January 27, 2022

THREE MINUTE THESIS®

A event recognizing research and creative talents of graduate students at the University of Idaho

Welcome to the University of Idaho's Three Minute Thesis ® Competition

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Thursday, January 27, 2022
3:00 PM PST in Clearwater Room, ISUB
Audience viewing available via **ZOOM** too

AN 80,000 WORD THESIS
WOULD TAKE 9 HOURS
TO PRESENT.
THEIR TIME LIMIT.... 3 MINUTES.

This competition was originally developed by the University of Queensland in 2008, and is now held in over 600 universities across the world. Today, 16 graduate students from the University of Idaho will compete to describe their research 180 seconds or less.

The 1st place winner receives $1000, 2nd place $750, 3rd $500, and the People's Choice $250.

The top three and the People's Choice winner in today's 3MT event will be given the opportunity to present their work at the Statewide 3MT event on February 15, 2022 (3PM MST) in Boise competing against the top students from Boise State University and Idaho State University for more awards and prestige. Watch ONLINE!

Thank you for participating in and celebrating graduate student research at the University of Idaho.

Proceedings

Opening Remarks and Officiator of Events

Jerry McMurtry, Ph.D.
College of Graduate Studies Dean

Judging Panel

Gabriel Potiniche , PhD
Professor & Chair – Mechanical Engineering

Sanjay Sisodiya, PhD
Professor – Business

Ben Hunter, PhD
Dean – University Libraries

Yvonne Nyavor, PhD
Neuroscience

Presenters

Sixteen graduate students representing Animal Sciences, Biological Sciences, Chemical Engineering, Computer Science, Education, Environmental Science, Fish and Wildlife, Movement Sciences, Plant Science and Soil and Water Systems

Presented by the College of Graduate Studies with special thanks to the U of I Office of the President and the Provost & Executive Vice President

University of Idaho
College of Graduate Studies

Competitors

Techniques for Enhancing Compiler Error Messages

Sana'a Algaraibeh PhD student in Computer Science under Dr. Terence Soule

A compiler is a communication tool; one of its primary roles is to detect errors and report those errors in understandable messages. Unfortunately, today's state-of-the-art compilers are efficient but still give poor error messages for common syntax errors. In general, human-computer interaction research recommends that a software system should help users recognize, diagnose, and recover from errors. This study investigated the difficulties of learning programming and then identified novice programmers' common errors. After that, the study analyzed how the mainstream compilers report the common errors. We found that the bad errors refer to the limitation of the parser, so we designed a novel solution that parses a source code in three phases. To answer the research question, can 3-phase parsing techniques help generate better syntax error messages, we will conduct an experiment to compare the quality of syntax error messages of the modified parser with that of mainstream compilers.

Irrigation of Historical Drylands: Consequences on Soil Microbes and Antibiotic Resistance

Amanda Bauer *MS student in Soil and Water Systems under Dr. Michael Strickland*

Forty percent of global landmass are drylands, supporting 1.8 billion people in developing countries - partially through irrigated agriculture. While desert farming can be helpful for food security, there are ecological consequences. By irrigating soil once too dry to support crops, the environmental conditions for organisms living within the soil are rapidly changing.

Soil bacteria produce antibiotics as an ecological, competitive strategy. In turn, antibiotic resistance can evolve within the soil community. Inherently, dryland soils have less abundant antibiotic resistance genes (ARGs) than more moist environments. But by manipulating environmental conditions through irrigation, soil community antibiotic interactions may shift. This presents a potential pathway for greater antibiotic resistance exposure to humans because ARGs have been shown to transfer from soil to crop. This research focuses on the transformation of semi-arid lands into lush, irrigated fields and the effects on soil bacteria, with implications to human health.

Competitors

Understanding Genetic Susceptibility to Parasite Infection in Katahdin Sheep

Gabrielle Becker PhD student in Animal Physiology under Dr. Brenda Murdoch

Gastrointestinal nematodes (GIN) are one of the most severe threats to sheep health. Sheep become infected with GIN by ingesting parasite larvae while grazing. Depending on the severity of the infection, sheep may experience weight loss, diarrhea, anemia, or death. Parasites can be difficult to control and many of the current anti-parasitic drugs are no longer effective. The aim of this research is to identify genetic differences between susceptible and resistant Katahdin sheep in order to better understand the genetic mechanisms contributing to the immune response. This study identified genetic markers within the immune gene EDIL3 that are associated with high fecal egg counts. We propose that these markers may be used to predict the immune status of Katahdin sheep to GIN parasite infection and may help producers identify animals who are at greater risk of severe infection. This work suggests the gene EDIL3 as a target for further research.

Eliciting Mathematical Reasoning in the Classroom: An Investigation of Tools for Success

Veronica Blackham PhD student in Education focusing on Curriculum and Instruction – Mathematics under Dr. Anne Adams

Classroom engagement of students in mathematical reasoning including mathematical justifications is extensively considered a productive mathematical practice. (e.g. Ellis, 2011; Yackel & Hanna 2003; Stein & Smith, 2011). The purpose of this research study was to investigate the influences on teachers' capacity to elicit mathematical justifications in the classroom. The sample of teachers being investigated had received extensive training on mathematical reasoning and teaching practices that promoted justifications. Results from the mixed-methods analysis take a closer look at relationships among teachers' knowledge of teaching mathematics, teachers' understanding of justification, and teacher success in eliciting student mathematical justifications in the classroom.

Competitors

A Whole-Reservoir Story: What Sediment, Nutrients, and Long-term Data Can Tell us from 30 Years of Limnological Sampling

Sarah Burnet PhD candidate in Fish & Wildlife under Dr. Frank Wilhelm

Harmful algal blooms (HABs) in surface waters worldwide decrease the aesthetic, recreational value, and use of potable source waters. This is important in the face of the expanding human population that relies on access to clean water. The overall goal of my Ph.D. dissertation will be to further the understanding of best management practices to improve the quality of lakes and reservoirs, with interest in the effects of excess nutrients (specifically phosphorus) which contribute to the growth of HABs. The opportunity presents itself at Willow Creek Reservoir (WCR), located in Heppner, OR, with data collected since 1984, that has only been analyzed minimally along with additional research computer during my Ph.D. Understanding the importance of nutrients such as phosphorus in the context of whole-lake dynamics will allow lake managers to (i) assess how best to allocate limited funds to remediation.

Integration of Chemical Heat Pump and Thermochemical Energy Systems

Aman Gupta PhD student in Chemical Engineering under Dr. Vivek Utgikar

Integrated Energy Systems (IES) are collaboratively controlled systems that dynamically apportion thermal and/or electrical energy to promote the production of various energy products, have potential to reduce GHG emissions, improve energy efficiency, improve electrical grid dependability, and enhance energy economics. Thermal energy storage (TES) is an advanced technology for storing thermal energy that can mitigate environmental impacts. Thermochemical energy storage (TCES) is based on the principle of employing a reversible chemical reaction for thermal energy storage. TCES can also be operated as chemical heat pump (CHP) by manipulating the reaction conditions. CHP are particularly suitable for delivering high temperature (>600°C) heat with the potential for temperature lifts > 400°C using reversible exothermic reactions. The Ca(OH)2/CaO reaction system is attractive for use in chemical heat pumps because of low chemical cost, and high energy density. Results on kinetic analysis, thermodynamic study and energy efficiency of the overall system will be presented.

Competitors

The Role of the Transcription Factor SlNAC4 in Abiotic Stress Tolerance in Tomato

Madigan Hawkins MS Plant Science student working with Dr. Fangming Xiao

The ability of plants to respond to dynamic environmental conditions is largely due to expression of transcription factor proteins that play a pivotal role in the genetic reprogramming required at all stages in plant development and in response to environmental challenge. Previous study of the tomato transcription factor SlNAC4 shows that it is significantly upregulated in response to abiotic stresses including high salinity, low temperature, and drought. Through Agrobacterium-mediated plant transformation and CRISPR gene editing, this study has generated tomato lines that either overexpress or lack the SlNAC4 protein, respectively. Abiotic stress assays, demonstrate that artificial overexpression of the SlNAC4 gene produces dramatically stunted plants with increased tolerance to drought stress, while knockout of SlNAC4 decreases plant tolerance to drought stress. Because SlNAC4 could be a potential target for manipulation of crop abiotic stress tolerance, understanding the mechanisms of SlNAC4 influence greatly benefits the plant science community.

A Mutation in The AGPS1 Gene Results in a Shift of the Carbon Flow from Starch Synthesis to Beta-Glucan Accumulation During Seed Development in Barley

Leila Jamalizadeh Plant Science Ph.D. candidate under Dr. Zonglie Hong

Beta-glucan is a dietary fiber that is accumulated only in cereal crops such as barley. In the diet, beta-glucan plays a significant role in the reduction of blood sugar and cholesterol level. Therefore, high beta-glucan content in grains has become a major goal of breeding programs for food barley cultivars. A barley mutant, CM1, producing about two times the beta-glucan content of the wild type, was isolated. The mutation was mapped to the AGPS1 gene that encodes the small subunit of AGPase, a key enzyme in starch synthesis. Biochemical analyses confirmed the reduction of the AGPase enzyme activity in the mutant plants and revealed the mechanism of how the carbon flow was shifted from starch synthesis to beta-glucan accumulation during seed development in CM1. This mutant is currently being used as valuable germplasm for the development of food barley cultivars with high beta-glucan in the grain.

Competitors

Heat Stress Effects on Mitochondria

Adamarie Marquez Acevedo MS student in Animal and Veterinary Sciences looking at Lactation Physiology with Dr. Amy Skibiel

The effects of heat stress on dairy cow performance are evident; with financial repercussions in the dairy industry of over 1$ billion. While the impact of heat stress on dairy cattle performance is heavily documented, there is a lack of research of the effects of heat stress at a cellular level. The animal science community understands the metabolic and molecular pathways disturbed by heat stress, but the cellular mechanisms through which heat stress impacts animal productivity are not well understood. Accumulating evidence supports the theory that mitochondrial dysfunction is an etiology of heat-stressed induced lactation depression. Mitochondria are responsible for cellular energy production and the partitioning of resource across lactation. They also act as primary stress indicators and chronic stress results in dysregulated and dysfunctional mitochondria. Recently, our lab discovered that heat stressed cattle downregulate expression of several proteins subunits of the electron transport chain (ETC) complexes in mammary and liver tissues. This suggests that mitochondrial aberrations are correlated with heat stress. To further understand this, the Skibiel lab proposes a controlled study approach to better understand mitochondrial dysfunction.18 multiparous Holstein dairy cattle will be divided into two treatment groups: heat stress (HS) and thermoneutral (TN). Mitochondrial function for each group will be evaluated at the end of the study by quantifying mass and activity. Productivity metrics will also be recorded.

Survey Development Examining the Association of Socialization & Physical Educator CSPAP Involvement

Christopher Merica *PhD student in Education focusing on Physical Education/Movement Sciences Teacher Education Program*

Nationally, 76% of school-aged children fail to meet recommendations for 60 minutes of daily physical activity (PA). Schools are advantageous to increase student PA using a whole-school approach, such as a comprehensive school physical activity program (CSPAP). Physical educators are suggested to be leaders of CSPAP, but prerequisite training is recommended. Physical education teacher education (PETE) programs are viewed as an ideal setting for training to occur, but research on the association of CSPAP training during PETE and current CSPAP involvement of physical educators is sparse. Additionally, limited research has investigated how physical educator experiences with PA promotion as a K-12 student or school organizational factors during employment are associated with CSPAP involvement. Thus, the purpose of research is to examine physical educators' childhood, PETE training, and school organizational factors associated with CSPAP involvement via two studies: (1) instrument development, and (2) results from a national sample of physical educators.

Competitors

Utilization of Copepods as Alternatives to Rotifers and/or Artemia for Weaning of Larval Burbot (Lota lota maculosa)

Moureen Matuha Environmental Science PhD student with Dr. Kenneth Cain

Burbot (Lota lota maculosa) are one of the most promising new species for commercialization as a foodfish. However, burbot larvae require live food for several weeks before they can be weaned onto commercial feeds. Production of live feed is expensive, labor intensive and often requires considerable aquaculture culture facility.

To determine if dependance on live feed could be reduced, the potential use of Otohime diet and frozen copepods in burbot larval culture was evaluated. Four feeding regimes (FR): FR-B (no Gemma diet), FR-C (no Salt Lake Artemia), FR-E (live Artemia, copepods and otohime diet) and FR-F (copepods and otohime diet) were compared to our standard production protocol: FR-A (live Artemia and Gemma).

The results demonstrated a potential for copepods as a substitute for live Artemia and provides a basis for reducing the amount and time of providing live feeds in burbot larviculture thus lowering production costs associated with their culture.

Genotypic and Phenotypic Determinants that Enable Methylorubrum extorquens to Survive Formaldehyde Stress

Akorede Seriki PhD student in Biological Sciences studying under Dr. Christopher J. Marx

A population of genetically identical bacteria growing in the same condition exhibits phenotypic diversity. This allows bacteria to evolve strategies to tolerate stress, such as formaldehyde - a metabolic toxin. Formaldehyde tolerance has been studied in Methylorubrum extorquens, an organism that can grow on methanol, which is oxidized to formaldehyde during its metabolism. This tolerance ability is heritable. However, a knowledge gap is the genetic basis for tolerance in some but not all members of the same population. Twenty-three genes were implicated in the tolerant population, 22% of which are involved in protein misfolding. We hypothesize that handling protein misfolding contributes to tolerance and there could be a link between these genes and tolerance. This will be tested via genetic modifications to some of these genes and single-cell analysis. The outcome will expand our knowledge of the behavioral responses of bacteria to environmental stress based on their genetics.

Competitors

CTE Online Using Multimodal Delivery Methods

Farjahan Shawon PhD in Education with an emphasis in Curriculum and Instruction under Dr. Raymond Dixon

The significance of this study lies in its potential contribution to the literature on delivering CTE curriculum online. While many schools are revisiting the importance of CTE in the K 9-12 curriculum, many face constraints in the form of instructional and laboratory resources. A case study of a CTE online program will add to the literature on online delivery in the K 9-12 system. Findings from this case study will also provide a model for the delivery of CTE programs in an equitable manner for diverse populations living in rural regions. From a practical perspective, this study will illustrate programmatic models for the delivery of CTE to produce entry-level technicians from secondary schools in rural regions that can be replicated in regions that are facing similar issues relating to workforce shortages and the out-migration of youth, which are disruptive factors to the economy of rural regions.

Evaluation of Variant Calling Programs for Analyzing Diversity Between U.S. Sheep

Morgan Stegemiller PhD student in Animal Physiology under Dr. Brenda Murdoch

Accurately identifying genomic DNA sequence variation is a critical step in discovering causal variants for biological traits and genetic diseases. Several programs can be used to detect variants, but these programs use different quality metrics that may affect call accuracy. Our aim was to compare the performance of two commonly used variant detection programs (GATK HaploptypeCaller and Freebayes) and call variants from fourteen U.S. sheep breeds. These results showed that Freebayes called an average of 6.11% more SNPs than GATK HaplotypeCaller. From the variants called we clustered the breeds based on genetic similarity which corresponds to different physical characteristics. Furthermore, the variants identified can be used to help determine the genetic cause for the different physical characteristics. This research provides a basis for understanding the genetic diversity within and between breeds and future insight into selection pressures of US breeds.

Competitors

Intercropping: An Approach to Sustainable Agriculture

Torrey Stephenson MS Environmental Science student under Dr. Zachary Kayler

Growing a single crop in a field can deplete soil health and compromise agricultural productivity. Intercropping—the practice of growing two or more crops simultaneously on the same plot of land—may be a more sustainable alternative.

Intercropping mixes often include pulse crops which can fix their own nitrogen, a critical nutrient. These crops may reduce fertilizer demand without damaging yields, resulting in economic and environmental benefits. Additionally, intercropping may support a more diverse soil microbial community, a key component of healthy and resilient soils.

As the global population continues increasing, sustainable agricultural practices will be critical to support the rising demand for food, fuel, and fiber. This research assesses measures of soil health such as nutrient status, resource allocation, and microbial diversity in intercropped fields in southern Idaho. The results of this work will help to assess the merit of intercropping as a sustainable production practice.

Cover Crop Diversity Effects Soil Microbial Community Diversity

Bronte Sone PhD in Soil and Water Systems under Dr. Michael Strickland

Agricultural soil carbon stores and biodiversity have been significantly reduced due to poor soil management practices and monoculture farming regimes. However, the implementation of cover crops offers a viable solution to improve soil carbon stores and increase diversification on farms. Yet, little is known about the effect of diverse cover crops on soil microbial communities, which are intrinsic to processes responsible for soil carbon sequestration and nutrient cycling. This study examines the effects of diverse cover crop mixtures on soil carbon, and bacterial and fungal community diversity. Our results suggest that the implementation of diverse cover crops can improve soil carbon stores by increasing carbon inputs and microbial biomass carbon, which is an indicator of long-term soil carbon storage. In addition, an increase in microbial diversity suggests greater agroecosystem resilience and resistance to disturbances such as drought and climate change.

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