

It's
time to shine.

Honors College Thesis Fair

May 30 – June 01, 2018



Oregon State
University

Yousif Almulla, Mathematics; Physics

Mentor: David Roundy

"An Efficient Electronic Structure Solver for Kane's Model of Quantum Computation"

Interesting Fact: A quantum bit is modeled.

Claudia Andersen, Renewable Materials

Mentor: Dr. Seri Robinson

"The Art and Science of Woodturning: A Year in Exploration"

Interesting Fact: White rot, a type of spalting fungi, results in extremely low density and unstable conditions in wood. Without proper care, it is easy to tear out large chunks of wood when turning, creating an uneven, often undesirable surface.

Apoorva Ayyagari, Bioengineering

Mentor: Dr. Sam Logan

"Variation in the Displacement and Dispersion of Young Children During an Inclusive Playgroup"

Interesting Fact: My research used a novel technique, a GoPro video camera, to measure physical activity patterns of children.

Arden Babb, Ecological Engineering

Mentor: Desiree Tullos

"A Comparative Analysis of Automated and Time-Integrated Sediment Samplers"

Interesting Fact: Increases in suspended sediment concentration can impact a variety of river characteristics including channel structure, water quality, aquatic habitat, and nutrient deposition.

Hannah Baker, Bioresource Research

Mentor: Inga Zasada

"Insights into the Host Range, Population Decline, and Pathogenicity to Potato of *Globodera ellingtonae*"

Interesting Fact: The nematode we are researching was discovered in 2008 and officially described as a new species in 2012

Trevor Baley, Biology

Mentor: Jonathan Kaplan

"An Argument for Development and Implementation of Artificial Organs: An Acceptable Use of Enhancement"

Interesting Fact: An average of 20 Americans die every day due to the lack of available organs for transplant, and roughly 116,000 are on the transplant waiting list

Matthew Ball, Physics

Mentor: Emily Shroyer

"Spectral Analysis of Upper Ocean Surface Wave Structure using xSOLO Floats in the Bay of Bengal"

Interesting Fact: Many of the waves that regularly reach shore have traveled thousands of kilometers to get there.

Jeremy Banka, Graphic Design

Mentor: Bill Loges

"Delve: A New Kind of Tabletop Game"

Interesting Fact: In a card game, rules not written on cards should be kept to a strict minimum. Each card is there to add one new rules element to the system. The complexity of strategy comes from their combination.

Lindsey Barton, Biology

Mentor: David Maddison

"Repetitive DNA profiles in Bembidion show variation in genomic architecture within and between closely related species"

Interesting Fact: The ground beetle genus Bembidion contains over 1,200 species worldwide with over 100 subgenera

Mitchell Bernards, Mechanical Engineering

Mentor: Jonathan Hurst

"Bipedal Robot Ankle Control"

Interesting Fact: ATRIAS, designed and built at Oregon State, set the robot running record without using ankles. The addition of ankles to Cassie, ATRIA's successor, promises faster walking.

Hayden Bialek, Electrical and Computer Engineering

Mentor: Dr. Matthew Johnston

"Viability of Single Photon Avalanche Diodes for use in Low Power Pulse Oximetry"

Interesting Fact: Pulse oximetry is often considered the "fifth vital sign" due to how essential it is in post operation patient monitoring.

Kevin Bishop, Electrical and Computer Engineering

Mentor: Matthew Johnston

"A CMOS-Based Microfluidic Cell Counter"

Interesting Fact: It takes about 60 seconds for a blood cell circulates through the human body.

Makenzie Brian, Electrical and Computer Engineering

Mentor: Bill Smart

"Design and Implementation of a Ride-On Car with Data Tracking for Use by Young Children with Developmental Differences"

Interesting Fact: This work seeks to explore one option to take data that could be correlated to improvements in fundamental movement skills in young children with developmental differences.

Emily Burney, Public Health

Mentor: Matthew Robinson

"Characterization of Mitochondrial Metabolism in L6 Rat Myoblasts"

Interesting Fact: Alterations to mitochondrial metabolism play a role in the development of insulin resistance, which mediates risk for metabolic diseases such as Type 2 Diabetes. As of 2017, 24.7 million people in the US were diagnosed with diabetes, which is estimated to cost \$327 billion nationwide.

Cadell Chand, Civil Engineering

Mentor: David Hurwitz

"An Evaluation of Door Zone Collisions between Bicycles and Vehicles"

Interesting Fact: Door zone collisions are one of the most common collisions between bicyclists and vehicles, but often go unreported.

Trisha Chau, Biochemistry and Molecular Biology

Mentor: Colin Johnson

"Characterization of Fer1L6 lipid binding properties and its expression in cell cycle"

Interesting Fact: Fer1L6 is the least characterized protein in its protein family.

Kathryn Chen, Chemistry

Mentor: Sandra Loesgen

"A Robust Mycobacterium smegmatis Assay to Identify Anti-tubercular Novel Natural Products"

Interesting Fact: Bacterial metabolites are a great source of drugs!

Emma Chilcote, BioResource Research

Mentor: Markus Kleber

"How do Microbes Induce Soil Water Repellency?"

Interesting Fact: Aliphatic constituents (lipids) are part of the extracellular matrix that soil microbes excrete. It is a relatively new area of research in the field soil of soil science, and has brought up the possibility that biological factors (versus physical, and chemical) play more of a role in soil phenomena than previously thought.

Alex Christensen, Nuclear Engineering

Mentor: Dr. Wade Marcum

"Examining Critical Heat Flux in a Nuclear Fuel Rod Using an Explicit Finite-Difference Scheme"

Interesting Fact: Under certain accident conditions in a nuclear reactor, a phenomena known as departure from nucleate boiling can occur, drastically reducing the amount of heat being transferred from the fuel rods into the coolant. This triggers a near instantaneous spike of several hundred degrees Celsius, compromising the integrity of the fuel rod. It is paramount to the safety of nuclear reactors that this complex phenomena is well understood under as many conditions as possible.

Megan Co, Mechanical Engineering

Mentor: Dr. Matthew Johnston

"Rapid Prototyping of Rigid and Flexible Microfluidic Devices"

Interesting Fact: Microfluidics can be used to detect for diseases using small fluid volumes on a nanoliter scale.

Nathan Coddington, Chemistry

Mentor: Dr. Sandra Loesgen

"Activating Natural Product Gene Clusters in *Phoma* sp."

Interesting Fact: Natural products from fungi are a source for therapeutic compounds such as penicillin and lovastatin. Under laboratory conditions, fungi do not express their full metabolic potential, so we have applied various methods to activate silenced biosynthetic gene clusters to alter secondary metabolite production.

Lauren Coe, Fisheries and Wildlife

Mentor: Taal Levi

"Diversity and composition of mammal and bird communities in northern Pantanal, Brazil"

Interesting Fact: The Pantanal wetland in Brazil has distinct bird and mammal communities depending on study site and degree of flooding. Jaguar (*Panthera onca*) was one of the most common mammals detected during both the dry and wet seasons.

Casey Collins, Nutrition

Mentor: Ingrid Skoog

"Changes to the Food Label: Engaging and Educating via Interactive Video"

Interesting Fact: This video project includes interactive game-like elements to increase engagement for students participating and will be used for future e-campus classes.

Samuel Cook, Biology

Mentor: Justin Sanders

"Development of an enzyme linked immunosorbent assay (ELISA) for the detection of Zebrafish Interleukin 1 beta upregulation"

Interesting Fact: Zebrafish have over 16,000 orthologous genes with humans

David Cornwell, BioEngineering

Mentor: Elain Fu

"Demonstration of an Alginate Valve in a Paper Microfluidic Device"

Interesting Fact: You can find sodium alginate in many fast food smoothies, as it is used as a food-grade thickener.

Tara Dunn, Natural Resources

Mentor: Randall Rosenberger

"Outdoor Recreation Health Impact Estimator: A tool for estimating the health benefits of outdoor recreation in Oregon"

Interesting Fact: If trail users in Coos county increased their weekly trail walking from 35 minutes per user per week to 150 minutes per user per week the cost of illness saving are estimated to be up to \$5.3 million.

Arek Engstrom, Bioengineering

Mentor: Stacey Harper

"Analyzing the use of the acellular DCFH assay as a means of determining oxidative stress induced in zebrafish embryos exposed to lanthanide nanoparticles"

Interesting Fact: My research helps provide insight into the possible use of high throughput, abiotic assays in the assessment of environmental toxicology of nanomaterials.

Kaelyn Estenson, Animal Science

Mentor: Gerd Bobe

"Antioxidant Effects of Blackberry Pomace on the Health of Transition Dairy Cows"

Interesting Fact: Transition cows are often under high risk for the development of metabolic disorders.

Kaylee Eyerly, Chemical Engineering

Mentor: Jennifer Richter

"Coming of Age through the Lens of Ekphrastic Poetry"

Interesting Fact: Ekphrastic poetry is poetry written about or inspired by art.

Katherine Fan, Biology; International Studies

Mentor: Dr. Adriane Irwin

"The Source of the Pain: A Correlative Study on Global Healthcare System Variables and Opioid Consumption Data"

Interesting Fact: The United States consumes roughly 80% of the world's opioids despite representing less than 5% of the world's population.

Yutong Fan, Business Information System

Mentor: Bin Zhu

"Risk Factor Distribution of Cardiovascular Disease in Shanghai, China"

Interesting Fact: It is way beyond my expertise.

Carly Ferguson, English and Education

Mentor: Dr. Soria Colomer

"High School Teachers' Approaches toward Canonical Literature through Culturally Responsive Teaching (CRT)"

Interesting Fact: Research presented at 2018 American Educational Research Association conference.

Samantha Finlay, Philosophy

Mentor: Robert Figueroa

"Ethical Considerations in Cuban Tourism"

Interesting Fact: Studies have shown that tourists act less ethically on vacation than they do in their daily lives (Ganglmair-Wooliscroft & Wooliscroft, 2016).

Patrick Flynn, Mathematics; Physics

Mentor: Arnd Scheel

"Localized Structures in a Diffusive Run-and-Tumble Model of *Myxococcus xanthus*"

Interesting Fact: Using simple physical principles of diffusion and run-and-tumble dynamics to develop a model for *Myxococcus xanthus*, we can predict the clustering behavior of the bacteria.

Briana Frink, Chemical Engineering

Mentor: Dr. Natalia Shulzhenko

"Identifying Bacterial Candidates Predicted to Regulate Lipid Metabolism in a Mouse Model of Diet-Induced Obesity"

Interesting Fact: My mentor is going to investigate my research results further.

True Gibson, Biochemistry & Biophysics

Mentor: Dr. Jonathan Kaplan

"A Bayesian Solution to the "Replication Crisis" in Science"

Interesting Fact: Recent revelations in many scientific fields have called into question the confidence we can have in the results of scientific studies. Endorsing a Bayesian approach can help one evaluate their stance on scientific claims in the light of conflicting evidence.

Jamila Godil, Microbiology

Mentor: Brian Dolan

"Impact of Unfolded Protein Response, USP14 & Nedd8 Inhibitors on Sal/Ak and 4T1 Tumor Cell Lines"

Interesting Fact: One of the inhibitors used, MLN-4924, is currently undergoing clinical trials to treat Mantle Cell Lymphoma (MCL).

Evan Gonnerman, Mechanical Engineering

Mentor: Dr. Brian Bay

"Achilles Assistance Device as a Passive Ankle Foot Orthosis for Achilles Tendon Injuries"

Interesting Fact: This device is a low-cost, easily manufacturable exoskeleton that allows for rural rehabilitation of the Achilles tendon.

Abigail Griffiths, Bioengineering

Mentor: Skip Rochefort

"Development of a Medicinal Infused Hydrogel Patch for the Treatment of Burns and Diabetic Ulcers"

Interesting Fact: The development a hydrogel burn patch that can be applied after a burn injury to help prevent infection, alleviate pain and encourage wounds to heal quickly would reduce the need for frequent and painful dressing changes.

Omeed Habibelahian, Computer Science

Mentor: Arash Termehchy

"Design and Implementation of an Analytics Interface for the "I Heart Corvallis" Mobile Application"

Interesting Fact: The interface will be directly used to evaluate the effectiveness of the application developed for my senior project.

Ethan Heusser, English

Mentor: David Biespiel

""Go Back to the Ground": Language, Memory, and the Question of Poetic Legacy""

Interesting Fact: In writing, absolutely nothing is truly original.

Katrina Hiebel, Zoology

Mentor: Michelle Kutzler

"Acupuncture increases matrix metalloproteinase type-2 enzyme activity in bovine caruncles after calving"

Interesting Fact: Acupuncture stimulates the production and release of catecholamines, estrogens, and growth factors. It has been used for reproductive disorders in dairy cattle including including delayed uterine involution, repeat breeding, and uterine infections.

Christopher Hinkle, Chemical Engineering; International Studies

Mentor: Milo Koretsky

"Toward Professional Practice: Student Learning through Participation in Engineering Clubs"

Interesting Fact: Engineering education is constantly changing, fueled by research on how students learn most effectively.

Isaac Hodges, Physics

Mentor: Davide Lazzati

"Off Axis Gamma Ray Burst Contribution to the Diffuse Gamma Ray Background in the 100-600 keV Range"

Interesting Fact: Gamma ray bursts are among the most luminous objects in the sky. As the name suggests however, they mainly emit gamma rays so we can't see them with the naked eye.

Douglas Holman, Biochemistry and Biophysics

Mentor: Molly Burke

"Adaptation to long-term osmotic stress in a domesticated *Saccharomyces cerevisiae* strain"

Interesting Fact: Yeast can produce over 500 different chemical compounds that affect the flavor and aroma of beer and wine (sake).

Yu-Tin Hsiao, Biochemistry & Biophysics

Mentor: Bo Sun

"The rigidity of extracellular matrix (ECM) affect human breast cancer cell attachment to ECM"

Interesting Fact: Vinculin attachment to the extracellular matrix changes with varying extracellular matrix rigidity.

Lea Hudson, Animal Science

Mentor: Monique Udell

"Canine and Feline Gazing Behavior"

Interesting Fact: When presented with an unsolvable task, dogs and 12-14 month human infants had no difference in their duration of gazing at a close proximity human for assistance.

Tyler Inberg, Electrical and Computer Engineering

Innovation Management

Mentor: Chet Udell

"Project Management and Design of a Modularized Internet of Things (IoT) Prototyping System"

Interesting Fact: The Internet of Things Industry predicts that 75.4 billion devices will be connected to the internet by 2025.

Victoria Jansen, Agricultural Sciences

Mentor: Dr. Andrew Ross

"Is a dedicated sourdough test baking method necessary for whole wheat sourdough breads"

Interesting Fact: I baked lots of loaves of bread

Rachel Johnson, Bioengineering

Mentor: Michelle Bothwell and Devlin Montfort

"Developing a Qualitative Assessment Instrument to Measure Conceptualization of Oppression and Privilege"

Interesting Fact: Bra-snapping, hair pulling, like-liking, and toxic masculinity are all related to engineering. Come see how

Anantha Poojitha Jujjuri, Microbiology

Mentor: Taifo Mahmud

"Investigating the synthesis of Gadusol"

Interesting Fact: Sunscreen is bad for coral reefs!

Amita Kashyap, BioResource Research

Mentor: Stephen A. Ramsey

"Long Noncoding RNA in the North American Beaver"

Interesting Fact: My work is part of the beaver genome project, which made Oregon State University the first PAC-12 to sequence the genome of its mascot!

Jasmin Kennard, Chemical Engineering

Mentor: Dr. Jeffrey Nason

"Homoaggregation of Hematite Colloids Near the Critical Coagulation Concentration of Potassium Chloride and Synthetic Freshwater"

Interesting Fact: Colloidal particles have one or more dimensions in the range of 1 nanometer (10^{-9} m) to 10 micrometers (10^{-5} m), but changes in aquatic chemistry can cause them to grow.

Jackson Keppen, Nuclear Engineering

Mentor: Dr. Todd Palmer

"Investigation into the Use of a Lead Slowing Down Spectrometer for Neutron Cross Section Analysis"

Interesting Fact: The total mass of the lead slowing down spectrometer is over 30 tons! It is heavy enough to pressure fuse the shielding material placed beneath it if precautions are not taken.

Alexandria Kershner, Biology

Mentor: Jim Myers

"Screening for Viral Disease in the OSU Tomato Breeding Program"

Interesting Fact: Viroids are tiny pathogens made of single stranded, circular RNA, and unlike viruses they don't code for any proteins.

Ryan Khalife, Political Science and Economics

Mentor: Christopher Nichols

"Drone Strikes and War: The Morality, Legality, and Politics"

Interesting Fact: The majority of Americans support US drone strikes in the Middle Eastern countries such as Pakistan, but only 3% of Pakistanis support these drone strikes. (Pew Research Center)

Claire Kiefel, Biology

Mentor: Dr. Michelle Kutzler

"Does Gonadectomy Contribute to the Pathophysiology of Canine Musculoskeletal Disease?"

Interesting Fact: Spayed and neutered dogs have a 17% increased incidence of canine hip dysplasia and a 2-3 times increased incidence of canine ACL injury compared to reproductively-intact dogs.

Debbie Kim, Microbiology

Mentor: Dr. Daniel D. Rockey

"Chromosomal Recombination Targets in Chlamydial Lateral Gene Transfer In Vitro"

Interesting Fact: Chlamydia has differences in inter and intraspecies recombination

Joseph Kim, Biochemistry & Biophysics

Mentor: Hong Moulton

"Assessing an Adult Zebrafish Model for In Vivo Delivery of Morpholino Oligomers"

Interesting Fact: Phosphorodiamidate morpholino oligomers, which are the primary compounds that I have studied, mimic the structure of DNA, yet has a backbone that is different enough to be stable in the bloodstream and is undetectable by nucleases.

Hannah Kirk, Biology

Mentor: Dr. Robin Pappas

"Psychedelics and Entheogens: Potential and Viability in Medical and Non-Medical Therapies"

Interesting Fact: Psychedelic Sciences were not only popular but prestigious in the honored academic circles of the 1950s. Following the Counter Culture Movement of the 1960s and the subsequent induction of the Controlled Substance Act in 1970, there has never been a freeze in scientific investigation such as there was. Psychedelics have cultural significance and evidence-supported potential to be used in psychotherapies for ailment and betterment.

Dillon Koch, Human Development and Family Science

Mentor: David Rothwell

"The Social Safety Net and Child Poverty in Oregon"

Interesting Fact: The Supplemental Poverty Measure is a relatively new measure for poverty, and includes government supplementation and benefits as income, to describe a more accurate picture of the impact of poverty in the United States.

Calvin Kocher, Anthropology and International Studies

Mentor: Dr. Joan Gross

¿Mba'eteko, Che? An Examination of the Roles of the Guaraní and Spanish Languages in the Cultural Identity of Paraguayan Migrants in Greater Buenos Aires"

Interesting Fact: Paraguay is the only country where an indigenous American language has official national status equal to a European language.

Kala Kopecek, Chemical Engineering

Mentor: Stacey Harper

"Redox characterization of lanthanide nanoparticles with a chemical probe"

Interesting Fact: Nanoparticles are all around us, in most products, even in your make-up. Because of this, figuring out their fate and transport in the environment has been an exploding area of research as it has become evident that they are ending up in places they shouldn't.

Amy Kutnerian, Chemistry

Mentor: Staci Simonich

"Analysis of Organochlorine Pesticides (OCPs) in Gray Whale Scat"

Interesting Fact: The research I'm doing could replace the current method to analyze pesticides in whales.

Colleen Kutzler, Animal Science

Mentor: Michelle Kutzler

"Prevalence of Intestinal Parasites in Healthy Llamas and Alpacas"

Interesting Fact: The total number of parasite eggs/animal increased from 2008 to 2017 (5 eggs to 56 eggs, respectively)

Charlotte Lamphere, Agricultural Sciences

Mentor: Michelle Kutzler

"A Report on the Goat Industries of Oregon"

Interesting Fact: 53 Oregon Goat Producers surveyed

Brody Larson, Management; Business Administration

Mentor: Lawrence Houston, III

"Help Me Out! How Coworker Interactions Can Influence Genuine Emotions"

Interesting Fact: The majority of the US economy is now service based, and many customer service workers are required to display positive emotions to customers, which is especially harmful for the employee if they are not genuine.

Emma Latta, BioHealth Science

Mentor: Dr. Linda Blythe

"Poly-ion Layers in Layer by Layer Coating of Bacteria: Growth and Zeta Potential"

Interesting Fact: Sheep and cattle have different ruminal microbes which causes differences in tolerance to toxins.

Spencer Lazaroff, Mechanical Engineering

Mentor: Dr. Deborah Pence

"Preliminary Numerical Study of a Condenser Using Fractal-Like Patterned Hydrophobic and Hydrophilic Sections"

Interesting Fact: Condensers in powerplants are incredibly expensive because their size is so massive. By using a hybrid surface with strips of differing hydrophobicity, it may be possible to reduce the total area necessary.

Mai Le, Biochemistry & Molecular Biology

Mentor: Arup & Gitali Indra

"Function of hair follicle stem cells (HFSCs) and human cathelicidin antimicrobial peptide in cutaneous wound healing"

Interesting Fact: Vitamin D dressings can be used to accelerate wound healing.

Kevin Le, Kinesiology

Mentor: Erica McKenzie

"Strength Training for Triathletes"

Interesting Fact: If something is impossible to measure, how do you conclude it helps?

Jasper Limon, Chemical Engineering

Mentor: Nick AuYeung

"Charging of a Thermally Regenerative Battery via Heated Aeration"

Interesting Fact: The purple anolyte was difficult to photograph since the IR filter on the camera I was using caused it to appear dark blue in photos.

Lisa Lin, Biochemistry/Biophysics

Mentor: Ling Jin

"Investigation of KHV Methylation in Latent and Productive Infection"

Interesting Fact: Koi fish get herpes, just like humans!

Olivia Loftin, Political Science

Mentor: Sarah Henderson

"Alexei Navalny: How to have opposition success in Putin's Russia"

Interesting Fact: It is speculated that Navalny was charged with embezzlement to crush his chance to run for president

Christiana Logan, Nutrition

Mentor: Norman Hord

"Nitrate and nitrite differentially affect respiration in zebrafish during exercise"

Interesting Fact: Nitrate supplementation in the diet of zebrafish causes a decrease in the oxygen cost of exercise!

Yuliya Lunina, Merchandising Management

Mentor: Ryann Reynolds McInay

"Music Stimuli in Retail Environments: A Cross-Cultural Comparison"

Interesting Fact: Classical music increases sales at wine stores, while also leading customers to buy more expensive wine in comparison to playing Top 40 hits.

Helene Matschek, Agricultural Science, French

Mentor: Dr. Larry Roper

"Exploring International Student Involvement"

Interesting Fact: Currently, 11.5% of Oregon State's student body are international students.

Kirra McCollum, Interior Design, Sustainability

Mentor: Marilyn Read

"Cohousing - The Answer to Sustainable Development"

Interesting Fact: Cohousing first started in Denmark during the 1970s.

Megan McEwen, BioHealth Sciences

Mentor: Joseph Catania

"Understanding the High Prevalence of Pediatric Dental Caries in Southeastern Oregon"

Interesting Fact: Lots of county specific research regarding this topic doesn't exist! Things in the state with regard to pediatric dental health seem to be very regionally, but not county or city-based.

Andrew McUne, Digital Communication Arts

Mentor: William E. Loges

"Developing a Questionnaire with the Intent of Measuring User Experience in Test Trials of Low-Cost Virtual Reality"

Interesting Fact: People who indicate that they are willing to use a View-Master virtual reality headset for longer than fifteen minutes are likely to refuse to use that longer time to watch a TV show on it.

Aimee Miller, Public Health

Mentor: Emily Tomayko

"Efficacy of the Wellness Focused "Be Orange Challenge" with Tracking to Promote Healthy Behavior Change"

Interesting Fact: Health behaviors and their subsequent health outcomes are directly linked, with behavioral causes accounting for nearly 40% of all deaths within the United States.

Catherine Mina, Political Science

Mentor: Kelsy Kretschmer

"The Women's March 2017: Predicting Participation in an Unprecedented Protest"

Interesting Fact: Our data discovered that participants in the 2017 Women's March were approximately 20% more likely to participate in a protest after the Women's March than individuals who did not participate in the 2017 Women's March. This leads us to speculate that the 2017 Women's March served as a "gateway protest" that may have led a number of individuals to leading a more civically engaged and politically active life, particularly in the form of protest participation, in a phenomenon we are calling "the Women's March Effect."

Ibrahim Moussaoui, Biology

Mentor: Prem Mathew

"What's Interesting about Interest? The Islamic Prohibition on Interest & Muslim Americans' Financial Understandings, Attitudes, and Behaviors"

Interesting Fact: In Islam, paying and receiving interest is prohibited based on the belief that money should not be a commodity that is lent out; instead, Islamic lending structures arrange loans on an equity basis.

Alamjit Nagra, BioHealth Sciences with Pre-Pharmacy Option

Mentor: Theresa M. Filtz

"Characterizing the interaction between BCL11b and TCF1 transcription factors in the control of the BCL-xL gene"

Interesting Fact: BCL11B and TCF-1 were determined to interact in HEK 293T cells.

Hai Yen Nguyen, Biochemistry and Biophysics

Mentor: Elizabeth Barstow

"Refugees Retelling History"

Interesting Fact: Focuses on highlighting literature by Vietnamese Americans on the topic of the Vietnam War.

Austin Nguyen, BioResource Research, Computer Science

Mentor: Massimo Bionaz

"Analysis of model organism viability through an interspecies pathway comparison pipeline using the dynamic impact approach"

Interesting Fact: In regards to adipogenesis, humans are closer to pigs than mice.

Duncan Ocel, Chemistry, Botany

Mentor: Kimberly Halsey

"Volatile Organic Compound Production by *Synechococcus* WH8102"

Interesting Fact: This research is pertinent to ecology and ocean acidification.

Alannah Oleson, Computer Science

Mentor: Margaret Burnett

"Pedagogical Content Knowledge for Teaching Inclusive Software Design"

Interesting Fact: Inclusive design is important in today's software industry, but there is little research about how to teach it.

In collaboration with 9 teacher-researchers across 8 U.S. universities and more than 400 computer and information science students, we embarked

Karan Patel, Microbiology

Mentor: David Williams

"Investigating the Effect of Sulforaphane on LncRNA Regulation in a Transplacental Nrf2 Knockout Mouse Model Exposed to Dibenzo[def,p]chrysene"

Interesting Fact: LncRNA may play an important role in a variety of regulatory pathways associated with carcinogenesis.

Shaylin Pfarr, Chemical Engineering

Mentor: Stacey Harper

"Methods to Assess Nanoparticle Bio-distribution in Embryonic Zebrafish"

Interesting Fact: This project involves cutting tissue 5x thinner than hair at -26 degrees Celsius.

Alexander Pho, Philosophy

Mentor: Dr. Allen Thompson

"Moral Disagreement and Moral Genealogy: Two Sources of Empirical Challenges to Robust Realism"

Interesting Fact: My thesis project is a partial defense of a metaethical view that maintains that there are objective moral facts. From what I can tell, no OSU Honors College student has completed a thesis project that is similar to mine.

Eric Qian, Chemistry

Mentor: Michelle Dolgos

"Electrical Properties in $\text{Bi}_2\text{Sr}(\text{A})\text{TiNb}_2\text{O}_{12}$ (A = Ca^{2+} , Sr^{2+} , Ba^{2+}) Aurivillius Phases"

Interesting Fact: Formation of this compound requires a furnace that reaches 1300 degrees Celsius, a temperature hotter than that of the Earth's upper mantle.

Monique Ramras, Biology

Mentor: Manoj Pastey

"The Detection of a Simple, Rapid, and Sensitive qPCR Assay for *Pseudocapillaria tomentosa* in *Danio rerio* Tissue Samples"

Interesting Fact: Pathogens may be detected through qPCR !

Michael Rebarchik, Chemical Engineering

Mentor: Liney Arnadottir

"Solvent and Dispersion Effects on the Hydrodeoxygenation of Acetic Acid on a Pd(111) Model Surface"

Interesting Fact: None

Michael Redle, Mathematics

Mentor: Nathan Gibson

"Modelling of Power Efficiency in a Magnetohydrodynamic Generator"

Interesting Fact: The implementation of a Magnetohydrodynamic Generator into a coal or natural gas power plant system could increase their efficiencies from about 40% to 60% or more.

Blake Reser, Industrial and Manufacturing Engineering

Mentor: Dr. Jonathan Velez

"The Creation and Implementation of a Vision and Mission Statement to Promote Positive Change in a Fraternity"

Interesting Fact: There are approximately 380,000 active Fraternity members nationwide, and I believe the implementation a Vision and Mission within their organizations, we can more effectively harness their motivation and align their efforts to ultimately improve the impact and perception of Fraternities in our society.

Nadjalisse Reynolds-Lallement, Biochemistry & Molecular Biology

Mentor: Kathy Magnusson

"Age-related differences in brain activations during spatial memory formation in a virtual Morris water maze task."

Interesting Fact: Older individuals tend to recruit additional brain regions in order to accomplish the same task as a younger individual.

Cristina Riani, Environmental Science

Mentor: Chris Still

"Moss and Liverwort Adaptations to Climate Variation"

Interesting Fact: Bryophytes (moss, liverworts) noticeably respond to changes in microclimate patterns, with some species adapted to wetter conditions and some drier, some adapted to fluctuation and some stability.

Bria Robertson, Mechanical Engineering

Mentor: Jamie Kruzic

"Technological Improvements in Surgical Techniques"

Interesting Fact: I handled pig skin!

Miranda Robinson, Speech Communication

Mentor: Chelsea Graham

"Presidential Framing of Failure: A Pentadic Rhetorical Criticism of President Donald Trump's Rhetoric on Policy Failure with Obamacare"

Interesting Fact: Unlike a majority of other forms of rhetorical criticism, Pentadic criticism is primarily concerned with identifying the motives behind someone's rhetoric rather than the effect that it has on the audience with the goal of understanding the rhetor's world.

Julianne Robinson, Ecological Engineering

Mentor: Desiree Tullos

"Domestic Well Aquifer Storage and Recovery"

Interesting Fact: This study was the first of its kind regarding the use of spring water in aquifer storage and recovery on a household scale.

Jesse Rodriguez, Physics; Mathematics; Nuclear Engineering

Mentor: Janet Tate

"Radial Velocity Profiles and Magnetic Field Probes for Hypervelocity Plasma Deflagration Jets"

Interesting Fact: The jet produced by the Stanford plasma deflagration accelerator has a lifetime of 10 millionths of a second (long for a plasma experiment), requires 8,000 volts to produce, travels at about 100,000 meters per second, and reaches about 180,000 degrees Fahrenheit.

Jessica Roland, BioResource Research

Mentor: Dr. Taifo Mahmud

"Exploring Pactamycin Biosynthesis"

Interesting Fact: The bacteria that produces Pactamycin is found in soil.

Ben Rosene, Chemical Engineering

Mentor: Dr. Sean M. Burrows

"Second Derivative Excitation Emission Resolution (SEC DEER)"

Interesting Fact: It is sensitive down to a single molecule

Mason Rouches, Biochemistry & Biophysics

Mentor: David Hendrix

"Classification and Analysis of Nucleotide-Nucleotide Interactions in RNA"

Interesting Fact: There are over 15 different stabilizing interactions that can take place between two bases in an RNA molecule.

Miles Rouches, Biochemistry and Biophysics

Mentor: Adrian F. Gombart

"The Cathelicidin anti-microbial peptide gene alters the mouse gut microbiome"

Interesting Fact: There are more bacteria in the human gut than there are cells in the human body and these bacteria contain more genes than the human genome.

Minnie Sakulsakpinit, Biology, Medical Humanities

Mentor: Eli Meyer

"Karyotyping the Chromosomes of *Platygyra daedalea*"

Interesting Fact: The species *Platygyra daedalea* is often referred to as the "brain coral" due to its shape and resemblance to the brain.

Bergen Sather, Biology

Mentor: Sean Newsom

"Characterization of the Cellular Respiration and Mitochondrial Metabolism in C2C12 Mouse Myoblasts"

Interesting Fact: The mitochondria is the powerhouse of the cell, this means it is responsible for converting the fuels you eat into the energy currency of the cell.

William Sato, Biochemistry and Biophysics

Mentor: Arup Indra

"Lipids of the Stratum Corneum as predictive biomarkers for the development of Atopic Dermatitis"

Interesting Fact: Lipids play an important role in maintaining epidermal barrier integrity. Changes in epidermal lipid composition have been linked to a variety of skin pathologies. Changes in lipid composition might prove to be useful biomarkers in predicting skin disease.

Mary Hadley Schoderbek, Biology

Mentor: Monique Udell

"Evaluating the Secure Base Effect in Shelter Dog-Shelter Volunteer, Foster Dog-Foster Volunteer, and Pet-Dog Owner Pairs"

Interesting Fact: The dog-owner relationship has been characterized as an attachment bond analogous to the child-parent relationship. While attachment relationships between pet dogs and their owners has been studied extensively, very little is known about attachment relationships between foster dogs and foster volunteers and shelter dogs and shelter volunteers.

Samantha Searles, Psychology; International Studies

Mentor: Dr. Aurora Sherman

"Gender Stereotypes in Halloween Costumes"

Interesting Fact: Female models are as likely to dress up as royalty as male models are likely to dress up as heroes.

Lucy Shaffer, BioResource Research

Mentor: Eli Meyer

"Chromosome visualization in a temperate anemone, *Anthopleura elegantissima*"

Interesting Fact: I was able to visualize condensed chromosomes from adult sea anemone tissue

Gabriel Shepherd, Industrial Engineering

Mentor: Dr. Christopher Stout

"Speak To Us: How to Get Millennials to Vote"

Interesting Fact: This paper explores if press releases from members of the House of Representatives, in categories such as Social Justice, Environmental Issues, and Education, have an effect on Millennial voter turnout.

Tanner Simpson, Physics

Mentor: David Roundy

"Broad Histogram Algorithm Comparison for the Square Well Fluid"

Interesting Fact: The simulations that I study in my research often run for months without stopping!

Amanda Sinclair, Psychology; Sociology

Mentor: Scott Akins

"Whatever it Takes: Examining the effects of post-arrest diversion and reentry programming on mental health court participants"

Interesting Fact: The repeated involvement of individuals with mental health disorders also places undue strain on budgets for both the judicial system and emergency resources. In one anecdotal incident, nine individuals accounted for just under 2,700 emergency room visits.

Kyler Stole, Computer Science; International Studies

Mentor: D. Kevin McGrath

"DemoFlow: Low Cost Flow Cytometry for Increased Access to Medical Diagnostics"

Interesting Fact: Flow cytometry uses lasers, light scatter, and fluorescence to rapidly analyze thousands of cells.

Kenneth Stout, Chemistry, Chemical Engineering

Mentor: Chris Beaudry

"A Pyrone Diels-Alder Approach to 4-Substituted Indoles"

Interesting Fact: The methodology developed in my project will be used to design new drug candidates for treating neurodegenerative diseases.

Jonathan Su, Bioengineering

Mentor: Kate Schilke

"Characterizing Bioactivity and Biocompatibility of Coatings for Endotoxin Capture in Treatment of Sepsis"

Interesting Fact: I genetically modified enzymes with unnatural amino acids to produce endotoxin binding bacteria!

Sean Sylwester, Electrical and Computer Engineering

Mentor: Rachael Cate

"Navigation Assistance for the Vision Impaired"

Interesting Fact: 253 million people worldwide living with vision impairment.

Winnie Tafempa Messa, Electrical and Computer Engineering

Mentor: Dr Ted Brekken

"Survey of power system vulnerability on the Pacific Northwest"

Interesting Fact: Wind and rain account for the largest percentage of outage events

Katherine Tallan, Mathematics

Mentor: Dr. Andrew Meigs

"Statistical Methods for Assessing the Likelihoods of Rupture Scenarios"

Interesting Fact: The earthquake rupture scenarios used to make policy decisions regarding natural hazard preparedness are often created using subjective geologic theory as opposed to a mathematically rigorous process.

Abraham Teklu, Physics

Mentor: Heidi Schellman

"Using Divertor Strike Point Splitting to Study Plasma Response and Its Sensitivity to Equilibrium Uncertainties"

Interesting Fact: My research was done at a national lab in San Diego, run by General Atomics and funded by the DOE. It deals with plasma containment to build a more efficient fusion energy device.

Dani Tellvik, English

Mentor: Eric Hill

"Posthumously, Yours: A Kunderian Approach to Fiction"

Interesting Fact: Kundera believes that fictional characters are existential possibilities.

Aileen Thai, Computer Science – Systems

Mentor: Rob Drummond

"Exploring Story Creation in Script and Graphic Novel Format"

Interesting Fact: In comics lettering, an 'I' with crossbars is only used for the personal pronoun, 'I'.

Ex) A character saying 'I like cats'. In all other cases, the letter 'I' should appear without crossbars.

Tasman Thenell, Computer Science

Mentor: Taal Levi

"WebModeler: Simulator for Modeling Mammal Depletion from Hunting"

Interesting Fact: WebModeler brings together research and researchers from three continents and spans a diverse array of topics including GIS, client-side web application development, and the politics of tribal hunting.

Kristin Thompson, Political Science; WGSS

Mentor: Michelle Inderbitzin

"Isolated Youth: An Exploration of Solitary Confinement in Juvenile Correctional Facilities"

Interesting Fact: Oregon incarcerates young people at a higher rate than almost every other state in the country, including Texas and Louisiana.

Tatiana Thompson, Chemical Engineering

Mentor: Carlos Jensen

"Design of SWEsters Mentorship Program for First-Year Student Success"

Interesting Fact: Our College of Engineering consists of only 20% women. SWEsters is meant to support them for success in college.

Lauren Trevis, Kinesiology

Mentor: Dr. Kathy Gunter

"Examining Relationships Between Participation in Community-Based Exercise Programs and Fall Risk Factors in Older Adults"

Interesting Fact: In the U.S. in 2014, falls led to 7 million injuries, 2.8 million older adults were treated in the emergency room for a fall, and 800,000 of those emergency room visits then resulted in further hospitalization. In the same year, 27,000 deaths were attributed to falls in the United States.

Macklin Turnquist, Chemical Engineering

Mentor: Stacey Harper

"Environmental Transformations of Nanoparticles in Natural Water Systems using a Hydrophobic and Hydrophilic Dye Assay"

Interesting Fact: Titanium dioxide nanoparticles are intrinsically hydrophobic in ultrapure water but became hydrophilic in natural waters due to natural organic matter and salts coating the nanoparticles.

Savannah Van Why, Biochemistry and Molecular Biology

Mentor: Dr. Michelle Kutzler

"The Genetic Diversity of Salukis in the United States"

Interesting Fact: Salukis are a relatively rare breed of dog in the United States who were first bred throughout the Middle East to chase down prey such as jerboas, rabbits, and gazelles.

Lorraine Waianuhea, Biology

Mentor: Joan Hagar

"Corvid Response to Forest Thinning in the Willamette National Forest:
Implications for Conservation of the Marbled Murrelet"

Interesting Fact: Thinning was originally only used as a technique to help maximize profits in timber, but now it is also used to enhance habitat for certain species. Thinning can help create habitat for some species, while at the same time making it unideal for others.

Raven Waldron, BioResource Research

Mentor: Stacey Harper

"Reduced Escherichia coli toxicity of benzethonium chloride through adsorption onto titanium dioxide nanoparticles"

Interesting Fact: Titanium dioxide nanoparticles can be used to decrease the toxicity of numerous different contaminants!

Dacia Williams, Kinesiology

Mentor: Joseph Catania

"Perceptions of Sexual Health Websites by Low Income Urban African American Youth and Service Providers"

Interesting Fact: Many urban African American youth do not have access to the sexual health information they need and often they are not provided this information in their home life nor are they taught adequate information in school.

Julia Wilson, Food Science and Technology

Mentor: Joy Waite-Cusic

"Validation of Baking as a Kill-Step for Salmonella in Cookie Dough"

Interesting Fact: I got to bake over 15 batches of cookie dough for this thesis!

Derek Wong, Chemical Engineering

Mentor: Dr. Vincent Remcho

"Restoring and Confirming Functionality of the Micralyne Microfluidic Toolkit"

Interesting Fact: The power supply board was 80's technology.

An Efficient Electronic Structure Solver for Kane's Model of Quantum Computation

Yousif Almulla^{1,2}, Fahd A. Mohiyaddin^{3,4}, Jacek Jakowski^{3,4,5}, Jingsong Huang^{3,4,5}, Travis S. Humble^{3,4}

¹Department of Physics, ²Department of Mathematics

Oregon State University, OR, USA

³Quantum Computing Institute, ⁴Computational Sciences & Engineering Division, ⁵Center for Nanophase Materials Sciences

Oak Ridge National Laboratory, TN, USA



U.S. DEPARTMENT OF
ENERGY

Office of
Science



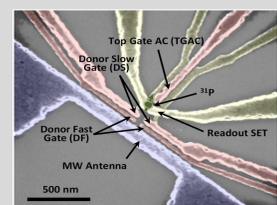
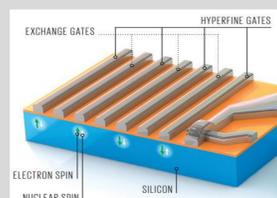
OAK RIDGE INSTITUTE FOR
SCIENCE AND EDUCATION
Managed by ORAU for DOE

Introduction

Despite many advances in quantum computing (QC), there remains no software for efficiently designing candidate QC devices. This requires modeling the coherence times of qubits and the fidelity of quantum gate operations in a qubit system. Our work involves constructing a **computational workflow** for gauging qubit coherence and gate fidelity, specifically for Kane's proposal of a silicon quantum computer. This project is focused on optimizing band structure and wave function calculations for a workflow.

Kane's Proposal

Kane's model uses electron and nuclear spin states of a ³¹P donor atom implanted into a pure ²⁸Si lattice as a qubit, and an oscillating magnetic field to perform quantum gate operations [1]. These gate operations perform unitary transformations on the donor wave function, which are the analog of classical gates acting on electrical current.

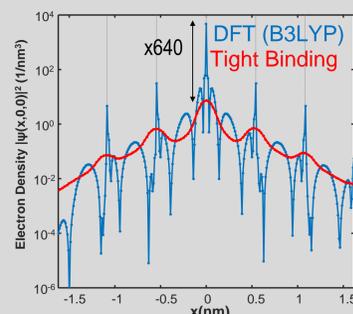


Methods



We are using the density functional theory (DFT) Vienna *Ab Initio* Software Package (VASP) to compute wave functions and band structures of pure ²⁸Si bulk for comparison with tight-binding (TB) calculations done with the Nanoelectronic Modeling software, NEMO-3D. This data will be used to tune the parameters of NEMO-3D to improve its accuracy, producing an electronic structure solver that is both efficient and accurate.

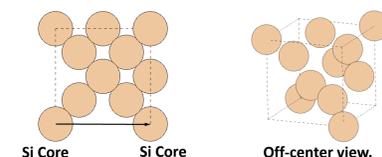
Figure 1. Comparison of DFT and TB wave functions from [2]. TB gets many of the details wrong at lattice sites, highlighting the need for greater accuracy if TB is to be used in a computational workflow



Motivation

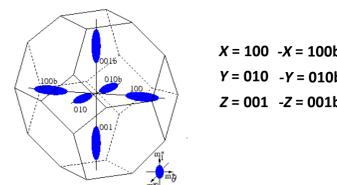
- Theory shows that with a universal quantum computer (one capable of performing any unitary operation) we can efficiently compute the solutions to problems that we do not how to efficiently compute with classical computation [2].
- Examples: Quadratic time speed ups in factoring integers and searching through unstructured spaces.

Silicon Lattice and Conduction Band Minima



A primitive unit cell for the fcc-diamond Si lattice. Arrow represents the length domain of wave functions plotted below.

Blue regions represent six degenerate conduction band minima (CBM) in Si bulk. These are the most energetically favorable states of the CB (band 5).



X = 100 -X = 100b
Y = 010 -Y = 010b
Z = 001 -Z = 001b

Results

Using the hybrid HSE06 functional in VASP, we computed a silicon semiconductor band gap of 1.15eV, wave functions for energy bands 1 - 8 of ²⁸Si bulk, and charge densities over silicon's unit cell. We have confirmed Koiller *et al.*'s result that over 90% of each of the CBM wave function's magnitude is due to just five **G** indices in the Bloch state basis, $u(\mathbf{r})$:

$$u_{\mu}(\mathbf{r}) = \sum_{\mathbf{G}} c_{\mathbf{G}}^{\mu} e^{i\mathbf{G}\cdot\mathbf{r}} \quad \phi_{\mu} = u_{\mu}(\mathbf{r}) e^{i\mathbf{k}\cdot\mathbf{r}}$$

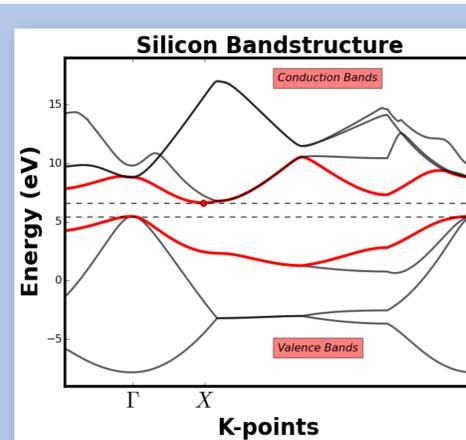
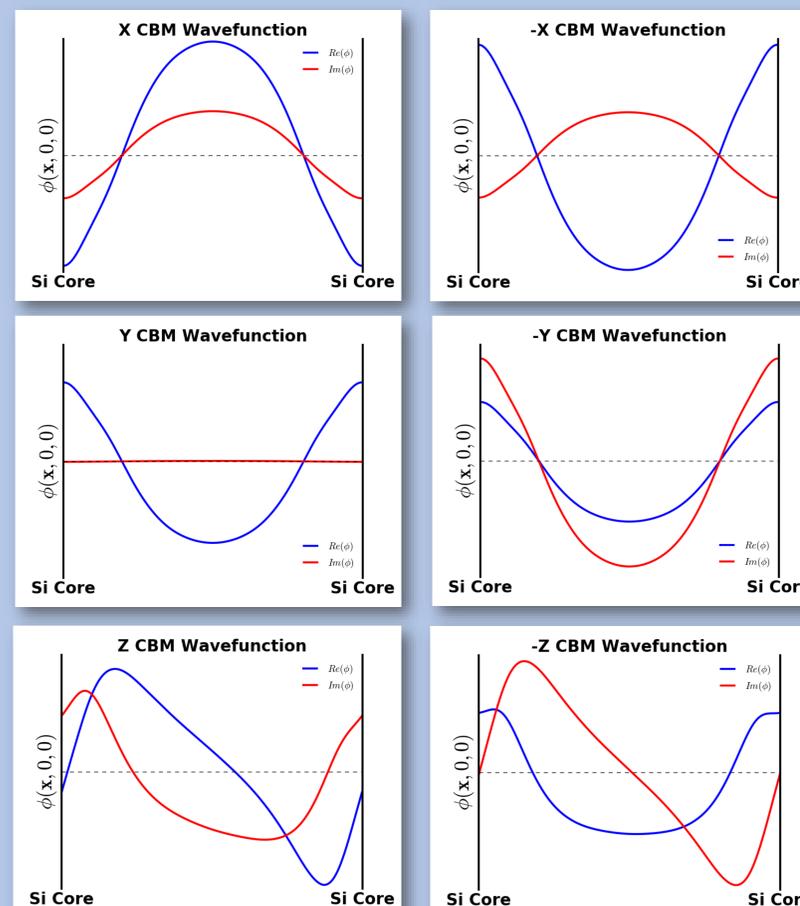


Figure 2. Si band structure diagram for energy bands 1 - 8. The valence and conduction bands are highlighted in red. CBM X is shown.



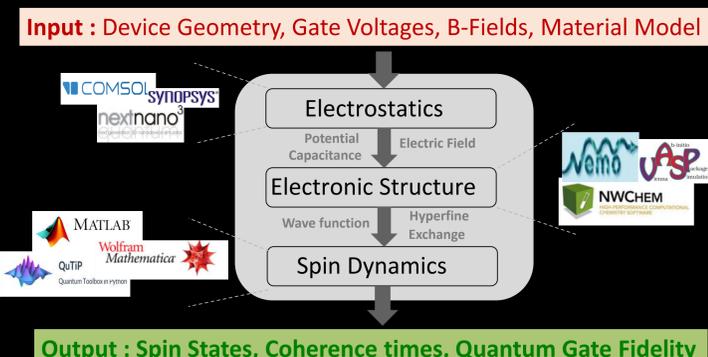
Figures 3(a-f). Conduction band minima wave functions plotted over one spatial period in the silicon lattice. There are six degenerate CBM, and hence six wave functions.

Conclusion & Discussion

The bandgap calculated and the band structure agree closely with those found in the literature, with 1.15 eV at our ground state (~0 Kelvin) calculation, and an empirical measure of 1.11 eV at 302 Kelvin in [4]. Electronic structures are temperature dependent, so this is to be expected.

The calculated wave functions are yet to be verified. We realized that VASP's projector-augmented wave formalism is not norm conserving, implying that the wave functions calculated by VASP are *pseudo* wave functions, rather than the true wave functions. This may be an issue since the goal is to improve NEMO-3D's efficacy; it would be best to tune the software to the true wave functions because these are based on first-principles and can extrapolate to different systems better. Tuning the parameters to a pseudo function may make NEMO excel for just one type of system.

Next Steps: Workflow



References

- [1] B.E. Kane. *Nature*, **393**, 133-137 (1998).
- [2] T. S. Humble et al. *Nanotechnology*, **27**, 42, 424002 (2016).
- [3] B. Koiller et al. *Physical Review B*, **70**, 115207 (2004).
- [4] Streetman, Ben G.; Sanjay Banerjee (2000). *Solid State electronic Devices* (5th ed.). New Jersey: Prentice Hall. p. 524.

Acknowledgements

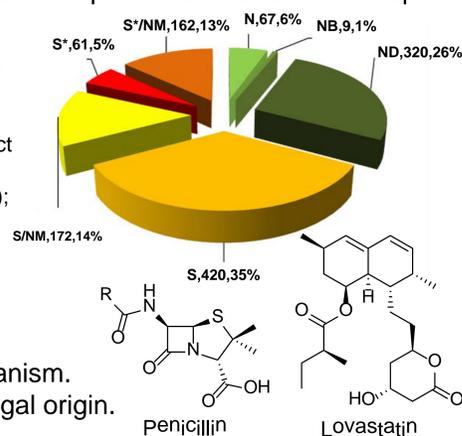
- This work was supported in part by the U.S. Department of Energy, Office of Science, and Office of WDTs under the Science Undergraduate Laboratory Internship program.
- Thanks go to the other authors and Dr. Paul Kent at CNMS for very helpful discussions regarding VASP and related DFT codes.

Introduction

65% of recently approved small molecule pharmaceuticals were inspired by natural products (NP).¹

Origin of all 1211 FDA small-molecule drugs between 1981-2014.

Key: N= Unaltered natural product; NB= Botanical drug; ND= Natural product derivative; S= Synthetic drug; S*= Synthetic drug (NP pharmacophore); S*/NM= NP mimic

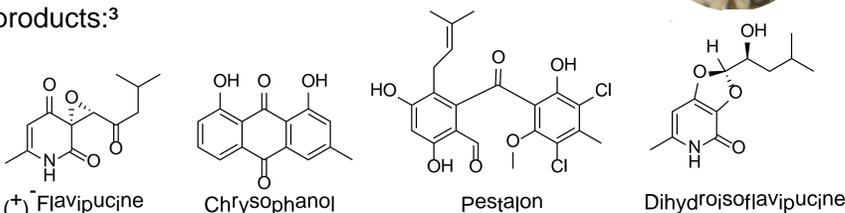


Natural products are secondary metabolites produced by plants, microorganisms, and animals that increase the survivability of an organism. E. g. penicillin and lovastatin of fungal origin.

Natural product biosynthesis is governed by biosynthetic gene expression

Endophytic Fungus *Phoma* sp. 7204

Endophytes are a good source for NPs and are known to produce more bioactive secondary metabolites than ubiquitous fungi.² *Phoma* sp. 7204 is a prolific producer of bioactive natural products:³



Secondary Metabolite Gene Activation

Culture Conditions

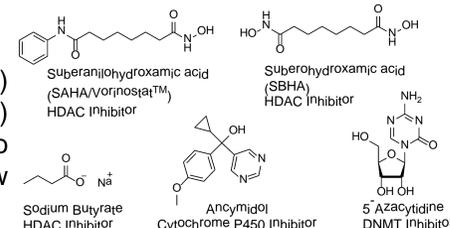
Environmental factors, such as media type, time of growth, flask volume, solid vs liquid media, and static vs shaking growth conditions have the potential to alter the metabolite production in fungi.⁴



Phoma sp. grown in a 24 deep well plate of various media types

Chemical Perturbation

DNA methyltransferase (DNMT) and histone deacetylase (HDAC) inhibitors have been shown to increase the production of new natural products in fungi.⁵



Methods of Gene Activation in *Phoma*

Chemical Perturbation

50 mL shaking cultures of malt-based media dosed with chemical modifiers were grown in biological duplicates for 14 days.

Chemical Modifier	Chemical	Dosage
HDAC Inhibitor	SAHA	1 mM
	SBHA	1 mM
	Sodium Butyrate	1 mM
DNMT Inhibitor	5-Azacytidine	1 mM
Cytochrome P450 inhibitor	Ancyimidol	0.01 mM

Environmental Factors

Flask Size

Cultures either grown in 50 mL or 1 L flasks of malt based media.

O₂ Levels

Cultures were grown either shaking or static to incorporate O₂ into the media.

Media Type

13 mL static cultures grown on various media types on agar, except rice and apple cider, were grown in biological triplicates for 14 days in 24 deep well plates.

* Indicates *Phoma* sp. 7204 did not grow

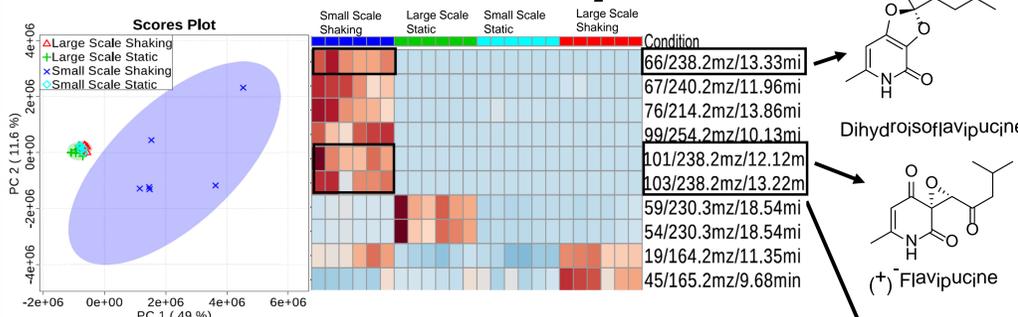
Media Type	
E2	Rice
YPD	FMM No NaNO ₃ *
FMM Low NaNO ₃ *	FMM High NaNO ₃ *
1158	Apple Cider

Metabolomics Analysis of NP Production

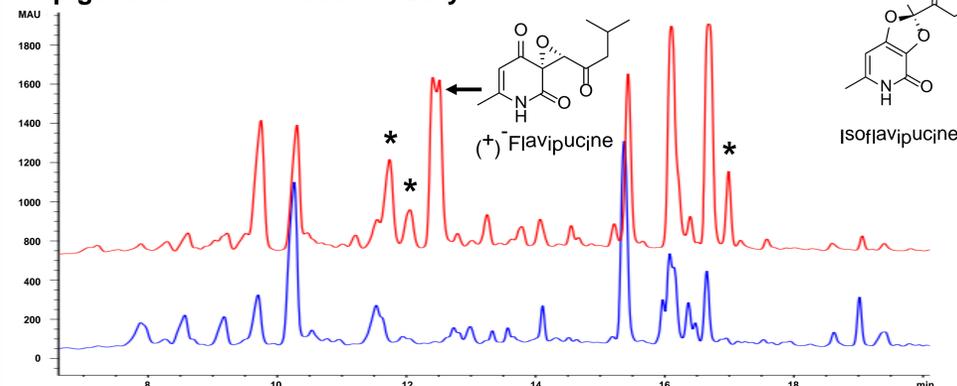
Multivariate analysis of LCMS data to determine statistically significant production of secondary metabolites was employed to guide isolation of targets.^{6,7}

Elicitation of (+)-Flavipucine Production

Environmental Factors: Flask Volume and O₂ Levels



Epigenetic Modifier: Sodium Butyrate



210 nm chromatogram of *Phoma* sp. extract, control is shown in blue, 1 mM sodium butyrate treated culture is shown in red

(+)-Flavipucine and other Flavipucine compounds are only produced when *Phoma* sp. is grown in 50 mL of shaking maltose-based media. When treated with 1 mM sodium butyrate, (+)-Flavipucine and three new compounds are observed.

Induction of New Metabolites from *Phoma*

Epigenetic Modifier: Sodium Butyrate

New compounds in the sodium butyrate culture were found at retention times 11.7, 12.0, and 16.9 minutes. These are not present in the control, and have been selected for isolation.

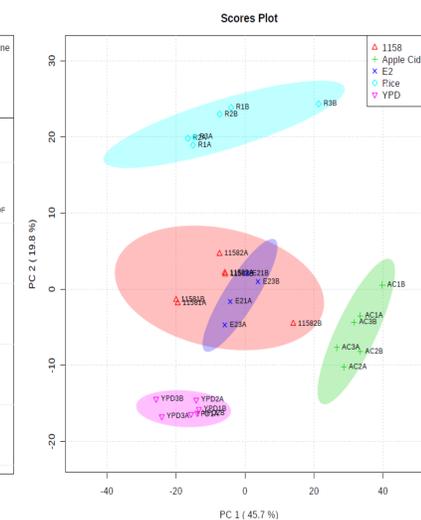
Multivariate Statistical Analysis

Multivariate analysis (principle component) of the LCMS data indicates that culturing *Phoma* in different media types (right) and in the presence of epigenetic modifiers (left) significantly alters its metabolic profile.

Chemical Perturbation



Media Type



The three unknown compounds induced from the sodium butyrate treatment will be isolated over the summer. Ion relative abundance analysis will be completed for the media type and chemical perturbation studies to provide us with compounds to isolate. Isolated compounds will be characterized with NMR, and tested for inhibition of human pathogens and cancer cell lines.

Acknowledgments

I would like to thank Oregon State University's College of Science and the Honors College for providing research funding through SURE and the DeLoach Work Scholarship, respectively. I would like to thank the Oregon State University Dept. of Chemistry, Dr. Loesgen, and the American Chemical Society for funding me to attend conferences. Finally, I would like to thank Dr. Loesgen and all of the other members in her research group for their support.

References

- D. Newman, G. Cragg, *J. Nat. Prod.* **2016**, 79 (3), 629-661
- a) H. Zhang, Y. Song, R. Tan, *Nat. Prod. Rep.* **2006**, 23(5), 828-829; b) B. Schulz, C. Boyle, *Mycol. Res.* **2005**, 109(6), 661-86; c) B. Schulz, C. Boyle, S. Draeger, A. Römmer, K. Krohn, *Mycol. Res.* **2002**, 106, 996-1004
- B. Schulz, S. Draeger, T. Cruz, J. Rheinheimer, K. Siems, S. Loesgen, J. Bitzer, O. Schloerke, A. Zeeck, I. Kock, H. Hussein, J. Dai, K. Krohn, *Bot. Mar.* **2008**, 51, 219-234
- S. Grond, I. Papastavrou, A. Zeeck, *Eur. J. of Org. Chem.* **2002**, 2002(19), 3237-3242
- B. Williams, J. Henrickson, A. Hoover, L. Andryllyn, R. Cichewicz, *Org. Biomol. Chem.* **2008**, 6, 1895-1897
- D. Adpressa, S. Loesgen, *Chem. Biodiv.* **2016**, 13, 253-259
- D. Adpressa, K. Stalheim, P. Proteau, S. Loesgen, *ACS Chem. Biol.* **2017**, doi: 10.1021/acschembio.7b00268

Development of an enzyme linked immunosorbent assay (ELISA) for the detection of Zebrafish Interleukin 1 beta upregulation

Samuel Cook

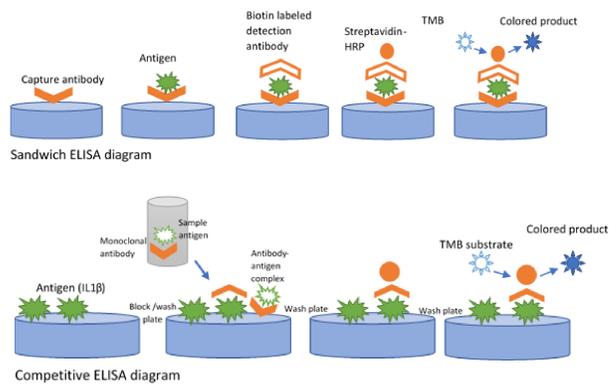
INTRODUCTION

The study and utilization of *Danio rerio* (Zebrafish) as a model organism has increased greatly in recent decades. Zebrafish have been found to possess many orthologs to human genes, one gene and protein of particular interest to the field of immunology is interleukin-1 β (IL1 β). It is a pro-inflammatory cytokine that is produced in an inactive pro-form before being post-translationally modified and excreted into its active form. The body of zebrafish research would benefit greatly from a sensitive assay based on monoclonal antibodies. Two monoclonal antibodies reactive against zebrafish IL-1 β were developed. These were used in conjunction to develop an IL1 β -specific sandwich ELISA assay system to detect native IL-1 β produced by bacteria-stimulated zebrafish leucocytes and individually to develop a competitive ELISA for the same purpose.

OBJECTIVES

- Develop monoclonal antibodies sensitive to IL1 β
- Create sandwich and competitive ELISAs to test protein upregulation
- Run qPCR to test gene upregulation
- Compare gene and protein regulation patterns in response to various bacteria

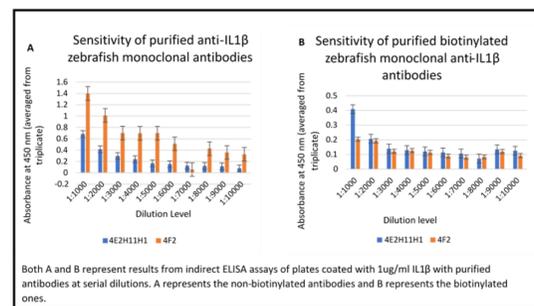
Diagrams of ELISA types



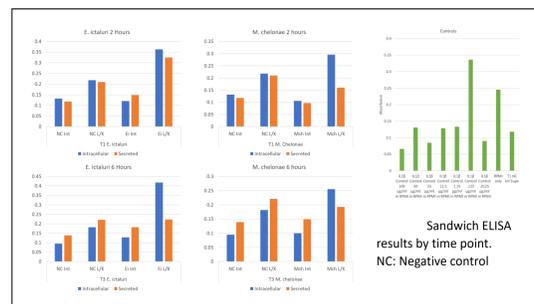
METHODS

- Zebrafish intestines, kidneys, and livers extracted and exposed to *Edwardsiella ictaluri* and *Mycobacterium chelonae* for 2, 4, or 6 hours
- Samples separated into intracellular and secreted proteins
- mRNA extracted and turned into cDNA
- cDNA used in qPCR to determine gene upregulation using $\Delta\Delta CT$ method (higher number means more gene copies).
- Antibody-producing hybridomas created and screened for IL1 β sensitivity and specificity via ELISA and western blot
- Monoclonal antibodies purified via protein G affinity chromatography
- Some antibodies biotin-labeled
- Sandwich ELISA (higher number means more IL1 β)
- Competitive ELISA (lower number means more IL1 β)

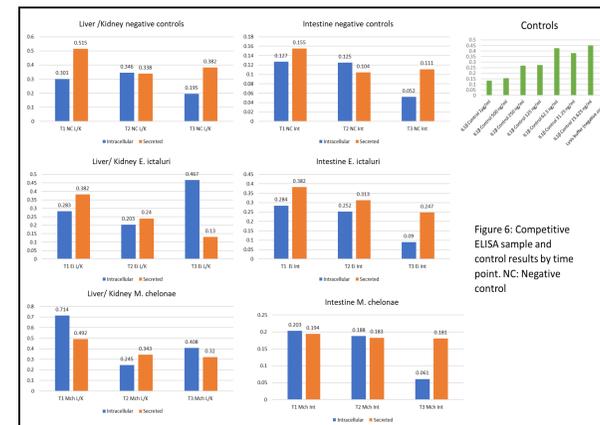
Sensitivity assay results



Sandwich ELISA results



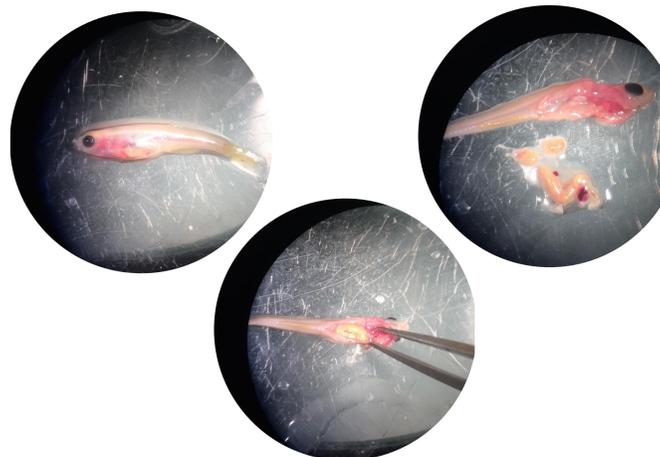
Competitive ELISA results



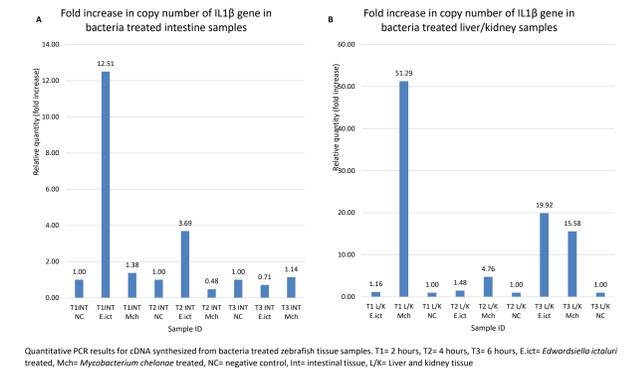
RESULTS

- Sandwich ELISA inconclusive
 - Likely due to biotinylation and low antibody sensitivity
- Competitive ELISA showed promising results
 - Fast response to *E. ictaluri* in all tissues
 - Minimal to no protein increase in response to *M. chelonae*
- qPCR results
 - Increased gene transcription in liver and kidney in response to *M. chelonae*
 - Minimal upregulation in intestines in response to *M. chelonae*
 - Rapid increase in

Zebrafish



qPCR results



CONCLUSIONS

- Responses make sense considering each bacteria
- Need more replication
- Need improved antibodies and biotin labeling process
- Expand to other bacteria and cytokines

REFERENCES

• Hawke, J. P., Kent, M., Rogge, M., Baumgartner, W., Wiles, J., Shelley, J., ... Peterson, T. S. (2013). Edwardsiellosis Caused by *Edwardsiella ictaluri* in Laboratory Populations of Zebrafish *Danio rerio*. *Journal of Aquatic Animal Health*, 25(3), 171–183.

• Livak, Kenneth J. and Schmittgen, Thomas D. (2001). Analysis of Relative Gene Expression Data Using Real-Time Quantitative PCR and the 2- $\Delta\Delta CT$ Method. *Methods*, 25(4):402 – 408.

• Whipps, C. M., Lieggi, C., & Wagner, R. (2012). Mycobacteriosis in Zebrafish Colonies. *ILAR Journal / National Research Council, Institute of Laboratory Animal Resources*, 53(2), 95–105. <https://doi.org/10.1093/ilar.53.2.95>

• ZFIN Data Contents. (n.d.). Retrieved October 23, 2017, from https://zfin.org/zf_info/zfin_stats.html

ACKNOWLEDGEMENTS

Thank you to Justin Sanders, Brian Dolan, and Amy Palmer for all of their help

High School Teachers' Approaches toward Canonical Literature through Culturally Responsive Teaching (CRT)

Carly Ferguson, Dr. Soria E. Colomer

CONTEXT OF STUDY

The study took place at a high school in western Oregon after achieving IRB approval. The name of this high school has been changed in accordance with IRB stipulations for the sake of anonymity and is signified as "West Meadow High School" for the purpose of this study. Like many districts across the nation, the high school in this school district continues to see an increasing population of culturally and linguistically diverse learners. In the 2014-2015 school year, the high school reported that 29% of their students self-identified as something other than white racially/ethnically and that twenty-nine different languages were spoken by their students. (Oregon Department of Education, 2015)

Five high school English language arts teachers participated in this study. Their names and any potentially identifying information has been changed to protect their anonymity, and they are referred to by the pseudonyms Sydney, Martha, Anne, Tim, and Mike throughout this study. These participants have been working as English language arts teachers for a varying range of times, with the most senior teacher having taught for twenty-eight years and the most inexperienced teacher having taught for ten years. As a department, they see students of all grades (9th through 12th) and skill levels.

RESEARCH QUESTIONS

- Is literature being taught using culturally responsive pedagogy in high school classrooms?
- If not, why are culturally responsive practices not being implemented?
- What are teachers' individual perspectives of culturally responsive teaching as a pedagogical approach?

METHODOLOGY

Each teacher was interviewed twice at the school during the fall of 2016—once before teaching a specific unit within their class and once after the completion of teaching this unit. Data collection consisted of open-ended, audio-recorded interviews and document analysis of unit lesson plans and materials such as handouts and worksheets that were given to the students to be used in-class for the unit. Audio recording was a requirement for these interviews. Lesson plans for the unit that fell between the two interviews were requested during the first set of interviews, but only one out of the five participating teachers was able to provide a complete unit plan. The second round of interviews was conducted after the unit had been taught and addressed the teachers' reflective thoughts on the unit. All interview questions were optional for the participant to answer.

Data analysis began during the transcription process of the audio recordings as well as in reviewing the unit lesson plans, handouts, and worksheets. The qualitative data analysis program Dedoose was used to code the interview transcripts. The eight tenets of culturally responsive teaching outlined by Ladson-Billings (1994) in defining the framework of CRT were utilized to determine the preset codes for this data [see Theoretical Framework].

THEORETICAL FRAMEWORK

The theoretical framework used to approach this project and address this disconnect between English language arts curriculum and diverse student populations is culturally responsive teaching. As a pedagogical framework, culturally responsive teaching strives to incorporate students' lived experiences and individual knowledges into classroom curriculum in order to improve their engagement with the subject being taught while simultaneously honoring and affirming the cultural background of the student (Gay, 2010).

The eight tenets that define the corresponding teaching practices of CRT (Ladson-Billings, 1994):

1. Reshaping curriculum
2. Intentional teaching methods
3. Inclusion of culturally and linguistically diverse (CLD) students
4. Small-group instruction
5. Student-controlled discourse
6. Teacher in the role of facilitator
7. Cultural sensitivity
8. Communication of high expectations

Findings

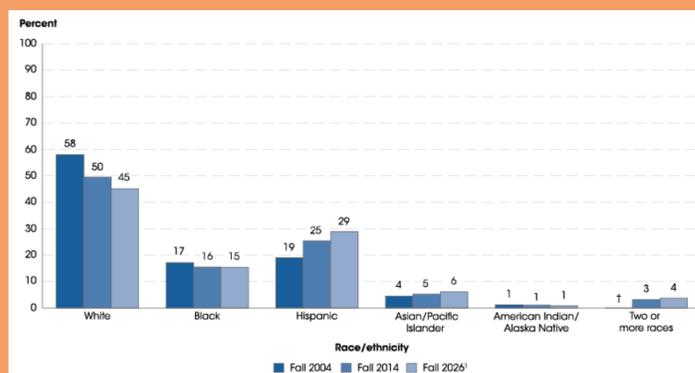
- CRT coincidentally 2016-2017 area of focus for school district's professional development
- All participants reported frustration at presentation of CRT, lack of understanding of definition or clear practices, but simultaneously expressed importance/relevance of CRT and desire to be more culturally responsive
- Noted perception that CRT is only beneficial for targeted learning populations rather than school population as a whole, impeding implementation of CRT
- Teaching practices demonstrate canonical lit taught in CR manner, and conversely more diverse texts taught in non-CR manner
- Every participant ranked self as primary decision-maker over their classroom curriculum (freedom to reshape curriculum and curriculum flexibility present)
- Personal writing exercises, supplementary texts, and small-group activities few examples of practices utilized to be more culturally responsive in classroom
- Reported disparity between student demographics in upper-level and lower-level classes impacting teachers' perceptions of which classes could be successfully engaged (overall, lower expectations communicated for "remedial" classes with reported overrepresentation in racially/ethnically diverse students)

Discussion

- Not so much a question of **what** is being taught so much as **how** it's being taught. Data indicates that it is possible to teach traditional, canonical texts in a culturally responsive manner. Furthermore, lesson plans provided by participants and interview responses indicate a slow, steady trend toward increasingly culturally inclusive texts with authors of more diverse backgrounds than simply white male. While flexibility in curriculum and reshaping of curriculum suggests culturally responsiveness something teachers are receptive to and striving for, overall lack of intentional methods ultimately determines lack of CRT
- Of greatest significance is overarching attitude of the participating teachers toward the presentation of "culturally responsive teaching" within the context of their professional development. A lack of agreement on key-terms and the corresponding teaching practices is preventing CRT from occurring even in situations where teachers are explicitly receptive to/ eager to be more culturally responsive

Implications of study and for further study:

- Establishing a working, concrete definition of culturally responsive teaching with clearly outlined and presented teaching practices developed in collaboration with the teachers who will be implementing them
- Examining the presentation of key concepts to teachers and the relationship between teachers and admin within professional development approaches/continuing education



Percentage distribution of students enrolled in public elementary and secondary schools, by race/ethnicity: Fall 2004, fall 2014, and fall 2026

Source: National Center for Education Statistics

Ten Most Frequently Taught Texts in U.S. High School English Language Arts Classrooms

- Golding, *Lord of the Flies*
- Fitzgerald, *The Great Gatsby*
- Hawthorne, *The Scarlet Letter*
- Lee, *To Kill a Mockingbird*
- Shakespeare, *Macbeth*
- Shakespeare, *Julius Caesar*
- Shakespeare, *Romeo and Juliet*
- Shakespeare, *Hamlet*
- Steinbeck, *Of Mice and Men*
- Twain, *Adventures of Huckleberry Finn*

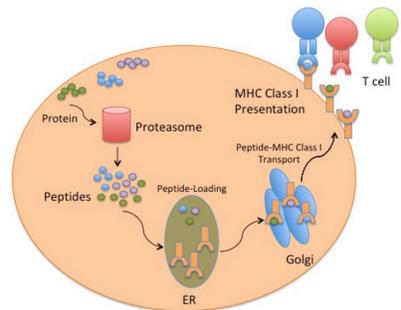
Problem: stagnant curriculum + increasingly diverse learning population = growing disconnect between our classrooms' texts and the students reading them

Impact of Unfolded Protein Response, USP14 and Nedd8 Inhibitors Upon Antigen Presentation in Sa1/Ak and 4T1 Tumor Cell Lines

Jamila Godil¹, Amy Palmer², Brandy Nagamine², Brian Dolan²

¹Department of Microbiology, College of Science, Oregon State University, ²Department of Biomedical Sciences, College of Veterinary Medicine, Oregon State University

Introduction



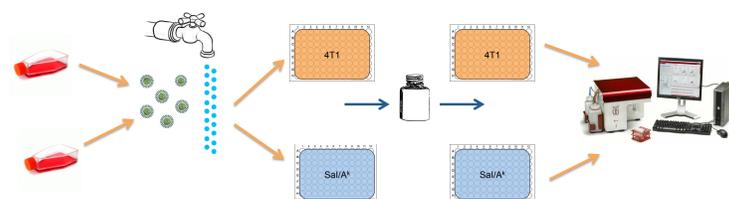
The adaptive immune system is comprised of a variety of cells that are responsible for responding to specific pathogens and providing immunological memory. Cells included in this category are B cells, T cells, and professional antigen presenting cells (APC). Antigens are transported from the sites of infection to the lymph node to be recognized by naïve B and T cells. After exposure to antigens, lymphocytes differentiate into effector cells and take action to remove the infection. Cytotoxic CD8 T cells eliminate self-cells that have become infected or transformed. This is accomplished by the binding of the T cell Receptor (TCR), expressed on the T cell, to the Major Histocompatibility Complex (MHC) Class I and antigenic peptide complex.

Antigen presentation follows many steps to promote viral peptides to the surface of the cell for T cell recognition. Cells use MHC I to present intracellular proteins, for interaction with T-cells. This mechanism allows our immune system to easily recognize foreign pathogens and target them for destruction via Cytotoxic T-cells. Two tumor cell lines, Sa1/Ak and 4T1, were used to study the three pathways of interest:

Unfolded Protein Response
USP14
Nedd8

Methods

- Tumor cells obtained and counted
- Majority of the cells washed with low pH buffer
- Both cell lines plated and treated with inhibitor
- Cells incubated with treatment for six hours
- Staining antibodies used to help with imaging the cells
- Analysis by Flow Cytometry



Results

A

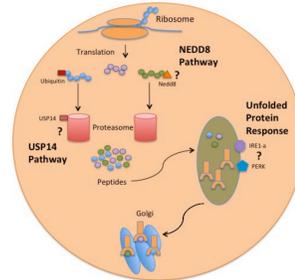


Figure A: The location of each pathway highlighted within the cell. The three pathways Unfolded Protein Response, USP14, and Nedd8.

B

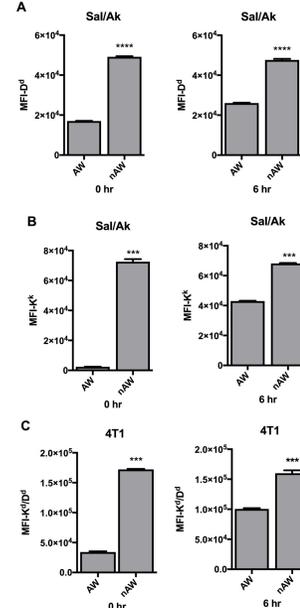


Figure B: Acid wash treatment degrades MHC Class I at the cell surface.

C

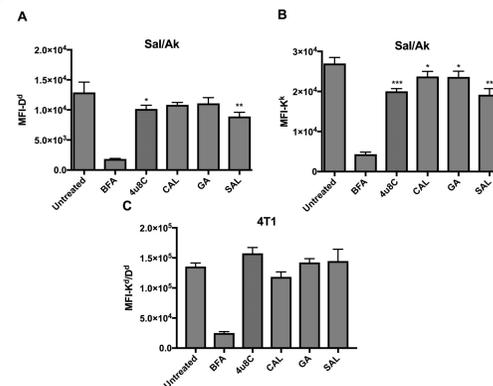


Figure C: UPR inhibitors had slight decrease in MHC Class I levels in Sa1/Ak cells and no effect on MHC Class I levels in 4T1.

D

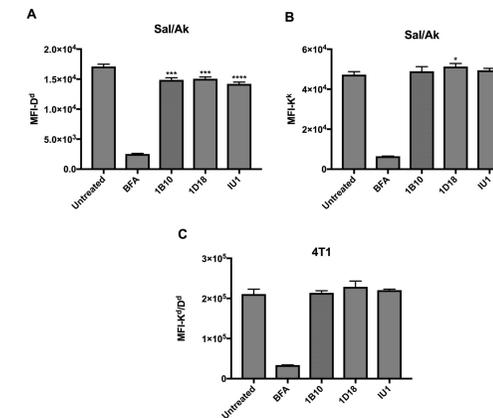


Figure D: Sa1/Ak cells, there was a statistically significant decrease in D^d levels following Usp14 treatment, but no change in MHC class I was noted for K^k nor for either MHC class I proteins in 4T1 cells

E

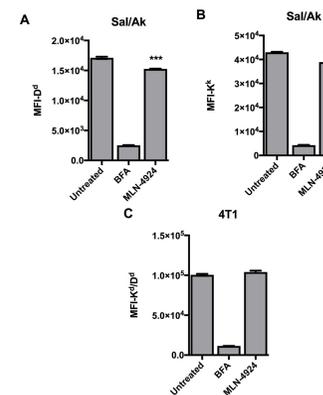


Figure E: The diagram indicates the inhibitor slightly decreased MHC Class I levels for Sa1/Ak cells. No change was seen in 4T1 cells

Conclusion

Collected data confirms:

- Acid Washing tumor cells reduces cell surface MHC Class 1 levels
- MHC Class 1 levels partially recover after six hours of culture
- UPR inhibitors slightly decreased MHC Class I levels in Sa1/Ak
- UPR inhibitors do not affect MHC Class I levels in 4T1
- Significant decrease in MHC Class I levels in Sa1/Ak D^d, but no change in K^k when treated with USP14 inhibitors
- No change observed in MHC Class I levels in 4T1 when treated with USP14 inhibitors
- MLN-4924 has a partial effect in Sa1/Ak cells and no effect in 4T1 cells

Future Directions

Analyze how peptide composition and quantity change upon inhibition

Acknowledgements

Special thanks to Brian Dolan for developing the project; Amy Palmer and Brandy Nagamine for guiding information; and Department of Biomedical Science in the College of Veterinary Medicine at Oregon State University for establishing the research opportunity.

Contact Information:

Jamila Godil: jamila.godil@gmail.com

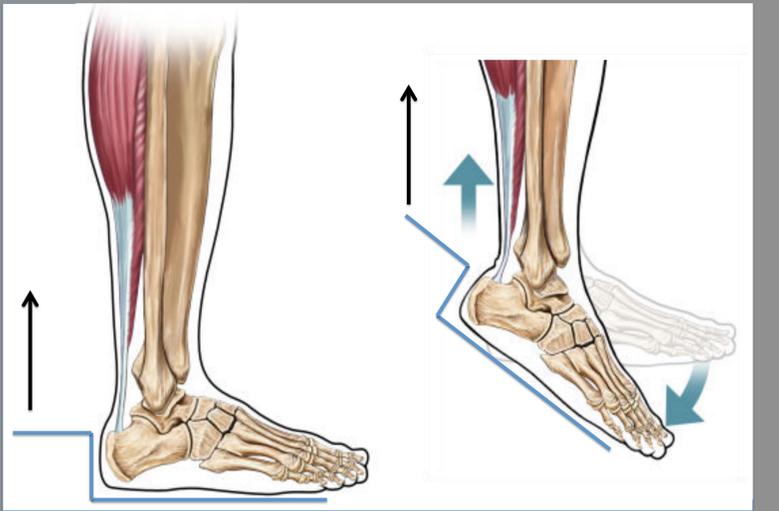


**ACHILLES ASSISTANCE DEVICE AS A PASSIVE ANKLE FOOT ORTHOSIS
FOR ACHILLES TENDON INJURIES**
OREGON STATE UNIVERSITY
EVAN GONNERMAN
MENTOR, BRIAN BAY
FEBRUARY 1, 2018
DEPARTMENT OF MECHANICAL, INDUSTRIAL, & MANUFACTURING ENGINEERING



ABSTRACT
An Achilles tendon injury can be devastating. Surgical methods to bring the muscle to full strength are not always available. Proposed is an ankle foot orthosis (AFO) that is entirely passive (does not add energy to the system) and uses the mechanical advantages provided by the walking gait of a person to decrease the energy exerted by the Achilles tendon during locomotion. The device is an exoskeleton consisting of two eccentric cams located near the knee joint that connect to extension springs. A lever arm extending horizontally from the ankle loads and unloads the springs through a lightweight twine. The main advantages of this AFO can be seen in cost, manufacturability, and adaptability. The AFO will be constructed from off-the-shelf parts purchasable through worldwide distributors and from rigid plastic components fabricated through additive manufacturing processes. This allows for a low cost, easily constructible exoskeleton that can be “printed” in any location. Furthermore, the spring/cam system mimics the advantages found in compound bows. The spring is extended during the locomotion phase where gravity and forward momentum are the driving loading forces. The result is a system that provides force in parallel with the Achilles tendon when its force exertion is at a maximum. All parameters of the device can be adjusted to fit any sized person and any severity Achilles injury. This Achilles assistance device bridges the gap between expensive conservative solutions and lengthy rehabilitation processes for Achilles tendon injuries.

INTRODUCTION
Achilles tendon injury can derail the career of an athlete, preclude a worker from a manual job, and put a professional’s life on hold for weeks. There are two common ways to address and aid the recovery of an Achilles tendon tear: surgical repair of the torn tissue or the conservative option of nursing the tissue to full strength [1]. The focus of this research is on AFOs as a conservative solution to the healing of a torn Achilles tendon. The device proposed in this paper will be centered on a passive method of assisting the Achilles tendon. Through utilizing basic mechanical advantages of the human gait and additive manufacturing processes, an inexpensive and easily manufacturable device will be designed for those recovering from Achilles tendon injuries .



METHODOLOGY
Device Components :

- Fused deposition modeled (FDM) rapid prototyped ABS insole
- Leg harness made from ABS, PLA, and carbon fiber
- Cam assemblies with bearings and shoulder bolt fasteners
- Vectran twine running from insole to springs
- Two 125 N/mm springs

Mathematical Methodology:
The methodology behind the Achilles assistance device is in the two eccentric cams located near the knee. These mechanical components provide passive energetic properties that allow for improvements in the gait of an injured subject. Equations 1 and 2 show the performance calculations for a linear spring while equations 3 and 4 show the same parameters for the cam configured device.

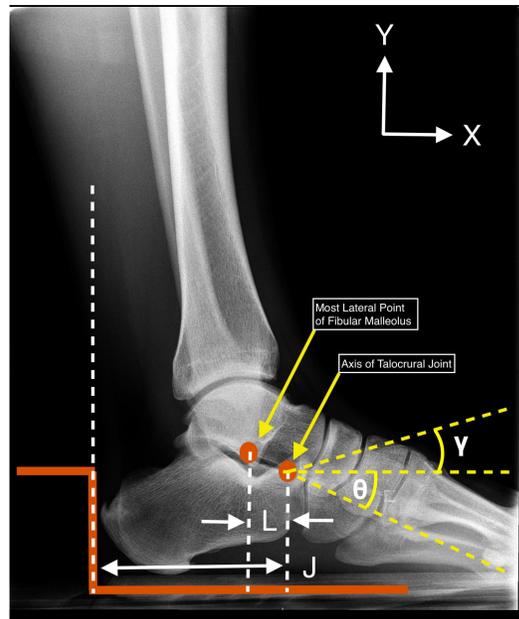
$$F = k * \theta * R \quad [1]$$

$$U = \frac{1}{2} * k * (\theta * R)^2 \quad [2]$$

$$F = k * \theta * (R - r * \cos(\theta)) \quad [3]$$

$$U = \frac{1}{2} * k * ((R * \theta)^2 - 2 * R * r * (\theta * \sin(\theta) + \cos(\theta))) + C \quad [4]$$

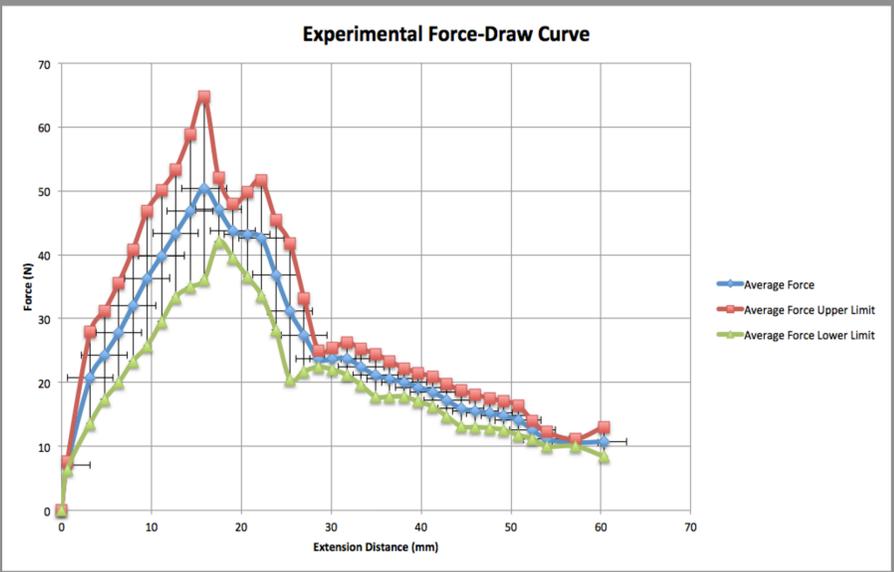
Equation 3 was developed by Randall D. Peters and shows the force stored using cam parameters and a rotation of the component [2]. By integrating Equation 3 it is possible to define force and energy performance characteristics that can be verified through analytical and experimental testing.



RESULTS
The maximum torque and elastic energy stored for linear spring systems and non-linear cam systems are as follows:

- Linear Spring Maximum Torque = 2.66 N*m
- Linear Spring Maximum Elastic Energy Stored = 0.44 J
- Non-Linear Cam Configuration Maximum Torque = 4.96 N*m
- Non-Linear Cam Configuration Maximum Elastic Energy Stored = 1.36 J

As can be seen by these results, simply by adding a cam into the exoskeletal system with the given parameters, the applied torque increases by 1.86 times and the elastic energy stored increases by 3.10 times. Using the same parameters as above, the physical model yielded a maximum torque of 6.05 N*m. Variance in spring constant ratings, measurement error in the analog force gauge, and friction in the bearing assembly can explain this difference. Furthermore, the predicted maximum torque value falls within one standard deviation of the experimentally determined value. The analytical and experimental results show an increase in torque and stored energy from a linear system while providing force characteristics in line with the human gait.



DISCUSSION
There is a need for inexpensive and non-surgical solutions to Achilles tendon injuries. With the increasing access to plastic additive manufacturing, the passive AFO proposed in this paper meets both criteria. The majority of the design can be printed on conventional 3-D printers using ABS and PLA plastic while the method of providing force in parallel with the Achilles tendon does not cause the user to unnecessarily fight an external force. There are many branches that can stem from this research. Passive solutions to intricate problems can decrease the cost of recovery for injured users. They also can be more variable to a large population because of their simplicity and lack of advanced programming designed for individual subjects. Research involving uncommon mechanical methods, such as the implementation of compound bow energy storage, can produce novel inventions and progress in biomedical device work. The implementation of an exoskeleton capable of assisting an individual in the recovery process of a torn Achilles tendon will aid in the research of other inexpensive, non-robotic solutions and provide a device that was previously inaccessible in rural areas.

REFERENCES

- [1] A. Soroceanu, F. Sidhwa, S. Aarabi, A. Kaufman, M. Glazebrook, “Surgical Versus Nonsurgical Treatment of Acute Achilles Tendon Rupture,” *Journal of Bone & Joint Surgery*, vol. 94, pp. 2136–2143, Dec. 2012.
- [2] R. D. Peters, Archer’s Compound Bow-smart use of Nonlinearity, 1400 Coleman Ave. Mercer University: Department of Physics, 2000. [Online]. Available: <http://physics.mercer.edu/petepag/combow.html>
- [3] Nucleus Medical Media, “Achilles Tendon: Lateral (Side) View,” Nucleus Catalog, April 30, 2015. [Online]. Available: <http://www.nucleuscatalog.com/achilles-tendon-lateral-side-view/view-item?ItemID=37049>. [Accessed: Jan. 14, 2017].
- [4] Mark, “X-Ray of My Foot,” My Achilles Tendon, Nov. 2013. [Online]. Available: <http://myachillestendon.com/2013/11/17/x-ray-of-my-foot/>. [Accessed: June 2017].



Development of a Medicinal Infused Hydrogel Patch for the Treatment of Burns and Diabetic Ulcers

Abigail Griffiths, Dr. Skip Rochefort
School of CBEE, College of Engineering, Oregon State University, Corvallis, OR



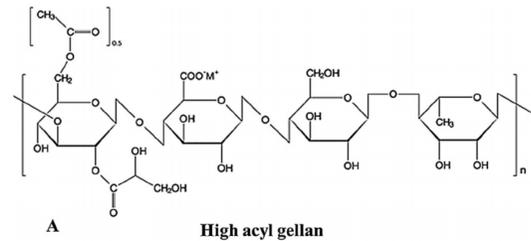
Goal

To develop a hydrogel burn patch that can be applied after a burn injury to help prevent infection, alleviate pain and encourage wounds to heal quickly. A gel formulation should be able to contain a proprietary medical mixture, be easily packaged and stored, and gradually release contents when applied to the burn.

Background

The degree of a burn is based on the severity of damage to the skin. Besides the pain associated with the burn injury due to damage and death of surrounding skin cells, there is a large risk for complications including infection, blood loss, and shock. Current practice for burn treatment typically includes changing dressings twice a day to ensure they do not dry out and reapplying medication. This process is often extremely painful for patients. By using a hydrogel, frequent dressing changes can be avoided as the patch will remain moist while it releases medication over time.

- **Gellan gum** is a water soluble polysaccharide used for drug delivery because of its biocompatibility. High acyl gellan gum gives gels flexible and elastic properties ideal for wraps and bandages.
- **Metamix** is a medicinal mix to be infused in gels made of a proprietary mixture of botanical compounds, which have healing and antibacterial properties obtained from *Meta Material Systems, Inc.*



Hydrogel Preparation Method Optimized

- CP Kelco CG-HA Pharmaceutical Grade Gellan Gum (1.75 wt% of water volume) was added to 80°C DIW under constant stirring until the solution was homogenous.
- *Metamix solution* (a combination of *Metamix concentrate* and glycerin) was added to the solution and mixed.
- *Metamix* composition varied from 15% to 35% by total solution volume.
- The 80°C solution was poured into 5cm by 5cm square molds to form gels with a thickness of about 2mm.
- Once cooled, gels were individually bagged and labeled as shown below. Gels were stored both at 25 °C and 4°C.

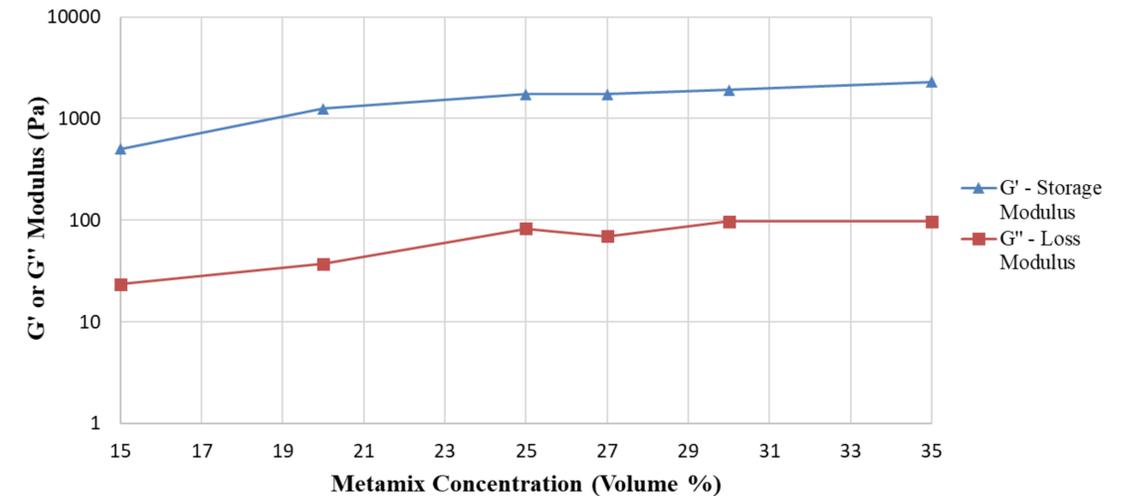
Observations of gels were taken periodically to monitor whether gels grew mold or exhibited syneresis (expulsion of liquid from the gel structure). A numbering system from 1 to 4 was used to track the mold and syneresis levels in varying storage conditions.

To attain quantitative data about the mechanical properties of the gels, dynamic oscillatory strain and frequency sweeps were conducted on a *TA Instruments AR2000ex Rheometer*. A rheometer measures the flow properties of a substance by comparing the storage modulus and loss modulus (G' and G'' respectively).



Results

Gellan Gum with Metamix Frequency Sweep at 1 Hz



Rheology – Across all *Metamix* concentrations the storage modulus was greater than the loss modulus, indicating that the gels were more elastic than viscous. The storage temperature of the gel (25 °C versus 4 °C) had no effect on the measured moduli.

Observations - Syneresis did not occur in gels containing less than or equal to 25% *Metamix* by volume at both 25 °C and 4 °C. Above this concentration syneresis was observed. Gels stored at 4 °C had significantly lower mold levels after 6 months compared to gels stored at 25 °C.

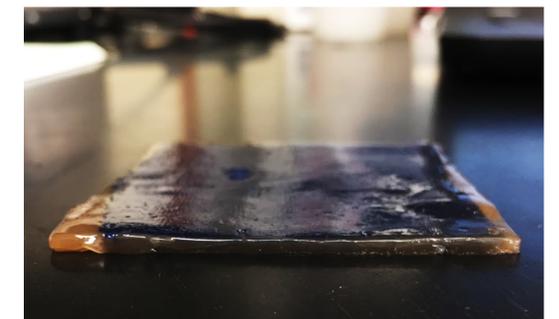
Conclusions

It was found that the optimum gel formulation has the following properties:

- 1.75 wt% Gellan Gum and 25% *Metamix* by volume.
- Does not lose liquid via syneresis when stored at 25 °C or 4 °C. Shelf-life of 6 months has been observed.
- The gel is elastic but resilient, retaining its original shape without tearing after being stretched (as would occur if applied to a wound).
- Experiments measuring the contact angle of the syneresed liquid from the gels show that a mixture of *Metamix solution* and water is released.

Future work

- Additional studies on the release rates of medicine from the gels will be further explored. A suitable simulator of human skin needs to be identified as a way to evaluate the composition of the liquid syneresing from the gels.
- A prototype of a fabric imbued with 25% *Metamix* gel has been made (see right), which could lead to a self-contained fabric wrap.



Acknowledgements

Thank you to Dr. Skip Rochefort and lab, Molly Carpenter, Pete & Rosalie Johnson and the Johnson Internship Program, the OSU Women's Giving Circle, and the UHC Experiential Award. *Metamix*, Hyaluronic Acid, and fabric materials were kindly supplied by Brian David of Meta Materials Systems, Inc.

TOWARD PROFESSIONAL PRACTICE

Student Learning through Participation in Engineering Clubs

Student: Christopher M. Hinkle | Mentor: Milo D. Koretsky



Photo: By Tomas Castelazo (Own work) [CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0) or GFDL (http://www.gnu.org/copyleft/fdl.html)], via Wikimedia Commons

MOTIVATION

- Extracurricular student clubs are prominent, but poorly understood learning opportunities.
 - Qualitative research can compliment survey-based studies by offering richer characterization of activities and learning.
 - Recent shift in education to reflect globalization, need for creative engineering practices, and better preparation for transition from school to the workplace.
1. How does each club function?
 2. What elements are most influential?
 3. How do the clubs contribute to student learning?

METHODS

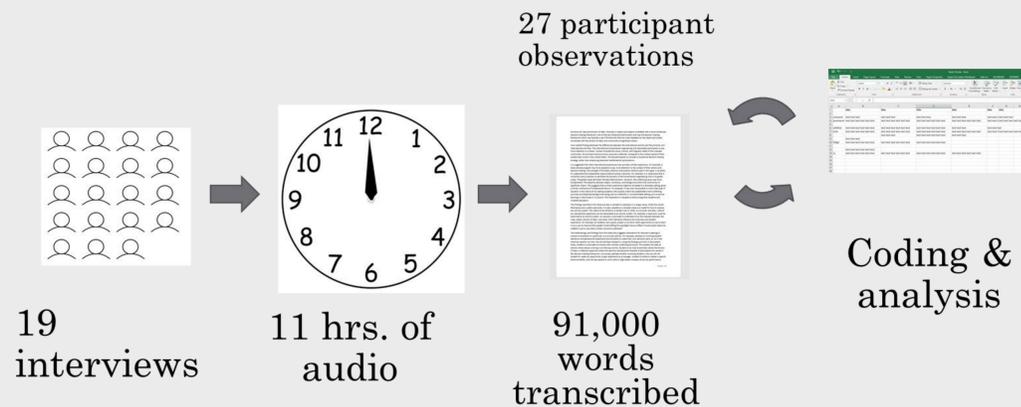


Figure: By Araling clock animation gif Case/White derivative work: User:ArmoReinhold [CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

DISCUSSION

Chemical car club:

Innovation, experimentation:

- Driven by relatively equal access (equal division of labor); emphasis on learning; de-emphasis on winning
- Can foster entrepreneurialism, creativity; important given recent emphasis on innovation

Formula racing

Structured, competitive experience

- Driven by large size, emphasis to win points, win competitions; performance oriented
- Analogous to industry (structured, focus on performance); can help prepare students for transition to workplace

Humanitarian Engineering Club

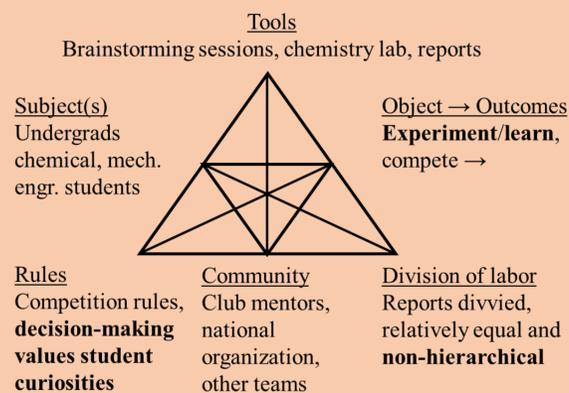
Learn to reconcile, communicate, seek feedback

- Driven by differences in culture, background, knowledge of students and community abroad
- Teaches students that engineering decisions must consider social context; this mindset could help avoid Flint, MI water crisis, or communication breakdowns between engineers and operators, clients, and other non-engineers

Implications

- Clubs are complex learning systems
- Understanding an activity can help educators (faculty, student leaders) more accurately portray their club
- If learning is tied to fundamental factors—like division of labor and club community—then specific learning experiences could be recreated by crafting a similar confluence of elements

RESULTS

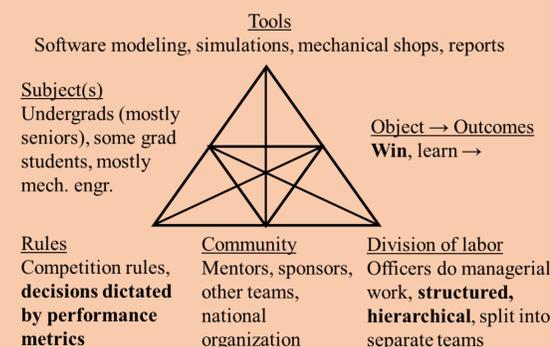


CHEMICAL CAR CLUB

- Competition, small size (20 members)
- Domestic
- Builds cars powered by chemical reactions
- Students learn creative engineering practices, entrepreneurialism



Photo: By User: Achodash (Own work) [CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

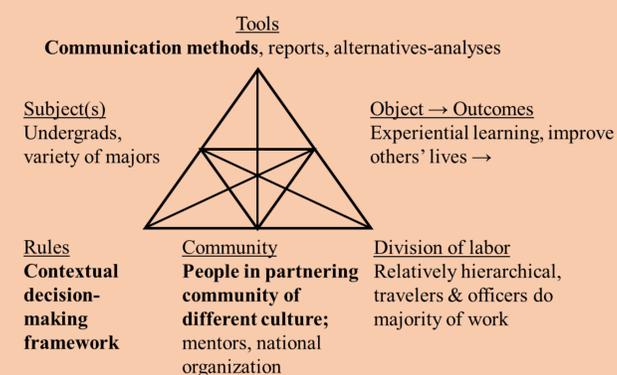


FORMULA RACING CLUB

- Competition, large size (100 members)
- International collaboration and competitions
- Builds and competes racing car
- Emphasis on performance (points), in-depth technical requirements similar to some engineering industries



Photo: By Ngchikit (Own work) [Public domain], via Wikimedia Commons



HUMANITARIAN ENGR CLUB

- Service-oriented, medium size (40 students)
- International project implementation
- Infrastructure projects in rural communities abroad
- Learn how to seek input and feedback, communication, reconciliation



Photo: By Bernard Amadei, EWB-1 Executive Director (http://www.ewb-international.org/images/BYOW.jpg) [GFDL (http://www.gnu.org/copyleft/fdl.html) or CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

ACKNOWLEDGEMENTS

- Thank you to the 19 interview participants
- Thank you to my thesis committee: Dr. Milo Koretsky (mentor); Dr. Philip Harding (representing chemical engineering); Rebekah Lancelin (representing International Degree)



Off Axis Gamma Ray Burst Contribution to the Diffuse Gamma Ray Background in the 100-600 keV Range

Isaac Hodges, Advisor: Dr. Davide Lazzati
Department of Physics, Oregon State University

Objectives

In this thesis, the objective is to simulate gamma ray intensity received from a population of unresolved gamma ray bursts and compare the simulated data to the observed gamma ray background. Gamma ray bursts are simulated using a light emitting blob cone model in the Python programming language.

Introduction

The diffuse gamma ray background (DGRB) is the remaining spectrum of gamma rays seen after subtracting known sources such as the galactic disk foreground. The DGRB is thought made up of a variety of sources such as active galactic nuclei, type 1a supernovae, and blazars. However, simulations of these sources show that they don't account for all of the observed gamma rays [1] [2] [4]. It is thought that unresolved gamma ray bursts might be able to account for some of the missing gamma ray spectrum.

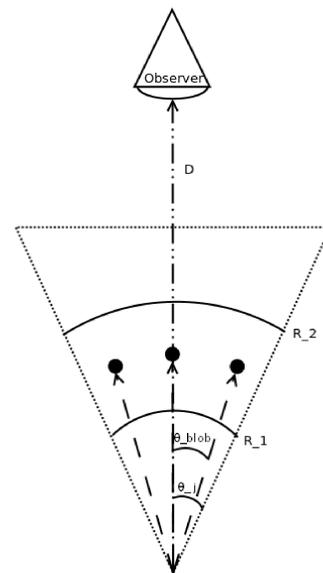
Gamma ray bursts (GRBs) are short but intense pulses of gamma rays that occur when relativistic jets of matter dissipate their kinetic energy as radiation [3]. Due to the relativistic nature of the jets, the radiation is beamed in the direction of the flow. The beaming effect is what causes GRBs observed from outside the jet to appear relatively dim. Typically, when we observe a gamma ray burst on its own the burst is beamed towards earth which allows us resolve the burst against the DGRB. In this thesis, the interest is in the bursts that are not beamed towards Earth and therefore are too dim to be resolved against the DGRB, but might still contribute to some of the observed gamma ray background.

Acknowledgments

I would like to thank my advisor, Dr. Lazzati. Without his endless help and patience, this project wouldn't have been possible. I would also like to thank many of my friends and colleagues at OSU who were willing to stay up late with me on Sunday nights to help with editing and revising.

Methods

Figure 1: A simplified 2D diagram of the GRB model used. In the actual simulations, 1000 blobs were used for each burst.



Methods

Gamma ray bursts are modeled using a set of light emitting blobs shot out in a cone from a single point of origin. Between distances $R_1 = 1 \times 10^{13} \text{cm}$ and $R_2 = 2 \times 10^{13} \text{cm}$ we assume the blobs begin to emit radiation in a blackbody spectrum characterized by the co-moving temperature of the fireball $T = 10^7 \text{K}$. Relativistic beaming and the Doppler effect is taken into account when calculating the luminosity of each blob. Individual blob luminosities are summed together to get the total luminosity and subsequently the radiation intensity of the burst. A GRB distribution is generated by assuming the GRB rate is approximately 10^{-3} times the star formation rate at a given redshift z . 2500 GRBs are generated with random orientations and their intensities are averaged over the course of a year. GRBs observed at an angle less than $\theta_j + 2^\circ$ are assumed to be resolved against the DGRB and are not included in the average observed intensity.

Important Result

In the energy range tested, off-axis GRBs only account for 1% - 7% of the observed gamma ray intensity.

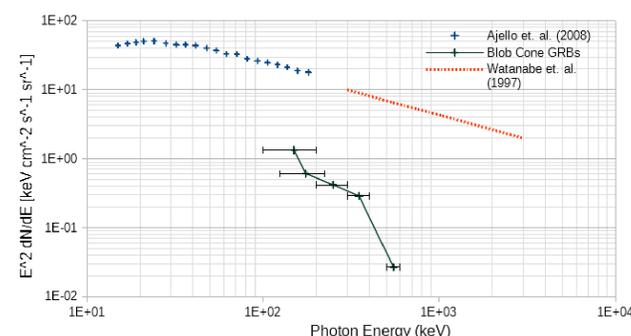
Results

Table 1: Average gamma ray intensity received from off axis gamma ray bursts. Each datum represents the intensity received from the associated energy band.

Energy Range [keV]	Intensity [$\text{keV cm}^{-2} \text{s}^{-1} \text{sr}^{-1}$]
100-200	1.33
150-250	0.61
200-300	0.42
300-400	0.29
500-600	0.027

Results

Figure 2: GRB intensity in comparison to the observed DGRB. Error bars represent the energy band over which the intensity was calculated.



Conclusion

While our code appears to work as intended, the GRB contribution to the gamma ray background came out much lower than expected. We find that at energies higher than 400 keV, the gamma ray background from GRBs falls off quickly. It is possible that GRBs might have higher contribution at lower energies $< 100 \text{keV}$, but those energies were not tested in this thesis and will have to be considered in future work.

Future Work

Many of the parameters we set in the code such as GRB rate and distribution, minimum angle of observation, and jet opening angle were little more than rough guesses. Future revisions of the code can be improved by refining these parameters so that they more closely reflect reality. Accuracy can also be improved by increasing the number of bursts simulated to get better averages and by increasing the resolution of each burst by using more blobs. Both of these changes however will come at the cost of more computation time.

References

- [1] Mattia Fornasa and Miguel A. Sánchez-Conde. The nature of the Diffuse Gamma-Ray Background. *Physics Reports*, 598:1–58, October 2015.
- [2] Yoshiyuki Inoue and Tomonori Totani. THE BLAZAR SEQUENCE AND THE COSMIC GAMMA-RAY BACKGROUND RADIATION IN THE FERMI ERA. *The Astrophysical Journal*, 702(1):523–536, September 2009.
- [3] Tsvi Piran. The Physics of Gamma-Ray Bursts. *Reviews of Modern Physics*, 76(4):1143–1210, January 2005. arXiv: astro-ph/0405503.
- [4] Pilar Ruiz-Lapuente, Lih-Sin The, Dieter H. Hartmann, Marco Ajello, Ramon Canal, Friedrich K. Röpke, Sebastian T. Ohlmann, and Wolfgang Hillebrandt. THE ORIGIN OF THE COSMIC GAMMA-RAY BACKGROUND IN THE MeV RANGE. *The Astrophysical Journal*, 820(2):142, March 2016.

Introduction

The North American Beaver (*Castor Canadensis*) is a semi-aquatic mammal and has many unique abilities, such as resistance to hypoxia and the ability to digest bark.¹ Long noncoding RNA (lncRNA, ≥ 200 bp), which are transcripts that do not encode proteins, are thought to primarily regulate genes through epigenetic mechanisms² and are not conserved across species.³ The purpose of this study is to discover beaver-specific lncRNA, as part of the OSU Beaver Genome Project (beavergenome.org).⁴



Source Credit: Dreams of Animals. animal-dream.com/beaver.html (2015)

Results

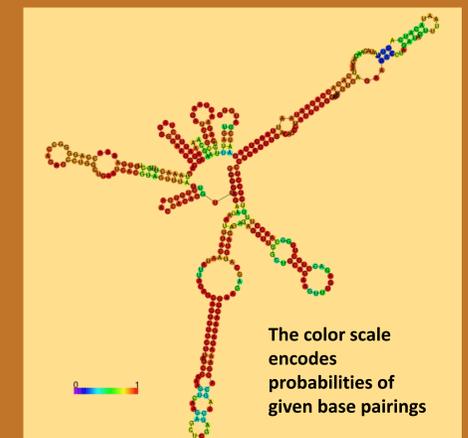
Table 1: Contig Retention through the Screening Pipeline

Step	# Contigs Eliminated	# Contigs Retained	% Contigs Eliminated
transfuse	N/A	86714	N/A
BLASTn	54402	32312	62.7
CPAT/FDR	32130	182	99.4
PFAM	0	182	0

Table 2: Novel lncRNA Contigs with Strongest Performance across Measurements

Contig	Measure				
	Length	MFE	Coverage	BLASTn alignment length	Intronic
contig41254.1	Yes	Yes	No	Yes	No
contig43610.1	Yes	Yes	No	No	No
contig44966.1	Yes	Yes	No	No	No
contig46102.1	Yes	Yes	No	No	No
contig45799.1	Yes	No	No	Yes	No
contig46542.1	Yes	Yes	No	No	No
contig46174.1	Yes	Yes	No	No	No
contig59927.1	No	Yes	No	Yes	No
contig62060.1	No	No	No	No	Yes

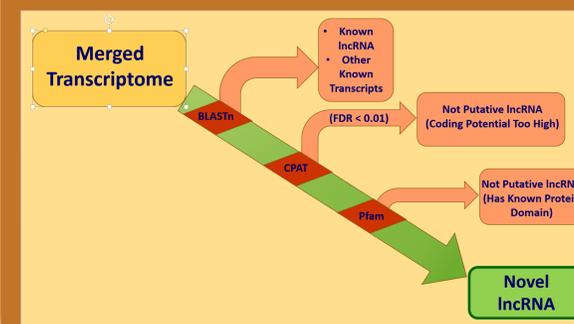
Figure 1: Predicted Secondary Structure of contig 41254.1



Methods

- Tissue samples collected from two beavers
- Pooled RNA sequenced on Illumina MiSeq 3000
- de novo* transcriptome assemblies: Trinity (k=25), Velvet Oases (k=39), and others
- Annotated and evaluated using BLASTn,⁵ Transrate,⁶ and BUSCO⁷
- Built “pooled transcriptome” using transfuse
- Screening Pipeline: used BLASTn,⁵ Coding Potential Assessment Tool,⁸ and HMMscan⁹ against the Pfam database¹⁰
- Secondary structures using RNAfold¹¹

Screening Pipeline



- 182 novel lncRNA contigs
- 113 annotated lncRNA contigs (BLASTn)

Literature Cited

- Nature Works. Beaver – *Castor canadensis*. <http://www.nhptv.org/natureworks/beaver.htm>
- Lee, J. T. Epigenetic Regulation by Long Noncoding RNAs. *Science* **338**, 1435–1439 (2012).
- Paralkar, V. R. et al. Lineage and species-specific long noncoding RNAs during erythro-megakaryocytic development. *Blood* **123**, 1927–1937 (2014).
- Beaver Genome Project. <http://www.beavergenome.org/> (2017)
- Basic Local Alignment Search Tool (BLAST). (National Center for Biotechnology Information (NCBI), U.S. National Library of Medicine).
- Smith-Unna, R. D., Boursnell, C., Patro, R., Hibberd, J. M., Kelly, S. TransRate: reference free quality assessment of de-novo transcriptome assemblies (2016). *Genome Research* **26**, 1134–1144 (2016)
- Simão, F. A., Waterhouse, R. M., Ioannidis, P., Kriventseva, E. V., and Zdobnov, E. M. BUSCO: assessing genome assembly and annotation completeness with single-copy orthologs. *Bioinformatics*. doi: 10.1093/bioinformatics/btv351 (2015)
- Wang, L. et al. CPAT: Coding-Potential Assessment Tool using an alignment-free logistic regression model. *Nucleic Acids Research* **41**, e74–e74 (2013).
- Finn RD, Clements J, Arndt W, Miller BL, Wheeler TJ, Schreiber F, et al. HMMER web server: 2015 update. *Nucleic Acids Research*. 2015;43:W30–8.
- Finn RD, Coggill P, Eberhardt RY, Eddy SR, Mistry J, Mitchell AL, et al. The Pfam protein families database: towards a more sustainable future. *Nucleic Acids Research*. 2016;44:D279–85.
- Institute for Theoretical Chemistry, University of Vienna. RNAfold WebServer. <http://rna.tbi.univie.ac.at/cgi-bin/RNAWebSuite/RNAfold.cgi>

Thank You

Oregon Zoo
Mitch Finnegan
Tim Storms
Amy Cutting
David Shepherdson

Project Status

- ✓ Discovered novel lncRNA (Table 1)
- ✓ Contigs of particular interest for further interest identified (Table 2)
- ✓ lncRNA contigs confirmed by secondary structure (Figure 1)
- ☐ Next: Tissue Atlas

¿MBA'ETEKO, CHE? AN EXAMINATION OF THE ROLES OF THE GUARANÍ AND SPANISH LANGUAGES IN THE CULTURAL IDENTITY OF PARAGUAYAN MIGRANTS IN GREATER BUENOS AIRES



Student Researcher: Calvin Kocher

Faculty Mentor: Dr. Joan Gross

Department of Anthropology, College of Liberal Arts

Abstract

The purpose of this project was to investigate the roles of different languages (namely Guaraní, Jopará, and Spanish) in the formation of Paraguayan cultural identity among Paraguayan migrants to the greater Buenos Aires region of Argentina. Though the Paraguayan community makes up the largest immigrant population in Argentina, outside of studies focusing on their participation in the labor market, very little about them has been studied. Paraguay's role as the only officially bilingual country on a national level in South America and the only country where the majority of the people speak an indigenous language give it a unique cultural identity in which language plays an disproportionate role.

Fieldwork for this project was realized in the Autonomous City of Buenos Aires, as well as in its suburbs in the province of Buenos Aires, in Gonzalo Catán and La Matanza. First, Paraguayan cultural spaces in Buenos Aires were observed in order to discern the language practice of the Paraguayan community in Argentina. In addition, six Paraguayan migrants from diverse backgrounds, social classes, and reasons for migrating were interviewed about how much of a role language played in the formation of their respective cultural identities.

The initial conclusions drawn are that while Guaraní is seldom used in its purest form, instead eschewed for its more creole form, Jopará, it plays a critical role in the formation of Paraguayan identity. The proficiency that most Paraguayans have in either of the two languages links them to their sense of nationhood and makes them feel unique, especially when living outside their country and being surrounded by monolingual Hispanophones. In an environment where their language practice and ability make them stand out, maintaining their Guaraní and Jopará language skills is often a way for migrant Paraguayans to form social circles with other Paraguayan expatriates and stay connected to their cultural roots.

Key words: Paraguay, Argentina, Buenos Aires, Guaraní, Spanish, Jopará, cultural identity, language ideology, migration.

Background

Cultural Identity and "Paraguayanness" (*paraguayidad*)

"Paraguayanness," or *paraguayidad* in Spanish (*tekove paraguaipegua* in Guaraní), can be defined as Paraguayan cultural identity. Paraguayan culture has its roots in the laws in the early parts of the 19th century, when the Supreme Dictator José Gaspar Rodríguez de Francia mandated that ethnic Spaniards could not marry among themselves, but rather with people of indigenous, African, or mixed ancestry in order to combat the vestiges of the Spanish racial caste system. Due to these laws, the population of Paraguay is very homogenous; 95% of the population self-identifies as mestizo, or having mixed European and indigenous ancestry (Central Intelligence Agency, 2016).

Due to this mixed heritage, Paraguay is the only country in Latin America where a majority of the population speaks an indigenous language, despite the fact that indigenous peoples make up less than 5% of the nation's total population (Central Intelligence Agency, 2016). Though many Paraguayans (especially those living in larger metropolitan areas like Asunción and Ciudad del Este) speak less Guaraní than their rural counterparts, the status of Guaraní in the country demonstrates national unity and pride. This is highlighted by Paraguayan expatriates, who use the language to connect with other Paraguayans outside the country, no matter their main language (Romero, 2012).

The Guaraní Language and Its History in Paraguay

The Guaraní language originated among the indigenous peoples of the interior of the South American continent. When Europeans first reached modern-day Paraguay and contacted these tribes in 1537, they found few natural resources, so the area stayed relatively free from colonial influence. Therefore, the first major impact made by Europeans in Guaraní-inhabited lands was made by the Jesuits (Page, 1999), who decided to use Guaraní as the main language in their missions. Most European men in the region married indigenous women, giving way to a new generation of mixed-race children who were raised by their mothers to speak more Guaraní than Spanish (Fernández, 2002). For these reasons, Guaraní quickly became the principal language and the *lingua franca* of the colony.

After Paraguay's first few presidents heavily repressed Guaraní in favor of Spanish, the language made a resurgence after the Chaco War with Bolivia, when it was used on the front lines to hide communications from enemy troops. Since the armed forces were inextricably linked to Paraguayan nationalism due to the country's militaristic past, the language started to become associated with patriotism and Paraguayan national identity (Nickson, 2009).

In 1972, during the writing of a new national constitution, Guaraní was given federal recognition, though it was not yet at the same level as Spanish. The then-president, Alfredo Stroessner, famously declared that "Guaraní constitutes the most highly valued cultural heritage of our country and it is the duty of every Paraguayan to learn it...since it is the vernacular language of our land." (Gynan, 2007). In 1989, the language was officially elevated to co-official national status alongside Spanish, and all schools and government documents are required to be bilingual in both languages.

Today, Guaraní is the second-most spoken indigenous American language in the world, the only one with official national status, and the only one where it is the preferred language of a non-indigenous population nationwide. Though Spanish remains the language of prestige, Guaraní is the language of the people.

Paraguayan Migration to Argentina

Paraguayan migration to Argentina has been common for many years. Paraguayans make up the largest immigrant group in any country with over 1.5 million Argentines either being born in Paraguay or claiming Paraguayan ancestry. Buenos Aires alone is home to nearly 400,000 Paraguayan citizens. In the past, Paraguayans typically have migrated to Argentina to escape political persecution or to seek better jobs or educational opportunities. The two main waves of Paraguayan migration to Argentina were between 1947 to 1960, after the Paraguayan Civil War, and from 1991 to the present, where the Paraguayan immigrant population has doubled. The Paraguayan immigrant population in Argentina is the only significant Paraguayan expatriate population in the world, with no other country hosting more than 100,000 Paraguayan citizens.

Objectives and Methodology

This project investigates the role that language plays in the formation of the cultural identities of Paraguayan migrants living in and around Buenos Aires, the largest city and capital of Argentina that plays host to the majority of the country's Paraguayan migrant population.

Paraguayans make up the largest expatriate group in Argentina, with over half a million Paraguayan-born people currently living in Argentina and with over one million Argentines estimated to have Paraguayan ancestry. The history behind this population's migration to Argentina as well as their labor practices have been extensively documented. However, their cultural identification and their linguistic practices have had little to no scholarly research performed. With Paraguay's unique linguistic and cultural identity within Latin America, this omission is somewhat shocking. This project sought to remedy this lack of research by studying the linguistic behavior and cultural identity of the modern-day Paraguayan-Argentine population.

This project's title is a little bit of a linguistic joke; the first word of the title, "mba'eteko," is a Guaraní greeting, while "che" is an interjection that, while difficult to translate, is roughly equivalent to the term "dude" as it's used in the Western United States. The title of this paper, then, would be a common greeting among Paraguayans living in Argentina, indexing both identities by using defining linguistic markers of both nationalities; indeed, over the course of my research there, I heard this exact greeting more than a few times.

Members of the Paraguayan migrant community were asked about their cultural and linguistic identities with respect to Paraguayan Spanish, Argentine Spanish (also called Rioplatense Spanish or Porteño Spanish), and Guaraní. Additionally, through observation of Paraguayan spaces, the linguistic behavior of Paraguayans in Argentina was observed to identify if they had any linguistic preferences, or if there were situations in which one language was preferred over the others.



A picture taken at an interview conducted in a Paraguayan social club in the Constitución district of Buenos Aires

Six Paraguayans of different backgrounds were interviewed to establish a diverse viewpoint of what it means to be Paraguayan. All people that participated in the project were acquaintances of the investigator. Paraguayan contacts contacted professors from the Instituto del Desarrollo Económico y Social (Institute of Economic and Social Development) in Buenos Aires so as to ensure no personal connection between the investigator and the interviewees. All interviews were conducted in Spanish and the information was later translated into English.

Additionally, Paraguayan spaces in Buenos Aires were observed, including the public festival held in the city celebrating Paraguay's Independence Day (14 May). This was done to determine the linguistic practice of Paraguayans in predominantly Paraguayan spaces to see which language they preferred to use. The proportions of Guaraní and of Spanish that were used were observed, as well as the uses of each language, who was speaking each, and when.

All questions asked in interviews were made into a script before the start of the project.

Results

All people interviewed said that they still identify as Paraguayan, despite many of them having spent decades of their life in Argentina. Most of them came for economic or educational reasons, not cultural ones, and still identify much more with their home country's culture. However, many of the interviewees stated that normally, the children of Paraguayan migrants born on Argentine soil tend to grow up much more Argentine than Paraguayan, and don't grow up with much knowledge of their roots or their home country's culture.

Generally, older interviewees said that there was more discrimination directed by Argentines towards Paraguayans than younger ones, especially when speaking Guaraní or otherwise expressing their cultural identities. Younger interviewees, on the contrary, did not perceive very much discrimination; they instead claimed that their friends were interested in finding out more about their culture.

There was a general sense among all interviewed parties that Guaraní was more appreciated by Paraguayans living outside the country than those still living within its borders. Guaraní is often associated with rural, uneducated populations by Paraguayans living within their own country, even though almost all Paraguayans use it on a daily basis and it is nearly impossible to go a day in the country without hearing it in some form.

Many Paraguayans feel more comfortable speaking Jopará or a mixed version of Guaraní than they do speaking either pure Guaraní or pure Spanish, to the point that the language that they often refer to as Guaraní is actually a form of Jopará, with pure Guaraní being referred to instead as *guaraní-guaraní*, *guaraní puro*, *guaraní académico*, or *guaraníete* (Mortimer, 2006). To them, pure Guaraní is a relic of the past that is taught in school but hardly anyone uses practically, while pure Spanish is the language of the rich and the colonizers. Jopará, on the other hand, is a middle ground, a language that they can call their own as well as the one language that they truly know they can speak.

Quotes

I have conversations in Guaraní, but it's all mixed together [with Spanish] ... Suppose that in Paraguay, it's only acceptable to speak in proper Guaraní. I, to speak Guaraní correctly, would have to study it, because I don't know proper Guaraní. I know Jopará. Some words, yes, I know in proper Guaraní, but not all of them.

—A.S., 57 years old

Sometimes Argentines discriminate against us because we speak Guaraní. They don't like it. To put it simply, I would say that yes, they do want to discriminate against us, because [when] they hear us speaking in Guaraní, they call us "piece of shit Paraguayan," that's discrimination right there.

—R.M., 35 years old

"To me, Guaraní is Paraguay. It's our roots, it's what we carry with us in our hearts, it's our tradition, it's everything to us! You can see what there is to offer in Argentina that you can't have back home, but you always carry a little Paraguay with you in your soul."

—M.G., 52 years old

In Asunción, you'll never see anyone in the middle class speaking Guaraní to someone else. That's just never going to happen. They'd be too embarrassed.

—E.B., 22 years old

For example, me, when I speak in Spanish, Guaraní just comes out. Our Paraguayanness bursts forth.

—A.S., 57 years old

Conclusions

For Paraguayans, the special meaning that this language has is very clear. Ever since before the Spanish arrived, Guaraní has been spoken on Paraguayan soil, and in the past century, the Paraguayan government has worked very hard to harness the power of the language and work with the people to communicate with them in their own language. Starting with the beginning of the reign of the Colorado Party at the beginning of the 20th century, the Guaraní language and bilingualism have been inextricably linked with Paraguayan national cultural identity.

Regardless, Jopará, which is very controversial among Guaraní purists, was the language more used among Paraguayans in observed public spaces and with the information given from the interviewees. Half of the interviewees spoke better Jopará than either Guaraní or Spanish. However, speaking Jopará requires a working knowledge of both Guaraní and Spanish, as demonstrated earlier in this paper. Jopará in itself is heavily dependent on Guaraní influences, and therefore carries much of the same nationalist connections without taking with it the stigmas associated with pure Guaraní.

Even though Guaraní still has rural and uneducated connotations in Paraguay, outside of it, the Guaraní language was amongst the first things mentioned by interviewed Paraguayans living outside the country when asked about their cultural identities. Despite the many difficulties that the language has had in its native land, when Paraguayans leave their country, they realize how unique their language is, how it represents them, and how it becomes a unifying force for their people in an increasingly globalized society, and they begin to value it much more as an unforgettable part of their national identity and their national pride.

Redox characterization of lanthanide nanoparticles with a chemical probe



Kala M. Kopecek,¹ Lauren E. Crandon¹, and Stacey L. Harper^{1,2}

¹School of Chemical, Biological, and Environmental Engineering

²Department of Environmental and Molecular Toxicology



Introduction

- The Organization for Economic Cooperation and Development (OECD) has identified redox potential (tendency of a species to acquire/lose electrons) as a parameter of interest when testing manufactured nanoparticles (NPs)
- This has previously been difficult to measure due to the dynamic nature and small size (10^{-9} m) of NPs
- This study aims to develop a rapid and easy method to measure relative redox potential of NPs
- The lanthanide oxide NPs (LnOxNPs) were chosen because of their metallic and reducing properties, as well as their use as catalysts

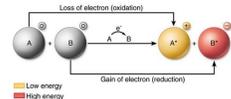


Figure 1: Reduction oxidation reaction (Kuo et al. 2014)

Hypothesis: Redox activity of LnOxNPs can be determined from intrinsic properties



Figure 2: Lanthanide series (Yeung et al. 2015)

Prediction: Redox activity of LnOxNPs will depend on the number of unpaired electrons in the outermost (4f) orbital

Approach

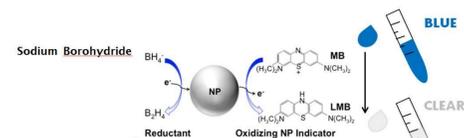


Figure 3: Methylene blue reaction (Corredor et al. 2015)

- The reactivity will be evaluated by measuring the initial reaction rate for the reduction of an organic methylene blue dye catalyzed by NPs
- Reaction is thermodynamically favorable but not kinetically favorable in these conditions so a catalyst is needed
- If the reaction occurs, the redox potential of the NPs must be intermediate of the dye and reducing agent
- Can observe this via colorimetric detection in the spectrophotometer

Materials

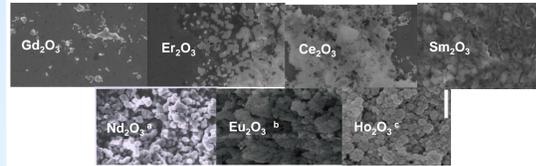


Figure 4: SEM images of LnOxNPs. Taken from Sekhosana et al. (2016)^a, Carron et al. (2016)^b, Milanese et al. (2015)^c

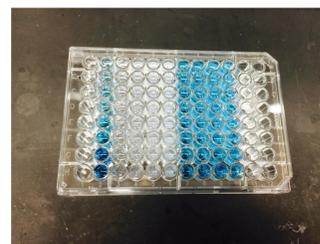
- LnOxNPs (above)
- MilliQ water
- HEPES buffer (to maintain pH)
- NaOH (to prevent bubbling)
- NaBH₄ (as a reducing agent)
- Methylene blue dye (changes color when reduced)

Methods

- 1000 ppm stock solutions of LnOxNPs prepared in MilliQ water and ultrasonicated for 2 mins
- A solution of NaBH₄ mixed with 15 micro liters of NaOH was prepared at a final concentration of 10mM in the plate
- A stock solution of HEPES buffer and methylene blue dye was prepared at a final concentration of 10mM and 0.04mM
- 96 well plate were prepared with reagents:

Figure 5:

- control milliQ
- control dye
- 100 ppm NP control
- 250 ppm NP control
- 500 ppm NP control
- 750 ppm NP control
- 100 ppm assay
- 250 ppm assay
- 500 ppm assay
- 750 ppm assay



- NPs plated last at a final concentration of 100ppm, 250ppm, 500ppm and 750ppm
- Plate run in the UV Vis spectrophotometer for 30 mins at a wavelength of 665 nm

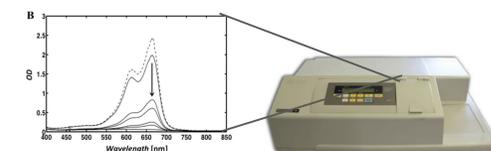


Figure 6: Wavelength in assay decreases over time (Corredor et al. 2015)

Data Analysis

- Change in absorbance over time was obtained for all 7 LnOxNPs

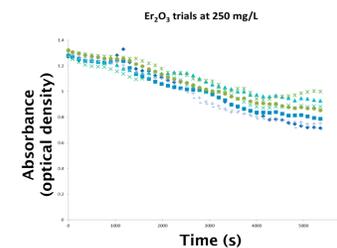


Figure 7: Decrease in absorbance among the 8 trials of Er₂O₃

- Average data fit to a 1st order kinetic reaction curve with equation shown below

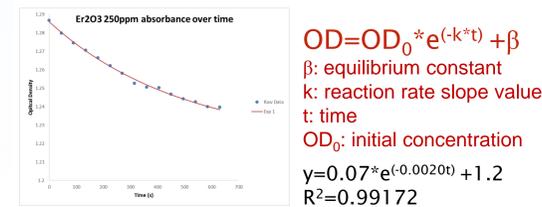


Figure 8: Average of the 8 trials for Er₂O₃ fit to a 1st order kinetic reaction curve

Results

- No clear trend seen in terms of just unpaired electrons

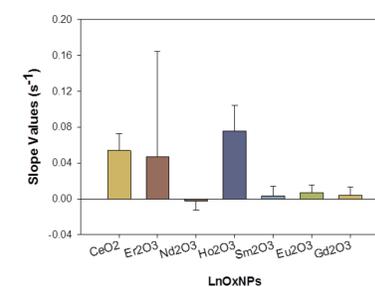


Figure 9: Slope (K) values for each of the 7 LnOxNPs for the initial reaction rate

	Ce	Nd	Sm	Eu	Gd	Ho	Er
Metal oxide:	CeO ₂	Nd ₂ O ₃	Sm ₂ O ₃	Eu ₂ O ₃	Gd ₂ O ₃	Ho ₂ O ₃	Er ₂ O ₃
Periodic number:	58	60	62	63	64	67	68
Un. E- outermost:	1	3	5	6	7	4	3
E- Configuration:	4f ¹⁴ /s ²	4f ¹⁴	4f ⁶	4f ⁶	4f ⁷ /s ²	4f ¹⁰	4f ¹¹
Size (pm):	182	182.1	180.2	204	180.2	176.6	175.7
Surface area (cm ²):	0.42	0.338	0.07	0.32	0.12	0.1	0.11
HDO (nm):	544.6	735.1	2412	808.6	1340.3	1553	1333
Bond length between O (Å):	2.27	2.35	2.31	2.3	2.29	2.25	2.24
Ion radius (Å):	1.07	1.183	1.158	1.37	1.138	1.101	1.09
Hydrophobicity (contact angles):	103	101	107	104	109	115	108
Band gap (eV):	3.65				5.28		
Electronegativity (χ):	2.794	2.808	2.819	2.828	2.809	2.828	2.83
Band gap (eV):	2.4	4.7	5	4.4	5.4	5.3	5.3
Ionization energy (eV):	36.76	40.41	41.4	42.7	44	42.5	42.7
Melting point (Celsius):	795	1024	1072	826	1312	1461	1497
Boiling point (Celsius):	3468	3027	1900	1429	3000	2600	2900
lattice energy (kJ/mole):	14.6	14.27	13.93	13.77	13.6	13.1	12.93
# of crystalline faces:							
lattice parameters A (hex): a	0.389	0.38293	n/a	n/a	n/a	n/a	n/a
lattice parameters B (monoc): a	n/a	n/a	1.418	1.411	1.4061	1.39	1.387
lattice parameters C (cubic): a	1.116	1.1077	1.0932	1.0866	1.0813	1.0607	1.0547

Figure 10: Compiled list of LnOxNP intrinsic properties based upon lit review to predict the reaction rate. Highlighted were hypothesized to be properties of interest

Results

- 5 parameters of interest: unpaired e-s (Une), Ln-O bond (Ln), hydrophobicity (H), electronegativity (Eg), surface area (Sa) chosen for analysis based on lit review & iteration

$$y = -0.54 - 0.0066Une + 0.20Ln + 0.17H - 0.34Eg + 0.01Sa$$

$$R^2 = 0.95$$

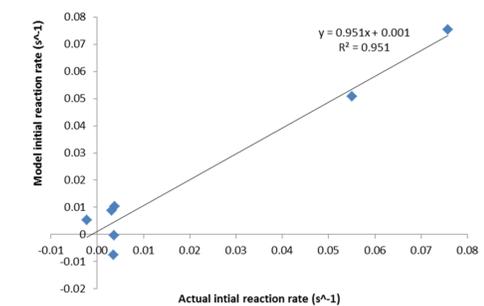


Figure 11: 5 highlighted properties of interest modeled in a multiple linear regression and plotted against the actual initial reaction rate slope values

Discussion

- All 7 LnOxNPs catalyzed the assay reaction at concentrations of 100 and 250ppm
- It is insufficient to model the redox potential in terms of just unpaired valence electrons in the outermost orbital
- Evidence suggests that multiple intrinsic properties need to be used to predict redox activity

Conclusion

The redox potential was found for 7 LnOxNPs through the use of a first order kinetic reaction model. The initial hypothesis was not the sole predictor of this reactivity. Therefore five variables, unpaired electrons, Ln-O bond, hydrophobicity, electronegativity, surface area are predicted to be parameters of interest for redox activity among LnOxNPs. Preliminary multiple linear regression models found a strong fit of these five variables as predictors of redox activity.

Acknowledgements

Special thanks to:
Oregon State University
Pete and Rosalie Johnson
Dr. Stacey and Bryan Harper
Dr. Skip Rochefort
Lauren Crandon & team



Analysis of Organochlorine Pesticides (OCPs) in Gray Whale Scat

Amy M. Kutnerian^{1,2}, Leigh G. Torres³, Staci L. M. Simonich^{1,2}

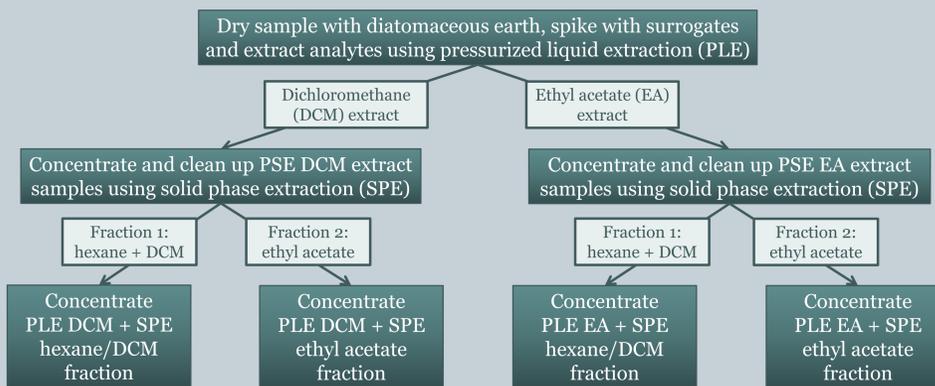
1. Department of Chemistry, Oregon State University, Corvallis, OR
 2. Department of Environmental and Molecular Toxicology, Oregon State University, Corvallis, OR
 3. Department of Fisheries and Wildlife, Oregon State University, Newport, OR

Acknowledgements: Oregon State University, SURE donors & support, the NIEHS Superfund Research Program, and the National Science Foundation

INTRODUCTION

Current methods to analyze pesticides in whales require the invasive collection of blubber or blood samples^{1,2}. Marine scientists have analyzed stress hormones in whale scat since the 1990s to determine health factors such as noise pollution and prey availability¹. This study presents a novel, noninvasive approach to analyze pesticide compounds in whale scat.

DEVELOPING THE METHOD

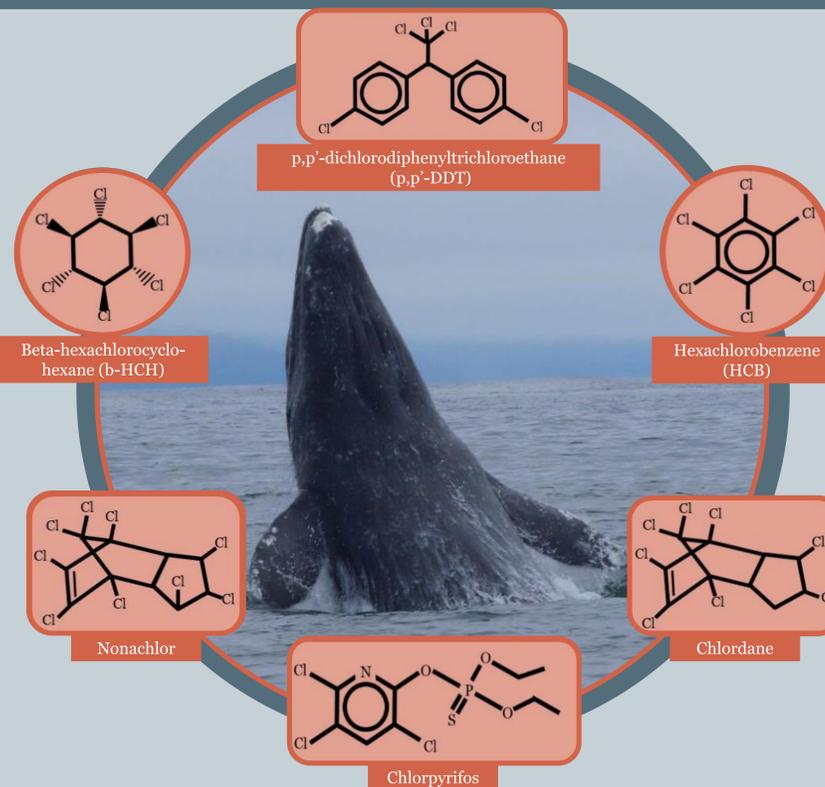
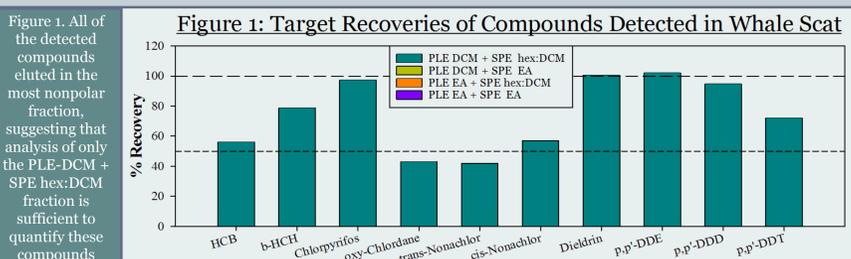


Spike all fractions with an internal standard and analyze using electron ionization (EI) and negative chemical ionization (NCI) gas chromatography/mass spectrometry (GC/MS)

As part of method development, variations in the sample processing and analysis were also tested. These adjustments included varying the sample size and analyzing SPE fractions both separately and combined. These adjustments were performed to maximize signal-to-noise ratio (see Table 1). Target recovery analysis was performed in triplicate to determine analyte loss and SPE fraction recovery (Figure 1).

Compound	Separate Fractions			Combined Fractions	
	150mg	300mg	600mg	150mg	300mg
HCB	✓	✓	✓	✓	✓
β-HCH	✓	✓	✓	✗	✗
Chlorpyrifos	✓	✓	✓	✓	✓
oxy-chlordane	✗	✓	✗	✗	✗
trans-nonachlor	✗	✓	✗	✗	✓
cis-nonachlor	✗	✓	✓	✗	✗
Dieldrin	✗	✓	✓	✗	✗
p,p'-DDE	✓	✓	✓	✗	✗

Table 1. The ideal sample size is ~300mg (dry weight) analyzed in separate fractions; most analytes are below the detection limit with masses below 300mg or that produce too much matrix interference.



SUMMARY

- This method can be used to quantify historic and current use pesticides (ex. DDTs, HCB, chlorpyrifos) in gray whales and potentially other whale species.
- The ideal dry scat mass for pesticide analysis is 300mg, with a minimum value of 150mg.
- Sample fractions should be analyzed separately to maximize the signal-to-noise ratio.
- Larger sample sizes would require a more efficient clean-up step.
- Future studies may apply this method to the analysis of scat from many different animal species, including other whales.
- The relationship between scat and tissue OCP concentrations must be established for future analyses.

SOURCES

1. Baggaley, K. To save endangered whales, look to the poop | Popular Science <http://www.popsoci.com/endangered-whale-poop> (accessed Aug 4, 2017).
2. Lundin, J. I., et al. *Arch. Environ. Contam. Toxicol.* **2016**, *70* (1), 9–19.
3. Tsygankov, V. Y., et al. *Mar. Pollut. Bull.* **2015**, *99* (1), 235–239.

RESULTS

The method developed in this study was used to analyze scat samples from three whales, two females of at least 22 years old, and one male of unknown age. The two females are identified as S2F1 and S2F2, and the male is identified as S5F6-A1. Figure 2 shows quantities of the compounds detected in the three live whale scat samples in ppb of dry scat weight, as well as in the sample collected from the stranded male that was used for method development. Detection of historic-use pesticides in the scat samples indicates these compounds persist in the marine environment despite their status as banned products in most countries.

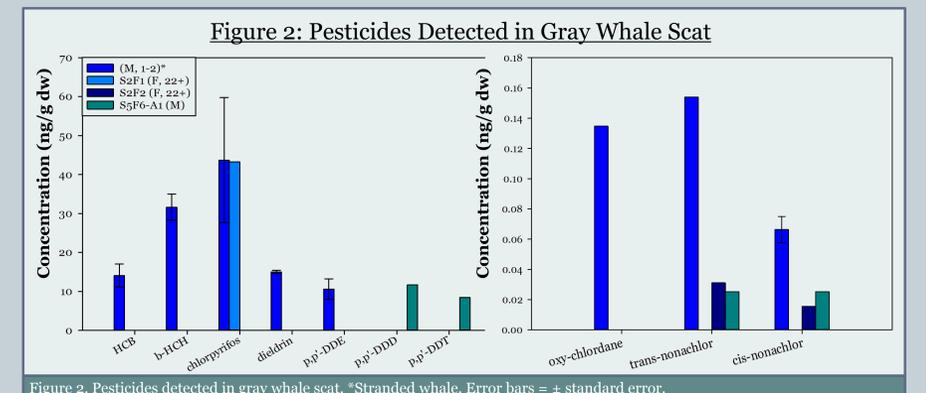


Figure 3: OCPs in Whale Scat vs. Tissue

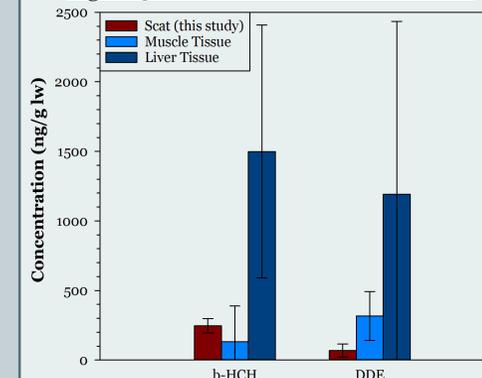


Figure 3. OCP concentrations (ppb of lipid weight) in gray whale scat, liver, and muscle tissues³. Error bars = ±σ.

A comparison of scat and tissue OCP concentrations is shown in Figure 3. Scat and tissue samples were collected from whales of the same population³. The large error bars indicate high variability in OCP concentrations for individuals in the same population, and are caused by variations in the age, sex, and pregnancy status of the whale. As Figure 3 indicates, the relationship between OCPs in scat and tissue is not clear.

If this relationship determined, scat samples, which are more readily available, can replace tissue samples for OCP analysis and provide a more comprehensive approach to quantifying these compounds in whales.



Figure 1: The beaker on the left contains the catholyte and is a light blue color. The beaker on the right contains the anolyte and is a dark purple color.

Abstract

To charge an ammonia-based electrochemical battery system, a system was designed that combined direct heating and aeration. Air was bubbled through the anolyte to absorb ammonia and then the ammonia filled air was bubbled through the catholyte which absorbed the ammonia. A method for charge level was developed using a lab built LED colorimeter to measure the ammonia content of the electrolytes.

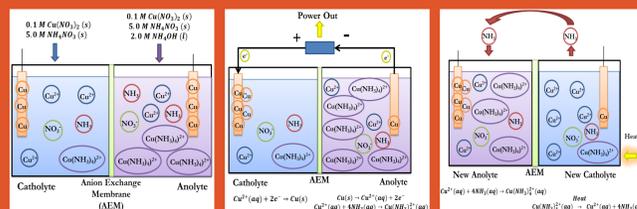


Figure 2: Ammonia-based battery system set-up (left), discharge (center), and charge (right).

Background

An ammonia-based electrochemical battery system has been previously shown to be regenerated via low-grade (130°C) waste heat. Such a concept is able to utilize the waste heat from a primary energy source (eg. heat lost during combustion of natural gas). Regeneration involves removing ammonia from the spent anolyte and adding ammonia to the spent catholyte to create new catholyte and anolyte solutions (Figure 2). Previously it was suggested to conduct the regeneration in a distillation column; however, heated aeration regeneration would allow for more direct, economic, and smaller scale designs.

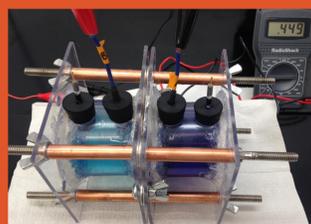


Figure 3: Thermally regenerative ammonia-based battery cell constructed of acrylic. Copper mesh electrodes with an anion exchange membrane separating the catholyte (left) and anolyte (right).

Charging of a Thermally Regenerative Battery via Heated Aeration

Jasper Limon, Dr. Nick AuYeung (Mentor)

School of Chemical, Biological, and Environmental Engineering

Oregon State University, Corvallis, Oregon 97331



Figure 4: The color shift from blue to purple as more ammonium hydroxide is added. The increase in ammine complex can be visually seen and correlates to the ammonia content.



Figure 5: Lab constructed LED colorimeter on left. UV/Vis spectrometer on right.

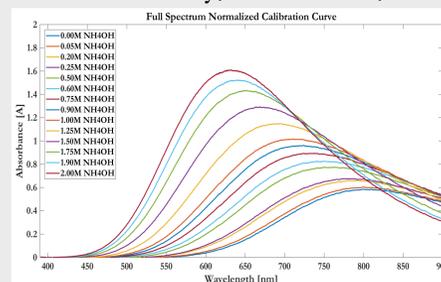


Figure 6: UV/Vis spectrometer full spectrum absorbance levels for calibration solutions. A shift in the max absorbance peak can be seen as the concentration changes. Absorbance values normalized based on absorbance value at 400 nm.

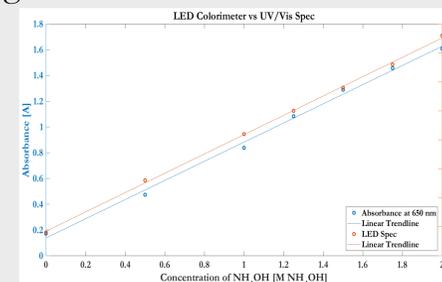


Figure 7: Comparison of the calibration curves for the LED spectrometer and the UV/Vis spectrometer. Both spectrometers show a linear trend with similar slopes.

Experiments

Colorimetry was used to find the ammonia content in the anolyte and catholyte to track the battery charge level. There is a color shift that occurs due to the formation of an ammine complex when ammonia is added to the electrolyte solutions. A LED colorimeter was constructed from a photodiode and blue LED that used an Arduino to evaluate the color based on the light absorbance through the sensor cell (Figure 5, left). A UV/Vis spectrometer was used for comparison (Figure 5, right). Calibration solutions were created by adding increasing amounts of ammonium hydroxide to the base catholyte solution (Figure 4). Absorbance values from the UV/Vis were taken at the 650 nm wavelength to compare to the LED colorimeter (Figure 7).

Heated aeration tests were conducted by using an oil bath to heat the anolyte to the desired temperature and aeration was achieved by using tube disperser frits. The impacts of air flow and temperature were evaluated (Figure 9 and 10). Tests directly transferred the ammonia from the anolyte into the catholyte by bubbling the air into the anolyte and then into the catholyte. Ammonia content was measured with the UV/Vis spectrometer.

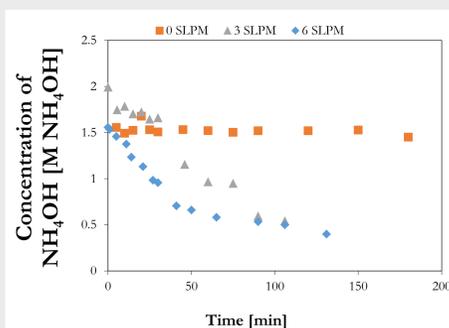


Figure 9: Comparison of air flow rate to the removal of ammonia from the anolyte over time (45 °C). Size of data marker shows propagation of errors based on standard deviation of the UV/Vis spectrometer.

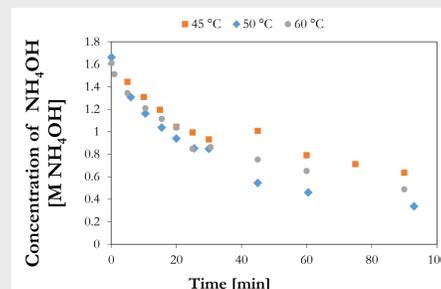


Figure 10: Comparison of the anolyte temperature to the removal of ammonia from the anolyte over time (3 SLPM air flow). Size of data marker shows propagation of errors based on standard deviation of the UV/Vis spectrometer.



Figure 8: Set up of aerating test that used two tube frit dispersers to bubble the ammonia from the anolyte (boiling flask) into the catholyte (Erlenmeyer flask). Condenser used to keep water from transferring.

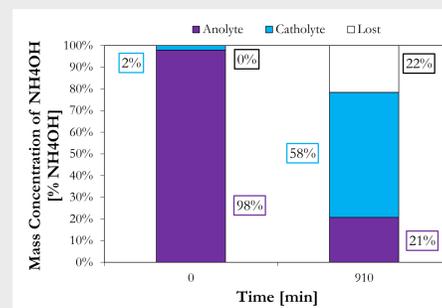


Figure 11: Mass balance for the ammonia based on absorbance concentration measurements from the UV/Vis spectrometer accounting for volume changes.

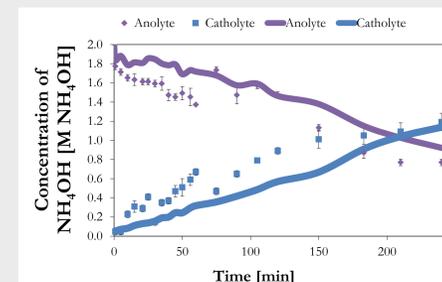


Figure 12: Comparison of the ammonia concentration in the anolyte and catholyte (50 °C, 3 SLPM). LED colorimeter data shown as points (error bars are standard deviation of three replicate points). UV/Vis spectrometer data shown as solid lines (line thickness showing propagation of errors based on standard deviation of the spectrometer).

Results

Tracking of ammonia concentration was successfully completed with the UV/Vis spectrometer as well as the LED colorimeter and were in agreement with each other. For the UV/Vis spectrometer there was a shift in the wavelength of the maximum absorbance peak towards 625 nm with increasing ammonia content (Figure 6). UV/Vis spectrometer absorbance values at a single wavelength (650 nm) were used to compare to the LED colorimeter. The low cost of the LED colorimeter compared to the UV/Vis spectrometer (\$50 vs. \$5000+) compensates for the lower resolution with the LED colorimeter. The colorimeter would work well to conduct quick checks on the battery charge level (Figure 12).

The transfer of ammonia was achieved by heated aeration. After 4 hours the anolyte ammonia concentration had decreased 79% and the catholyte had gained 72% of the removed ammonia. Dosing of ammonia would be required to compensate for the inefficiencies in the process. Higher air flow helps speed the charging process (Figure 9) and higher temperatures might allow for more ammonia to be removed before a stagnation point is reached (Figure 10).

Conclusions

Heating the anolyte to 60 °C for 4 hours with an air flow rate of 3 liters/min produced a 79% decrease in ammonia content in the anolyte with 28% lost from the system and the recovery percentage of ammonia into the catholyte was 61%. This research also led to the development of an inexpensive LED colorimeter used to track the ammonia removal process to determine the anolyte recharge level. Future work could adapt the LED colorimeter with a flow cell to allow for automated charge readings. Another solvent (eg. ionic liquid) could be used to increase the energy density of the system by increasing ammonia solubility.

Special Thanks To

- Dr. Nick AuYeung
- Dr. Alex Yokochi
- Dr. Zhenxing Feng
- Andy Brickman
- The Johnson Internship Program and Dr. Skip Rochefort

Design and Implementation of a Ride-On Car with Data Tracking for Use by Young Children with Developmental Differences

System Specifications

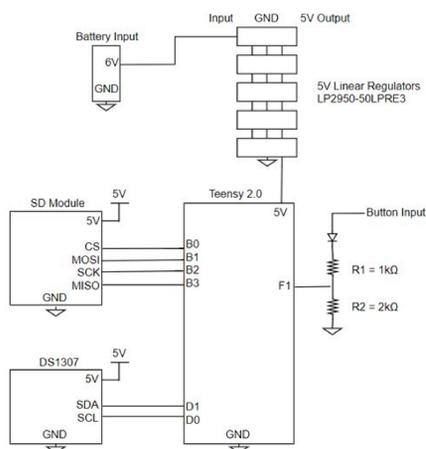


The ROCs also allow children to interact with their family and peers in new ways.

Photo Credit: Alan Calvert, College of Public Health and Human Sciences

HARDWARE

The system includes 5 5V linear regulators, a 5V Teensy 2.0 with an ATmega32u4 microcontroller, an SD card module, and a DS1307 Real Time Clock (RTC) module. The Teensy 2.0 microcontroller allows the system to stay relatively cheap and compact. The RTC module allows the system to keep time without connection to the internet via I2C protocol. The linear regulators bring down the 6V from the car battery. The SD Card module allows the data to be written to a micro SD card via SPI protocol. The voltage divider allows the button to pull pin F1 high or low depending on the status of the button. This voltage divider also has a diode on it which ensures no current will flow back into the battery through the button and serves the purpose here of lowering the voltage from the battery. A schematic diagram can be seen below.



Hardware Schematic

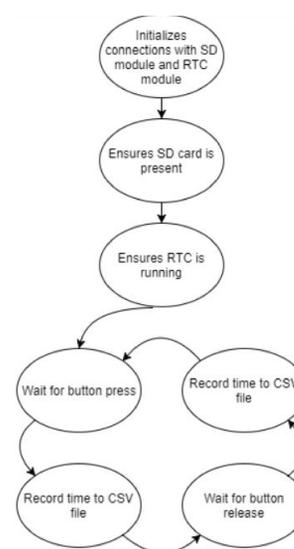
OVERVIEW

- Collects time and date of each button press
- Compact and easy to mount
- Easily adaptable to other cars
- Cost-efficient

SOFTWARE

The code initializes the peripheral connections, ensures the SD card is present, and confirms the RTC is running. It then records the time the button began being pressed and, when the button is released, records that time in the format of (day of week, year, month, day of month, hour, min, sec, duration \n), where \n denotes a newline of the text file. This text file can then be converted to a csv file based on the previously stated format. The code was prototyped in Arduino Sketch with the final implementation written in C. The C implementation uses two open source libraries to handle taking data from the RTC and writing data to the SD with a Fat32 file system format. These libraries are credited in the code. There are a few specific lines of code that only need to be set once, such as the correct time being set to the RTC.

There is also a MATLAB code associated with this project. The MATLAB code reads the csv file to output graphs that can show use data for the ROC (eg. frequency of use during times of day). The code creates graphs for frequency of use data based on the collected date/time and duration data.



Code Flow Chart

Importance

BACKGROUND

This work presents the design and modification of a commercial children's ride-on car to effectively collect usage data. The design is cheap and could be easily modified to gather more information. This will serve as a viable way to collect information about how motorized independence can help children with developmental differences. Children with developmental differences do not develop the same level of social, language, and cognitive skills as other children without mobility limitations [1,2]. There is growing evidence that suggests the frequent use of a ride-on car (ROC) may help increase these skills [3-8]. The increased mobility and independence that the ROC provides has been shown to do so in a few specific cases, although there have been no large-scale studies on these effects [4]. Many children with developmental differences do not have access to affordable wheelchairs through insurance until they are at least 3 years of age [3]. For many developmental skills, this is too late. Studies have shown that short-term ROC use for these children is feasible [4-8]. This work seeks to explore one option to take data that could be correlated to improvements in fundamental movement skills for such studies in a cost-effective manner [9].

GOALS

The goals of this project were to explore the options to design and modify a commercial children's ROC to take use data for children with developmental differences and provide a working system. A working system will collect time stamped use data from the ROC, save this data in an easily accessible format on an SD card, and provide graphs of the use data when input to the associated MATLAB script. The system viability will be determined based on an overall low cost, ability to take data, and ability to securely mount within the frame of the ROC. The system will be tested on a modified ROC to ensure proper functionality.



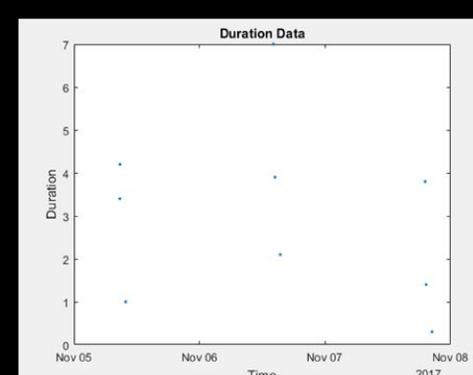
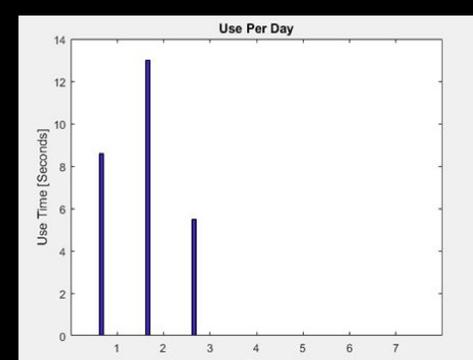
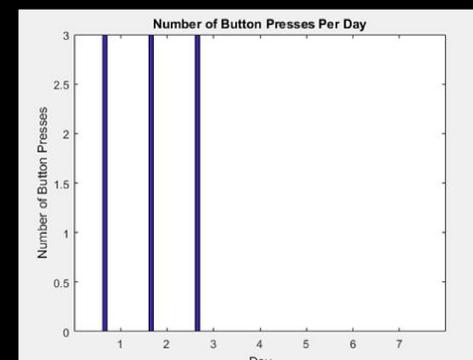
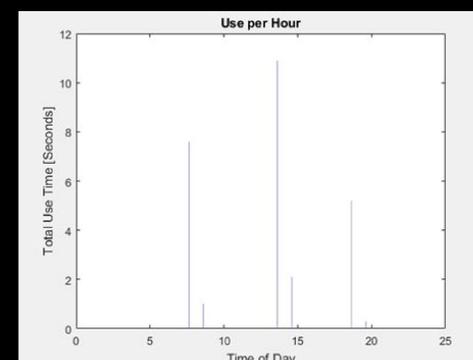
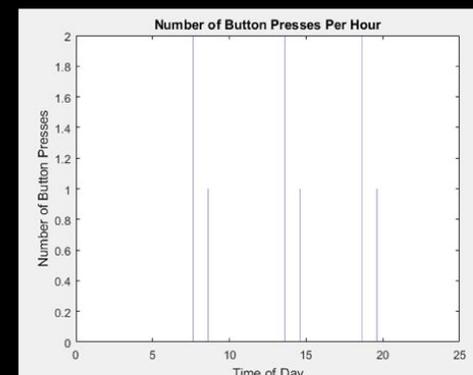
The ROCs can be used for exploration and play.

Photo Credit: Alan Calvert, College of Public Health and Human Sciences

References:
 [1] Casey, J., Paleg, G., & Livingstone, R. (2013). Facilitating Child Participation through Power Mobility. *The British Journal of Occupational Therapy*, 76(3), 158-160.
 [2] Guerette, P., Furumasa, J., & Tefft, D. (2012). The Positive Effects of Early Powered Mobility on Children's Psychosocial and Play Skills. *Assistive Technology*, 01 January 2012.
 [3] Feldner, H., Logan, S., & Galloway, J. (2016). Why the time is right for a radical paradigm shift in early powered mobility: The role of powered mobility technology devices, policy and stakeholders. *Disability and Rehabilitation: Assistive Technology*, 11(2), 89-102.
 [4] Logan, S. W., Huang, H. C., Stahlin, K., & Galloway, J. (2014). Modified Ride-on Car for Mobility and Socialization: Single-Case Study of an Infant With Down Syndrome. *Pediatric Physical Therapy*, 26(4), 418-426.
 [5] Huang, H. B., Ragonesi, C. C., Stoner, T., Peffley, T., & Galloway, J. (2014). Modified Toy Cars for Mobility and Socialization: Case Report of a Child With Cerebral Palsy. *Pediatric Physical Therapy*, 26(1), 76-84.
 [6] Ragonesi, C., Chen, X., Agrawal, S., & Galloway, J. (2010). Power mobility and socialization in preschool: A case report on a child with cerebral palsy. *Journal Of Sport & Exercise Psychology*, 32, 532.
 [7] Huang, & Chen. (2017). The use of modified ride-on cars to maximize mobility and improve socialization-a group design. *Research in Developmental Disabilities*, 61, 172-180.
 [8] Lynch, A. C., Ryu, J., Agrawal, S., & Galloway, J. (2009). Power Mobility Training for a 7-Month-Old Infant with Spina Bifida. *Pediatric Physical Therapy*, 21(4), 362-368.
 [9] Logan, S., Feldner, H., & Galloway, J. (2015). Modified Ride-On Car Use by Children With Complex Medical Needs. *Research Quarterly For Exercise And Sport*, 86, A99.

Testing

GRAPH OUTCOMES



Understanding the High Prevalence of Pediatric Dental Caries in Southeastern Oregon

Megan McEwen; Joseph Catania, Ph.D.

Introduction

The prevalence of pediatric dental caries (PDC) is 55.7% nationally¹, 52% in Oregon, and 73% in Southeastern Oregon². We examined prevention programs, clinical services, and water Fluoride levels in Southeastern Oregon to understand the high PDC prevalence in the region.

Methods

Sources of all data estimates are described in Table 1.

Table 1. Sources of Data Presented

Data/Variable	Data Sources/Computation
Demographics	U.S. Census Bureau (2010-2015) ³
School Data	Oral Health Unit (2014-2015) ⁴
Dental Care ⁵	Oregon Board of Dentistry data set (2015) ⁵ . The number of dentists and hygienists: population ratio was generated by summing the number of dentists and hygienists registered/county relative to the under 18 YRS population in a given county.
Local PDC Prevention Programs	Oral Health Unit and web search of PDC prevention programs (i.e. sealant programs) (2015) ⁶ . Phone survey of local public health departments (2015).
Water Fluoridation	Fluoride levels ⁷ were obtained for 2012/2014. The CDC data set provides estimates of water that has been naturally fluoridated or externally fluoridated for recipients of state regulated water. The difference between the population and number of people on state regulated water provided estimates for individuals using well water.

Results

Figures 1 and 2 provide prevalence estimates for PDC nationally¹ for 2011-2012 (ages 6-8), for the state of Oregon, and regions of Oregon (for 2011-2013; ages 6-9)². The specific region of interest is composed of seven counties (see Figure 2; Baker, Crook, Grant, Harney, Lake, Malheur, Wheeler).

Figure 1. Comparison of Pediatric Dental Caries

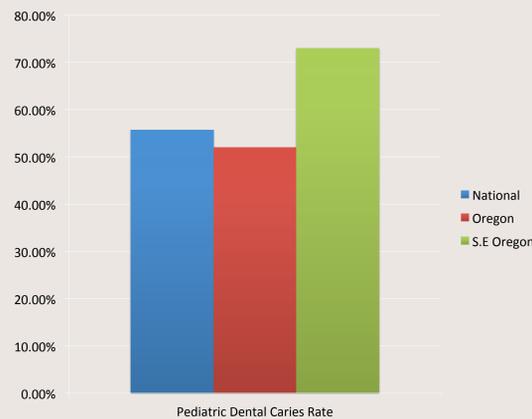
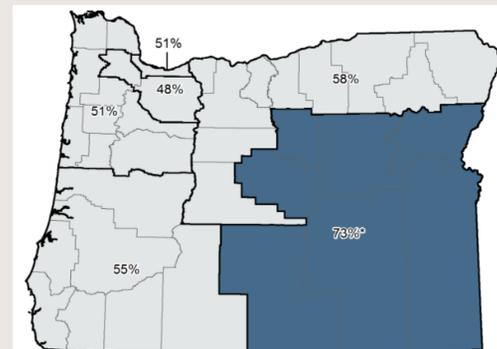


Figure 2. Cavity Rates ages 6-9 by Geographic Region²



*Statistically different from the statewide average of 52%
Map developed by Oral Health Authority/Public Health Division.

Table 2 provides data on water fluoridation by county⁷ and shows the proportion of residents on well water. Relative to Benton county all SE counties have a smaller percentage of their population drinking fluoridated water. We estimated that approximately 95% of the population is drinking inadequately Fluoridated water in 4 of the 7 counties

Table 2. Water Fluoridation in S.E. Oregon (2012/2014)

County:	Baker	Crook	Grant	Harney	Lake	Malheur	Wheeler	Benton
Pop.: *	16005	21630	7185	7200	7829	30380	1358	87572
% City Water (N)	74% (11874)	55 (11804)	67 (4832)	65 (4665)	53 (4113)	55 (16852)	70 (950)	68 (59942)
% UnFl* City water (N)	74% (11874)	91 (10784)	67 (4832)	65 (4832)	25 (1013)	12 (2,062)	51 (480)	4 (2277)
% Well Water (N)	26% (4131)	45 (9826)	33 (2353)	35 (2535)	48 (3716)	45 (13528)	30 (408)	32 (27630)
Total % UnFl Water** (N)	100% (16005)	95 (20610)	100 (7185)	100 (7200)	60 (4729)	51 (15590)	65 (888)	34 (29907)

*Pop = Population; UnFl= Unfluoridated.
**Total = $\frac{N_{on\ well\ water} + N_{unfluoridated\ city\ water}}{N_{Pop}}$

Table 3 provides data on PDC prevention programs⁴ in the counties of interest. We found no programs being delivered by local health departments, except for one in Lake county (First Tooth)⁶. State based programs (OHA: School based sealant and fluoride programs) were common. The OHA programs have been running continuously since 2002. In addition, a prevention program (i.e. Tooth Taxi) occurred in 6 of the 7 counties for limited periods of time. Consequently, for some years the percentage of schools receiving prevention programming may be higher than shown in Table 3.

School based PDC prevention programs (see Table 3) have limited reach, and the ratio of dentists to people under age 18^{3,5} in 4 of the 7 counties is quite low (1:>400) (see Table 4), in contrast to Benton county (our comparison) where the ratio is 1:245.

Table 3. Proportion of Elementary and Middle School Programs Receiving PDC Prevention Programs (2011-2015)

School Year	Baker	Crook	Grant	Harney	Lake	Malheur	Wheeler	Total Served**
2011-12	46% (5/11)*	0 (0/5)	36 (4/11)	27 (3/11)	0 (0/9)	30 (6/20)	0 (0/6)	25 (18/73)
2012-13	46% (5/11)	40 (2/5)	36 (4/11)	27 (3/11)	0 (0/9)	40 (8/20)	0 (0/6)	30 (22/73)
2014-15	73% (8/11)	100 (5/5)	64 (7/11)	36 (4/11)	22 (2/9)	80 (16/20)	100 (6/6)	66 (48/73)

*Number of programs receiving prevention divided by the total number of elementary and middle school programs in the county; Note: multiple programs may be housed in a given school, but not all programs in a school may have received prevention, so each program was counted separately.
** Total served = total all programs receiving prevention/total of all programs.

Table 4. Access to Dental Care

	Baker (3105)*	Crook (4196)	Grant (1322)	Harney (1461)	Lake (1448)	Malheur (7656)	Wheeler (212)	Benton (14712)
Dentists: Children	1: 444	1: 1049	1: 330	1: 292	1:724	1:450	1:106	1: 342
Hygienist: Children	1: 518	1: 525	1: 441	1: 1461	1: 362	1: 365	1: 212	1: 245

*Denotes the population under 18 in each county.

Table 5 provides a cross comparison of the counties of interest. Based on the findings of the characteristics mentioned; availability of basic prevention resources, access to fluoridated water at home and the presence of PDC prevention programs in 2011-2012, each county was ranked on a scale of 1-7; 1 being the weakest and 7 being the strongest.

Table 5. County Cross Comparison

	Crook	Lake	Malheur	Harney	Baker	Grant	Wheeler
County Ranking	9	20	21	21	21	27	36

As shown, Crook has the lowest ranking and Wheeler has the highest. Based on the rankings it is predicted Crook county had PDC levels at or above the regional average, and Wheeler had PDC levels at or below the regional average. It is likely that more intensive preventive strategies will need to be implemented in Crook county than others with stronger rankings.

Discussion

Based on our descriptive findings and published literature the high PDC prevalence in Southeastern Oregon is likely due to the following factors:

- Inadequate and inconsistent water fluoridation.
- Insufficient coverage by school-based PDC prevention programs.
- Poor ratio of dental health providers to the number of at risk youth in Southeastern Oregon.

A number of social and geographic factors may influence future dental public health efforts in Southeastern Oregon:

- Programs are needed to overcome the barriers of geographic access to dental services for low income, rural counties.
- Mobile dental unit programs, such as Tooth Taxi, should be further developed and supplemented in these counties.
- Anecdotal evidence and state-wide surveys suggest a large proportion of the population is opposed to water fluoridation. School based and community based programs to increase the frequency and quality of brushing and flossing may support oral health in areas of low or inconsistent fluoridation.
- Further, programs to facilitate the reduction in consumption of cariogenic substances including soft drinks and fruit juices, etc. may also compensate for the lack of fluoridated water.

Reference

- ¹Dye BA, Thornton-Evans G, Li X, Iafolla TJ. (2015). Dental caries and sealant prevalence in children and adolescents in the United States, 2011-2012. NCHS data brief, no 191. Hyattsville, MD: National Center for Health Statistics
- ²Oregon Smile Survey. (2012). Oregon Health Authority: public health division, center for prevention and health promotion, maternal and child health section. Retrieved October 1, 2015 from <http://public.health.oregon.gov/prevention/wellness/oralhealth/Documents/smilesurvey2012.pdf>
- ³Quick Facts Oregon, United States Census Bureau (2010-2015). Retrieved November 7, 2015, from <http://www.census.gov/quickfacts/table/PST045215/41>
- ⁴Oregon Oral Health Surveillance System 2002-2015. (2015). Oregon Health Authority: Public health division: Center for prevention & health promotion, oral health program. Retrieved October 1, 2015 from <http://public.health.oregon.gov/prevention/wellness/oralhealth/Documents/OralHealthSurveillanceReport2015.pdf>
- ⁵Oregon Board of Dentistry. (2014). All Available Information for Dentists and Dental Hygienists CDC. Received on March 15, 2016. Data request form retrieved from <http://www.oregon.gov/dentistry/forms/datarequestfrm.pdf>
- ⁶Oregon Oral Health Coalition. (n.d). First Tooth Program. Retrieved September, 2016. From <http://www.orohe.org/first-tooth-program/>
- ⁷Centers for Disease Control and Prevention. (n.d). Oregon-List of Counties: My Water's Fluoride, Oral Health. Retrieved September, 2016 from <https://nccd.cdc.gov/DQH/MWF/default/CountyList.aspx?state=Oregon&state=41&stateabbr=OR&reportLevel=1>

PEDAGOGICAL CONTENT KNOWLEDGE FOR TEACHING INCLUSIVE SOFTWARE DESIGN

Alannah Oleson *Mentor: Margaret Burnett*

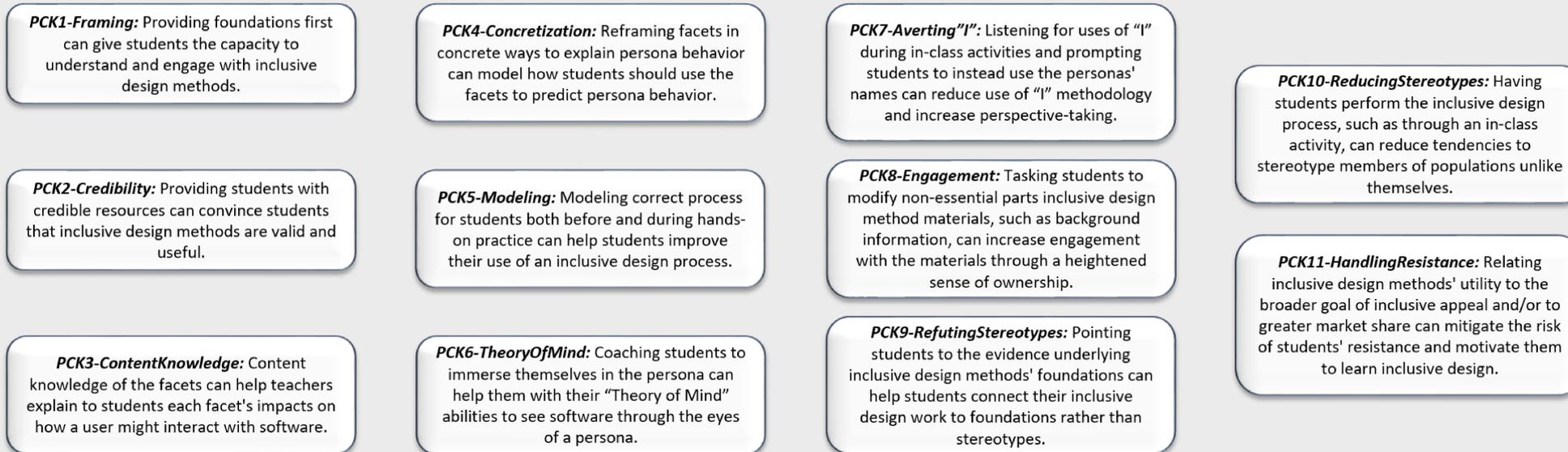


Figure 1: Eleven pieces of pedagogical content knowledge (PCK) for teaching inclusive software design methods. Each PCK represents some knowledge that teachers can leverage to promote better learning outcomes and instill knowledge of inclusive software principles in students.

INTRODUCTION

Today's software engineers often end up with interface design responsibilities. As a result, it is important that they learn user experience design principles and methods.

However, prior work has shown that software rarely supports all usage styles or abilities. Therefore, future software engineers should learn *inclusive* design principles and methods, focusing on creating software that is usable by all.

Even basic design skills are difficult to teach. This can cause misunderstandings and impede learning when educators teach software design classes. Since inclusive design is a newer discipline, we know even less about how to teach it.

One way to address this lack of knowledge is to develop *pedagogical content knowledge* (PCK) for inclusive software design. PCK is the intersection of

- *pedagogical knowledge*, or knowing teaching strategies, and
- *content knowledge*, or knowing the topic at hand.

PCK is both domain- and audience- specific and can promote better learning outcomes across a variety of disciplines.

Research Question: What PCK do teachers need to teach inclusive software design?

To explore this question, we studied computer and information science students and their professors as they learned and taught GenderMag (<http://gendermag.org>), a method to identify gender-inclusiveness issues in software interfaces. We chose GenderMag due to its explicit focus on inclusivity, well-established foundations, proven effectiveness, and relatively young age for a software interface inspection method (<2 years).

METHOD: ACTION RESEARCH

- *Action research:* longitudinal field study conducted by a group facing a problem. Group members' attempts to solve the problem produce data, which informs further interventions
- 9 teacher-researchers, 400+ students, 8 universities (Table 1)
- To facilitate information sharing and collaboration: created GenderMag-Teach wiki (Figure 2)
- Data: 6 sources
 - Teachers (3): interviews, emails, teaching materials
 - Students (3): in-class observations, feedback, course evals
- Analysis: affinity diagramming + qualitative coding to create student learning issues codeset; qualitative analysis of teachers' experiences to add context

Teacher	Course Topic	Level	# Students
T1N	HCI	Undergrad	unknown
T1N	HCI	Graduate	unknown
T2N	HCI: Design	Undergrad	37
T3X	HCI: Design	Mixed	35
T3X	Seminar: Diversity in Tech	Graduate	16
T3X	Seminar: Ethics of Tech	Undergraduate	59
T4N	HCI: Usability	Undergrad	59
T5N	HCI: Usability	Graduate	29
T6N	SE: Capstone Project	Undergrad	27
T7N	SE: Fundamentals	Undergrad	83
T8N	SE: Game Dev	Mixed	21
T9N	SE: Internet Dev	Graduate	25

Table 1: Teacher-researchers and students by course. Teachers self-identified as either an expert (X) on GenderMag or a novice (N), teaching 12 courses that reached more than 400 students. Participants were located in eight different U.S. states.

RESULTS: PCK FOR TEACHING INCLUSIVE DESIGN

Some students showed evidence of strong learning (Figure 3) and reacted favorably toward the material. Others resisted learning the material and even showed instances of gender bias around the topic of gender-inclusive software. Teachers reacted in a variety of ways, with some being more successful than others at promoting learning.

We found 11 pieces of PCK specifically for teaching inclusive software design methods to university-level students (Figure 1).

Each PCK is tied to an observed *risk* to students' learning and drawn from a teacher's *mitigation strategy* to address that risk.

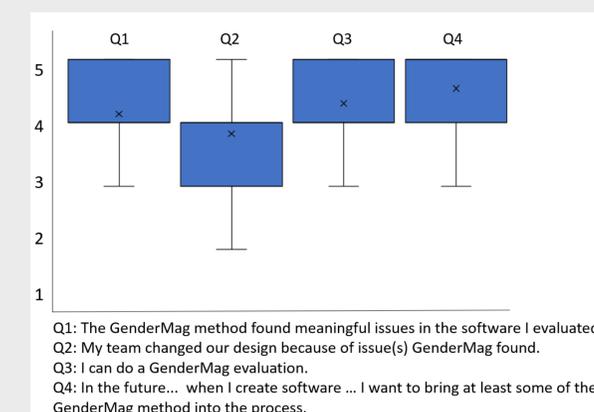


Figure 3: Student evaluations of their own learning (1 = strongly disagree, 5 = strongly agree) from 132 responses. On all four questions, students rated their understanding and application of the material positively.

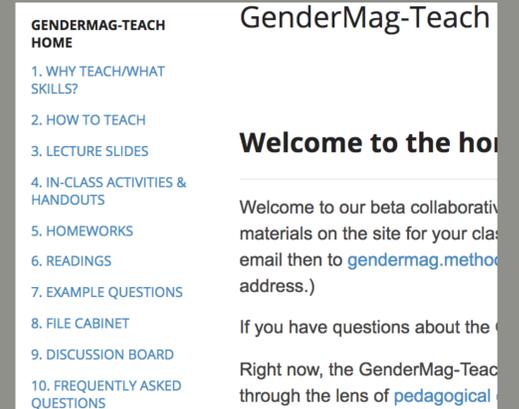


Figure 2: Structure of the GenderMag-Teach community wiki, provided as a resource and knowledge repository to teacher-researchers. Available in full at the GenderMag website (<http://gendermag.org>), which has added it to their list of resources.

DISCUSSION

This work presents the first study of PCK for teaching inclusive design. We found four broad categories of PCK:

1. Students who are skeptical about individual differences in problem-solving may be convinced by data (PCK 1, 2)
2. Learning the an inclusive design method's content and process requires careful scaffolding before, during, and after active practice (PCK 3, 4, 5)
3. Some students struggle with perspective-taking and stereotyping of their target inclusive population, but various strategies can engage students in more appropriate and useful reasoning (PCK 6, 7, 8)
4. Some students hold gender biases, political stances, and interpersonal fears to discussing inclusion in the classroom, but connecting goals to evidence, engaging students in the process, and discussing the benefits of inclusion can mitigate resistance (PCK 9, 10, 11)

IMPLICATIONS & FUTURE WORK

Though this work is exploratory in nature, it provides implications for inclusive design PCK in many domains:

- **Research:** testable hypotheses that learning outcomes depend on students' (a) existing perspectives on inclusion or (b) abilities to take the perspective of a target inclusive population member
- **Practice:** strategies for addressing resistance and bias that arises when teaching inclusive design; importance of scaffolding and corrective feedback in promoting inclusive perspectives and methods
- **Industry:** raises the possibility of "presenter PCK" for inclusiveness and diversity workshops at companies

Addressing the creation of inclusive software can be one route by which we advance diversity in the technology field. Academia and industry can both do their part to promote inclusive software principles, and a solid PCK foundation will be a great help in doing so. By ensuring tomorrow's software practitioners understand the importance and impact of inclusive software, we can take one more step toward enabling everyone to use software to its fullest potential.



Investigating the Effect of Sulforaphane on LncRNA Regulation in a Transplacental *Nrf2* Knockout Mouse Model



Oregon State University

¹Karan A. Patel, ^{1,3}Lisbeth K. Siddens, ¹Hyekyoung (Hannah) You, ^{1,2,3}David E. Williams

1. Dept. Of Environmental and Molecular Toxicology, Oregon State University, Corvallis, Oregon 97331. 2. Linus Pauling Institute, Oregon State University, Corvallis, Oregon 97331. 3. Superfund Research Program, Oregon State University, Corvallis, Oregon 97331.

Abstract

Dibenzo[*def,p*]chrysene (DBC) is a highly potent environmental carcinogen belonging to a class of compounds known as polycyclic aromatic hydrocarbons (PAHs). Nuclear Factor Erythroid-2-Related Factor (*Nrf2*) is a transcription factor vital to the oxidative stress response. Consequently, *Nrf2* deficiency in animal models has shown increased tumor incidence compared to those expressing *Nrf2* while treated with certain environmental carcinogens. Sulforaphane (SFN), a chemopreventive agent from cruciferous vegetables, induces phase II antioxidant genes via interaction with *Nrf2*. This enhances resistance to carcinogenesis. The primary objective of this study was to analyze the abundance of various long non-coding RNA (lncRNA >200bp) utilizing a *Nrf2* knockout mouse model. LncRNA are known to possess various mechanisms, which influence gene expression. LncRNA regulation was evaluated in lung tissue from adult offspring exposed *in utero* to DBC. SFN was used as a dietary chemopreventive agent in some treatment groups to compare tumor incidence in 10-month old adult offspring. This phytochemical was exposed to the fetus transplacentally and through lactational exposure. The two treatment groups utilized are as follow: control lung from adult offspring; lung from adult offspring born to mothers given a SFN diet. A commercially available LncProfiler RT-qPCR array (System Biosciences, Mountain View, CA. #RA930A-1) was used to examine the lncRNA profiles of the treatment group relative to the control. This study is being conducted in efforts to document a potential correlation between fetal exposure to PAHs, abundance of cancer associated lncRNA and the impact of the *Nrf2* genotype in the presence of the prototypical *Nrf2* agonist, SFN.

Methods

- This lncRNA analysis is based on a larger study carried out by the research group utilizing the ICR-*Nrf2* transplacental mouse model that also scrutinized DBC carcinogenesis. Mothers were subject to SFN diet on GD9 until weaned.

Diet	Treatment
Control	Corn oil (5ml/kg)
SFN (400ppm)	Corn oil (5ml/kg)

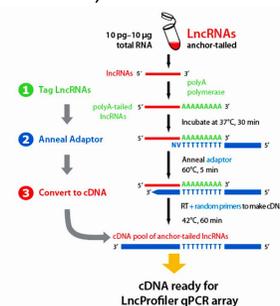
- Total RNA was isolated from control lung and lung tissue from SFN treatment archived from an ICR-*Nrf2* transplacental mouse model. RNA was quantified using a ND-1000 spectrophotometer (Thermo Fischer Scientific, Wilmington, DE) and checked for quality using an Agilent 2100 bioanalyzer (Agilent Technologies, Santa Clara, CA).

Total RNA extracted with TRIzol[®] reagent

RNA quality check

Real time quantitative PCR

- A commercially available LncProfiler qtPCR array (System Biosciences, Mountain View, CA. #RA930A-1) was used to examine the lncRNA profiles of cancer specific lncRNA of the treatment group relative to control. The qPCR data was normalized to a U6 snRNA control and expressed through fold regulation values. Data was segregated by sex and *Nrf2* genotype (*Nrf2*^{+/-} or *Nrf2*^{-/-}).



Mouse LncProfiler qPCR Array

	1	2	3	4	5	6	7	8	9	10	11	12	
A	Adapt33	Air	AK007836- upstream of	AK141205- Nanog	AK028236- Oct4	AK062072	ATIA	atp9Peg11	B2 SIN RNA	BACE1AS	BC1	BGN-As	
B	BORG	CDL1- antisense	Diox3as	Dlx1as	Emx2os	Evt2	Foxo2-as	GA55	Gomafu	GSD-as	H19	H19 antisense	
C	mHOTAIR	HOTTIP	Hoxa11as	HGF2AS	Jpx	Kcnj1ot1	linc1242	LINC1331	linc1368	Linc 1812	linc1547	linc1582	
D	linc1609- long	linc1609- short	linc1610- long	linc1610- medium	linc1610- short	Linc 1823	Linc 1823	lincENC1	lincRNA- Cox2	lincRNA- p21	lincRNA- Sor2	LINC-MD1	
E	LXRBV	Mai1t	masCRNA	MEG3	MEG9	MSUR1	Msa1as	Neat1	Neat1	Nespa5	Nkx2-2AS	NROD	
F	Oto2os	PNC	PINC1AB lncform	PIG1	Rcom3nat	Rip1 hot spot	Rip1 transcript	Rlan	Rimst	RNCR3	SCAR (K18L1- AS)	Six3os	Six3og-down 9
G	SNHG1	SNHG3	SNHG4	SNHG5	SNHG6	Snz3ot	SRA	Tdr	TUG1-	Vz2ot1	V30 RNAs	W71-AS	
H	Xit	Y RNAs	Zeb2NAT	Zfp11	Zfp21as	Zfp3ot	18s rRNA	RNU43 (snRNA)	GAPDH	Beta Actin	U6 snRNA	No assay control	

Results

Figure 1. LncRNA Regulation In 10-month old A) male and B) female progeny from SFN exposure

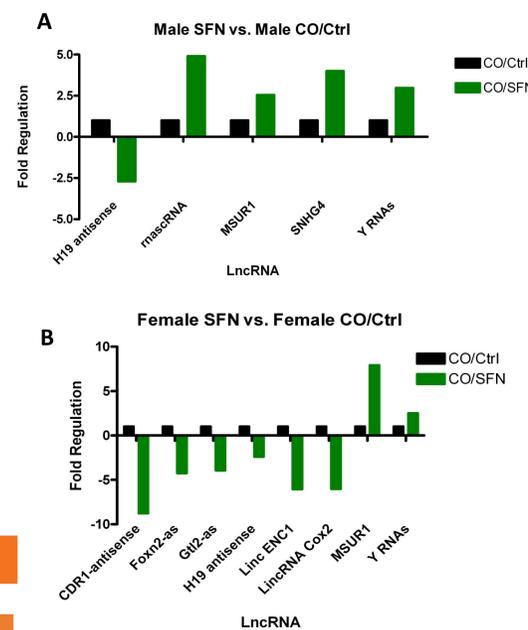


Figure 2. LncRNA Regulation In 10-month old A) male het and B) male null progeny from SFN exposure

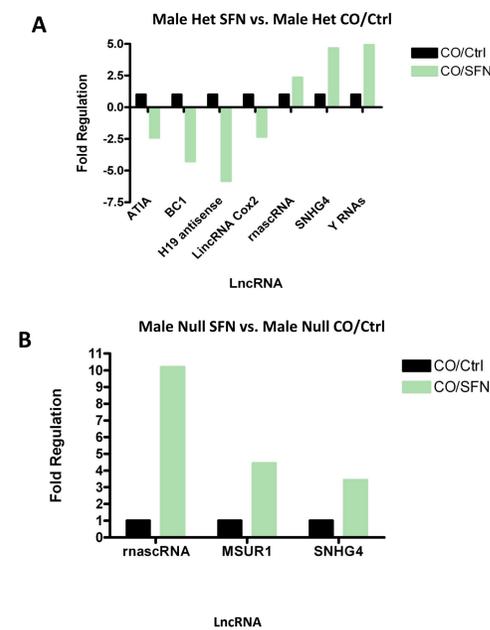
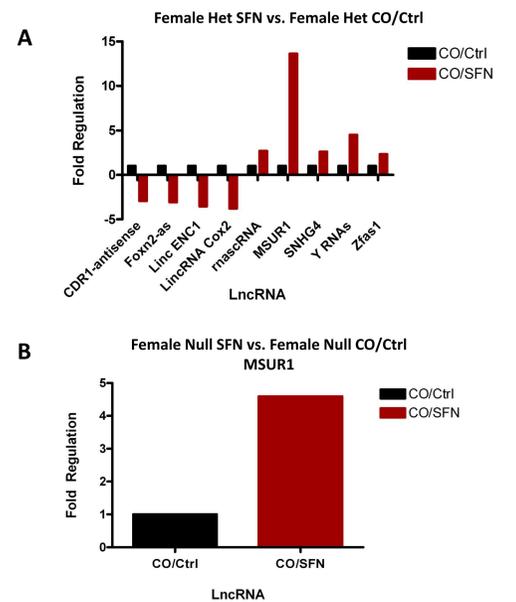


Figure 3. LncRNA Regulation In 10-month old A) female het and B) female null progeny from SFN exposure



Regulation of specific LncRNA in mouse lung from 10 month old progeny transplacentally and lactationally exposed to a SFN diet, measured relative to control with corn oil diet (CO). Negative fold regulation values indicate net down regulation of LncRNA. (*p<0.05)

Conclusion & Future Work

- SFN treatment up-regulated rnascrRNA, MSUR1 and Y-RNAs in 10 month old progeny.
- Considerable down-regulation in LincENC1, LincRNA cox2, and H19 antisense were observed.
- MascRNA and MSUR1 were up-regulated in mice with genotype *Nrf2*^{+/-} (het) or *Nrf2*^{-/-} (null).
- MSUR1 protects cells in a dose dependent manner by decreasing levels of hydroxyl radicals and oxidation of proteins.

Future work

- Select LncRNA will serve as target substrates for new chemotherapies and drug discovery.
- Future work will investigate the role of these various LncRNA in carcinogenesis.
- The role of specific LncRNA and their influence on mRNA and protein regulation will be further scrutinized.
- The abundance of LncRNA and the the impact of the *Nrf2* genotype in the presence of the prototypical *Nrf2* agonist SFN will be investigated further.

Acknowledgements

Supported by: OSU Agriculture Research Foundation (ARF), "Phytochemical Supplement From Cruciferous Vegetables and Protection of the Fetus from Exposure to Carcinogens: Role of Long Non-Coding RNAs"

Supported by NIH grant PO1CA90890

URSA-Engage Funding (Oregon State University)



Solvent and Dispersion Effects on the Hydrodeoxygenation of Acetic Acid on a Pd(111) Model Surface

Michael Rebarchik and Dr. Líney Árnadóttir

Overview

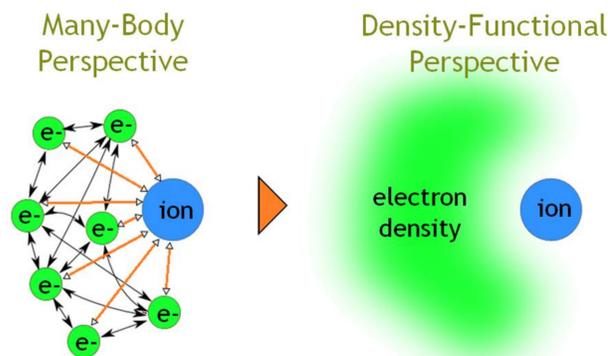
As fossil fuel reserves continue to diminish, the need for alternative energy sources continues to grow. One of the most promising alternatives is biofuel because of its potential for high energy density and similarity to conventional fuels. Traditionally, biofuels have been produced through the transesterification of triglycerides, but they have suffered from disadvantages such as high viscosity and poor oxidation stability. Alternatively, a hydrodeoxygenation process can be used to convert triglycerides into hydrocarbons more similar to conventional fuels.

Motivation

Because of the water-gas shift, it is difficult to experimentally determine the dominant hydrodeoxygenation pathway. Density Functional Theory (DFT) can be used to isolate the surface reactions and better understand the reaction pathways. This in turn can lead to better catalyst design in the production of biofuels.

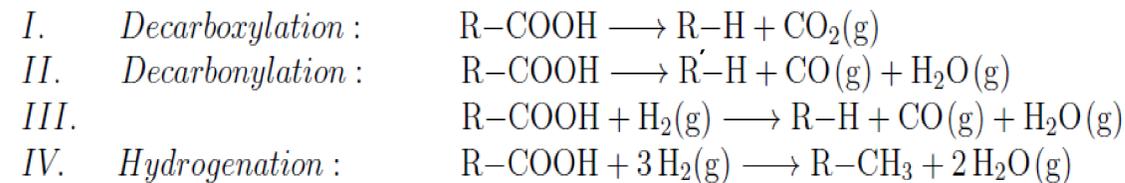
Density Functional Theory

Density functional theory (DFT) is a quantum mechanical computational technique used to solve the Schrodinger equation based on electron density. It is one of the most common computational chemistry methods and can be powerful in predicting trends.



Reaction Paths

Hydrodeoxygenation can take several different reaction paths.



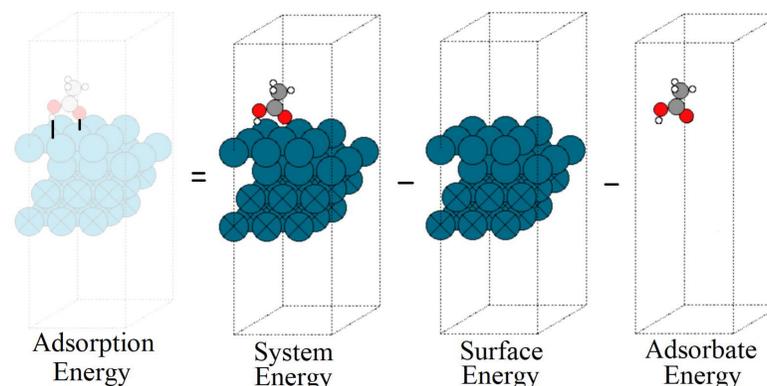
Reactions III and IV require an excess of H_2 which make them unfavorable when compared to reactions I and II. The decarboxylation and decarbonylation reactions result in a hydrocarbon chain one carbon atom shorter than the corresponding acid through the removal of CO or CO_2 .

Approach

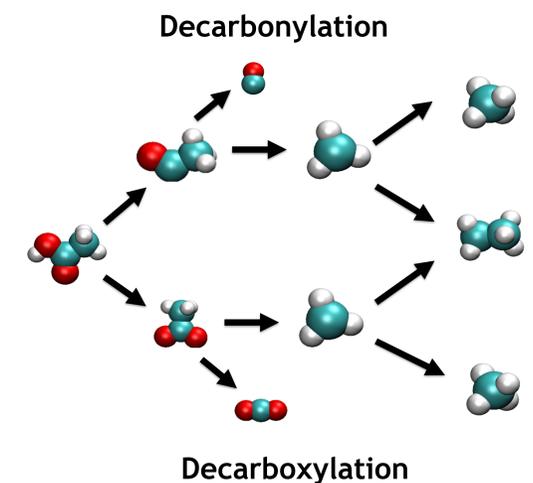
The decarbonylation and decarboxylation reaction pathways were modeled to determine the effect of dispersion and solvent effects on the hydrodeoxygenation reaction pathways. The three testing conditions were:

1. Vacuum
2. Vacuum with van der Waals forces
3. Vacuum with solvent

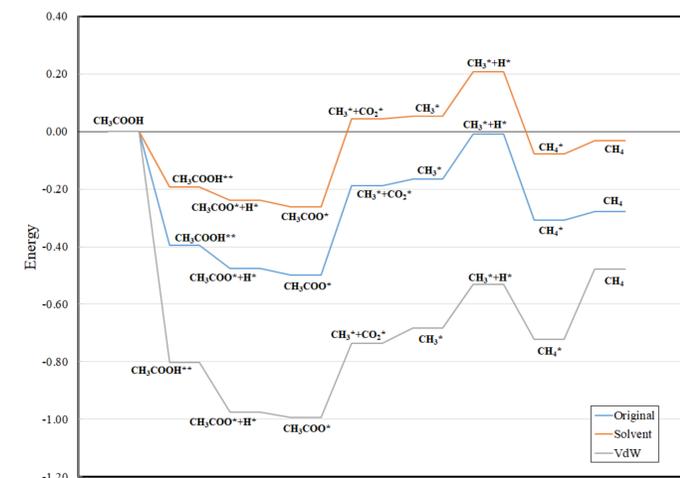
Van der Waals forces were calculated using the DFT-D3 method of Grimme.^{2,3} Solvent interactions were modeled using an implicit solvent model to minimize additional computational time. VASP was used for all DFT calculations.



Reaction Network



Carboxylation Reaction Results



Conclusions

The decarboxylation was found to be energetically favored. The inclusion of solvent effects increased the reaction energy for all predicted pathways. Dispersion forces lowered the decarboxylation reaction energy and strengthened the adsorption energy of all species. Additional microkinetic modeling is needed to determine how the changes may affect the dominant reaction pathway.

References

- 1 http://www.magmat.org/wp-content/uploads/2014/04/DFT_vs_MB.png
- 2 Grimme, S.; Ehrlich, S.; Goerigk, L. *J. Comp. Chem.* **32**, 1456 (2011)
- 3 Grimme, s.; Antony, J.; Ehrlich, S.; Krieg, S. *J. Chem. Phys.* **132**, 154104 (2010)

Acknowledgments

Sean Seekins, Ph.D. Candidate, OSU School of CBEE
Lynza Halbers, Ph.D. Candidate, OSU School of CBEE

Nadjalisse C. Reynolds¹, Jimmy Y. Zhong², Kathy R. Magnusson¹, Matthew E. Swarts³, Cherita A. Clendinen², Scott D. Moffat²,

¹Dept Biomedical Sciences, College of Veterinary Medicine & Linus Pauling Institute, Oregon State University, Corvallis, OR 97331

²School of Psychology, College of Sciences, Georgia Institute of Technology, Atlanta, GA 30332

³School of Architecture, College of Design, Georgia Institute of Technology, Atlanta, GA 30332

Assessing spatial memory in both rodents and humans with the Morris water maze

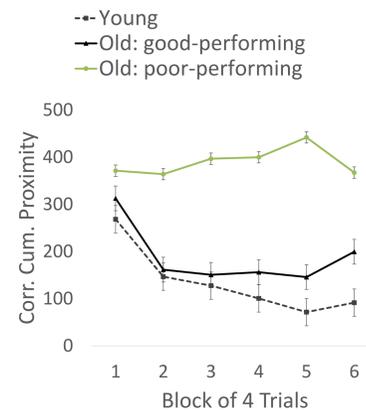
The process of aging affects every part of a person's life, from their physical abilities to their mental functioning. One of the cognitive effects of aging is impaired spatial memory. To gain further insight into age-related differences in spatial memory, a new virtual Morris water maze task was developed. **Its design was motivated by the traditional Morris water maze that is commonly used to assess spatial learning and memory formation in rodents [1] and has been used to create a model of age-related spatial memory differences in both rodents [2] and humans [3].**



A subgroup of older adults exhibited relatively poor search performance

Fig. 1: Morris water maze performance measured by CCProx to the platform is shown as a function of trial. Adjusted means and SEMs are shown after correcting for the covariate effect of computer experience (for visible trials only) or mean visible pathlength.

A Hidden/Place Trials (out of scanner)



B Hidden/Place Trials (in scanner)

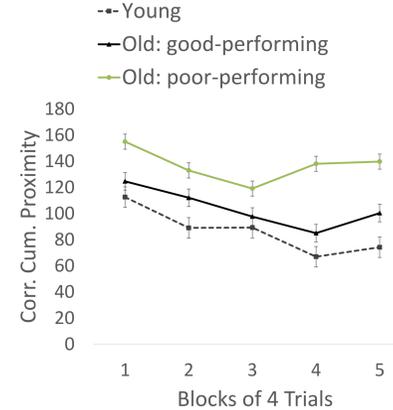


Fig. 1A: A 6 (Trial Block) x 3 (Age Group) ANCOVA showed significant main effects of age group ($p < .001$) and trial ($p = .019$) and a group x trial block interaction ($p = .006$). Post-hoc analysis showed the young ($p < 0.001$) and good-performing older ($p = 0.002$) outperformed the poor-performing older group.

Fig. 1B: A 5 (Trial Block) x 3 (Age Group) ANCOVA showed a significant main effect of trial ($p = .022$). Post-hoc pairwise comparisons showed that younger still outperformed the older poor-performing participants ($p = 0.025$).

C Probe Trials

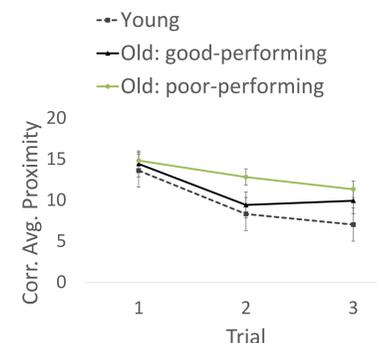


Fig. 1C: A 3 (Trial) x 3 (Age Group) ANCOVA showed significant main effects of age group ($p < .001$) and trial ($p < .001$). Post-hoc Bonferroni comparisons showed a significant difference between young and poor-performing older adults ($p < .001$). All participants performed better in the second and third trials compared to the first ($p < .001$).

D Visible/Control Trials

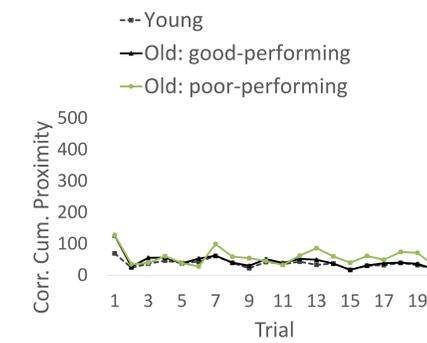


Fig. 1D: A 20 (Trial) x 3 (Age Group) ANCOVA showed significant main effects of age group ($p < .001$) and trial ($p < .001$). Post-hoc pairwise comparisons showed a significant difference between young and poor-performing older adults ($p = .045$).

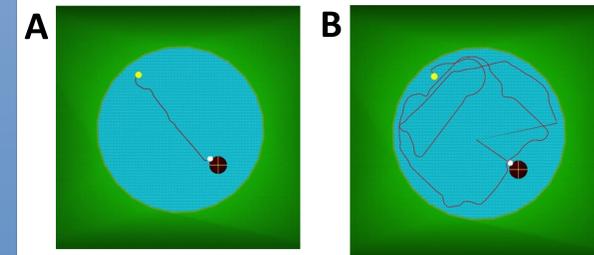
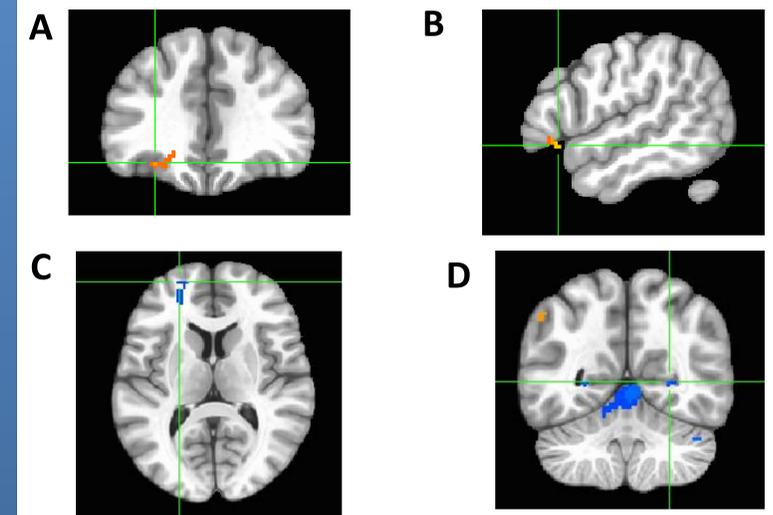


Fig. 2. Overhead views of paths taken to reach the hidden platform by one young participant (A) and one older participant (B) during hidden trial 17.

Good-performing and poor-performing older adults displayed different patterns of brain activations relative to the young

Fig. 3. fMRI images showing blood-oxygen level dependent (BOLD) responses in the brains of young participants based on [Hidden/Probe - Visible/Control] contrast. fMRI scans were analyzed with AFNI to show brain region activity at a group-level voxel-wise threshold of $p = .005$ (cluster-level corrected at $p = .05$).

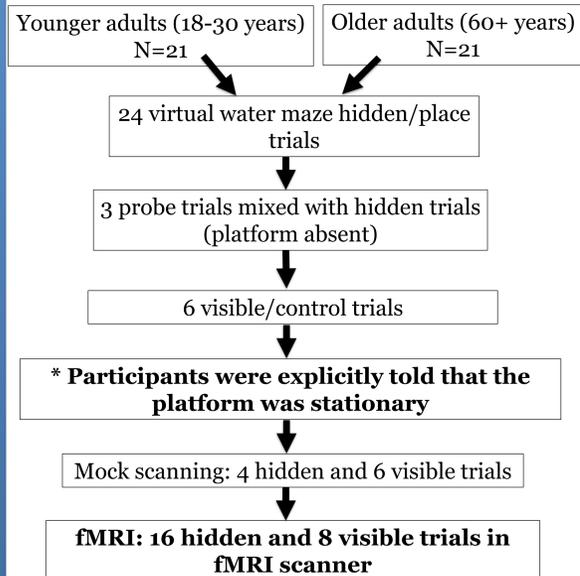


- Greater activation was seen in the **R. posterior parahippocampal gyrus** and less activation in the **L. medial frontal gyrus** among younger adults compared to older adults. [see Fig. 3A, 3D]
- Greater activation was seen in the **R. orbitofrontal cortex** in older poor performers compared to older good performers [see Fig. 3B].
- Greater activation was seen in the **L. medial prefrontal cortex** in older good performers compared to older poor performers [see Fig. 3C].

Conclusion

- Search performance of older participants was associated with different patterns of activation within the prefrontal cortex.
- Poor-performing older adults' challenges with acquiring the spatial learning and memory formation may be related with certain deficits in prefrontal executive functioning/processes.
- Older participants relied more than young on regions of the prefrontal cortex when completing a spatial memory task, suggestive of a neural compensation mechanism at work.

Methods



- Participants: 21 young adults [mean age = 22.3], 11 older good-performing adults [mean age = 66.3], 10 older poor-performing adults [mean age = 65.1].
- Older adults were separated into good-performing and poor-performing groups based on a **median split** performed on their corrected cumulative proximity data.
- The virtual water maze was created using **Unity 3D** and fMRI data was processed with **Analysis of Functional NeuroImages (AFNI)**.

- **Corrected Cumulative proximity (CCProx)** [corrected for starting position] was the primary dependent variable used to assess search performance.
- **Mean visible pathlength** (from 20 control trials) was used as a covariate in the analysis of hidden trials to control for age-related differences in visuomotor control ability.
- Self-reported **computer experience** was used as a covariate in the analysis of control trials.

References

1. Morris, R. G. (1981). Spatial localization does not require the presence of local cues. *Learning & Motivation*, 12:2, 239-260.
2. Gallagher, M., Burwell, R., & Burchinal, M. (1993). Severity of spatial learning impairment in aging: development of a learning index for performance in the Morris water maze. *Behav. Neurosci.*, 107:4, 618-626.
3. Zhong, J. Y., Magnusson, K. R., Swarts, M. E., Clendinen, C. A., Reynolds, N. C., & Moffat, S. D. (2017). The application of a rodent-based Morris water maze (MWM) protocol to an investigation of age-related differences in human spatial learning. *Behav. Neurosci.*, 131:6, 470-482.

Acknowledgments

Support provided by NIH grant [K18 AG048706](#) and CVM Pilot Project funds to KRM and by OSU URSA-Engage and Life Scholars funds to NCR.

Domestic Well Aquifer Storage and Recovery

Julianne Robinson, Desirée Tullós, Todd Jarvis

What is ASR?

Methods to augment water supply and storage capacity are becoming increasingly important in the face of increasing demand for water and a changing climate. In some areas, this has taken the form of aquifer storage and recovery (ASR), which involves injecting water into a well during a time of water surplus (i.e. winter) and storing it for later recovery when water is more scarce (i.e. summer), essentially using the aquifer as an underground reservoir. Although groundwater and surface water-sourced ASR has been implemented on a large scale for industrial, municipal, and agricultural uses (Embleton 2012), its potential as a tool for domestic well owners, particularly in utilizing spring water, is largely unexplored (Robinson 2017).

Study Objectives

- Evaluate the feasibility of spring-sourced domestic-scale ASR for a site outside of Toledo, Oregon
- Develop an assessment strategy for well owners interested in implementing ASR.

Study site

The study site is located on private land outside of Toledo, Oregon. A natural spring exists on the property and produces water continuously throughout the winter and spring, but dries up in the summer. A borehole well was recently drilled nearby the spring and produces approximately 1/8 gallons of water per minute. The goal of ASR is to store spring water in the well during the winter and recover the water for use in the summer when spring water is no longer available.



Above: study site location. (Google Maps)

Figure 1. Proposed ASR schematic.



Water is pumped from the spring/shallow well in the winter.



New well on top of ridge provides storage for injected water...

...which is then recovered in the summer months when other sources of water are unavailable.

Methods

The block diagram below depicts the geology and geography of the study site. Key points of interest are the spring, the new well (recently drilled, proposed injection well for ASR), and the old well. These points help identify the location of the water table, the direction of flow, and the aerial and lateral extent of the aquifer.

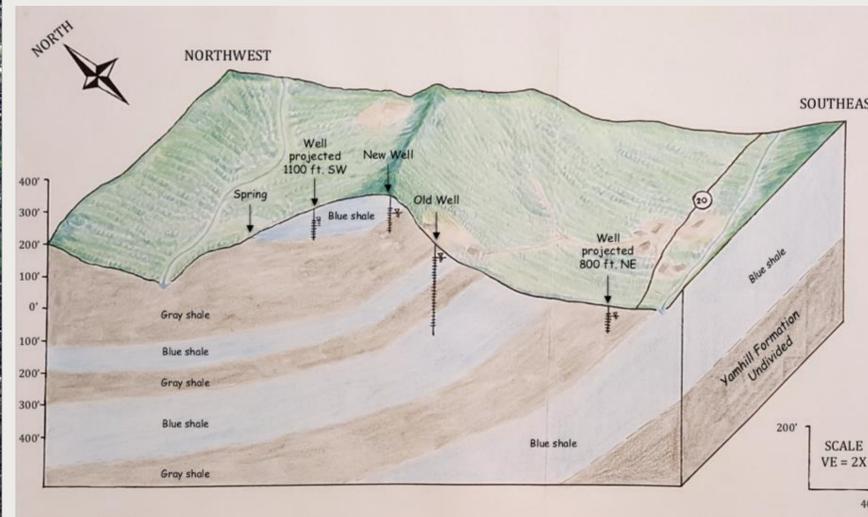


Figure 2. Conceptual hydrogeology block diagram

Table 1: ASR Scales and Sources. The table below compares and contrasts different ASR scales and sources, with the proposed framework labeled "Domestic well/spring."

Criteria	Requirement	Domestic Well/Rainwater Springfield, OR Embleton (2012)	Municipal Well/ Other Wells Warren, OR Mansfield (2015)	Domestic Well/Seasonal Spring Toledo, OR (this case study)
Regulatory	Permitting	UIC ¹ authorization by rule	OWRD ² /OHA ³ /ODEQ ⁴	UIC authorization by rule
	Water Rights	None – exempt.	Municipal Wells	None – exempt.
Hydrogeologic	Design	Pre-treatment	- Injection tests - Recovery tests	- Conceptual model of hydrogeology - Pump test - Injection test
	Engineering	Plumbing from roof to well	Existing SCADA ⁵ and plumbing from wells to ASR well	- Plumbing from spring-tank-well - Measure all that goes in and out
	Timing	Winter: storage Summer: recovery	Storage/recovery at will	Winter: storage Summer: recovery

1 – Underground Injection Control program; 2 – Oregon Water Resources Department; 3 – Oregon Health Authority; 4 – Oregon Department of Environmental Quality; 5 – Supervisory Control and Data Acquisition

Results

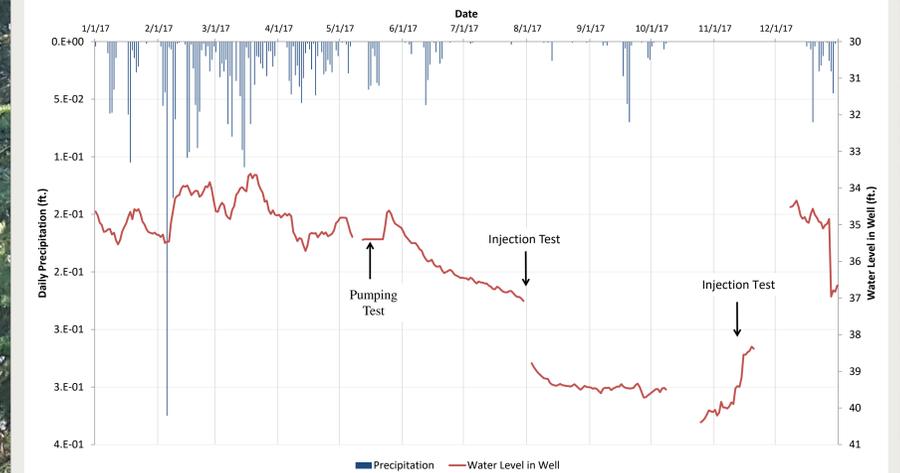


Figure 3. Static water level in well and average precipitation

The feasibility criteria used in this study were organized into hydrogeologic, regulatory, and economic characteristics. The conceptual model (figure 2), water level data (figure 3), water quality tests, and data from pumping and injection tests (figure 4) were used to assess the suitability of the aquifer for ASR use.

Method	Transmissivity (GPD/ft.)	Equation
Pumping test, Cooper and Jacob (1946)	1.5	$T = \frac{264Q}{\Delta(s - s')}$
Estimate from geologic unit description (Freeze 1979)	4	$T = Kb$

Figure 4. Transmissivity estimates

The table above shows estimates for transmissivity using two methods; both yielded relatively low values. We estimate that the well is capable of storing approximately 80 gallons per day (GPD) during the storage phase and could produce an estimated 120 GPD during the recovery phase. Due to the low transmissivity, an automated pumping system would likely need to be implemented to facilitate periodic inputs and withdrawals from the well.

Future research

Successful implementation of ASR in the Oregon Coast Range could provide well owners with a year-round supply of water, but depends on hydrogeologic feasibility at a very local scale. Future research should address ASR well design and the implementation of automated ASR systems for use in exempt wells.



References

Embleton, David (2012). Use of Exempt Wells As Natural Underground Storage and Recovery Systems. *Journal of Contemporary Water Research & Education*, Vol. 148(1), pp.44-54.

Mansfield, B. (2015). A Second Use: An unsuccessful water supply well proves aquifer storage can be a key to success. *Water Well Journal*, December 2015, pp. 30-32.

Robinson, J., Jarvis, T. and Tullós, D. (2017). "Domestic Well Aquifer Storage and Recovery Using Seasonal Springs." *Water Resources IMPACT*, 19(5), 22-23.

Acknowledgements

Support for this research was provided by the Institute for Water and Watersheds at Oregon State University, using funding from the USGS 104(b) Water Resources Research Institutes program. Thanks to Jakob Wiley for his legal and technical assistance, and to the Wiley family for access to their well and property.

Contact information: robinsju@oregonstate.edu

Exploring and Characterizing Pactamycin Biosynthesis

Jessica Roland¹, Mostafa Abugrain, Ph.D.², Taifo Mahmud Ph.D.²

BioResource Research¹, Department of Pharmaceutical Sciences², Oregon State University, Corvallis, OR 97331

ABSTRACT

Pactamycin, derived from the soil bacterium *Streptomyces pactum*^[1], is a cytotoxic antibiotic that resides in the aminocyclitol family as a natural product.^[2] Consisting of a cyclopentane ring, 3-aminoacetophenone, and 6-methylsalicylate, the chemical structure of Pactamycin is complex, but unique.^[3] The antibiotic has shown various forms of biological activity, such as powerful antitumor character, but it has never been used as a clinical drug because of its immense toxicity towards mammalian cells.^[4] With the profound potential of this bacterium derivative, research has been conducted to reduce and channel its cytotoxicity, so that it may be used as a therapeutic agent against adverse cells such as tumors. Synthetic organic chemistry has been used to manipulate the chemical structure of Pactamycin, in order to examine the changes in its biological activity; however, due to the complex structure of the antibiotic, additional methods have been utilized, such as genetic engineering and biosynthetic approaches.^[5] In this project, a new biosynthetic pathway has been proposed in order to gain a better understanding of the formation of Pactamycin, so that Pactamycin analogues can be synthesized in order to create new therapeutic agents.

INTRODUCTION

For over 50 years, Pactamycin has intrigued scientists with its complex structure and potent cytotoxicity.^[6] Consisting of a center cyclopentane ring, 3-aminoacetophenone, 6-methylsalicylate (6-MSA), N,N-dimethylcarbamate, alkyl, amino, and hydroxyl groups—see **figure 1**—this natural product resides in the Aminocyclitol family and originates from the soil bacterium *Streptomyces pactum*^[3,1]. Because of its molecular structure, Pactamycin has demonstrated various forms of biological activity, such as acting as a powerful antibacterial agent against both Gram-positive and Gram-negative bacteria.^[7] Additionally, contrary to prior belief that Pactamycin operates as an inhibitor of ribosomal initiation, recent studies show that it instead inhibits translocation, ultimately disrupting protein synthesis by selectively interacting with the E site of the 30S ribosomal subunit.^[3,8,9] Pactamycin has shown antiviral and antiparasitoid activity, as well.^[5] For these many reasons, the cytotoxic antibiotic has been sought for use as a clinical drug, but has never actually been used, due to its vast toxicity of all mammalian cell types—helpful or harmful. Therefore, because of its incredible potential, research has been conducted to reduce and direct the cytotoxicity of Pactamycin, with the overall goal of creating therapeutic agents for mammalian clinical benefit.

For this project, a new pathway has been hypothesized for the biosynthesis of Pactamycin; see **figure 2**. Within this pathway, enzymes including PtmA, PtmB, PtmD, PtmN, and PtmG facilitate the modification of the substrate by the following respective enzymatic activities: aminotransferase, carbamoyl transferase, methyltransferase, ketoreductase/oxidoreductase, and deacetylase. Although the respective functions of the enzymes PtmA, PtmB, PtmD, PtmN, and PtmG are supported by putative evidence, many steps within this proposal remain unclear, specifically the order in which the substrates are catalyzed. In the pathway which has been proposed in order to gain a better understanding of the biosynthesis of Pactamycin, it begins with the substrate UDP-N-acetylglucosamine (UDP-GlcNAc). The first scheme of the pathway is that UDP-GlcNAc gets oxidized by PtmN on the fourth carbon of the six-membered ring. The oxidized product then undergoes aminotransferase via PtmA on the same carbon. The transaminated product then undergoes carbamoyl transferase by PtmB, where the amino group from the previous step connects to the incoming carbamoyl group. PtmG then deacetylates the ketone on the third carbon in the ring. The mysterious part about this scheme is that the function of PtmJ could take place intermittently at any time during the previously described step-by-step synthesis. Because of this, the exact function of PtmJ remains unknown, as well as whether or not the multi-step enzyme-catalyzed process where the first substrate UDP-GlcNAc gets modified is uninterrupted by the enzymatic activity of PtmJ or not. Lastly, another peculiar characteristic of the biosynthetic pathway is the connection of the Acyl Carrier Protein (ACP) all throughout the process.^[10]

OBJECTIVES

- Conducting protein solubility from the enzymes PtmA, PtmB, PtmD, PtmN, and PtmG.
- Expedite enzymatic reactions of the soluble proteins and appropriate substrates to either uncover findings that support the proposed pathway of Pactamycin biosynthesis or otherwise refute it.
- Examine the peculiar connection of the Acyl Carrier Protein (ACP) throughout the process.
- If products of the reactions are as expected, the soluble proteins will then be purified.
- Lastly, the products will be further characterized.

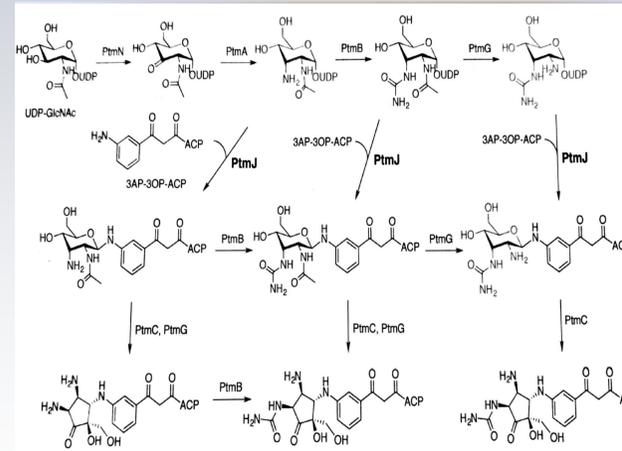


Figure 2. Proposed Pathway of Pactamycin Biosynthesis

MATERIALS & METHODS

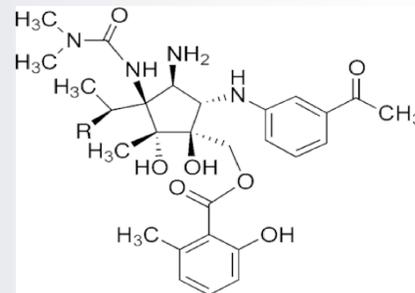


Figure 1. Pactamycin Chemical Structure

The overall procedure is as follows: The Pactamycin biosynthetic gene cluster (*pct*) was identified and derived from soil bacterium *S. pactum* by sequencing an 86 kb continuous chromosomal region.^[2] Thus, containing all of the genes of interest for this specific project—PtmA, PtmB, PtmD, PtmN, and PtmG—*pct* will then undergo individual amplification for each specific gene by Polymerase Chain Reaction (PCR). The PCR products for each amplified gene will then be separately cloned and digested by appropriate restriction enzymes for the vectors that the linear DNA are to be harbored in. An Agarose Gel will then be run to see the results of the ligation.

The newly ligated vectors will be transferred into the *Escherichia coli* competent cell. After growing on an agar plate, one colony will be inoculated—the bacteria will be put into a culture to grow until it reaches a high enough density to be induced. After induction and further overexpression, the overexpressed product in each flask will be divided among two falcon centrifuge tubes, which will then be centrifuged. The samples will then be prepared for sonication and will ultimately be run through the SDS gel. After observing the gel, soluble proteins will be able to advance to the next steps within the procedure: enzymatic reaction, purification, and further product characterization.

Figure 3. pET-28a(+) vector

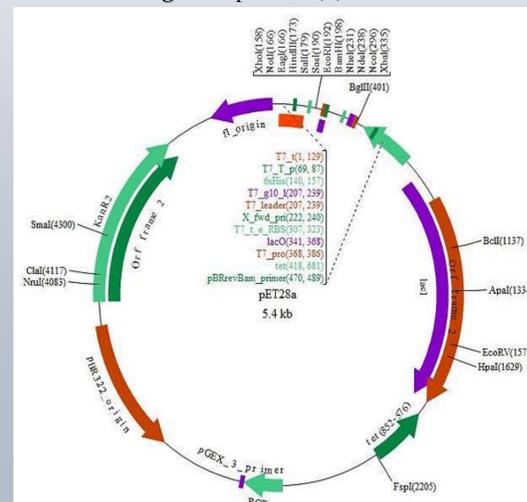
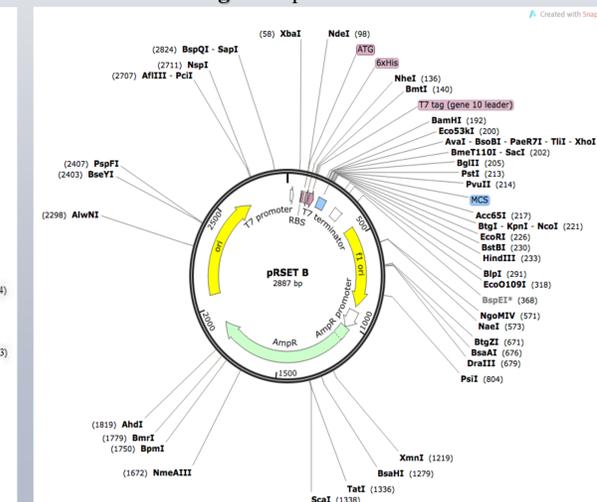


Figure 4. pRSET B vector



RESULTS

Lane 1: ptmA (supernatant); 45kDa apparent weight
Lane 2: ptmA (cell debris)
Lane 3: marker
Lane 4: ptmB (supernatant); 63kDa apparent weight
Lane 5: ptmB (cell debris)
Lane 6: ptmN (supernatant); 40kDa apparent weight
Lane 7: ptmN (cell debris)
Lane 8: empty pRSET B (supernatant)
Lane 9: empty pRSET B (cell debris)

Fig 5. SDS-PAGE Gel 1



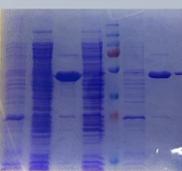
Lane 1: ptmD (cell debris); 40kDa a.w.
Lane 2: ptmD (supernatant)
Lane 3: ptmG (cell debris); 50kDa a.w.
Lane 4: ptmG (supernatant)
Lane 5: marker *a.w.=apparent weight

Figure 6. SDS-PAGE Gel 2

Lane 1: ptmG (cell debris); pET-28a(+); 100ul buffer
Lane 2: ptmG (supernatant); pET-28a(+)
Lane 3: ptmG (cell debris); pRSET B; 100ul buffer
Lane 4: ptmG (supernatant); pRSET B
Lane 5: marker
Lane 6: ptmG (cell debris); pET-28a(+); 500ul buffer
Lane 7: ptmG (cell debris); pRSET B; 500ul buffer

Actual Weights:
PtmA: 43.12kDa
PtmB: 62.81kDa
PtmD: 39.46kDa
PtmG: 41.69kDa
PtmN: 38.72kDa

Fig 7. SDS-PAGE Gel 3



DISCUSSION & CONCLUSIONS

When analyzing the SDS-PAGE gel, the lane with the biggest band determines whether or not the protein is soluble—if the big band is in the supernatant lane, then it is soluble, and if the big band is in the cell debris lane, then it is insoluble. Therefore, PtmG is still not soluble. Additionally, the apparent weight of PtmG, while harbored in both vectors pET-28a(+) (figure 3) and pRSET B (figure 4), do not match the actual weight of PtmG, which is approximately 41.69kDa. For PtmG expressed in the pET-28a(+) vector, the apparent weight is a small 25kDa, and when PtmG is harbored in the pRSET B vector, the apparent weight is more than 50kDa. Nevertheless, the soluble products—PtmA, PtmB, PtmD, and PtmN—will undergo the enzymatic reaction, and potentially purification and further characterization.

WORKS CITED

1. Bhuyan, B.K. (1962). Pactamycin production by *Streptomyces pactum*. *Appl. Microbiol.* 10, 302-304.
2. Mahmud, T., Flatt, P. M., & Wu, X. (2007). Biosynthesis of Unusual Aminocyclitol-Containing Natural Products#. *Journal of Natural Products*, 70(8), 1384-1391. doi:10.1021/np070210q
3. Kudo, F., Kasama, Y., Hirayama, T., & Eguchi, T. (2007). Cloning of the Pactamycin Biosynthetic Gene Cluster and Characterization of a Crucial Glycosyltransferase Prior to a Unique Cyclopentane Ring Formation. *The Journal of Antibiotics*, 60(8), 492-503. doi:10.1038/ja.2007.63
4. Guha, G., Lu, W., Li, S., Liang, X., Kulesz-Martin, M. F., Mahmud, T., Ganguli-Indra, G. (2015). Novel Pactamycin Analogs Induce p53 Dependent Cell-Cycle Arrest at S-Phase in Human Head and Neck Squamous Cell Carcinoma (HNSCC) Cells. *Plos One*, 10(5). doi:10.1371/journal.pone.0125322
5. Lu, W., Roongsawang, N., & Mahmud, T. (2011). Biosynthetic Studies and Genetic Engineering of Pactamycin Analogs with Improved Selectivity toward Malarial Parasites. *Chemistry & Biology*, 18(4), 425-431. doi:10.1016/j.chembiol.2011.01.016
6. Abugrain, M. E., Lu, W., Li, Y., Serrill, J. D., Brumsted, C. J., Osborn, A. R., ... Mahmud, T. (2016). Interrogating the Tailoring Steps of Pactamycin Biosynthesis and Accessing New Pactamycin Analogues. *ChemBioChem*, 17(17), 1585-1588. doi:10.1002/cbic.201600261
7. Ito, T., Roongsawang, N., Shirasaka, N., Lu, W., Flatt, P. M., Kasanah, N., Mahmud, T. (2009). Deciphering Pactamycin Biosynthesis and Engineered Production of New Pactamycin Analogues. *ChemBioChem*, 10(13), 2253-2265. doi:10.1002/cbic.200900339
8. Brodersen, D. E., Clemons, W. M., Carter, A. P., Morgan-Warren, R. J., Wimberly, B. T., & Ramakrishnan, V. (2000). The Structural Basis for the Action of the Antibiotics Tetracycline, Pactamycin, and Hygromycin B on the 30S Ribosomal Subunit. *Cell*, 103(7), 1143-1154. doi:10.1016/s0092-8674(00)00216-6
9. Polikanov, Y., Osterman, I., Szal, T., Tashlitsky, V., Serebryakova, M., Kusochek, P., Sergiev, P. (2014). Amicoumacin A Inhibits Translation by Stabilizing mRNA Interaction with the Ribosome. *Molecular Cell*, 56(4), 531-540. doi:10.1016/j.molcel.2014.09.020
10. Abugrain, M. E., Brumsted, C. J., Osborn, A. R., Philmus, B., & Mahmud, T. (2017). A Highly Promiscuous β -Ketoadyl-ACP Synthase (KAS) III-like Protein Is Involved in Pactamycin Biosynthesis. *ACS Chemical Biology*. doi:10.1021/acscchembio.6b01043

Acknowledgements: I would like to thank all members of the Mahmud lab, the Department of Pharmaceutical Sciences, Wanda Crannell, Kate Field, and the BioResource Research program for assisting me in my growth as a young scientist.

Developing a Questionnaire with the Intent of Measuring User Experience in Test Trials of Low-Cost Virtual Reality

Andrew McUne, College of Liberal Arts
Dr. William E. Loges, Department of New Media Communications



Abstract

This paper details the development and pre-testing of a questionnaire designed for assessing the user experience of a View-Master virtual reality headset, and discusses the theory in the field of user experience used to carry out that effort. A group of eight researchers drafted the questionnaire collectively, with the intent to understand the improvements that could be undertaken on a piece of technology based on either the acclaim or disdain of a user. 51 respondents participated in our trials and survey. Analysis of the resulting data shows significant evidence that those who value interactivity are also more open to using non-native apps in a VR headset, and that men are more willing than women to be seen using the View-Master VR viewer in public.

Background

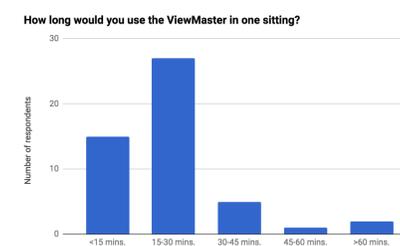
The medium of virtual reality (VR) has evolved considerably in the past decade, and with the recent upswing in VR product development it is now necessary for numerous questions to be answered. A valid and reliable questionnaire that asks respondents about their experience with VR would be valuable.

The setting for this research was a course at the undergraduate level at Oregon State University, for students receiving a degree in Digital Communication Arts. Eight students participated in the class, which was less than desirable, but sufficient for a manageable distribution of responsibilities. The idea to develop a questionnaire to determine the user experience of an object or event was presented by Dr. Loges at the beginning of the ten-week term, and then it was given to the students to create the project.

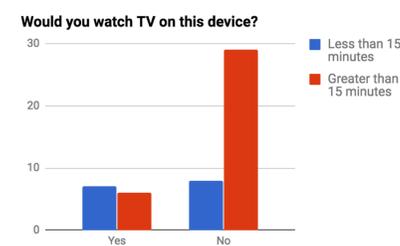
Methods

Respondents were drawn from a class of students in a New Media Students were told that participating in this research would be allowed by the professor as an alternative project to one that would be assigned in class. To compartmentalize the questions in our survey, we set out to define a set of values as an initial guide for writing, and also to organize data when we collected it. Each and every one of these values needed to be meaningful to the user of the View-Master in a distinct and describable way. These values were: *portability, durability, comfort, simplicity, interactivity, desirability, versatility, and emotion*. Full definitions for each of these concepts were written in the report.

Respondents arrived at a predetermined trial location on an individual basis. A compatible smartphone would be inserted in the VR viewer, with a free demo version of the View-Master® Discovery Underwater app already loaded on-screen. The respondent would be told to use the application, and to stop either when he or she did not feel inclined to continue or when the demo ended. A researcher would then give the respondent a copy of the drafted survey and allow him or her to complete it at the table. Upon finishing the survey, the researcher would receive it from the respondent and give the respondent a final sheet of paper containing a list of prompts for his or her class assignment, from that respondent's professor, after which they would depart. Data was entered into an online-hosted spreadsheet, and this spreadsheet was then downloaded and imported into SPSS Statistics for data analysis.



"How long would you use the View-Master in one sitting?" Fig. 1.



"Would you watch TV on this device?" Fig. 2.



Fig. 3 - The Mattel View-Master VR Viewer (Closed Unit) Sridhar, S. (2016, March 1). Google Store starts selling View-Master and C1-Glass Cardboard VR Viewers. Retrieved March 23, 2017, from <http://www.fonearena.com/blog/176707/google-store-starts-selling-view-master-and-c1-glass-cardboard-vr-viewers.html>

Results

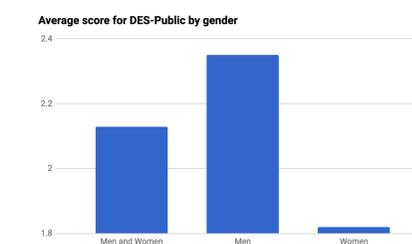
Upperclassmen are more open to the View-Master being used to teach mathematics and English. Of the 49 respondents who indicated their answers appropriately, 12 of 27 upperclassmen said that the View-Master could be used to teach mathematics ($X^2 = 3.8$, d.f. = 1, $p = .05$), and 11 of 27 upperclassmen said that it could be used to teach English ($X^2 = 4.4$, d.f. = 1, $p < .05$).

There is a mutually positive relationship between the value of interactivity and willingness to use the View-Master for more than the apps that are made for it. ($F = 5.3$, d.f. = 1, $p < .05$).

Those who said that they could sit for longer periods of time also said that they would not use the View-Master to watch TV ($X^2 = 4.8$, d.f. = 1, $p < .05$). 29 of the 35 respondents who indicated that they would use the View-Master for at least 15 minutes at a time also said that they would not use it to watch television. By contrast, 8 of the 15 respondents who would only use the View-Master for bouts smaller than 15 minutes indicated that they would not watch TV on it. (See figs. 1-2.)

Men are more willing to be seen with this in public than women ($F = 4.7$, d.f. = 1, $p < .05$). (See Fig. 4.)

Analysis was also conducted on the effectiveness of the survey in addressing the values that were drafted at the onset of the project, and on the reliability and validity of the experiment. The survey was considered successful when concerning its reliability, as well as interactivity, comfort, and simplicity, but areas including emotion and durability could have been investigated further, even in this basic level of inquiry.



Gender of respondents v. willingness to be seen with the View-Master in public. Fig. 4.

Conclusion

Continuing this research would involve editing the questionnaire, drawing out a larger sample, amassing more stock View-Master VR viewers, and testing user experience with virtual reality on a much larger scale, with several finite hypotheses to drive the editing and testing. This should be undertaken. The findings from this project are prime for further investigation.

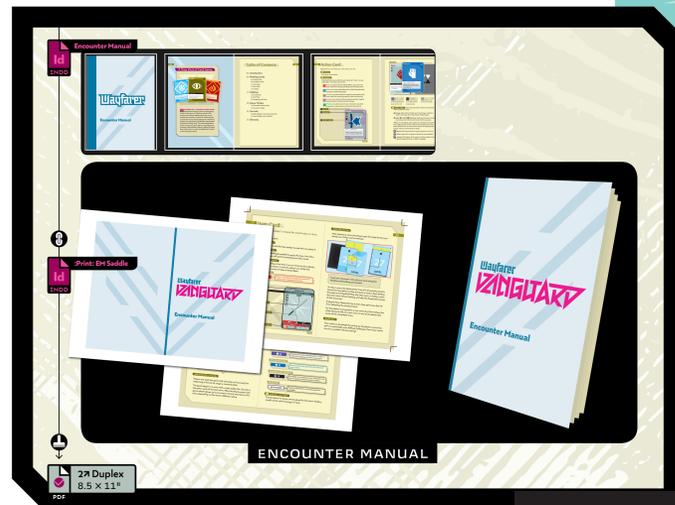
DELVE

A NEW KIND OF TABLETOP GAME

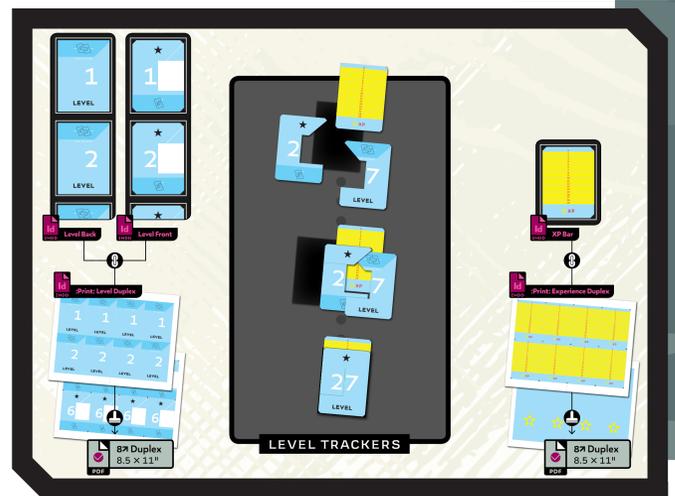
VERSION HISTORY



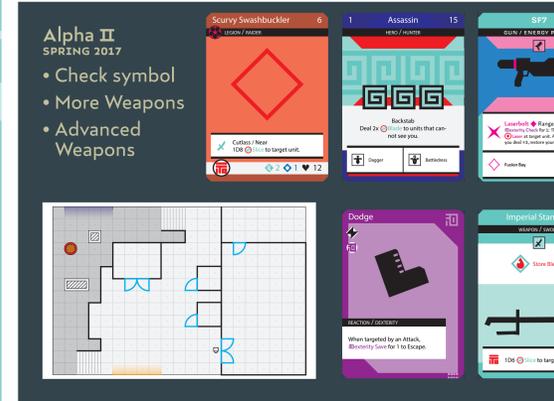
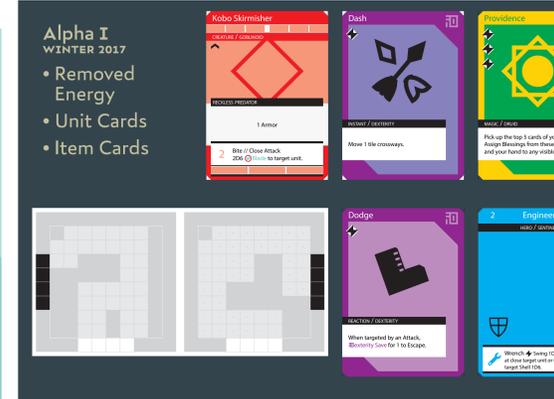
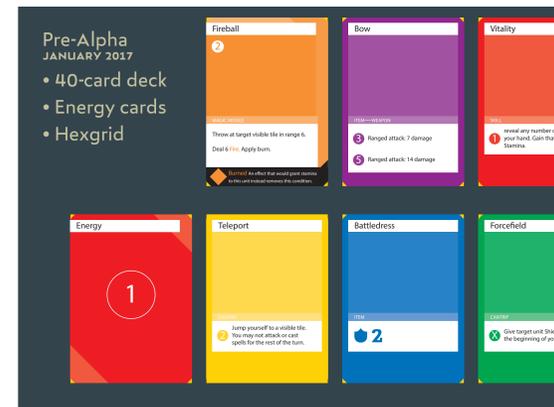
CARDS



BOOKS



TRACKERS



by Jeremy Banka with the advice of Bill Loges. Cover Illustrated by Sam Stember

Risk Factor Distribution of Cardiovascular Disease in Shanghai, China

By: Yutong Fan

Mentor: Bin Zhu

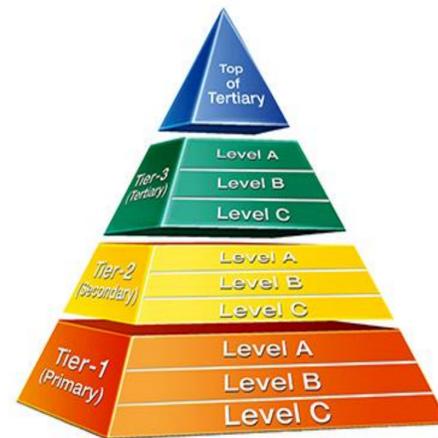
An overview of China's Medical System

Hospitals in China have one of the highest patient volumes throughout the world, and they start to take advantage of these data and information, but these valuable data are far away from being well utilized.

A comparison between China and America on Health Expenditures in 2014:

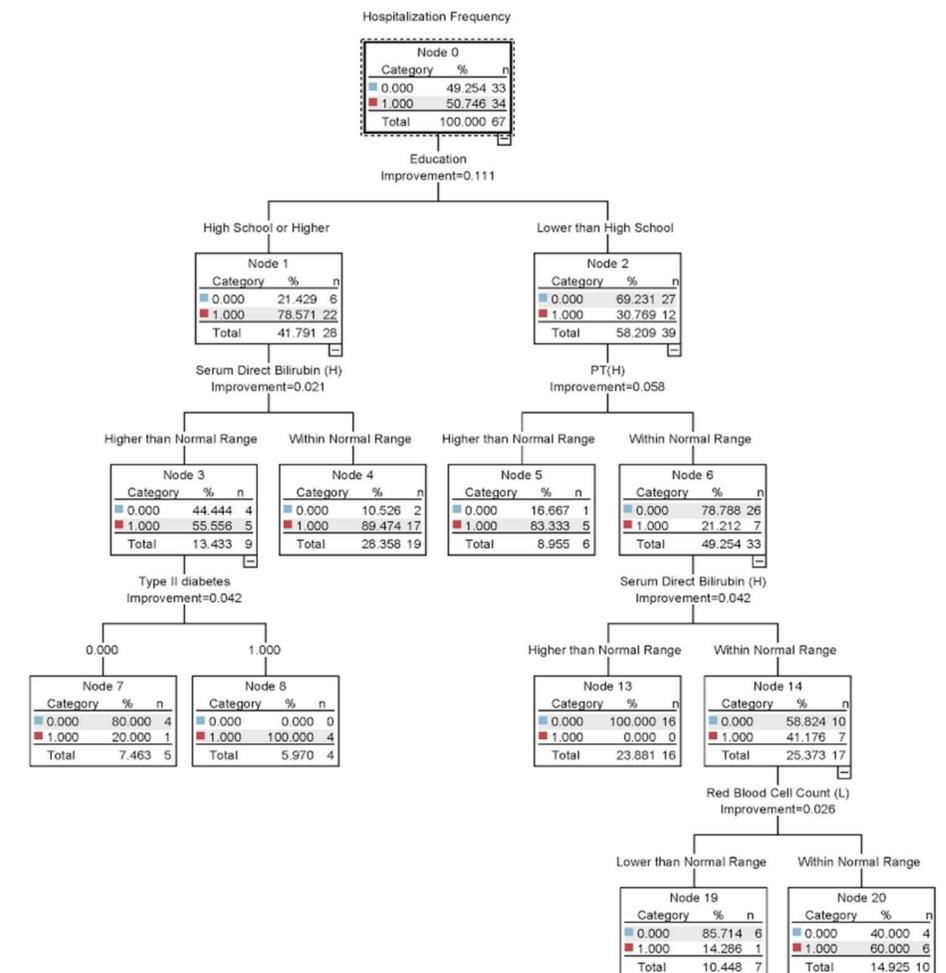
Statistics	China	United States
Total Health Expenditure	3.5 trillion dollars	3.0 trillion dollars
Total Health Expenditure (per Capita)	419.73 dollars	9402.54 dollars
Total Health Expenditure (% of GDP)	5.55%	17.14%
Out-of-pocket health expenditure (% of total expenditure on health)	31.99%	11.05%
Out-of-pocket health expenditure (% of private expenditure on health)	72.35%	21.37%

3-tiers 10-level Hospital Grading System



http://cancer.cliffordhospital.com/About_Us/32.html

Result:



Dependent and Independent Variables

Dependent Variable:

- Hospitalized frequency
 - 0 = Hospitalized more than once
 - 1 = Hospitalized only once
- Independent Variables (34 in total):
 - 5 Demographics
 - 2 Diagnosis
 - 16 Abnormal Lab Index (Higher than Normal Range)
 - 11 Abnormal Lab Index (Lower than Normal Range)

Conclusion:

