molecular design processes for organic solar cells application

What relevance will it have on the community, society, and in your research field? I hope that my work will provide the guideline for future solar cell applications so that we do not have to use extra fund and time. I enjoy my research knowing that my work may, in the future, lower the cost for solar cell applications to affect my family as well as the community for alternative energy.

What did you find? I operated the 2 systems. They are several substituents that give the result lower than 2.0eV (our expected value)

What is the future for your research project? Based on our theoretical results, the next step is working toward the experimental and compared the data of two methods.
Thin-film Fabrication for High Pressure Thermoelectric and Electrical Resistivity Studies

Jorge Reynaga, Dr. Rama Venkat and Dr. Ravhi S. Kumar
Mentor: Dr. Ravhi S. Kumar

Abstract

Thermoelectric materials are of interest for applications such as thermoelectric coolers in microprocessors and power generators in cars. The efficiency of thermoelectric materials is quantified by a figure of merit ZT, where Z is the thermoelectric property of the material and T is the absolute temperature. High pressure plays an important role in understanding these changes for the figure of merit of thermoelectric thin-films. To study the thermoelectric thin-films a direct approach begins with fabricating the thin-film on the surface of an amorphous silicon nitride membrane. The thin-film material properties depend on structure and transport properties which can be investigated easily. Also, in recent years superconductivity has attracted great attention of various research groups since the discovery of low temperature superconductors with transition temperatures (T_c) comparable to high temperature superconductors. Diamond cell with proper electrical probes is a necessity in order to investigate the structure-T_c relationship with high pressure. If we could successfully fabricate the electrical probes by depositing thin-films on a diamond, then it reduces the use of electrical wires as probes inside the diamond cell, as the wires are easily breakable at high pressure. Hence, we have studied different Molybdenum (Mo) electrode fabrication and alternate methods to deposit thermoelectric thin-films using sputtering deposition (physical vapor deposition). Here we describe various stages of fabrication of the probes with the thin-films.

Thin-film Fabrication

The Mo thin-films were prepared with a RF magnetron sputtering system in the solid state laboratory at the Electrical Engineering Department of UNAM. The growth process of the thin films were deposited under Ar atmosphere and the gas flow rate in the chamber was then controlled by a flow control valve. The yield of the sputtered films were controlled by various sputtering conditions, such as inert gas pressure, applied voltage and target substrate distance. The Mo films were grown at a base pressure of 0.01 Torr, a 500W power and 0.5 Torr ion energy, and deposited on the substrate at a temperature of 300°C. The thickness of the Mo films was measured using a profilometer, and the thickness of the deposited Mo films was found to be 300 nm.

Progress

The first problem that we faced was the substrate contamination; we defined the cleaning condition to improve the adhesion of Mo to the diamond substrate. The second problem was the undulation growth of columnar structures and islands during the sputtering deposition of the Mo thin-films; we improved the thickness of the substrate and decreased the substrate area to achieve the desired growth. The third problem was the unevenness on the Mo thin film because of the difference in the surface conductivity between the Molybdenum and the diamond. We changed the sputtering pressure to avoid high changes in the substrate temperature during the sputtering process.

Impacts and Applications

The diamond anvil cell is used as a mechanical pressure device to study materials under extreme conditions. Such experiments will allow us to study the phase transition in various materials and hence linking this to the change in their properties. Since our interest is to investigate electrical and thermoelectric properties of different materials, we are required to modify the DAC device to take measurements in-situ. Such experiments could be performed using a four probe circuitry device on top of the diamond cell which will allow us to conduct electrical and thermoelectric properties measurements. The fabrication of the microcircuit was done by masking and applying a thin-film deposition as described before. The microcircuit was fabricated with Molybdenum because of its stability at high pressures and great electric conductivity.

Why Fabrication of Thin Films on Diamond Anvil Cell?

The thermoelectric and superconducting materials are crucial for renewable energy. The efficiency of this materials is heavily dependent on interrelated material properties. The shift from bulk to low dimensional structure material is essential to increase the power factor and the critical temperature in thermoelectric and superconductors respectively. Such research will allow our group to study the properties low-dimensional structure under high pressure and low temperatures. Finding of such promising materials can lead to the development of efficient TEG’s-Thermoelectric generation, where waste heat can directly be converted into electric power, also high T_c superconductors can be used to fabricate power transfer lines, which power loss would be avoided.
Title: Thin-film fabrication for high pressure thermoelectric and electrical resistivity studies

Abstract: Thermoelectric materials are of interest for application such as thermoelectric cooler in microprocessors and power generators in cars. High pressure plays an important role in understanding the changes in the figure of merit of thermoelectric thin films. To study the thermoelectric thin films a direct approach is to fabricate the thin film on the surface of a diamond anvil, so that the pressure dependence of structure and transport properties can be investigated easily. If we could successfully fabricate the electrical probes by depositing thin films, then it reduces the use of electrical wires as probes inside the diamond cell, as the wires are easily breakable at high pressure. We have study different Molybdenum (MO) electrode fabrication and methods to deposit thermoelectric thin films using sputtering deposition (physical vapor deposition).

Why are you doing this project? Find Renewable Energy sources, cut our burning fuel dependence and became more efficient in electric power generation.

What problem are you trying to solve? Thin-film Thermoelectric materials under high pressure is a rising field among researchers, many challenges still exist around the characterization techniques need to be used to determine the properties. I focus on optimizing a technique that will allow researchers to conduct in-situ measurements.


Why is your project worth researching? Thermoelectric material can be use from microprocessors as thermoelectric cooler to cars as power generators. Superconductors’ materials can be used in superconductive transmission lines and magnets.

What relevance will it have on the community, society, and in your research field? The discovery of new superconductors and thermoelectric materials will help the society to have more energy efficient products. My project will help us make more precise measurement of the superconductors and thermoelectric materials properties under high pressure and low temperatures.

What did you find? The adhesion coefficient of the Mo thin-film on diamond can be improved by changing the sputtering deposition conditions, such as power and pressure.

What is the future for your research project? Measure the properties of thermoelectric materials and superconductors applying high pressure and low temperatures.
Groundwater: Solution to the Las Vegas Water Problem?

Rosa Perez and Christopher A. Ruiz

University of Nevada Las Vegas • SCI 101 • Ms. Alicia Simon, Adviser

Abstract

A contentious debate is taking place in different sectors of the community on how to manage the area’s groundwater supply. The debate affects the residents of Las Vegas, with a tremendous impact on the future of Las Vegas. Economists benefit from the commercial developments that grow in tandem with their urban centers. This paper presents a statistical study of the SNWA’s Groundwater Development Project and discusses the issues and solutions. Groundwater is abundant, accessible, and cheap, but exploitation and over-pumping can have serious environmental effects. As well, it is important to control the use of groundwater to ensure a sustainable supply for Las Vegas’ water problems can be resolved.

Introduction

The explosive growth in Las Vegas has resulted in an unprecedented demand for more water (Figure 1). The Colorado River accounts for 90% of its water supply while the Las Vegas Valley groundwater basin provides the remaining 10% (Figure 2). Data collected by the USGS in 2000 showed that the two sources together accounted for some 240,000 acre-feet of water that was consumed in Nevada (USGS: Data File). The water supply, however, has been able to keep pace with one of the fastest population growth rates in the nation.

The problem is compounded by declining water levels in the two primary reservoirs at Lake Mead and Lake Powell due to the effects of global warming and the increased demands on an already stressed river system. Drought related conditions in the river began in 1995, yet critical levels in 2000 persist to this day (Water Resource Plan) 9. This prompted policymakers and water managers to study plans contained in the Sustainable Water Authority (SNWA)’s Groundwater Development Project that would decrease reliance on the Colorado River by developing primarily groundwater (or “non-river”) resources. A major component of the project will require transporting groundwater from the northeastern part of the state to Las Vegas. It takes a proactive stance on the water situation and, yet, raises a serious ethical question due to perceived lack of concern for environmental and conservation issues.

While the benefit of having a suitable supply of water in drought-stricken Las Vegas is quantifiable, the risk to the environment is priceless. The question, “Should residents of Las Vegas pursue proposals for extensive groundwater development to meet future water needs?” becomes relevant from an environmental perspective. This is a sensitive issue that requires a thorough and relevant study of the pros and cons which, hopefully, will provide the common ground in the formulation of a clear-cut policy on groundwater development.

Disadvantages of Groundwater Development

To meet increasing demands in Las Vegas, the SNWA applied for water rights in Lincoln and White Pine counties to facilitate “large-scale groundwater withdrawal” for current and future needs (Williams et al. 689).

SNWA’s Water Resource Plan: The plan will add about 134,000 acre-feet of water annually to the state’s water reserves, augmenting the 300,000 acre-feet annual diversion from the Colorado River (a). Reliance on surface water from the Colorado River is expected to decrease (Figure 2). The SNWA believes that any unused water that is kept in the lake will only benefit the river system in the long run. Studies conducted by the USGS show that groundwater provides about 97% of available freshwater in the region which is more than what is in rivers and lakes. It is abundant, of fairly good quality and has low-cost benefits that make it attractive to water planners. It is easily accessible because there is need for it, making it a very important component of any management plan to Las Vegas water problem. It comes as no surprise that in Las Vegas, as in other places in the nation, groundwater finds the greatest utility for public and domestic purposes, as well as thermoelectric power generation and irrigation.

According to the USGS, groundwater is free of “particulate matter, such as leaves, soil, and bugs…” because of the earth’s natural filtration system, making it cheaper to maintain and readily available for use barring significant contamination (‘Groundwater Quality’). One of groundwater’s more active properties is its reliability in dry seasons or droughts because of a large pool stored below ground that is essentially free from the effects of evaporative losses (‘World Water Day’). In short, and in the face, the Southwest where afternoon temperatures in the summer can be brutally high, groundwater can provide a stable reserve over time. The Hydrologic Cycle

Water in the Las Vegas

The Hydrologic Cycle

MEASURING WATER

According to Trout Unlimited’s Western Water Project, one acre-foot of water contains 33,055,000 gallons which would fill a football field 1 foot deep. Depending on where you live, the rainfall on average, between one quarter and one inch an acre foot per year.

Disadvantages of Groundwater Development

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Bibliography


Title: Groundwater: Pros and Cons

Abstract: A contentious debate is taking place in different sectors of the community on how to manage the state's groundwater system. It is a battle whose outcome, regardless of who wins, will have a tremendous impact on the future of Las Vegas. Economic benefits always seem to downplay environmental considerations in the policy-making process often with serious consequences. This paper takes a look at the SNWA’s Groundwater Development Project and provides a discussion of the issues for and against it. Groundwater is inexpensive, relatively abundant and accessible. However, over-pumping of groundwater can have significant environmental consequences, as well. It is our hope that the issues presented here will lead to more open dialogue so that an equitable solution to Las Vegas' water problem can be reached.

Why are you doing this project? To enhance the learning experience by promoting effective research techniques and extensive use of Lied library resources.

What problem are you trying to solve? This would be the Las Vegas water problem.

What tools or equipment are you using? Research, mainly to provide more knowledge of the pros and cons to groundwater development so that a common ground is reached.

Why is your project worth researching? It is relevant to our times, considering that Las Vegas has projected so much economic growth and this is causing so much burden on the state's natural resources.

What relevance will it have on the community, society, and in your research field? Policies affecting the environment will definitely have a huge bearing on future generations which is why it is important that there is agreement on the best alternative to fix the current problem without jeopardizing prospects for the future.

What did you find? There is no easy answer, unfortunately, to Las Vegas' water problem. More environmental studies have to be conducted to ensure that the project will be self-sustaining and not harm the environment.

What is the future for your research project? It is our hope that water managers/policy makers see eye-to-eye on issues alongside environmentalists and concerned individuals so that an equitable solution to Las Vegas' water problem can be reached.
Title: New Urbanism Theory and Community Health in Las Vegas

Abstract: New Urbanists present both a theory for strong community development and an architectural planning program for moving towards sustainable urban environments. They argue neighborhoods should be compact, pedestrian-friendly, with mixed-usage of housing and activities, and available public spaces. These design elements foster and encourage social interaction among residents which creates and enforces neighborhood community. I tested New Urbanism Theory by performing ethnographic fieldwork to assess the quality of neighborhoods in Las Vegas. Then I compared neighborhood qualities to residents’ responses to their neighborhood, neighbors, and quality of life from the Las Vegas Metropolitan Area Social Survey. My results confirmed New Urbanist claims.

Why are you doing this project? I am a native to Las Vegas and I have always been interested in incorporating and applying my academic work to Las Vegas. I want to be part of the efforts to improve Las Vegas.

What problem are you trying to solve? The problem is what characteristics does it takes to make a more sustainable Las Vegas.

What tools or equipment are you using? Journal databases from the library, the Las Vegas Metropolitan Area Social Survey, neighborhood field notes

Why is your project worth researching? My project offers some insight into how people experience community and quality of life in Las Vegas. These are important as Las Vegas moves towards becoming more sustainable (socially, environmentally, and economically).

What relevance will it have on the community, society, and in your research field? Robert Puntam wrote about social capital defined as the connections, trust, and reciprocity among individuals. He wrote about how social capital in America has declined over the past decades. Other scholars have argued that decline in social capital correlates with lack of civic engagement, loss of safe public spaces & neighborhoods, etc... These are important issues to community, society, and environmental & urban sociology.

What did you find? My project confirmed New Urbanist claims. I also found other important neighborhood features that correlated with neighborhood community that were not explicitly New Urbanism.

What is the future for your research project? I will defend my honors thesis (research project) in a couple of weeks. I will also be presenting it at the American Sociological Assn Annual Meeting this summer. I also hope my project helps the next phases of the Las Vegas Metropolitan Area Social Survey. This project has definitely inspired me to continue my studies into community, sustainably, and environmental sociology.
Hunger Awareness

SPOTLIGHT ON HUNGER

Since 2000, unemployment rates in the Southern Nevada Area have been at an all-time high, as of January 2009, (14.9%). In addition, not only has our homeless population reached an all-time high, but the demand for food shelters have increased immensely. To address the hunger problem in Southern Nevada, the UNLV SIFE team developed an awareness campaign, as well as raised funds for purchasing nutritional meals for the homeless and food insecure in Southern Nevada. To get college students and community members more informed about Southern Nevada’s Hunger Problem UNLV SIFE partnered with other on-campus organizations to host a myriad of events. Among them include the:

Oxfam Hunger Banquet, in which we brought college students through simulations of hunger born regionally and interirmarily. We gauged students in dialogues that would foster thoughts and solutions to food shortage problems.

Beat Hunger: a program where local musicians came together to raise funds on the UNLV campus. We also held a small scale guitar and drum Jam Session to incorporate fun and uniqueness into an awareness event.

Food From the Hart, a fundraiser in partnership with our local B&Hs at Albertsons, on Valentine’s Day, to raise funds and bring awareness.

We have partnered with ThreeSquare, our local food bank which serves over 150,000 Southern Nevadans. In addition, we have partnered with 2 local banks, an animal hospital, Starbucks, and the UNLV College of Business to further our Spotlight on Hunger Campaign. Thus far, the UNLV SIFE team has raised the funds to purchase over 1,140 meals.

SUMMER FOODS PROGRAM

Over the summer of 2010, the UNLV SIFE team helped a child development center cover the costs of over 15,000 meals. Over 50% of Southern Nevada Students receive free/reduced price meals all school. Unfortunately when the summer months come a majority of these students’ families can’t cover their food costs. Not only are these students unable to have constant source of food, but they are unable to focus on their academics as a result. To address these needs our UNLV SIFE team worked with a child development center, the Fellowship Christian Academy, to help with a marketing plan.

Throughout the year, the Center functions as subsidized day care and provides low-income parents the ability to leave their children in a safe, supervised environment so parents are able to work more hours. When the academic year ends, the center functions as a soup kitchen for children.

During the summer the Center provides children between the ages of 3-months-18 years old with the opportunity to come in and receive nutritional hot meals throughout the day. (2 meals and a snack)

We developed the Center’s proposal for the Nevada State Summer Food Grant, a part of the Federal Food & Nutrition Grant.

After we secured the grant, we helped the Center execute the marketing plan. We identified advertising and canvass the center’s target demographic marketing. Our marketing plan helped the center increase their enrollment by 20%, compared to their usual cyclical decrease of 50%.

We are proud to announce that the Fellowship Christian Academy will continue to serve the community and feed its children. With UNLV SIFE’s help the Center is fully sustainable into the foreseeable future.

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UNIVERSITY OF NEVADA,
LAS VEGAS

2011 Annual Report
Title: Students and Free Enterprise

Abstract: UNLV SIFE is part of an international non-profit organization that works with leaders in business and higher education to mobilize university students to make a difference in their communities while developing the skills to become socially responsible business leaders. Participating students form teams on their university campuses and apply business concepts to develop outreach projects that improve the quality of life and standard of living for people in need. In addition to the community aspect of the program, SIFE’s leadership and career initiatives create meaningful opportunities for learning and exchange among the participants as well as the placement of students and alumni with companies in search of emerging talent. With a myriad of efforts ranging from college prep, financial literacy, hunger awareness, and ESL workshops, UNLV SIFE is becoming more of an integral part of the Las Vegas Metropolitan community.

Why are you doing this project?
What problem are you trying to solve?
What tools or equipment are you using?
Why is your project worth researching?
What relevance will it have on the community, society, and in your research field?
What did you find?
What is the future for your research project?
Title: Depictions of Gender and Sexuality in Japanese Anime and Manga

Abstract: This presentation will explore research into gender and sexuality in anime and manga as compared to popular U.S. displays of gender and sexuality using a brief historical and cultural contextual background on manga and anime. I will discuss a comparison between U.S. and Japanese gender and sexual depictions in anime/manga and popular American media. Lastly, I discuss the potential for anime and manga in exploring gender and sexuality in U.S. studies, as well as my current, ongoing research with individuals in anime/manga groups.

Why are you doing this project? This research is of particular interest to me in my personal history. My interest in anime and manga developed into a genuine curiosity about the non-western sexuality and gender themes in Japanese anime and manga and how these themes might be interpreted uniquely by western audiences.

What problem are you trying to solve? I am exploring the relationship between sexual and gender identity in the U.S. when that relationship is impacted by an intense interest in Japanese anime and manga.

What tools or equipment are you using? I am utilizing scholarly research about Japanese anime and manga, as well as conducting formal in-depth interviews on members of the anime and manga subculture in Las Vegas.

Why is your project worth researching? Most people know someone or a child who has a deep interest in Japanese anime and/or manga as it has become a mainstream form of U.S. popular culture. My research focuses on how this interest can influence personal sexual and gender identity, which can lead to a greater understanding of identity formation within the U.S. when non-U.S. media are involved.

What relevance will it have on the community, society, and in your research field? Anime and manga sub-culture has been neglected in sociological and media research concerning its influence on gender and sexuality attitudes and perceptions.

What did you find? I found through my research thus far that Japanese anime and manga has a pervasive and lasting relationship with cultural themes of Japan's history. The reproduction of these themes has led to elements of very non-western sexual and gender expressions in this media.

What is the future for your research project? I am currently involved in in-depth interviewing of members of the anime and manga subculture in Las Vegas. Using Gerbner's theory of cultivation, I hope to discover if there is a measurable and unique influence on gender and sexuality attitudes and perceptions on U.S. consumers.
Title: The Persistence of the Gender Wage Gap in the United States

Abstract: By analyzing Current Population Survey data from the last five decades, it is possible to determine the factors that most heavily contribute to the differences in pay that exist between the genders and what the underlying causes are. The research done by myself and Dr. Carroll explores the effects of marriage, human capital investment, children and effort on the pay disparity in the United States, using statistical analysis and with reference to the work done previously on the subject by Gary Becker.

Why are you doing this project? I am doing this project as a continuation of an independent study paper focusing on the effects of human capital investment on the gender wage in the context of Gary Becker's work on the subject (which I was introduced to in Topics in Microeconomics course).

What problem are you trying to solve? We are trying to determine the impact of different variables (proxies for Becker's concept of effort) on the wage differential between men and women.

What tools or equipment are you using? We are using the statistical software Stata.

Why is your project worth researching? This project is worth researching because it analyzes different variables that contribute to the gender wage differential, and actually explains away many of the differences between the earnings of men and women.

What relevance will it have on the community, society, and in your research field? I believe that our research gives context to both Becker's work, and to the issue of gender discrimination in general. It highlights preconceptions people may have, and explains the generalizations away while introducing other aspects of the topic that provide a broader perspective on the issue and how gender discrimination truly affects the workforce in the United States.

What did you find? We found that much of what Gary Becker was experimenting with when he first published his paper 'Human Capital, Effort, and the Sexual Division of Labor' is applicable in the real world when proxies (such as education, presence of children, etc.) are used to represent Becker's idea of "effort". We also found that many of the differences between the earnings of men and women are not as great as they are generally perceived to be, and that the gap between the earnings of men and women is closing.

What is the future for your research project? In the future we hope to publish this paper.
Abstract
HIV is a sexually transmitted disease that develops into AIDS. There is no cure for it, only treatment. In this paper, we look at the pros and cons of disclosing this type of information. People who decide to disclose their HIV status may have various reasons for doing so, but most do it for emotional support and for prevention of spreading the disease. Those who decide to keep it private mainly do it to not face rejection, discrimination, deprecation, and loss of respect.

(Petronio page 72) The problem with creating a public database is that many organizations are against the idea of disclosing personal information. Through documents as old as the Constitution, government officials have deemed a public database to be unethical. It conforms with individuals’ basic rights. Others still argue that creating such a database would lower the spread of HIV, saving hundreds of lives. The balance between patient’s privacy and the well-being of society has yet to be found.

We want to prevent the spreading of AIDS, so disclosure should be mandatory. By knowing who has the disease the chances of spreading it become minimal. In exchange, patients should be treated just as any other person.

Introduction
HIV/AIDS weakens a person’s ability to fight off infections and cancer, thus creating an extremely weak body that is susceptible to many diseases. Because it is such a serious issue, the idea of creating a public database has been circulating. The database would be similar to a state’s sex offender registry. But along with the idea of publishing AIDS victims have come many arguments. The main argument against the database is that it would go against patients’ privacy rights. Others argue it would cause public humiliation to the peoples infected and possibly cause riots to break out against them. Although the thought of innocent people being ridiculed over a virus is unfortunate, the fact that these people may be spreading HIV to unaware citizens is even more unfortunate. That is why some believe that taking the risk of public humiliation of victims is well worth the possibility of lowering the spread of the fatal virus. This forces HIV and gay advocacy groups to confront the burning question: Which do you value more—your privacy or the chance to halt this pague? (Eskanazi Paragraph 1)

Conclusion
Since the beginning of the HIV/AIDS epidemic, well over half a million people have died of AIDS in the United States. A virus as deadly as cancer should be given more extreme solutions. It may not be considered ethical in some eyes, but anyway of reducing the increase of people infected should be taken into consideration. Simply reinforcing safe behavior and urging HIV testing is not enough to end the epidemic.

Yes, the thought of publicly humiliating is terrible, but if serious measures are not taken, the HIV virus will continue to spread. And because the main way to spread it is through unprotected sex and needle sharing, this means that young people are very much at risk. With young age comes ignorance, and going as extreme as a public database may not likely open the eyes of teens who are engaging in these practices. AIDS is one of the most serious, deadly diseases in human history, and if a public database is what it takes to reduce the spread, then it should be attempted.

Bibliography


Title: HIV Patients' Rights

Abstract: HIV is a sexually transmitted disease that develops into AIDS. There is no cure for it, only treatment. In this poster, we look at the pros and cons of disclosing this type of information. People who decide to disclose their HIV status may have various reasons for doing so, but most do it for emotional support and for prevention of spreading the disease. Those who decide to keep it private primarily do it to not face rejection, discrimination, degradation, and loss of respect. (Petronio Page 72) The problem with creating a public database is that many organizations are against the idea of disclosing personal information. Through documents as old as the Constitution, government officials have deemed a public database to be unethical. It confronts with individuals’ basic rights. Others still argue that creating such a database would lower the spread of HIV, saving hundreds of lives. The balance between patient’s privacy and the well-being of society has yet to be found. We want to prevent the spreading of AIDS, so disclosure should be mandatory. By knowing who has the disease the chances of spreading it become minimal. In exchange, patients should be treated just as any other person.

Why are you doing this project? I am doing this project because HIV is a topic that is worth researching. It is such a deadly virus, that it deserves to be researched closely in hopes to find ways to stop the spread.

What problem are you trying to solve? I am trying to resolve whether or not an HIV public database is an ethical solution to the HIV epidemic.

What tools or equipment are you using? I used scholarly journal entries along with books and articles to compile information.

Why is your project worth researching? My project is worth researching because HIV has killed so many people already, there is no reason why it should continue. Creating a database is a proposed solution to the problem.

What relevance will it have on the community, society, and in your research field? It will help individuals who are struggling with forming an opinion on whether or not an HIV database is ethical.

What did you find? I found many strong arguments for the public database, along with strong arguments against. Some arguments even reference to the U.S. Constitution.

What is the future for your research project? I hope my research will be examined by many and it will help uncertain peoples decide that a HIV database would indeed be an ethical decision.
The Effects of Working Memory on High and Low Working Memory Capacity

Colleen M. Parks, Christine A. Agnir
Department of Psychology, Honors College

INTRODUCTION
Stress is known to have detrimental effects on memory. Acute stressors can trigger an increase in cortisol, which are adrenal hormones that respond to stress (McHugh et al., 2010). Trait anxiety is the psychological, physiological state and stable tendency to respond to threatening stimuli. It has emotional, behavioral, and somatic components and is considered to be a stable characteristic of personality (Endler & Parker, 1990; Vigna & Conner, 2008). Individuals with high levels of trait anxiety are vulnerable to increased stress levels compared to individuals with low levels of trait anxiety.

Working memory is how information is stored over a short amount of time and is used for complex tasks, such as reasoning and problem solving (Baddeley, 2000; Porcelli et al., 2008). Individuals vary in working memory capacity. Working memory capacity predicts performance on higher level cognitive tasks like reasoning; for example, high span working memory individuals have a greater capacity to withhold remembered information than low spans, but high spans are more susceptible to "choke under pressure" compared to low spans. "Choking under pressure" refers to decreased skill performance in high-pressure situations (Beilock et al., 2004).

Acute stress is a factor that impairs working memory (McHugh et al., 2010). Emotional stimuli have been used in long-term memory studies. The emotional content of information is important in long-term memory studies that have focused on stress, but it is unknown if the valence of the stimulus matter for working memory tasks. Little research is known to use emotional pictures for ni-back tasks. Our goal is to determine whether these factors may significantly disrupt the working memory process of efficiently completing complex tasks.

PURPOSE
- Investigate whether an acute stress will have the same or different effects for individuals with high and low working memory capacity
- Investigate whether stress effects on working memory capacity differ for emotional and neutral materials

METHODS

STUDY
- UNLV students will be recruited from Psychology classes for course credit.
- Participants will be randomly assigned to the stress condition (cold pressor task or control condition (warm water)).
- Participants will complete the following tasks in order:
  - OSPAN Task
  - State vs. Trait Anxiety Inventory (STAI)
  - Cold Pressor and Warm Water Conditions
  - 2-back Task

PREDICTIONS
- High working memory capacity individuals will have increased performance in the control condition compared to lower working memory capacity individuals.
- High working memory capacity individuals will have lower performance than lower working memory capacity individuals when exposed to the stress condition.
- Performance in low working memory capacity individuals will increase because they are less susceptible to "choke under pressure" compared to high working memory capacity individuals.

REFERENCES

Title: The Effects of Working Memory on High and Low Working Memory Capacity

Abstract: Acute stress is a factor that impairs working memory (McHugh et al., 2010). Emotional stimuli have been used in long-term memory studies. The emotional content of information is important in long-term memory studies that have focused on stress, but it is unknown if the valence of the stimuli matter for working memory tasks. Little research is known to use emotional pictures for N-back stimuli. Our goal is to determine whether these factors may significantly disrupt the working memory process of efficiently completing complex tasks.

Why are you doing this project? Working memory performance may depend on individual’s level of trait anxiety.

What problem are you trying to solve? Investigate whether an acute stress will have the same or different effects for individuals with high and low working memory capacity. Investigate whether stress effects on working memory capacity differ for emotional and neutral materials.

What tools or equipment are you using? UNLV students will be recruited from the Psychology Subject Pool for course credit. Participants will be randomly assigned to the stress condition (Cold Pressor Test) or control condition (warm water). Participants will complete the following tasks in order.

Why is your project worth researching? Working memory is how information is stored over a short amount of time and is used for complex tasks, such as reasoning and problem solving.

What relevance will it have on the community, society, and in your research field?

What did you find? High working memory capacity individuals will have increased performance in the control condition compared to lower working memory capacity individuals.

What is the future for your research project? Our goals are to continue to determine whether these factors may significantly disrupt the working memory process of efficiently completing complex tasks.
Should Primates Have Legal Rights?

Hannah Barton and Zhimin Chen

Abstract

A primate having legal rights is a controversial topic these days. Many other countries around the world support the idea of great apes having legal rights, because we for one are one of the five great primates. Others do not support this trending topic as much as others. These types of people believe that great apes such as chimpanzees are superb testing animals for medical purposes, because of the fact that they are closely related to mankind. Organizations such as Great Ape Protection, work towards protecting the rights of these great apes since they cannot speak for themselves. In many other countries, the legal rights of great apes are already official, although here in the United States people are still debating on this sensitive topic. Here we are presenting both arguments toward great apes able to have legal rights.

Counter-argument and Rebuttal

Not all of the people support granting rights to primates; for instance, in the United States, some scientists doing researches on chimpanzees concern the outcome of such a law which will ban use of chimpanzees in laboratories. Carrie Woollnott from Federalation of American Societies for Experimental Biology claims that animals together with chimpanzees are indispensable in medical research (Mess). Apparently, animals play a significant role in the laboratories. Since chimpanzees have the closest genetic relationship with humans, they are crucial in medical research. However, "they have proved poor models for research on human diseases and demand for them as test subjects has dwindled" (Lang). Chimpanzees together with the other three great apes are extremely similar to humans, and they are not as much important as in labs any more; they should be freed and protected by giving them rights to enjoy their lives.

Conclusion

From genetic relationship to mental abilities, from mental abilities to behavioral similarities, the great apes are undoubtedly the closest living creatures to humans. They are intelligent, they can learn, they can communicate with humans, and they can express their wills. They have behaviors similar to humans; they have curiosity, they feel depressed, and they tell lies. These marvelous connections can not be ignored. All the great primates, including bonobos, chimpanzees, gorillas, humans, and orangutans, should share the most basic legal rights. Indeed, the great apes should be granted legal rights.

Literature Cited


Title: Should Primates Have Legal Rights?

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Why are you doing this project? We are doing our project to show our interest in having legal rights for our closest relatives, the Primates.

What problem are you trying to solve? What are the Legal Rights for Primates?

What tools or equipment are you using? PowerPoint

Why is your project worth researching? It is a current and ongoing debate.

What relevance will it have on the community, society, and in your research field? It will show whether or not future scientists will be able to use Primates as laboratory test subjects.

What did you find? Many countries already have legal rights for primates, although the United States do not have any sort of rights currently. There have been bills proposed, but no laws passed. This is an ongoing topic in the United States.

What is the future for your research project? If we cannot use primates as test subjects how will we know what medicine will be safe for humans? Although we continue to mistreat primates while undergoing these laboratory testing’s, are we abusing one of our closest relatives? The future is open to many things, and whatever choices are made, there will be advantages and consequences to our society.
Chelation Therapy as a Treatment for Autism

Abstract

As medical advances continue to be made, there has yet to be an effectively consistent cure to the commonly known condition of autism. Some researchers and physicians state that by using chelation therapy, it could help cure mercury poisoning in autistic individuals who were affected by vaccines or other sources. Because of the lack of research and knowledge about chelation therapy, there has been some controversy as to the ethics of providing chelation therapy to autistic children. The families that are put through these trials are faced with high costs, and no guarantee that their child could be cured. But to some families, a little hope is better than none when thinking about the future of their child. Other families refuse to put their child through the therapy due to the effects it could have upon their child, and continue to wait for further advancements in medicine.

Autism Increased Sharply in Several States

The prevalence of autism in 8-year-old children increased significantly in the last 10 years — notably Autistic and Asperger — where the Autism and Developmental Disabilities Monitoring Network (ADDMD) tracks autism spectrum disorder (ASD). Experts are uncertain whether the increases are due to true increases in autism or other factors, such as increased awareness of the disorder and a broadened diagnostic spectrum.

Changes in ASD Prevalence, 2002-2006

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Introduction

Ethical Question

Is using chelation therapy on autistic children unethical?

What is Autism?

Autism is a condition in which the individual has an impaired ability to relate to other people, repetitive behaviors and delays in language. "Ritualistic behavior, hand flapping, communication (or under sensitivity to pain and self-injurious behaviors like head-banging) are also common" among individuals diagnosed with autism. Many of the first signs of autism begin at birth. Some of the more common symptoms include "failure to make eye contact or react with the smiles and gestures that are the foundation of human interaction." It is also uncommon, however, for signs of autism to start in adults when the child is about two years old. Since signs start to show after a period of what seemed to be a normal development in the child, the cause of autism is based on the vaccinations given during this time. Brain scans illustrate that children, as well as adults, diagnosed with autism have brains that are structured and function in a different way than brains of non-autistic individuals. Recent autopsies have shown that the brains of autistic individuals are in fact larger than non-autistic individuals. Studies also showed that the white matter is smaller and densely packed cells in the limbic system of the brain. The limbic system is involved with "learning, memory, emotion and behavior." This is a reason as to why autistic individuals have difficulties when it comes to social interaction, but they are able to become experts on other subjects. For instance, Temple Grandin, author of Thinking in Pictures, "has built a distinguished career as an animal scientist." (Grandin)

The Pros of Chelation Therapy

Research studies at Cornell University published in an issue of Environmental Health Perspectives showed that chelation therapy is in fact an effective way to improve the condition of the patient, but result from exposure to lead (Hg). In the past, many physicians had also reported positive results in improving the behavior of autistic children after the children had undertaken a chelation process to rid them of mercury. After seeing these results, the Autism Research Institute (ARI) responded by holding a “Consensus Conference on the Effectiveness of Chelation in Autism” in New York City, Texas, February 3rd through 11th, 2001.” (ARI) The conference consisted of 25 physicians and scientists with an understanding of mercury and the detoxification of mercury. Some of the physicians were parents of autistic children. These physicians had also carried out the process of detoxification of mercury on their children and had positive results. Along with the children of these seven physicians, these physicians had also used chelation therapy on over 3,000 patients. Approximately 1,500 of the 3,000 patients had been diagnosed with autism (ARI).

Discussion

Conclusion

Although chelation therapy does have its risks, some individuals may still take the chances and continue on with the treatment. If one is planning on administering chelation therapy for his or her autistic child, it is extremely important that they take all precautions. One should get a physician to take tests that check for the amount of heavy metals in the body before even deciding to carry out the chelation therapy. It is also recommended that the levels of vital minerals in the body are monitored during as well as after the duration of the chelation treatment (Hg). Some may continue to argue and say that chelation therapy is unethical, but most likely will not stop some parents from carrying on the treatment in hopes of curing their children from autism.

Bibliography


Title: Clelation and Autism

Abstract: As medical advances continue to be made, there has yet to be an effectively consistent cure to the commonly known condition, Autism. Some researchers and physicians state that by using chelation therapy, it could help cure mercury poisoning in autistic individuals who were affected by vaccines or other sources. Because of the lack of research and knowledge of chelation therapy, there has been some controversy as to the ethics of providing chelation therapy to autistic children. The families that are put through these trials are faced with high costs, and no guarantee that their child could be cured. But to some families, a little hope is better than none when thinking about the future of their child. Other families refuse to put their child through the therapy due to the effects it could have upon their child, and continue to wait for further advances in medicine.

Why are you doing this project? We decided to do this project because we were interested in the ethics of chelation therapy towards autistic children.

What problem are you trying to solve? We were trying to solve whether it was ethical or not to put an autistic child through chelation therapy.

What tools or equipment are you using? The tools we used for this project were outside research information on chelation therapy and autism.

Why is your project worth researching? Our project is worth researching because there are many cases of autism throughout the world, and many doctors are trying to find a cure. As medical advances occur, chelation therapy may be one step towards a cure, but still needs to be studied.

What relevance will it have on the community, society, and in your research field? If researchers can better understand the effects of chelation therapy and how it will affect its patients it may be a stepping stone towards finding a cure to autism. And to start with something is better than nothing at all.

What did you find? We found that there are still harmful effects that may happen to the patient. More research needs to be put towards finding out whether autistic children actually need chelation therapy. As of right now, the negative effects of chelation therapy out weight the positive effects towards autism.

What is the future for your research project? We hope that some of our information will help spark someone’s interest, someone with bigger and better resources, so they can seek out a safer way to cure autism. Or inspire others on whether to put their child through chelation therapy.
Pain Threshold, Tolerance and Catastrophization in Women with Dyspareunia

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ABSTRACT

• This study examined the impact of pain and sexual stimuli on the experience of experimentally induced pain, as well as pain threshold, tolerance and catastrophization levels in women with dyspareunia compared to control women.

INTRODUCTION

• Dyspareunia, defined as recurrent pain in the genital/pelvic region during sexual intercourse, is a highly prevalent female sexual dysfunction, affecting up to 22% of women between the ages of 18 and 24, by some estimates.

• Women with dyspareunia display a general sensory dysregulation, manifested as increased sensitivity to touch and pain stimuli at non-genital sites, such as the arm, leg, and inner thigh.

• Previous research has shown that women with dyspareunia share many of the same cognitive tendencies associated with other chronic pain conditions (e.g., pain catastrophization, somatosensory amplification).

• Questions remain regarding the relationship between cognitive variables and pain experience in dyspareunia. Are there specific cues that affect pain threshold and tolerance? How are pain threshold and tolerance related to cognitive variables such as catastrophization?

• The answers to these questions could have important implications for the treatment of this distressing sexual dysfunction.

METHOD

• Twenty-nine women with dyspareunia and sixty control college women between the ages of 18-29 participated.

• Participants were assigned to one of three conditions in which they viewed pictures depicting physical pain, sexual activity, or neutral objects.

• Participants then underwent a cold-pressor test to assess pain threshold and tolerance of the non-dominant hand.

• Participants completed questionnaires related to pain catastrophization, sexual functioning and somatosensory amplification.

QUESTIONNAIRE MEASURES

Sample items from the questionnaires

Pain Catastrophization Scale (PCS)
“Keep thinking how badly I want the pain to stop.”

Mental Health Inventory (MHI-18)
“During the past month, how often did you feel that you had nothing to look forward to?”

Female Sexual Function Inventory (FSFI)
“Over the past 4 weeks, how would you rate your level of discomfort or pain during or following vaginal penetration”

The Somatosensory Amplification Scale (SSAS)
“I am often aware of various things happening within my body”

RESULTS

ANOVA
• 3x2 for pain threshold and tolerance: Significant results for Group: (p < .05) Dyspareunia group had lower threshold and tolerance than control women.

Significant Group Differences
• FSFI total score (p = .000), with dyspareunia group (M = 21.57, SD = 6.37) reporting more dysfunction than the control group (M = 28.09, SD = 6.63).

• PCS total score (p < .05), with dyspareunia group (M = 9.59, SD = 3.98) reporting higher levels of ruminating than the control group (M = 7.63, SD = 10.89).

Significant Correlations within Dyspareunia Group
• Positive correlations between pain intensity rating (scale of 1-10) and PCS magnification r = .409, p = .005 and pain distress rating and SSAS total r = .516, p = .001.

• Positive correlations between pain score and arousal r = .373, p = .005, satisfaction r = .387, p = .005, and total r = .510, p = .001, (note: higher pain scores indicate less dysfunction)

DISCUSSION

• Analyses of the stimuli reveal that women with dyspareunia had significantly lower pain threshold and tolerance levels than control women.

• Women with dyspareunia displayed higher levels of pain catastrophization and dysfunction than control women.

• In the dyspareunia group only, the higher the woman’s propensity for pain catastrophization, the lower her pain tolerance. Interestingly, in the dyspareunia sample, a negative correlation was found between pain catastrophization and the length of time a woman had been experiencing pain during intercourse, indicating that pain catastrophization might be highest shortly after dyspareunia onset.

• The findings further contribute to the body of research demonstrating generalized sensory dysregulation in women with dyspareunia, and highlight the relationship between pain catastrophization, sexual function, and the experience of pain in women with dyspareunia.
Title: Pain Threshold, Tolerance and Catastrophization in Women with Dyspareunia

Abstract: This study examined the impact of pain and sexual stimuli on the experience of experimentally induced pain, as well as pain threshold, tolerance and catastrophization levels in women with dyspareunia compared to control women.

Why are you doing this project? I am working in the Human Sexuality psychology lab on campus and was given the opportunity to help a graduate student complete her dissertation research. As a student who is seeking graduate studies, I thought it would be very interesting to get involved with this project.

What problem are you trying to solve? The goal of the current research is to explore cognitive correlates related to sexual pain, such as catastrophization.

What tools or equipment are you using? We show participants photos on a computer and run them through a cold pressor test. This test consists of the participants putting their non-dominant hand into 2-4 degree C. water while we time with a watch how long their threshold and tolerance was. Next, we administer questionnaires.

Why is your project worth researching? The findings further contribute to the body of research demonstrating generalized sensory dysregulation in women with dyspareunia, and highlight the relationship between pain catastrophization, sexual function, and the experience of pain in women with dyspareunia.

What relevance will it have on the community, society, and in your research field? The findings will contribute to clinical treatments and assessments for women who suffer from dyspareunia. Furthermore, it may spark more research in this area.

What did you find? We found that women with dyspareunia had significantly lower pain threshold and tolerance levels than control women. Also, women with dyspareunia displayed higher levels of pain catastrophization and dysfunction than control women. Interestingly, in the dyspareunia sample, a negative correlation was found between pain catastrophization and the length of time a woman had been experiencing pain during intercourse, indicating that pain catastrophization might be highest shortly after dyspareunia onset.

What is the future for your research project? The goal is to extend the current research on female sexual dysfunction in an effective manner that can be understood and applied in a clinical setting.
Sexism In The Sciences
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Abstract

Sexism is not just relevant to the sciences but in all fields of study. Women are more likely to be research scientists than to have senior positions in the sciences. More men than women are going to college. More women than ever before are graduating with a degree in the sciences and other male dominant fields, but despite the increase of female academic success there are still fewer women in careers like the sciences and academia. Many factors contribute to sexism in the sciences. Most are social factors including women’s motherhood and family commitments, social interactions of female’s and males from early youth, and social barriers in the field, and possible biological explanations.

Introduction

In the modern era, as more women have entered the workforce, issues of sexism have affected the ability of women to advance their careers. In this paper, you will be informed about some of those factors.

Women have a tendency to worry balance between their career and other personal aspects of their lives then men do. Historically, American society is patriarchal, male dominated, and to some extent it still is today. In academic fields have been dominated by men including biology, chemistry and math.

However, in recent years more women are majoring in these science fields and pursuing advanced degrees. Still, why are there more male participants in math and science then females? Studies have shown several factors for why there are fewer females; the most dominant issue is family commitments. As the mother of the household often takes care of their family and cares for them, a female is more likely to give up her career for her family. Other issues to consider when assessing the gender gap in science careers are: biological characteristics of the genders, invisible barriers and social upbringing. In our study we try to understand why there is sexism in the sciences, how sexism affect the success of woman and in what ways women may face discrimination.

Discussion

Women may face discrimination because of their family commitments. Women often have a conflict between the time they need to devote to family and to their career. Family is often a full commitment and many women give up their educations in order to spend more time with their families (Glazer). The science field requires long hours of research and dedication and it is difficult to maintain a balance between work and family time. Many women give up or put their careers to the side in order to take care of their families instead. Also if women take time off from their careers to raise children it may be difficult to start their career again (Greenfeld).

Studies have been done to determine the gap between males and females (Gwyneth). Biological factors are heavily debated because females and males have been demonstrated to use their brains differently (Glazer). Biology was used to justify the fact that more men than women historically attended college but now there is a higher percentage of women going to college and more than half of them succeeding in getting their degrees, especially in the sciences and math/computer science fields (Clark). This data indicates that women are not intellectually hampered by biology.

PhDs for Women Increased Steadily

The percentage of science PhDs awarded to women steadily increased from 1996 to 2001, with women making dramatic gains in engineering. In life sciences, women now earn nearly half the PhDs awarded.

Percentage of Science PhDs Earned by Women


The graph here illustrates the amount of PhDs earned by woman from 1996 to 2001 (Glazer).

Specifically in the biological science, "women have earned the majority of bachelor degrees and more than 39% of all doctoral degrees since 1996, women only represented 48% of the biological bachelor degrees and 35.6% of doctoral level biologists in 2003 (Wyp.)". Despite females holding more undergraduate degrees the amount of females that achieve advanced degrees is less than male students.

The social upbringing of females and males in their youth is a crucial point. Where boys were brought up to more challenging and forceful in giving their opinions, females, are taught to refrain from such behavior. Instead females are told to be quiet in the classroom and not to be aggressive (Glazer). Also in both school and work females face the challenges of the glass ceiling, which is "the language to describe the artificial barriers that block women and minorities from advancing to the top -- in business, labor, government and other institutions throughout the American work place (Adams)". Males don’t face this challenge and often times deny the glass ceiling itself.

Analysis

Females can be just as successful as males in today’s society. What we drew from the research is that despite the numerous successes of women everywhere, they are still being discriminated in ways that limit their full potential. Family commitments shouldn’t collide with women’s career goals and women should be supported by institutions to balance work and family (Adams). We can draw from the research that females do want to be on par and equal with males. But the glass ceiling and social upbringing often affects the performance of women. To create a more successful career path for women the barriers holding females back should be abolished although this is a long and difficult path.

Conclusion

Sexism in the sciences and other fields of study for women is undeniable. Efforts to eliminate barriers are steady but slowly being reduced. In the sciences, engineering, and other areas women struggle more so than men to maintain their careers because of family commitments. Studies indicate that men do not spend as much time on family issues and that their careers and are more likely to become established. Women are making advancements in academia and in the sciences but traditional bias and family commitments often prevent them from reaching their full potential.

The graph here illustrates the amount of PhDs earned by woman from 1996 to 2001 (Glazer).

References

Title: Female Sexism

Abstract: Sexism in the sciences is not just relevant to the sciences but in all fields of study. Woman are steadily on the rise, many going to college, and much more graduating with a degree in sciences and other male dominated fields. But despite the increase of female academic success, there are still fewer females in careers like science and professorship. Many factors contribute to sexism in the sciences, those factors being motherhood and family commitments, social interactions of female and male from early youth, social barriers in the field, and possible biological theories.

Why are you doing this project? We are doing this project because there is a frowning trend of females in the sciences and other fields of study; we wanted to explore how this trend is going, and the success of females.

What problem are you trying to solve? We are trying to determine if sexism in the sciences is relevant and ethical.

What tools or equipment are you using? We did research on the computer by using data to compare our thesis.

Why is your project worth researching? The project has been a thrill for us to research on. It was worth it with all the time and effort we went to find information on this topic as well as the findings that others may find in the future.

What relevance will it have on the community, society, and in your research field? This project is relevant towards the careers that females want to pursue, which are traditionally male dominated.

What did you find? We found that there is sexism in the sciences. It would be difficult to eradicate such, because movement of abolishing sexism in the sciences and many other fields as well is slow.

What is the future for your research project? It is to inform all students alike; of both genders that sexism may or may not affect their success. It is undeniable that such barrier like sexism exists, and is another road to bear with and take it down.
Placebos: Ethical Research or Unethical Deceit?

Tawnya Schirmeister and Sabrina Crilley

Abstract
There is an ongoing debate between whether or not it is ethical for researchers to use placebos while studying terminal illnesses. Within this debate there are two parties, the party that believes that it is ethical and the party that believes that it is not. Both parties have valid points and have very detailed arguments against one another. When describing whether or not the use of placebos is ethical or not, you must first understand what a placebo is, and what the different types are. This paper goes over what a placebo is, what the different types are, and the main points that each party has. This paper also goes over whether or not the use of placebos is ethical. Of course every person has their own ethical opinion.

Introduction
A placebo can be defined two different ways. A placebo is usually a pharmacologically inert preparation prescribed more for the mental relief of the patient than for its actual effect on a disorder; or as an inert or innocuous substance used especially in controlled experiments testing the efficacy of another substance (as a drug) (merriam-webster.com). There are also two different types of placebos; there are inert placebos and active placebos. An inert placebo does not have any harmful or beneficial consequences caused by its “active” ingredients. Inert placebos can superficially mimic the “active” treatment by taste, shape, and color. An active placebo is specifically designed and used to mimic some of the side effects of the intervention to further secure blinding in a study (Edwards, Stevens, Brauboltz, Liford, and Swift 1). There has been a “renewed interest” in active placebos in surgical trials. There is also a growing interest for active placebos in pharmacology as well. Placebos are now being used in research studies that are conducted on trying to find a cure for terminal illnesses. This brings up a strong ethical question on whether or not researchers should use placebos when treating terminally ill patients. With every ethical question there are two sides. There is a side that believes that it is ethical and there is a side that believes that it is not.

Positives
- Placebos should be used because they give patients reassurance and comfort (Miller, Collica 40-44).
- Placebos are ethical because they provide patients with reassurance and comfort. Just the ritual of going to the doctors and taking the medication can make them feel better. During research on terminal illnesses, patients need to feel reassured and comfortable or they could sway the results.
- Placebos can also provide beneficial treatment to patients (Miller, Collica 43-44).

Negatives
- Placebos are used to help find new medication (De Zulua 11-12).
- When researchers are trying to figure out if a new type of treatment works better than the older one, they use placebos. For this to work, the patient also has to be reassured that they are one part of the better treatment group even though they may not be.
- Though this can be considered lying to the patient and breaking the sacred bond between the doctor and patient, they are doing it for the better of everyone else. In randomized studies to determine whether or not there is a new and better treatment to breast cancer, women would sign up for the study, not to help themselves, but to help all of the future women that get it (Bach, 2011).
- Therefore, using placebos is ethical because though it might be hurting people now, they are using it to help people in the future.
- Some placebo trials uphold a superior treatment option for patients (Biller-Andorno 6).
- When random placebo-controlled trials were being used for HIV-positive pregnant women in developing countries, men were deprived of available treatment (De Zulua 9). These trials were done more harm to individuals now than it would help individuals in the future because some women were not getting the treatment that they deserved. If there is a treatment that can save a woman and her unborn child’s life, it should be taken advantage of immediately.
- Even if the cheaper treatments that they are testing for are effective, some local governments refuse to use them (De Zulua 9-10).
- In South Africa, a large number of pregnant women are infected with HIV. Pharmaceutical companies are offering treatment for these women at a reasonable cost. However, the government will not implement this treatment due to possible denial that HIV causes AIDS (De Zulua 10).
- The use of placebos often leads to mistrust between a patient and their doctor (Biller-Andorno 6).
- Once a patient discovers that they were given a placebo instead of actual treatment, they feel as though their physician lied to them. Trust is extremely important for patients with terminal illnesses. They are in an extremely vulnerable state and put a lot of faith in the hands of their caregivers. If a particular doctor is willing to lie about the effectiveness of medication, what else are they lying about?
- The use of placebos instead of actual treatment goes against the duty of a physician (De Zulua 11-14).

Analysis
Doctors don’t only use sugar pills to give their patients a placebo effect. Some use drugs for other purposes. If a doctor uses an antibiotic as a placebo, the patient may benefit from its bacteria-destroying abilities but also experience unnecessary negative side effects (Miller, Collica 3). Many people do not appreciate lies. When a doctor gives a patient a placebo, they are not telling them the truth about the medication they are taking. As soon as the patient learns about the placebo, they will feel as though they have been deceived by someone they should trust. When a patient is being treated for a terminal illness, trust is especially vital as these patients are trusting doctors to save their lives (Miller, Collica 3). While it is wrong to lie about the effectiveness of medication, it may be necessary for research. A placebo can only be effective if the patient is unaware that it is a placebo. Placebo effects can help determine whether a new medication actually works or if it works because the patient wants it to work. While the use of placebos may help cure a specific terminal illness, it will often require the doctor to be dishonest with their patient (De Zulua 11-12). It is more important to cure one patient now, or pursue the possibility of curing many in the future?

Conclusion
Doctors do not need to lie to patients in order to discover whether a medication is effective or not. In order for the use of placebos in terminal illnesses to be ethical, patients must give consent. By simply telling research participants that they may get medication or they may get a placebo, researchers can avoid being dishonest without giving too much away (Miller, Collica 6). These placebos should not have any benefit to a patient’s health in order to determine the true effects of the treatment. Placebo trials can only be ethical if they do not deny available treatment to patients. Terminally ill patients have the right to get treatment if it is available to them. When used properly, placebos can be extremely useful in research. While it is the duty of a physician to provide the best possible care to individuals, it is also the duty of researchers to discover technology to help stop these illnesses from growing.

References
Title: Placebo Effects in Terminal Illnesses

**Why are you doing this project?** We are doing this project to further our understanding of what we are learning in MATH 365

**What problem are you trying to solve?** How much more accurate is the least squares method

**What tools or equipment are you using?** MATLAB

**Why is your project worth researching?** Because it can predict how fast UNLV will grow

**What relevance will it have on the community, society, and in your research field?** It will help show that it is beneficial to invest in UNLV because of its growth rate.

**What did you find?** The least squares method is better for predicting short term data but not long term because it grows too fast.

**What is the future for your research project?** Discover a more accurate method for far future enrollments.
Using Placebos in Research Involving Terminal Illnesses
Mark Day and Ryan Hicks

Abstract
Placebos are medical interventions that falsely lead patients to believe that they are receiving treatment and that their condition is being changed, when truly no specific treatment is being administered. Using placebos in research involving terminal illnesses has become debatable. While a placebo could potentially give way to new treatments through testing alongside a specific drug in a clinical trial, the placebo itself may fail and the patients is not cured leading to possible mortality. It has been found that using placebos in research like performing surgeries, can aid in medical or clinical research and could help our society financially by discouraging unnecessary operations. On the other hand, there are also risks involved, including the health risks that may result from the placebo-controlled trial, and most importantly the justification and ethics of using placebos on patients without their consent. While evaluating several studies involving placebo-induced treatments, we have discovered methods in which placebos can help society, although these useful means can also raise issues regarding one’s ethics. Using placebos in treatments will not necessarily treat the illness itself, but they can be beneficial towards research in discovering new treatments for terminal illnesses.

Discussion
Placebos have helped patients make full recoveries from their terminal illness on their own until the patients are told that the treatment they received is not the drug they were told that they were receiving. In one particular case the treatment failed and the patient had a relapse after reading an article about the ineffective drug, and the patient became more sick than before the treatment had taken place. This particular case involved the trial-stage cancer drug called Krebiozen. Krebiozen was a drug that was supposed to be the end to cancer, but this was not the case. The drug never got approved and instead was less effective than the placebo given in the double blind trial. The reason that the Krebiozen placebo helped the patient get better was because of the mental effect that taking a drug to cure them was working and their mind telling their body that this will help it so it did, though it only worked because the patient believed it would. This shows how the mind can effect the body in more ways than one. The placebo itself can be used to help the human but at the same time it can hurt since placebos fool the mind into thinking that the body is receiving treatment and the patient will feel fine but in truth the body isn’t fine at all. The placebo is tricking the brain into easing the pain naturally so that the patient won’t feel it and think that they are cured. Another point is that placebo-controlled trials can hinder the research and treatment of terminal illnesses. For example, one article claims that in certain drug trials, administered by the Food and Drug Administration deny patients with cancer from getting access to potentially lifesaving drugs. One of the ways the FDA prohibits cancer patients from receiving potential life-saving vaccines, is through the increasing requirement for companies to hold randomized and placebo-controlled trials with new cancer treatments. The potential health risks and mainly the ethics of using placebos on patients makes placebo research debatable (FDA Rules: Hinder Cancer Vaccines).

Analysis
The two topics that have been discussed here illustrate the ethics of placebo research in terminal illnesses. In The Placebo Effect the patient had a full recovery from being told that the medicine given to them would help them fully recover. This can be ethical in some ways but it mostly isn’t ethical at all because telling the patient that the placebo will help them get better is false because it truly has no actual medical effects. Their condition goes back to the way it was and will eventually lead to death. The other topic demonstrates how having a placebo can hinder the treatment of terminal illness which in turn can hurt the patient even more than it already has and the patient can no longer be helped and will be forced to wait for the inevitable untreated because of specific guidelines that must be followed.

Conclusion
The use of placebos is mainly just a way of psychological treatment. Placebo treatment does not treat the illness itself. Performing placebo-controlled trials on patients is unethical if they are not informed and have not given their consent. Even if the patient is terminally ill, they should have the right to know exactly how they are being treated.

Bibliography

Fig. 1. Argusen, Peter. The Placebo Effect - The Triumph of Mind over Body.
Title: Using Placebos in Research Involving Terminal Illnesses

Abstract: Placebos are medical interventions that falsely lead patients to believe that they are receiving treatment and that their condition is being changed, when truly no specific treatment is being administered. Using placebos in research involving terminal illnesses has become debatable. While a placebo could potentially give way to new treatments, through testing alongside a specific drug in a clinical trial, the placebo itself may fail and the patient is not cured leading to possible fatality. It has been found that using placebos in research, like performing surgeries, can aid in medical or clinical research and could help our society financially by discouraging unnecessary operations. On the other hand, there are also risks involved, including the health risks that may result from the placebo-controlled trial, and most importantly the justification and ethics of using placebos on patients without their consent. While evaluating several studies involving placebo-induced treatments, we have discovered methods in which placebos can help society; although these helpful means can also raise issues regarding one’s ethics. Using placebos in treatments will not necessarily treat the illness itself, but they can be beneficial towards research in discovering new treatments for terminal illnesses.

Why are you doing this project? Should humans be used as placebos for research.

What problem are you trying to solve? Is it ethical to use placebos in research involving terminal illnesses? Is it ethical to use placebos on patients who believe that they are really being treated for their illness?

What tools or equipment are you using? FDA Article

Why is your project worth researching? Using placebos in treatments will not necessarily treat the illness itself, but they can be beneficial towards research in discovering new treatments for terminal illnesses.

What relevance will it have on the community, society, and in your research field?

What did you find? The use of placebos is mainly just a way of psychological treatment. Placebo treatment does not treat the illness itself. Performing placebo-controlled trials on patients is unethical if they are not informed and have not given their consent. Even if the patient is terminally ill, they should have the right to know exactly how they are being treated.

What is the future for your research project? Furthering our research in this topic.
Title: Dynamic Decision Making and Race Games

Abstract:

Why are you doing this project?

What problem are you trying to solve? (1) How do players generally perform? (2) Does player performance change over time?

What tools or equipment are you using?
Why is your project worth researching?
What relevance will it have on the community, society, and in your research field?
What did you find?
What is the future for your research project?
Title: Naturalized Mexican Immigrants and their Voting Behavior

Abstract: Despite the increasing population size of Latinos (individuals who are of Hispanic descent) in the United States, the number of Latino voters is not increasing. This is based on the ratio of Latino residents and those who are registered to vote. Between 2000 and 2004, Latinos accounted for 50 percent of the population growth; however, they represented only 24 percent of new voters. When compared to white and black voters, only 59 percent of Latinos were eligible to vote in 2004 compared to the 97 percent of white eligible voters and 94 percent of black eligible voters. Even though Latinos rose to 41.3 million in 2004, Mexicans represented the largest documented immigrant group in the United States, but they also represented the largest group with the lowest voter turnout rates. Thus, it is important to understand the reasons why Mexican immigrants who have naturalized decide to vote.

Why are you doing this project? Explain determinants of voting with a main focus on the effects of membership in Mexican hometown associations.

What problem are you trying to solve? Does membership make it more or less likely that Mexican immigrants who have naturalized will vote?

What tools or equipment are you using? The Latino National Survey (LNS) contains 8,634 un-weighted and completed interviews of self-identified Latino/Hispanic residents of the United States. Interviewing began on November 17, 2005, and continued through August 4, 2006. The survey covered several cities and states with a high number in Latino population. The sample was stratified by geographic designation, meaning that each state sample was a valid, stand-alone representation of that state's Latino population. The survey asked questions regarding their demographics.

Why is your project worth researching? This project will attempt to reconcile the contradictions of Mexican immigrants and voting.

What relevance will it have on the community, society, and in your research field? This shows that membership in hometown associations is a primary determinant in voting behavior among Mexican immigrants who have naturalized.

What did you find? The logistic regression analysis shows that having an interest in politics has a positive effect on voting for Mexican immigrants who have naturalized.

What is the future for your research project? Further research is necessary to explain this effect due to the contradicting research that exists on the impacts of hometown association membership.
SHOULD DESIGNER BABIES BE REGULATED?

By: Alec Madriga and Natasha Bates

Abstract

Designer babies have been frequently used to help present genetic defect of offspring. The two main procedures that can help process offspring of having a genetic defect is by IVF, Preimplantation Genetic Diagnosis. It is a topic currently being debated ethically on whether it is safe to design a baby and how far people would go to design a baby before it gets out of hand. Two sides can be approached to this topic. Should designer babies be regulated or should it not be regulated? A concern is that people will be playing God by designing babies which will lead to the creation of a super race. There are 7.3 million women (between ages 15-44) in the U.S. that are infertile. There are 2.1 million men and women in the U.S. who cannot conceive a baby (within 12 consecutive months).

Introduction

Designer babies is a term coined to describe certain breeds in the field of assisted human reproduction. Its purpose and main goal is to give parents more control over their offspring’s genetic outcome before they ever even exist. Designer babies can be related to the popular dystopian novel, A Brave New World. A Brave New World is a novel by Aldous Huxley (published in 1932) that depicts a society 532 years from now in which they create humans in bottles and these humans live predetermined lives. Humans are created by The Director of Hatcheries and Conditioning and by the Biochemical’s. Process. In this process, one egg is divided into a bud and every bud grows into one embryo, which then grows into a full-sized adult. 96 babies come from one embryo. “During the gestation period the embryos travel in bottles along a conveyor belt through a factory like building, and are conditioned to belong to one of five casts: Alpha, Beta, Gamma, Delta, or Epilope.” (Speckshes). This is called “Designer babies” in our world today, in which we use processes similar to the Bokanowski’s Process such as In Vitro Fertilization and PGD and the Director of Hatcheries and Conditioning are the doctors. This film is based on the circumstances when the first “test tube baby”, Louise Brown, was born on July 25, 1978 (Blair 12). She grew up to be as healthy as any normal baby could be. However, the procedures of designing babies we know now are not limited to just producing a healthy infant anymore. Embryos can be chosen so that the parents can have their offspring fit the preference they had in mind. This, of course, provokes ethical questions such as the risk of the idea of having designer babies will return and be open for the public to explore. These procedures are not available just in the United States, but as well as other countries such as the United Kingdom and Canada. They have had their own experiences with these treatments (Petersen 24). Designer babies are inevitable, sooner or later its regulation would be a topic of importance.

In Vitro Fertilization

Louise Brown, the first “test tube baby,” was conceived with the help of a process known as in vitro fertilization (IVF). The process involves taking an egg cell(s) from the woman’s ovaries, exposing it to sperm outside of the body, allowing fertilization, and putting a fertilized egg(s) back into the woman’s uterus. It is a difficult process that requires money and patience because of its low rate of success. There are many risk to IVF. By the end of the experiment, 150 of 311 patients who underwent in vitro fertilization had successful deliveries (Lovel). There were also 49 patients who were in the middle of pregnancy at this time. Research shows that, in average, the probability of a successful treatment decreases as the woman’s age increases (American Pregnancy Association). Despite the low rate of success and the burden it places on the mother, it’s still a popular choice. One of the most well known success stories of IVF involves a woman named Nadya Suleman. Though IVF, she was able to give birth to octuplets. Suleman’s status as a single, unemployed woman presents difficulties when it comes to caring for eight offspring (Scientific American). Legislators responded to this by taking action at a state level, but the same could not be said for the federal administration, which could establish some kind of regulation through the health care reform (Scientific American). IVF is regulated in other countries. In vitro fertilization is one of the few easier infertile couples could give birth to a child, but it is not the only way. Two other well known procedures are fertility medications and artificial insemination. Variations of IVF include gamete intracytoplasmic injection (GIFT) and zygote intracytoplasmic injection (ZIPT; American Pregnancy Association). In vitro fertilization because the foundation which preimplantation genetic diagnosis was added on to.

Preimplantation Genetic Diagnosis

PGD, Preimplantation Genetic Diagnosis, is a reproductive procedure that prevents birth defects and avails genetic diagnosis or termination of pregnancy. It was discovered by Edwards and Edwards in 1966. They didn’t have the success until 1986. PGD can be used to screen for inherited diseases and chromosomal abnormalities. It can help prevent diseases such as Tay–Sachs disease, cystic fibrosis, muscular dystrophy, sickle-cell disease, and thalassemia syndromes. It can also be used to help mice with Duchenne muscular dystrophy, fragile X-syndrome and Huntington’s disease.

Why should Designer Babies be regulated?

"One of the main reasons why regulation has been proposed is due to the threat of assisted human reproduction in the form of eugenics. There is to be some kind of authority that can establish limits. • With a high cost, procedures such as in vitro fertilization and preimplantation genetic diagnosis can only be afforded by those of the higher class. There will be a great imbalance in society if being wealthier began to mean being healthier and superior in genetic structure. • Like Mr. Salem’s case, patients who don’t have a considerable amount of income could not afford just enough money for the treatments. If their treatments are successful, they will only have enough money to support their newborn. It will not only be detrimental to the fact that these patients are in, but it also takes away from the community that will support them. • Others would argue that by choosing which embryos should develop and eliminating the rest, humans would be doing what the nature of life is supposed to be doing. This is more of an argument that helps for lines to be drawn between the advancement of technology and the role of nature. • If the future were a widespread use of IVF and PGD, there will still be people who will choose or have no choice but to give birth naturally without any genetic enhancements. In a world with healthier and much fit humans, normal babies will no longer be born."

Why shouldn’t Designer Babies be regulated?

"Even though the pro-choice movement has different goals to those fighting against designer baby regulation, they still share the two most powerful things that support their cause. Being Crazy and Greedy. Designer babies should not be controlled by any kind of authority because it is the women’s choice to undergo the procedures and that hardly has anything to do with anyone else. • PGD could help families who have had a long history of inherited diseases. With the diseased embryos eliminated, these families would no longer have to suffer the physical, emotional, and financial strain brought on by these ailments. • Without any interference from outside organizations, researchers could study the human genetic makeup more efficiently and at a faster pace. The more scientists find out about each gene and which changes have effects on them, the better they can prevent diseases from occurring."

It is understood that many couples do not wish to conceive a genetically defective child due to the hardships that come with having a genetically defective child. Designing a baby to help prevent birth defects is an ethically just reason to do so. Even though IVF and PGD do not guarantee healthy babies, the rapid growth of technology in this field of study, can cause many couples to go to the extreme to conceive a perfect child. This can be proven to be an unethical reason to design a baby. If your child is already healthy why should you perfect them even more? There have been laws made in the UK, a popular country that uses both IVF and PGD regularly, which only give licenses for using PGD for specific diseases such as, cystic fibrosis, hemophilia, beta-thalassemia, sickle-cell disease, Duchenne muscular dystrophy, fragile X-syndrome, and Huntington’s disease.

Bibliography


Title: Should Designer Babies be Regulated?

Abstract: Designer babies have been frequently used to help prevent genetic defect of offspring. The two main procedures that can help prevent offspring of having a genetic defect is by IVF, In Vitro Fertilization, or PGD, Preimplantation Genetic Disorder. It is a topic currently being debated ethically on whether it is okay to design a baby and how far people may take the procedures to design a baby before it gets out of hand. Two sides can be approached to this topic: Should designer babies be regulated or should it not be regulated? A concern that is plaguing the minds of many people is whether designing babies will lead to the creation of a super race. There are 7.3 million women (between ages 15-44) in the U.S. that are infertile. There are 2.1 million men and women in the U.S. who cannot conceive a baby (within 12 consecutive months).

Why are you doing this project?
What problem are you trying to solve?
What tools or equipment are you using?
Why is your project worth researching?
What relevance will it have on the community, society, and in your research field?
What did you find?
What is the future for your research project?
Intelligent Design and its Place in the Classroom

By Victor Trinh & Micky Mezgebu

ABSTRACT

Since the dawn of time, there has been controversy surrounding the question of origin of man. This debate has poured into the public school forum, as well making the curriculum more difficult for teachers. Creationism, as we all are aware of, is the dominant belief held by the public school, as the other hand, is the competing theory of the mechanisms of creation. The most dispute among the scientific and religious field is that further complicated the question of intelligent design being integrated into the curriculum of public schools is addressed here. With the aid of research and personal experience, this paper attempts to give both sides of the argument, along with analysing the components of each theory. Intelligent design advocates are for the idea of accommodating what they have coined "intelligent design" into the classrooms of American schools. The opponents of intelligent design (evolution supporters): However, claim that this is preposterous because intelligent design is not even considered a real science. Science is based on the fact that hypotheses can be tested empirically and proven a number of times before they become theories. According to evolution proponents, intelligent design does not complete such task. Intelligent design supporters believe that even if evolution explained origin of man, there would have to be a creator since humans are complex beings. This and other questions will be covered throughout this paper.

ETHICAL QUESTION

Should intelligent design be taught alongside evolution in public schools?

PROS

Intelligent design declares that the sheer complexity of nature is evidence of a Designer, the creator of all life on earth. Professor Michael Behe defines this through the phrase "irreducible complexity" (Ayala 44). Advocates of ID believe that it should be taught alongside evolution because students would be given a broader perspective in science. They claim evolution as only a theory with many holes (such as missing links) that can only be explained through intelligent design. Another argument in favor of intelligent design is openness, often seen through multiple replications of experiments and the crossroads of theories. According to ID supporters the idea has as much right as any other theory to be discussed and taught in schools (National Academy of Sciences, Institute of Medicine). It provides an alternative to the predominant theory of evolution. In the apparent controversy of science and religion, intelligent design is often espoused by supernaturalist creations who are against the naturalistic, nonreligious proponents of evolution (Godfrey 49).

CONS

On the other side, scientists urge the importance of evolution to the field of biology, as well as science as a whole. They also state that evolution is not "just a theory," but rather that ID assumes a misconception that a theory is simply an educated guess, when clearly evolution should not be seen as that (Smith 37). Evolution has gained much of its legitimacy from strict experimentation. An expansive Tree of Life and molecular biology provide much evidence to how evolution confirms much of the processes and observations made by scientists. According to proponents of evolution, these foundations are what separate it from intelligent design, and therefore the concept of ID should have no right to be taught in public schools because it lacks the evidence. In addition, people against intelligent design claim that the concept is merely a "creationist alias," religion pretending to be science (Godfrey 49).

CONCLUSION

While evolution may be seen as crucial to the science curriculum, it would be for the best not to have intelligent design replace, or even be taught alongside, evolution. First, ID is not substantiated by scientific evidence and likewise its only evidence is taken from lack thereof (National Academy of Sciences, Institute of Medicine 43). As fundamental evolution is to a student's understanding of science and biology, teaching ideas of intelligent design and creationism would more likely confuse students rather than give them a broader perspective in learning. Evolution is widely accepted and substantiated by evidence, while intelligent design stands in open contradiction of it. As philosopher Thaddeus says, "Nothing in biology makes sense except in the light of evolution" (Godfrey 27). Students that are taught evolution would have a better grasp of science and biology, while possibly forming a closer relationship with their environment. Thus, ID should not be taught in public schools because it is not a genuine form of science. It undermines the process of teaching evolution in the curriculum. Intelligent design is the result of the complex relationship between science and religion, and while it is popularly seen to be a controversial and conflicted black-and-white debate, they are simply two different schools of thought. Science and religion are not to be in constant conflict, as said, "needlessly placing them in opposition reduces the potential of both to contribute to a better future" (National Academy of Sciences Institute of Medicine 47). This conflict is prevalent, yet is an oversimplification of the history between science and religion (Ferringer 10). Today, the controversy of science and religion is often seen through the media. In reality, there are disagreements within both science and religion, and many examples of science and religion in harmony (Ferringer 10). Many devout Christians believe that evolution was a mechanism created by God, contradicting the popular view that evolutionists are generally atheists. Within their own scopes, science and religion have the potential to benefit the lives of many people by shining understanding and meaning into our lives (Ayala 90).

WORKS CITED


Title: Intelligent Design and its Place in the Classroom

Abstract: Creationism, is the dominant belief held by the public. Evolution, on the other hand, is the competing theory of the mechanisms of creation. The recent dispute among the scientific and political field that has furthermore complicated the question of intelligent design being integrated into the curriculum of public schools is addressed here. We attempt to give both sides of the argument, along with analyzing the components of each theory. Intelligent design advocates are for the idea of accommodating what they have coined “intelligent design” into the classrooms of American schools. The opponents of intelligent design (evolution supporters); however, claim that this is preposterous because intelligent design is not even considered a real science. Science is based on the fact that hypotheses can be tested empirically and proven a number of times before they become theories. According to evolution proponents, intelligent design does not complete such task. Intelligent design supporters believe that even if evolution explained creation of man, there would have to be a creator since humans are complex beings. This and other questions will be covered throughout the poster.

Why are you doing this project? We completed this project in order to become more familiar with the place of religion in the classroom. The connection between science and religion has always been of interest to us, and we wanted to explore its limits in the public sphere.

What problem are you trying to solve? In the poster, we attempted to answer the question of whether or not intelligent design should be integrated into the public school curriculum along with evolution.

What tools or equipment are you using? Microsoft Powerpoint to complete our poster.

Why is your project worth researching? Religion and science are always going to be conflicting, and it is better to be aware of both points of view before having an opinion. This can be done by researching. Not only will it make one aware of other views but provide insight into current events concerning the topic, as well.

What relevance will it have on the community, society, and in your research field? It gives the ability to draw a public course of action. Conflicts can bring interest, and in becoming more aware of this topic, people can become entrenched in finding a solution or a middle ground to the question of religion v. science.

What did you find? We found that there is a middle ground to reach in the argument between evolution supporters and intelligent design advocates. It is acceptable to believe the mechanisms of evolution are what make life possible on earth, along with the help of a creator.

What is the future for your research project? We have not prepared in thinking about that yet.
Title: What should be taught in sex education?

Abstract: There has been an ongoing controversy as to what topics of sex education should be integrated into normal school curriculum. Many argue that only abstinence should be taught while others believe in a more comprehensive course. Surveys and studies show that opinions differ from specific areas around the United States; parents have a strong outlook on what their children should learn; teachers have different ideas about what they think should be taught. However, surveys have shown no correlation between abstinence-only programs and the delay of sexual intercourse throughout adolescent life (Stover 45). Informing students of all the consequences such as contracting an STD or the chances of becoming pregnant is important because for the students who have already engaged in sex, it teaches them to be smart and safe, or maybe even deter people who have not had intercourse from even wanting to do it because they learned about the costs. In conclusion, a complete sex education includes both the comprehensive material (such as contraceptives, pregnancy, sexually transmitted diseases) and abstinence.

Why are you doing this project? We're doing this project to learn how to conduct a research, make use of resources, and creating a scientific poster.

What problem are you trying to solve? What should be taught in sex education?

What tools or equipment are you using? library resources (online)

Why is your project worth researching? It is worth researching because it is a major debate. This topic can influence the number of future pregnancies and number of STDs.

What relevance will it have on the community, society, and in your research field? It will make the community a safer and healthier place.

What did you find? We found that along with teaching abstinence, STDs, contraceptives, and pregnancies should be taught as well.

What is the future for your research project? Possibly future surveys taken to see the effectiveness of an abstinence-plus curriculum vs. an abstinence-only program.
Should Intelligent Design be taught alongside Evolution in public schools?  
Chelsea Opendedy and Christina James

Introduction

This dissertation examines the role of Evolution and Intelligent Design (ID) within educational school systems. Evolution is the theory of life through a scientific method and ID is the creation of life through a religious perspective.

The overall purpose of this project is to discuss how the teaching of ID in schools alongside evolution in science classes. The first phase of this project consists of research on the positive aspects of teaching ID within the school system and how it can be beneficial to students. The second part of this project involves the negative aspects of teaching ID in schools alongside evolution within science classes.

Evolution and Intelligent Design Defined

Evolution is the creation of life through a scientific method.

Intelligent Design is the belief that creation of life was governed by a higher being, resulting in a religious belief.

Cons of Intelligent Design

For periods of time, there has been much debate between the teachings of Intelligent Design (ID) and Evolution. Withholding the teachings of Intelligent Design in science classes results in a more structured and ordered approach. These macro evolution of life through a scientific method is the best way to study the development of life on Earth.

Proponents of teaching intelligent design believe that children should be taught the controversy as they are well grounded in their opinions, and so they may express their own views as to what is correct. They believe that evolution and intelligent design should be taught at equal length and parallel attention. They also wish evolution to be "taught as theory whose validity is questioned." (Pinker 1) Intelligent Design advocates strongly believe that "there is a gap in evolutionary theory and explain that life's complexity is evidence of a guiding hand." (Irwin 1) They believe that the earth and all life happened by imputer. One specific example of this would be the "Raggedy mechanisms of bacteria is unexplained, cellular has an evolutionary predecessor and so must have been designed." (Stevens and Tulloch 2) This means that no scientific fact or evidence can show any earlier version of the natural evolution of this phenomenon, and therefore cannot prove it did evolve at all. Due to the gap in the field evolved and the problem of the possibility of life's complexity, Intelligent Design should be taught either both or neither.

To demonstrate the implications of intelligent design teaching in schools, we may examine the Greensburg School District in western Wisconsin and the entire state of Ohio. The Greensburg school district recently mandated that "alternative theories of evolution be taught" (Pinker 1). The state school board of Ohio recognizes intelligent design to be taught along side evolution. In this, two examples set the precedent of teaching both theories equal balanceability. This demonstrates that these controversial views can be taught side by side without major issues in the schooling system. This successfully strengthens the intelligent design believers' argument to implement both teachings in schools nationwide. However, even with the good that both ideas can be taught together, the controversy will forever continue.

Pros of Intelligent Design

Programs of teaching intelligent design believe that children should be taught the controversy so that they are well grounded in their opinions, and so they may express their own views as to what is correct. They believe that evolution and intelligent design should be taught at equal length and parallel attention. They also wish evolution to be "taught as theory whose validity is questioned." (Pinker 1) Intelligent Design advocates strongly believe that "there is a gap in evolutionary theory and explain that life's complexity is evidence of a guiding hand." (Irwin 1) They believe that the earth and all life happened by imputer. One specific example of this would be the "Raggedy mechanisms of bacteria is unexplained, cellular has an evolutionary predecessor and so must have been designed." (Stevens and Tulloch 2) This means that no scientific fact or evidence can show any earlier version of the natural evolution of this phenomenon, and therefore cannot prove it did evolve at all. Due to the gap in the field evolved and the problem of the possibility of life's complexity, Intelligent Design should be taught either both or neither. As a result, they are not merely taught a theory that is not strongly backed by current evidence.

To demonstrate the implications of intelligent design teaching in schools, we may examine the Greensburg School District in western Wisconsin and the entire state of Ohio. The Greensburg school district recently mandated that "alternative theories of evolution be taught" (Pinker 1). The state school board of Ohio recognizes intelligent design to be taught along side evolution. In this, two examples set the precedent of teaching both theories equal balanceability. This demonstrates that these controversial views can be taught side by side without major issues in the schooling system. This successfully strengthens the intelligent design believers' argument to implement both teachings in schools nationwide. However, even with the good that both ideas can be taught together, the controversy will forever continue.

Conclusion

In conclusion, Intelligent Design should be taught alongside Evolution and given equal attention. Even though Intelligent Design cannot be proven, it provides another explanation of how the universe came about. Evolution still cannot fully explain facts with facts and figures below. So far, both are probable ways and should be taught so students can understand the full controversy and have the right to choose which theory they want to believe in.

References

Title: The roles of Evolution vs Intelligent Design (ID) within educational school systems

Abstract: Evolution being the creation of life through a scientific method and ID being the creation of life through a religious point of view. The overall proposing question to be discussed throughout this project is whether or not ID should be taught in schools alongside Evolution within science classes. The first phase of this project involves research of the positive teachings of ID within the school system and how it can be beneficial to students. The second part of this project involves the negative aspects of educating students the proposed theory of ID. The final phase revolves around the favored conclusion to educate students of both teachings, Evolution and ID, within the education system.

Why are you doing this project? It was an assignment for SCI 101.

What problem are you trying to solve? Should Intelligent Design be taught alongside Evolution in public school?

What tools or equipment are you using? Poster, research, computers

Why is your project worth researching? It is a major controversy between the science and religious fields.

What relevance will it have on the community, society, and in your research field? It could change the public school education.

What did you find? Intelligent Design should be taught in public schools.

What is the future for your research project? No further research
Maeleen Witte

Email: wittem@unlv.nevada.edu
Mentor/Advisor: Alicia Simon
Educational Institute of Project: UNLV
Department: SCI 101
Research Site: UNLV

Title: Ethics of Paid Gamete Donation

Abstract: This presentation shows the standing ethical questions in the aspect of gamete donation, analyzes them, and contrasts them. This article primarily focuses on whether it is ethical to pay a donor for their gametes (sperm or egg). Within this presentation, we question whether donation should be purely altruistic and not motivated by incentives.
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Location of High School: Henderson, NV
Mentor/Advisor: Alicia Simon
Educational Institute of Project: UNLV
Department: Biology
Research Site: Lied Library

Title: Ethics behind Stem Cell Research

Abstract: Advancement in embryonic stem cell research can cure the world of sicknesses in ways that were only imagined. Out of all the stem cells, embryonic stem cells have the capabilities to develop into any cell and tissue type. Embryonic stem cell research is controversial due to how these cells are harvested. In harvesting these cells, the embryos are destroyed; further halting any development of a human being. We began our research by asking why this topic is an ethical issue. Using various media resources, we took key points from both sides and also looked into the latest advancements that may eliminate the need to continue developmental research in embryonic stem cells. Keywords: stem, cells, controversy, research

Why are you doing this project? We are interested in the topic that we chose. The research may be able to cure sickness in the future. If more people do research on this topic, then more people will be aware of stem cell research.

What problem are you trying to solve? There are a lot of questions surrounding this topic. Even though there has been a lot of media attention, no one really knows how they harvest stem cells. We just wanted to further educate our classmates as well as the audience at the symposium.

What tools or equipment are you using? We used our libraries search engines to find our sources.

Why is your project worth researching? The possibilities behind stem cells are endless; however due to how controversial it is, there is not a lot of funding towards it. This also includes finding close alternatives to embryonic stem cells.

What relevance will it have on the community, society, and in your research field? Since my partner and I are going into medicine and the health field, we are both very interested in medical breakthroughs that can help people. If we could use embryonic stem cells to fight various illnesses, our whole community will benefit from this development.

What did you find? We found information on how exactly these cells are harvested, what they are, and key points from both arguments. We also found possible alternatives that have been developed within the last couple of years.

What is the future for your research project? There is still debate concerning ethics and morals pertaining to using embryos. Since here has been a recent lift of the federal funding ban concerning this type of research, there might be a huge change in the near future.
EXPLORATORY STUDIES INTO POSSIBLE USES OF CALCAREOUS DOLOSTONE ON THE SHIWWITS PLATEAU

Jennifer Durk, Lauren W. Falvey and Karen G. Harry
Department of Anthropology, University of Nevada Las Vegas

CLAY ADDITIVE

The Shiwits Plateau clays are smectite clays, capable of adsorbing large quantities of water. This property makes the clays overly plastic, difficult to work, and subject to cracking while drying. In other areas of the world, potters have been known to add calcium to such overly plastic clays to improve their properties for ceramic manufacture. Experiments were undertaken to investigate whether powdered calcareous dolostone added to the Shiwits Plateau clays might function in a similar manner.

To investigate this issue, ground clays were mixed with dolostone and sand temper. Four sets of pastes were produced: (1) a set containing no temper and no dolostone; (2) a set containing dolostone but no temper; (3) a set containing temper but no dolostone; and (4) a set containing both temper and dolostone. The clays were made into tiles, which were fired at the center to form vertical walls, and fired to a temperature of 700°C.

CLAY ADDITIVE RESULTS

The pastes containing calcareous dolostone were less sticky compared to those without the dolostone. However, this effect was slight.

All test tiles formed cracks during drying and firing. However, this effect was most pronounced for tiles lacking both dolostone and temper. All six of these tiles broke in half during the firing process, compared to only two of the other tiles.

Our data suggest that the addition of powdered dolostone does not reduce the plasticity of Shiwits Plateau clays, though in our experiments the results were minor. We are currently conducting additional studies to determine whether this effect is magnified when larger quantities of dolostone are used. Chemical and petrographic studies are also underway to determine whether calcareous dolostone was added to pottery made on the Shiwits Plateau.

BACKGROUND

Excavations on the Shiwits Plateau suggest that calcareous dolostone was regularly procured and used by the inhabitants of the Mt. Dellenbaugh region. Calcareous dolostone, a soft, powdery calcareous carbonate, is not local to the Mt. Dellenbaugh area, but was presumably procured from somewhere beneath the rim of the Grand Canyon. In this poster, we present the results of exploratory experiments into possible uses of this resource. Specifically, we evaluate the performance characteristics of powdered dolostone with reference to two activities: ceramic manufacture and pigment production.

In 2006, the University of Nevada Las Vegas initiated excavations at Lava Ridge Ruin, a sixteen-room pueblo dating to the middle 12th century. Despite the fact that the site was located on a volcanic substrate, abundant fragments of white, chalky sedimentary stones littered the site. X-ray diffraction analysis of the material indicates that the rock is a calcareous dolostone, comprised primarily of dolomite and calcite.

Often, these stones – which sometimes, though not always, exhibited wear on their edges – were found on room floors or in niches in room walls. These recovery contexts suggest that this non-local resource was important to the inhabitants of Lava Ridge Ruin. However, why these rocks were procured and how they might have been used is unknown.

Experiments were conducted to explore two possible functions for the calcareous dolostone. These include use (1) as a clay additive, and (2) as a pigment.

PIGMENT EXPERIMENTS

Ethnographic evidence suggests that Puebloan people have a variety of uses for white pigment, including paint for pictographs, body decoration, and wall murals. To investigate whether the dolostone might have been used for similar purposes, we conducted experiments to test whether powdered dolostone can function as a base for paint, and how well the resulting paint adheres to other materials.

To conduct the experiments, we ground the calcareous dolostone into a fine powder using sandstone and sandstone tools, two materials found at Lava Ridge Ruin. We then mixed the powder into paint using a variety of different binding agents. The binding agents tested included (1) water, (2) saliva, (3) commercial agar jelly, and (4) egg whites. The resulting mixtures were then painted onto a tabular rock and allowed to dry.

PIGMENT RESULTS

Our results indicate that calcareous dolostone can function as a base for paint. However, they also show that the rock type used to process the pigment and the binding agent selected influences the paint properties.

Pigment processed using sandstone contained fewer impurities and resulted in lighter colored paint than pigment processed with saliva. The goal was to produce a white paint; sandstone would have been preferable to saliva.

Of the binding agents tested, egg whites and a combination of water and agar agar adhered best to the stone, while pigments mixed with saliva adhered poorly. However, the water and saliva binders produced whiter paints when compared to the egg white and agar mixes, which produced an off-white color.

ACKNOWLEDGEMENTS

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Stephanie Wilson and Angela Platterton
Title: Exploratory Studies into Possible Uses of Calcareous Dolostone on the Shivwits Plateau

Abstract: Excavations at pueblo habitation sites on the Shivwits Plateau suggest that calcareous dolostone was regularly procured and used by the inhabitants of the Mt. Dellenbaugh region. Calcareous dolostone, a soft, powdery calcium carbonate, is not local to these sites but was presumably procured from somewhere beneath the rim of the Grand Canyon. In this poster, we present the results of exploratory experiments into possible uses of this resource. Specifically, we evaluate the performance characteristics of powdered dolostone with reference to two activities: pigment production and ceramic manufacture.

Why are you doing this project? I am doing this project in order to find the possible uses of calcareous dolostone found on the Shivwits Plateau.

What problem are you trying to solve? Calcareous dolostone has been discovered at various sites on the Shivwits Plateau. Due to wear patterns observed on the dolostone’s surface it appears that they are may have been utilized as some sort of resource. We are trying to find what use or uses the dolostone could have provided. The uses of the stone we studied were its performance characteristics as a pigment and its possible use in the manufacturing of ceramics.

What tools or equipment are you using? Tools utilized during experimentation were calcareous dolostone and sandstone along with a pestle and mortar in order to grind and powder the dolostone. Clay from the Shivwits Plateau area was also utilized in order to assist with making ceramic tiles. Commercial agave juice, water, saliva, and eggs were used in the process of producing pigments as well.

Why is your project worth researching? This project is worth researching because it helps provide insight on how prehistoric populations on the Shivwits Plateau survived in such a harsh, desolate environment.

What relevance will it have on the community, society, and in your research field? By researching the possible uses of calcareous dolostone we can hope to learn more about the history that occurred on the Mt. Dellenbaugh region and help contribute to the studies of ceramic and pigment production.

What did you find? Although the studies of calcareous dolostone used as a clay additive were inconclusive, its use in pigment production proved possible, with water and saliva binders producing whiter paint.

What is the future for your research project? Other studies are underway including the use of calcareous dolostone in architectural mortar and plaster.
Relationship between Perceived and Actual Quality of Data Checking
Hunter Speich, Sophia E. Karas, Dan N. Erota, Kelly E. Grob, & Kimberly A. Barchard
University of Nevada, Las Vegas

Abstract

Data quality is critical to reaching correct research conclusions. Previous research has demonstrated that some methods of data checking are better than others, but not all researchers use the best methods. The purpose of this study was to examine the relationship between perceived data quality and actual data quality. A total of 29 participants completed this study. Participants checked that letters and numbers had been entered correctly into the computer using one of three randomly assigned data checking methods. Afterwards, they rated the quality of their data checking method. The sample correlations between perceived and actual data quality were small to moderate and confidence intervals for the population correlations did not include high values. We conclude that the relationship between internal and perceived data quality is not high. Researchers should not trust their subjective evaluations of perceived data checking effectiveness. They need empirical evidence of the quality of their data checking.

Introduction

Data entry accuracy is extremely important to researchers who desire exact results. This study attempts to reveal research to which subjects’ perceptions of the quality of their data checking methods are flawed; in other words, the discrepancy between perceived data checking quality and actual data checking quality. It may be the case that subjects rely on faulty versions of data checking methods, mistakenly believing them to be accurate.

Accurate study results depend heavily on correcting mistakes in the relevant data entry. It is hard to overestimate the destructive impact a single entry error can have on study outcomes. For instance, significant 

\[ t \text{-test results can be misinterpreted to be non-significant, or a moderate correlation might be misinterpreted for zero (Barchard, Pace & Burns, 2008). Thus, statistical results might be rendered invalid. Such problems, however, are easily preventable with the use of better data checking methods.} \]

The comparison of different data checking methods consistently proves Double Entry to be more reliable than both Single Check and Visual Checking (Reynolds-Haertle & McBratry 1992). Though the Read Aeid method was more time-consuming than Double Entry, Double Entry was demonstrated to have a much higher error detection rate. And yet, despite recognizing the importance of data quality, researchers nonetheless persist in using data checking methods inferior to Double Entry. Perhaps researchers do not use double entry because they mistakenly believe their method to be very accurate. If researchers are good judges of accuracy, their perceptions are all right. However, if actual accuracy is not highly related to perceived accuracy, researchers may be using ineffective methods of data checking. The purpose of this study is to examine the relationship between perceived data quality and actual data quality.

Method

Participants

A total of 29 (14 male, 15 female) undergraduate students participated in this study to receive course credit. Their ages ranged from 18 to 39 years (mean = 22.3, SD 6.0). The participants identified themselves as 13.8% African American, 27.6% Asian, 24.1% Caucasian, 24.1% Hispanic, 6.9% Native Islander, and 3.4% Other.

Measures

Perceived quality was measured with two items. Participants were asked to rate the data checking method they used in terms of its accuracy and reliability. After the participants completed the data entry, filled out a questionnaire.

Actual quality was measured using a five-point scale, where Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5. Higher scores indicate that subjects have greater confidence in the data checking method’s reliability and accuracy. Actual accuracy was measured as the number of correct entries in the database after data checking was complete. Perceived accuracy was measured using the same. Participants were asked to rate the data checking method they used in terms of its accuracy and reliability.

Procedures

This study was conducted as an in-person study that participants could complete at a scheduled time with an administrator. Participants completed the study in person during supervised 90-minute sessions. Before starting the data checking, participants watched a video on Excel to ensure they knew how to use the program. Then participants were randomly assigned one of these data-checking methods: Double Entry, Visual Checking, or Read Aeid to check data in Excel. The data checked included numbers and words. The data checking was done in two groups, once for practice and once to be scored. When using Double Entry the participants compared the data on the screen to data on a piece of paper. Once the data was checked, they would type in the data on a different paper and Excel would run a comparison of the original data and the newly typed data to check for accuracy. The data comparison is used to catch missed errors that the computer can go back and correct. With Visual Checking the participant read over the data once and visually compared it with data on a sheet of paper to make sure it was correct. With Read Aeid the administrator read the data out loud to the participant who then read the data on a monitor. The participant would then have had the reader read the data if it seemed incorrect and then change the mistakes they caught. After all of the data checking was complete, the participants then completed a survey based on a five-point scale.

Analysis

We calculated two correlations: the correlation between perceived reliability and actual accuracy and the correlation between perceived accuracy and actual accuracy.

Results

The correlation between perceived reliability and actual accuracy was moderate and approached significance (r(27) = .49, p = .053). A 95% confidence interval for the population correlation is given by the interval [.15, .72]. The correlation between perceived accuracy and actual accuracy was very small and non-significant (r(27) = .21, p = .350) and a 95% confidence interval for the population correlation is given by the interval [-.26, .46]. Thus, neither of these correlations are strong.

Discussion

The purpose of this study was to examine the relationship between perceived and actual data quality. Although one of the two correlations was statistically significant, neither correlation was large. Our research had a 95% confidence interval for the population correlations showed that there is no evidence that the population correlations are large. This suggests that people are poor judges of the quality of the data checking methods they use. We conclude that subjective judgments of data quality cannot be used as a substitute for an empirical evidence of the quality of a data checking method. Efficient data entry is essential to facilitating the integration of data. It allows us to store, process, and share information rapidly with others around the world. One may question, however, the quality of the data presented. Which, out of “Double Entry”, “Visual Checking”, and “Read Aeid”, is the most precise in regards to accuracy and reliability? Double Entry has been found to be the most accurate method of data checking. Johnson, H.C., et al., (2010) though its tendency to reveal human error, in contrast to “Visual Checking” and “Read Aeid”, makes it seem flawed, it is a prudent form of data entry. Therefore, we hypothesized that the Double Entry method would result in fewer errors, but the participants would also rate it lower for accuracy and quality.

Due to lack of participants, the study did not produce significant data to prove or disprove our hypothesis. Had there been enough participants to allow for sufficient data, the study may have revealed differences in quality among the various data entry methods. The data at present shows the correlation between actual and perceived data quality is not strong. Therefore, researchers should not trust their subjective judgments on the effectiveness of their data checking methods. They need empirical evidence of the quality of their data checking.

Future research will use larger sample sizes and will likely find significant results based on the three different data checking methods. This future research should determine if these results of accuracy, reliability, and perceived quality hold true for all three methods. Leading to comparisons and discoveries of new methods of data entry or the improvement of existing methods.

References


Title: Relationship between Perceived and Actual Quality of Data Checking

Abstract: Data quality is critical to reaching correct research conclusions. Researchers attempt to ensure that they have accurate data by checking the data after it has been entered. Previous research has demonstrated that some methods of data checking are better than others, but not all researchers use the best methods. Perhaps researchers continue to use less optimal data checking methods because they mistakenly believe that they are highly accurate. The purpose of this study was to examine the relationship between perceived data quality and actual data quality. A total of 29 participants completed this study. Participants checked that letters and numbers had been entered correctly into the computer using one of three randomly assigned data checking methods. Afterwards, they rated the quality of their data checking method. The sample correlations between perceived and actual data quality were small to moderate and confidence intervals for the population correlations did not include high values. We conclude that the relationship between actual and perceived data quality is not high.

Why are you doing this project? The purpose of this study was to examine the relationship between perceived data quality and actual data quality. We felt that it would be interesting to see if researchers perceive their data entry method to be more accurate than it actually is.

What problem are you trying to solve? To see if researchers perceive their data entry method to be more accurate than it actually is.

What tools or equipment are you using? Online research software.

Why is your project worth researching? If researchers are using inefficient methods of entering data, this study could give reason to abandon those methods for more efficient means of entering data.

What relevance will it have on the community, society, and in your research field? The scientific world revolves around empirical data. That data is generally written out and processed later through data entry. The process can take a long time and errors are sometimes overlooked. This study examines three commonly used methods of data entry: Read Aloud, Single Entry, and Double Entry.

What did you find? Since we had a low amount of participants, our results were not able to prove or disprove our hypothesis. Had there been enough participants, we feel that there would have been significant differences among the quality of the data entry methods.

What is the future for your research project? Future research will use larger sample sizes and will likely find significant results based on the three different data checking methods.
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Educational Institute of Project: UNLV
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Title: Intermodal Knowledge (IK)

Abstract: In everyday experiences, infants constantly encounter dynamic faces, though they often see static faces in research settings. Infants’ show a preference for female stimuli, but it is not known whether this preference is affected by the type of stimuli. This study examines how the type of stimuli (i.e., photographs or videos) affects infants’ ability to match gender and voice. Five, eight and eleven month-old infants saw side-by-side images of male and female faces paired with either a male or female voice. The goal of the procedure is to determine how the type of stimuli influences intermodal preferences in infants. At this time, data collection is underway. It is hypothesized that infants will perform better with dynamic female faces.
Title: Examining the Construct Validity of the Metaphors Test

Abstract: Emotional Intelligence is a multi-faceted construct. Existing tests do a good job of measuring some aspects of Emotional Intelligence. The Metaphors Test (Barchard, 2004) was designed to measure the ability to decipher the emotional content of ambiguous sentences. This test may measure a new facet of Emotional Intelligence. The purpose of this research was to examine the construct validity of the Metaphors Test as a measure of Emotional Intelligence. Using a sample of 281 undergraduates, the Metaphors Test was correlated with the four branches of the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer, Salovey, & Caruso, 2004): Perceiving Emotions, Using Emotions to Facilitate Thought, Understanding Emotions, and Managing Emotions. The four correlations were all moderate, positive, and statistically significant. These results provide promising evidence of construct validity. Future research should select the items with the highest correlations with the MSCEIT. This will enable researchers to create a revised, shorter version of the Metaphors Test with higher construct validity.

Why are you doing this project? We did this project because it is part of the lab I am currently in. My supervisor created a test, The Metaphors Test, and we needed to know whether the test was valid or not. We needed to know this so we could use it in future research.

What problem are you trying to solve? We wanted to figure out whether the test has construct validity or not, or whether it measures Emotional Intelligence or not.

What tools or equipment are you using? We are using research that we attained a couple semesters ago of participants taking the Metaphors Test, and other Emotional Intelligence tests.

Why is your project worth researching? This project is worth researching because the Metaphors Test may measure a new facet of Emotional Intelligence which has not previously been tested. All aspects of Emotional Intelligence are important towards coping with life and social interaction. If we have found a new aspect that can help people in the future, that is definitely for the better.

What relevance will it have on the community, society, and in your research field? If our supervisor created a valid test of emotional intelligence, it can be used in the future on both kids and adults to test their emotional intelligence.

What did you find? We found that the Metaphors Test did correlate with other tests of Emotional Intelligence.

What is the future for your research project? Future research should further examine whether the Metaphors Test is valid. We have found some good beginning research, and follow up would really help.
Analysis of Morris Water Maze Data with Bayesian Statistical Methods

Maxym Myoshynychenko¹, Anton H. Westveld², Jefferson W. Kinney³

¹Assistant Professor of Statistics, Department of Mathematical Sciences
²Assistant Professor, Department of Psychology

1. Abstract

Neuroscientists commonly use a Morris water maze to assess learning in rodents. In this kind of a maze, the subjects learn to swim toward a platform hidden under opaque water as they orient themselves according to the cues on the walls. This protocol presents a challenge to statistical analysis, because an artificial cut-off must be set for those experimental subjects that do not reach the platform so as they do not drown from exhaustion. This fact leads to the data being right censored. Our experimental data compares learning in rodents that have chemically induced symptoms of schizophrenia to a control group. Here, a cut-off of 60 seconds was used. Utilizing Bayesian inferential procedures, we account for the censoring in the data and compare the results of learning between the treatment and control groups.

2. Introduction

2.1 Biological background

Disorders such as schizophrenia feature symptoms related to dysfunction of memory and learning. To investigate neural-structural changes involved, we used phencyclidine and ketamine, the drugs that block (antagonists) GABA, and NMDA receptors in the brain, respectively, to alter learning in rats. Ketamine induces psychosis in schizophrenia patients in remission [3] and produces symptoms of the disorder when administered to healthy subjects [1]. Also, ketamine impairs animals’ ability to learn spatial information [4]. On the other hand, little is known about the effect of phencyclidine on learning and memory; however, GABA receptors antagonist enhancement retention [2]. We evaluated the role of NMDA and GABA receptors in spatial learning and memory through a Morris water maze.

2.2 Experimental design

Morris water maze:
- A circular pool filled with opaque water tentatively divided into four quadrants.
- A dark platform on which the rats could stand.
- Cued cues on the walls.
- The rats had to find the platform in no more than 60 seconds in order to prevent damage to themselves.

Fig. 2: Morris Water maze

3. Data

For the course of the experiment, each rat was randomized into one of four treatment categories:
- Saline-Saline (control)
- Saline-Phencyclidine
- Ketamine-Saline
- Ketamine-Phencyclidine

Experimental day consisted of:
- Two injections 15 minutes apart
- Fear water maze trials immediately following the second injection.

During each of the subjects:
- Placed in a random quadrant
- Allowed to swim until they found the platform or until 60 seconds had passed
- Stayed on the platform for 30 seconds
- Placed under a heat lamp
- Returned back into their respective cages.

Table 1: Description of the experiment

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The censored data can be naturally thought of as missing, so we do not observe the data that would have been obtained if the rat was allowed to continue swimming after 60 seconds.

\[ \log(\text{censored data}) = \log(\text{actual data}) \geq 30 \text{sec} \]

For inference we consider a Bayesian approach. As such we used the following prior distributions:

\[ \pi(n | \theta) \propto \Gamma(n+1, \theta) \]

Where:
- \( \Gamma(\cdot) \) is the gamma function
- \( n \) is the number of successes
- \( \theta \) is a parameter

\[ \pi(n | \theta) = \frac{1}{\theta^n} \Gamma(n) \]

For inference we consider a Bayesian approach. As such we used the following prior distributions:

4. Preliminary Analysis

Due to the skewness of the response (time to find the platform), we considered a log transformation of the data (Figure 4). In future work we will consider modeling the untransformed data directly.

5. Results

5.1 Comparison of the treatments - differences in posterior means

5.2 Comparison of the treatments - differences in new predicted responses

Fig. 4: Log of time to find the platform without the censored data

For our preliminary analysis, we considered data from the first trial on day 8 (days 1-5 were training days). Thus, for each of the four treatment groups, we had 10 rats. This reduction in the data removed the statistical difficulty of dependence, which we will account for in future work.

We considered the following model for the data for a particular treatment group:

\[ y_i = \beta_0 + \beta_1 x_i + \epsilon_i \]

\[ \epsilon_i \sim N(0, \sigma^2) \]

Where:
- \( y_i \) is the response variable
- \( \beta_0 \) is the intercept
- \( \beta_1 \) is the slope
- \( x_i \) is the predictor variable
- \( \epsilon_i \) is the error term
- \( \sigma^2 \) is the variance

Table 3: Comparison probabilities of posterior predictive distributions

6. Discussion and Future Work

Table 3 and 3 compare the four treatments. Based on the comparisons of posterior means, one can conclude that only treatment groups with ketamine had a high probability of making a difference in the mean swimming time (Table 2). Furthermore, these probabilities are lower if we were to predict the difference in the time for a new rat based on the treatments (Table 3). Therefore, prephenate does not appear to reverse the learning impairments caused by ketamine in the present experiment. This may either be due to an insufficient dose of phencyclidine being administered, or due to the fact that GABA receptors are not very important for spatial learning. This question will be addressed in future experiments.

In the future, we will consider the following model for each group to adequately handle the within and across treatments dependencies of the data:

\[ \pi(n | \theta) = \frac{1}{\theta^n} \Gamma(n) \]

Additionally, we will consider other distributions beyond a normal.

References

Title: High Pressure – Variable Temperature Studies on Pressure Transmitting Media: "Analysis of Morris Water Maze Data with Bayesian Statistical Methods."

Abstract: Neuroscientists commonly use a Morris Water Maze to assess learning in rodents. In his kind of a maze, the subjects learn to swim toward a platform hidden in opaque water as they orient themselves according to the cues on the walls. This protocol presents a challenge to statistical analysis, because an artificial cut-off must be set for those experimental subjects that do not reach the platform so as they do not drown from exhaustion. This fact leads to the data being right censored. In our experimental data, which compares learning in rodents that have chemically induced symptoms of schizophrenia to a control group of rodents a cut-off of 60 seconds was used, and is the mode of the distribution. Utilizing Bayesian inferential procedures, we account for the censoring in the data and compare the results of learning between the treatment and control groups.

Why are you doing this project? To improve methods used to analyze behavioral data.

What problem are you trying to solve? What is the best way to analyze water maze data?

What tools or equipment are you using? Software environment for statistical computing called R.

Why is your project worth researching? Outcomes may aid discovery of better therapies for diseases like schizophrenia.
Introduction
Infants experience difficulty when recognizing male, but not female, faces presumably due to lack of experience with male faces (Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002). We examined if increasing infants' experience with faces improved their recognition of faces.

Method
• Two to three month-olds were assigned to one of three conditions: Male video, Female video, and No video.
• Male and female video groups viewed the video each day for a month:
  • Video consisted of six different faces.
    - Faces were matched to ethnicity of primary care giver.
  • Purpose of video was to provide experience and familiarize infants to male or female faces.

Experiment 1
• Infants were familiarized to 4 pairs of novel male faces (faces not included in the video) shown twice for 15 s each.
• At test, infants saw a familiar face paired with a novel face shown twice for 10 s.
• If infants recognized the familiar male face, they should look longer at the novel face.

Experiment 2
• Experiment two was identical to experiment one except the faces were female instead of male.
• If infants recognized the familiar female face, they should look longer at the novel face.

Experiment 3
• Follow up infant-controlled habituation study, tested if infants’ processed faces featurally or holistically (Cashon & Cohen, 2004).
• When tested infants saw:
  • One familiar face
  • One composite face
  • One novel face
• If infants processed the faces holistically, they should look at the composite face longer than the familiar face.
• If infants are processing male faces, they should look longer at the novel face than the familiar face.

Results
Experiment 1
For the male faces, infants in the male video condition showed a familiarity preference, infants in the female condition showed a novelty preference, and infants in the no video condition showed no preference.

Experiment 2
For the female faces, infants in the female video condition showed a familiarity preference, and infants in the male video and no video showed no preference.

Experiment 3
None of the infants in any condition were able to distinguish the familiar face from the composite face. Only infants in the male video condition showed an increase in looking time from the familiar face to the novel face.

Discussion

Experiment 1
Infants in the male video condition showed a familiarity preference, instead of a novelty preference as expected. Infants may have developed a preference for the faces shown on the entertaining video, which may have generalized to the male faces shown during testing. They may have expected the familiar face to become dynamic, similar to the faces in the video leading them to prefer the familiar rather than novel male face.

Infants in the female video condition showed a novelty preference for the male faces. Because infants are adept at processing female faces in every day life, video exposure may have aided the infants processing of faces in this format. Therefore, infants were able to process the male faces more efficiently simply because of video exposure.

Experiment 2
Infants in the male video and no video conditions did not show a familiarity or novelty preference for female faces. A trend towards a novelty preference is forming and with added participants significance may be likely.

Infants in the female video condition showed a familiarity preference. Similar to infants in the male video condition from Experiment 1, infants might have developed an expectation for familiar female faces to be entertaining. This anticipation may produce the belief that the face will talk or music will play resulting in longer looking towards the familiar face during test trials.

Experiment 3
Distinguishing the composite male face from the familiar male face may still be a difficult task for infants at this age regardless of video experience.

Infants in the male video condition spent more time looking at the composite and novel faces as compared to female video condition infants. Perhaps, again, with the expectation that the faces would become active. Subsequently, infants in the female video condition showed a significant increase in looking from the familiar to the novel face providing further evidence that these infants were better processors due to added experience with faces.

References

This research was supported by grants from the National Institute of Child Health and Human Development (HD46487) and the National Science Foundation (0645761).
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Research Site: UNLV

Title: Male and Female Facial Recognition in Infants: Does Experience Matter?

Abstract: Young infants with female primary caregivers are able to differentiate familiar female faces from novel female faces but not male faces. Experience processing faces may be important for being able to discriminate among similar-looking faces. Subsequently, increasing infants’ experience with less familiar faces should improve their ability to differentiate those types of faces. This study examined if infants’ experience with faces affected their recognition of new faces. Prior to testing, 2-3 month old infants were assigned to one of three conditions: a male video, a female video, and no video condition. Infants were familiarized to both male and female faces during test. For the male faces, infants who saw the male video showed a familiarity preference, infants who saw the female video showed a novelty preference, and infants who saw no video showed no preference. For female faces, infants showed no preference when assigned to the male video and no video condition, while infants assigned to the female video (n = 5) showed a familiarity preference. A follow up infant-controlled habituation study tested if infants processed faces featurally or holistically. During testing, infants saw one familiar face, one composite face, and one novel face. None of the infants in the male video, female video, or no video conditions were able to distinguish the familiar face from the composite face. Only infants in the female video condition showed an increase in looking time from the familiar face to the novel face.

Why are you doing this project? We are doing this project to learn how babies categorize faces, which might lead to various stereotypes. If so, early interventions could be possible.

What problem are you trying to solve? We are trying to solve if babies experience with faces affects recognition of novel faces.

What tools or equipment are you using? We are using 2 monitors, 2 video cameras for recording purposes, Super Coder, and Habit X 2.0.

Why is your project worth researching? We can learn how babies social environment affect their future choices and to learn if babies stereotype.

What relevance will it have on the community, society, and in your research field? This study will assist in the future interventions related to stereotyping.

What did you find? We found that experience affects how babies look at novel faces.

What is the future for your research project? Our future is to recruit more participants for future studies.
Title: Patterns and Processes in Transitional Justice

Abstract: The Nuremberg and Tokyo trials indicated the first time in history that criminal tribunals were international in scope and due to human rights violations. As a result, the study transitional justice began. With the foundation of the Nuremberg and Tokyo trials established, nations have continued in the tradition: El Salvador, Rwanda, South Africa, and Cambodia have experienced, or continue to experience, transitional justice. The point of principal interest here is why and when does agencies of the United Nations initiate and involvement in this process, and how does this vary?

Why are you doing this project? Realism, idealism, constructivism, pluralism and solidarity are only a few schools of thought that attempt to contextualize interstate relations at the international level.

What problem are you trying to solve? Explain the variation of international involvement in domestic civil wars with particular focus on the United Nations and its agencies.

What tools or equipment are you using? A comparative study of recent transitional justice cases will be completed in the attempt to identify the variables that encourage or discourage international (UN) involvement.

Why is your project worth researching? The reasons that international organizations choose to become embedded in civil wars vary and those variations are multi-tiered.

What relevance will it have on the community, society, and in your research field? Preliminary research has led me to believe that media attention and geopolitical pressures are strong determinants of foreign policy actions.

What did you find? Trade relations, allies, media attention, diaspora communities and the need for international actors to appear to be good willed, are common motivations that pressure international organization to intervene.

What is the future for your research project? UN and related agencies will continue to be part of our research.
Learning mechanisms for acquiring knowledge of tonality in music
Rikka Quam, Matthew Rosenthal, and Erin E. Hannon
University of Nevada Las Vegas

Introduction
Most people think that musical knowledge is exclusive to trained musicians. Actually, casual music listeners have implicit knowledge of important structural aspects of music, such as tonality. Tonality contributes to the feeling of expectation one would experience when hearing someone sing "Oh, isn't it?". Knowledge of tonality can be learned through the statistics of music (Krumhansl, 1990). However, learning mechanisms have rarely been investigated experimentally (Cronk et al., 2002). Artificial grammar learning experiments have shown that listeners can acquire highly structured knowledge, such as syllable co-occurrence and language syntax through passive exposure. (Gaffney et al., 2000; Saffran, 2001). Two experiments used an artificial grammar learning paradigm to explore mechanisms by which listeners could learn about tonality. Experiment 1 investigated whether listeners could infer tonal prominence from the frequency of pitch occurrence. Experiment 2 investigated whether listeners could infer tonal prominence from contingencies between pitch and melodic position.

Stimuli and Methods

Experiment 1
a) Participants listened to a two-minute familiarization having a specific frequency of occurrence distribution. Following the familiarization, participants were asked to determine which of two test melodies was most like the familiarization.

b) Participants listened to a two-minute familiarization having a specific frequency of occurrence distribution. Following the familiarization, participants listened to test melodies and judged how well a probe tone fit with each.

Design
Experiment 1
a) Participants listened to a two-minute familiarization having a specific frequency of occurrence distribution. Following the familiarization, participants were asked to determine which of two test melodies was most like the familiarization.

b) Participants listened to a two-minute familiarization having a specific pitch-melodic distribution. Following the familiarization, participants listened to test melodies and judged how well a probe tone fit with each.

Stimuli and Methods

Experiment 2
- All stimuli were composed of 480 sounded pitches and were two minutes long.
- Faux stimuli were composed of 289 sounded pitches and were two minutes long.

- For each distribution, one sub-set of notes occurred primarily on strong beats and another sub-set of notes occurred primarily on weak beats.
- Test melodies were composed of 116 sounded pitches and were 3 seconds long.

Participants were familiarized to:

- Distribution A or Distribution B

- Effect of frequency of occurrence

- Effect of distribution position

- No effect of familiarization

Conclusion
- Listeners categorized melodies by the frequency, with which pitches were sounded and by contingencies between melodic position and pitch.
- Listeners provided the highest fit ratings for notes that occurred frequently and for notes that occurred at strong melodic positions.
- Thus, listeners may acquire tonal knowledge using these two distribution cues.
- Future research may explore sensitivities to different strengths of the melodic hierarchy.

References
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Title: Learning Mechanisms for Acquiring Knowledge of Tonality in Music.

Why are you doing this project? I am a research assistant in the UNLV Auditory Cognition and Development Lab and had the opportunity to become more involved in this research project. I was very interested in investigating how people learn to expect tonal events in music.

What problem are you trying to solve? We are trying to understand what mechanisms might be involved in tonal learning. Tonality contributes to the feeling of anticipation one would experience when hearing someone sing “do re mi fa so la ti” without singing the final “do”. We ask, how did you learn to expect the final "do"? This project identifies potential learning mechanisms that are involved in tonal knowledge acquisition.

What tools or equipment are you using? Audio clips and instructions were presented via PsyScope software (Cohen, MacWhinney, Flatt, & Provost, 1993). We used Digital Performer 4.6 and Reason 3.0 software to create audio stimuli.

Why is your project worth researching? Tonal learning mechanisms have rarely been investigated experimentally. Our project aims to understand two mechanisms that may underlie auditory cognition during development and how those mechanisms are modified as a result of experience listening to music and language.

What relevance will it have on the community, society, and in your research field? In the field, this research provides evidence as to how structural aspects of music, such as tonality, may be learned and represented in the brain. Since the concept of learning music through tonal cues to prominence lies parallel to the concept of learning language through word boundaries, our project may indicate important tools infants and children use to learn language. Infants and children probably rely on similar properties (frequency and rhythm) to develop a working knowledge of language.

What did you find? Results indicate that listeners categorized melodies by the frequency with which pitches were sounded and by contingencies between metrical position and pitch. Listeners provided the highest fit ratings for notes that occurred frequently and for notes that occurred at strong metrical positions. Thus, listeners may acquire tonal knowledge using these two distributional cues.

What is the future for your research project? We hope to publish our findings. Future research may explore sensitivities to different strengths of the metrical hierarchy.
Can Female Genital Mutilation Victims Benefit From Corrective Surgery: To Regain Sexual Pleasure And Be “Whole” Once Again?

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BACKGROUND

Female Genital Mutilation (FGM) is the removal or cutting of the external female genitals, all procedures including and/or the entirety or other injury to the female genital organs for traditional or non-medical reasons. (World Health Organization, WHO, 1997)

Key Facts:
- Currently estimated at 100 to 140 million girls & women worldwide are living with consequences of FGM
- An estimated 12 million girls in Africa from age 10 and above are victims of FGM
- Girls between infancy & age 15 are at greatest risk

Consequences

Immediate complications:
- Severe pain & bleeding
- Hemorrhage
- Shock
- Acute Urinary Retention
- Infections
- Uterine prolapse
- Injury to adjacent tissue

Long Term Complications:
- Psychological and psychosocial trauma
- Marital problems
- Childbirth complications
- Infertility
- Difficulties with Menstruation
- Vaginal Fistulas
- Chronic pelvic infections

Prevalence

There are four types of FGM:
Type I: Partial or total removal of the clitoris &/or prepuce (clitoridectomy)
Type II: Partial or total removal of the clitoris and the labia minora with or without excision of the labia majora (excision)
Type III: Narrowing of the vaginal opening with creation of a covering seal by cutting & positioning the labia minora &/or the labia majora and the labia minora.
Type IV: All other harmful procedures to the female genitalia for non-medical purposes.

Clitoral Repair Surgery

✓ Restores Pleasure
✓ Restores body

According to Dr. Marit Bowers, (2009), “The restoration of sexual pleasure is possible because the entire clitoris is present, not just the amputated portion.” Bowers explains, “Sensation is restored through FGM because the amputated portion retracts back and then gets covered by scar tissue. This creates a new labia minora in many cases by utilizing the available surrounding skin. The exposed sensory portion, true of overlying skin and scar tissue, is then there to function.”

RESULTS

The complication associated with FGM can be severe. In a single surgical procedure developed by Professors Dr. Peter Pollock, "victims' ages are under 15 usualy experience severe pain with no relief, and a third to as much as 90% of those who survive the surgery are likely to experience psychological and psychosocial trauma."

For this reason, a non-profit organization that offers surgery to women whose children have been revised by FGM, "has been working with Dr. Pollock and his team since 2000 to provide surgical treatment for women in the United States, South America, and Europe." According to the United Nations, the organization has performed more than 1,000 surgeries on women in more than 20 countries.

CONCLUSIONS

Clitoral reconstruction is a major challenge for physicians, nurses, and midwives. This procedure is often considered to be a "bleach" of the patient's sexuality. Therefore, the training of medical professionals to perform this procedure is crucial. For this reason, the medical community has been working on developing new techniques and procedures to improve the outcomes of these procedures. One of the main challenges is to ensure that the patient's sexual function is restored, and this can be achieved by performing a clitoral reconstruction surgery. These surgeries are performed by specialized surgeons who have extensive experience in this field.

BIBLIOGRAPHY

(References and sources are included in the document)
Title: Can Female Genital Mutilation Victims Benefit From Corrective Surgery: To Regain Sexual Pleasure and Be “Whole” Once Again?

Abstract: Female Genital Mutilation (FGM) is defined by the World Health Organization, (WHO), as the removal or cutting of the external female genitalia. WHO estimates between 100 and 140 million girls and women worldwide currently live with the consequences of FGM. The study finds that through corrective surgery, pre/post therapy, counseling, and sexual education victims to FGM can regain sexual pleasure providing them a chance to be “Whole” once again.

Why are you doing this project? The purpose of this research is to bring awareness about FGM and the development of clitoral corrective surgery.

What problem are you trying to solve? Advocacy for the abandonment of FGM and bring awareness as well as educate victims about the benefits of corrective surgery.

What tools or equipment are you using? Information from various literatures such as medical journals, electronic articles, websites, news articles, reports and studies relative to the topic.

Why is your project worth researching? There are immediate and long-term consequences even death associated with FGM and have been thought to be irreversible; however the development of a simple surgical procedure “offers hope for victims of FGM.”

What relevance will it have on the community, society, and in your research field? Bring awareness of the worldwide human rights violation that is forced upon women, girls, and infants each year. It will create awareness for victims, since many have traveled to the U.S. and are living amongst us suffering from the consequences of FGM. It will provide researcher information about the development of corrective surgery, paving the way for future research and development to provide FGM victims a chance at regaining sexual pleasure and be “Whole” once again. My project is only the beginning to understanding the physical and psychological effects of FGM and the reconstructive surgery.

What did you find? As professionals learn to identify the physical facets of FGM it is imperative to understand its psychological and emotional effects as well. Clitoral mutilation in the name of cultural traditions, religion and/or social factors does not protect women and/or girls from experiencing traumatic psychological and physical damage. FGM victims can benefit from corrective surgery, pre and post therapy, counseling, and sexual education and can regain sexual pleasure providing them a chance to be “Whole” once again.

What is the future for your research project? We are working on getting approval from the IRB to conduct further studies as it is of great necessity to analyze the emotional and psychological effects post-surgery.
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Title: Can exercise ameliorate increased sensitivity to cocaine in maternally separated rats?

Abstract: Maternal separation in rats, which is used as a model of child neglect, has been reported to increase sensitivity to drugs of abuse. Previous work supports that exercise can be beneficial and reverse effects of stress; however it is unknown whether exercise can ameliorate psychostimulant hypersensitivity in maternally separated rats. We will study the effects of exercise on cocaine conditioned place preference (CPP) in maternally separated (MS) and control rats. Mixed sex litters will be assigned to the MS or control condition. MS will be separated for 3 hrs/day during PN 2-14, and controls will be briefly handled. All pups will be weaned at PN21 and housed individually in standard cages (control) or cages with exercise wheels (experimental). Cocaine conditioned place preference training will take place during PN 40-49, and CPP will be tested on PN 50. We expect MS rats to be more sensitive to the conditioned reinforcing effects of cocaine and that exercise will reduce conditioned reinforcing effects of cocaine in controls and normalize the response in MS rats.
Abstract: The production of artificial life is not a goal that has been achieved, but is one that could be within the next decade. The process of creating a virus is far simpler than creating something truly alive, however, Dr. J Craig Venter and his team are attempting it. The problem that arises is attempting to transfer data from a computer terminal into a truly living life form. The classification of an artificial life form is one that is self-sustaining and self-replicating due to a manmade genome. The opportunities include the ability to edit and create life while sitting at a desktop computer. Using the four letters that make up all DNA, G, A, T, and C, Venter is attempting to pair them up in such a way that will allow for truly manmade life. Thus far, it has still required some basis of existing life to do so, building an existing bacteria was a 15-year long process. The next step will not be any easier, creating a completely new life, one that has not dealt with natural selection and does not have a determined purpose other than what those creating it will have for it. Practical and possible uses include creating cleaner fuel sources and developing chemical weaponry using diseases created entirely in a lab to which no human would have immunity to. In 2008, at the J Craig Venter Institute, the first artificial bacteria was created, it was made to spawn a whole new mainstream field of study and interest in pushing these studies forward. The difficulty is in the fact that one cannot simply throw a large stream of letters together and have a working life form. Life as we know it took hundreds of millions of years to develop. If you have one sequence that does not work with the rest, your creation will not be able to exist and function.
Title: Genetic Engineering: Designer Babies

Abstract: Human beings were created individually for a purpose, not for a man’s own glory. It is not about the look of the child but what is inside and what they are capable of doing. We should work to shape them to be the best they can be through experiences and trial and error, not make them flawless right out of the womb. For example, if manufactured humans were created with a genetic defect that has just been lying dormant, unknown to the creators that were triggered by a certain event it could lead to harm to themselves and others. Nevertheless, designer babies are a wave of the future that should be embraced by all.

Why are you doing this project? It was the most interesting out of the choices given.

What problem are you trying to solve? The effects of genetic engineering for personal benefits. For instance, designing your own child because you want them to have a certain eye color.

What tools or equipment are you using? None.

Why is your project worth researching? It could be a possibility in the near future.

What relevance will it have on the community, society, and in your research field? It could bring division to society because it will no longer be against race but against genetically designed humans and natural humans.

What did you find? That eugenics may only be for rich people.

What is the future for your research project? That we will have enough technology and equipment to produce the next future baby.
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Title: Learning Mechanisms for Acquiring Knowledge of Tonality in Music

Abstract: Most people think that musical knowledge is exclusive to trained musicians. Actually, casual music listeners have implicit knowledge of important structural aspects of music, such as tonality. However, few researchers have explored tonal learning mechanisms experimentally. Two experiments employed an artificial grammar learning paradigm to explore tonal learning. Experiment 1 investigated whether listeners could infer tonal prominence from the frequency of pitch occurrence. Experiment 2 investigated whether listeners could infer tonal prominence from contingencies between pitch and metrical position. Frequency and metrical position contributed to listeners’ judgments of note stability. Thus, these mechanisms may be involved in tonal knowledge acquisition.

Why are you doing this project? I was very interested in investigating how people learn to expect tonal events in music.

What problem are you trying to solve? We are trying to understand what mechanisms might be involved in tonal learning. Tonality contributes to the feeling of anticipation one would experience when hearing someone sing “do re mi fa so la ti” without singing the final “do”. We ask, how did you learn to expect the final "do"? This project identifies potential learning mechanisms that are involved in tonal knowledge acquisition.

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