

A stylized illustration of two hands against a solid blue background. The top hand is brown and holds a blue pen, with a green and purple ink splash at its tip. The bottom hand is purple and holds a yellow pen, with a purple and green ink splash at its tip. The two pen tips are positioned close together, suggesting an interaction or collaboration.

CELEBRATION OF
STUDENT RESEARCH
& CREATIVITY
2024

2024 CELEBRATION OF STUDENT RESEARCH & CREATIVITY

April 16

Student Research Poster Session

5:00 – 6:15 p.m.

Frazier Hall

Reception

6:00 – 6:30 p.m.

Wyatt Center for the Arts foyer

Student artwork in the McGarth Gallery

Program

Student readings, music, and creative projects

6:30 – 7:30 p.m.

Black Box Theater

Theater Capstone

7:45 p.m.

Black Box Theater

April 21

Honors Student Thesis Presentations

12:30 p.m.

Centro Atrium

ABOUT THE BECVAR ARTISTS IN RESIDENCE PROGRAM

The Lansing School of Nursing and Health Sciences established the Artist-in-Residence program in the 2002-2003 academic year. This program examines the art and science of Nursing and Health Sciences through the eyes of an undergraduate student working in the fine and creative art mediums. Endowed by Mrs. Arthur N. BecVar in 2006 in honor of her husband, this program exemplifies the diverse and many creative and artistic talents of the BecVar family. Having earlier established an endowed nursing scholarship fund during Art's lifetime, with this endowment Jayne BecVar further connects her desire to support and provide to our community caring, ethical graduates. It is our mutual desire that the students' experiences in this program, as viewed through the arts, will give them new ways of thinking to inform their clinical practice, the health care profession, and patient contact and care.

The 2023-2024 Becvar Artists in Residence are Kaina Stallard and Kel Proctor.



Kiana Stallard

Kiana Stallard is a senior Digital Art and Design, Arts, and Technology double major. Along with being one of the BecVar Artists in Residence (2023-2024), she was the recipient of the Norton Art Scholarship in 2022. On campus, Kiana is a Knights of Color mentor, the Vice President of the Asian and Asian American Student Union, the President of the Multiracial Student Union, and a member of the Arts and Sciences student advisory council. Moving forward, she hopes to own her own business with a focus on video game design, computer graphics, and interactive media.

Artist Statement: As an artist, a central theme in my work revolves around identity exploration. I delve into questions such as: What shapes our identities? And why do certain experiences define us? Through this project, I aim to raise awareness about Childhood-Onset Fluency Disorder, commonly known as stuttering. As this project developed, it has undergone various shifts in both content and storytelling approaches. Despite this, I have crafted a personal narrative partnered with 3D animated visuals to express my innermost thoughts, struggles, and eventual acceptance of my fluency disorder. I understand that merely sharing a narrative might not fully convey the challenges of living with a speech disorder. Nevertheless, I hope that by sharing a part of my journey, it can provide solace to others with this disorder, letting them know they are not alone. I am deeply grateful to become a part of the BecVar Artist in Residence family. This opportunity has been transformative, and I am thankful for the experience!

Cover by: Kiana Stallard - The Hobbyist (2024) - Digital Illustration

The Hobbyist is a digital illustration piece that simply comments on the parallels between a digital artist and a traditional fine artist (painter). The color palette of this piece is both vivid and simultaneously muted with the intent to depict internalized tension between the two styles.



Kel Proctor

Kel Proctor is a junior honors student at Bellarmine University where she majors in English and minors in creative writing. Kel is vice president of the literary society on campus, Ariel Literary Society, and creative director of the writing club on campus, Pen and Sword. She also works as a writing tutor.

Artist Statement: The Healthcare system is vast and the work that those in this system do is invaluable. It was important to me to highlight what these workers do as well as my own experience with the healthcare system. While some poems take on the perspective of a nursing student, others reflect upon my experiences with mental health and chronic illness. They aim to show my appreciation for the healthcare system and those who work within it.

Catharsis Waiting for the Shuttle

I felt life on the bench
Outside the therapist's office
While the trees stood still,
Leaves aching in the dry air.
Nearby, the farm was growing
Pawpaws and the bees were dancing
To speak and I was crying
For a fatigue deep in the marrow
Of my rib cage.
The sky was a crystalline hue
Of a desaturated light
And I ached.
"Our bodies are not made
To hold this stress," she said.
And I am breaking up,
Joint by joint, snapping
Tendons and raining
Teeth. But I will rest.
One day, I will rest.

Celebration of Student Research & Creativity

April 16, 2024

UNDERGRADUATE STUDENTS

Actuarial Science	7
Biochemistry and Molecular Biology	9
Biology	12
Chemistry	16
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Data Science	22
Environmental Science	27
Foreign Languages and International Studies	32
History	33
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GRADUATE STUDENTS

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Education and Social Change	41
Health Professions	43
Medical Laboratory Science	44
Physical Therapy	44

SPECIAL THANKS TO

Dr. Susan Donovan, President

Dr. Mark Weigand, Vice President for Academic Affairs and Provost

Dr. Jon Blandford, Assistant Provost

Mrs. Connie Smith, Director of Office of Sponsored Projects

Mr. Adam Elias, Director of Innovative Learning Systems

Ms. Chris Ekstrom, Administrative Assistant College of Health Professions

UNDERGRADUATE STUDENTS

ACTUARIAL SCIENCE

POSTER 1

The Mathematics of Poker Theory

Hayden Horn/ hhorn@bellarmine.edu / Faculty Mentor: Greg Kelsey

In this study, we delve into the strategic complexities of poker, seeking to uncover the balance between optimal gameplay and exploiting opponents' weaknesses to boost winnings. We utilize poker rules, probability theory, and advanced counting techniques to create a comprehensive table outlining winning probabilities for each Texas Hold 'em hand. By integrating mathematical principles with live player data, our tailored model maximizes profits and provides significant insights into effective poker strategies.

POSTER 2

Can You Solve a Game of Chess

Evan Gousha/ egousha@bellarmine.edu / Faculty Mentor: Bill Fenton

Chess is a game of many complexities and encapsulates technical decision making and rigorous strategy. The intricacies of this deceptively simple game are vast, but is it possible to solve a chess game using mathematics? The goal of this project is to analyze the possible relationships and connections between chess and mathematics, looking to where math can enhance a player's chances of winning a chess game. This poster examines a wide array of circumstances where different math principles can be applied in a chess game to give a player a technical advantage over their opponent. This project begins by examining the fundamentals of chess, including the characteristics of each piece, as well as the rules of the game. Research shows that math is intrinsic in chess, as many aspects of the game are quantifiable. This project analyzes the effectiveness of game theory in the strategic planning of moves, particularly in openings and endgame sequences, by utilizing game trees in decision making to weigh advantages and disadvantages of different moves. Utilizing principles of combinatorics and general probability, it is possible to examine the probability of possible subsequent move variations to gain a winning position. Ultimately, one can use

math to develop better chess skills such as gameplay strategy and decision making in the endgame.

POSTER 3

The Mathematics of Guitar

Naat Ambrosino / nambrosino@bellarmine.edu / Faculty Mentor: Bill Fenton

This project serves as an overview of the mathematics that come into relevance for the design and performance of guitars. Priority is placed on presenting information in a way that is accessible for both mathematicians and guitarists. In terms of design, virtually all modern guitars are designed with equal temperament in mind, while historical predecessors were fashioned for other systems such as just intonation. Since these systems derive notes differently, there are marked trade-offs in utility and sound associated with choosing either. For the realm of performance, this project focuses on analyzing guitar harmonics using both practical examples and pure mathematics.

POSTER 4

Inherited Genetic Disorders and Markov Chains

Caleb Puckett / cpuckett@bellarmine.edu / Faculty Mentor: Bill Fenton

This project models the passing of genetic disorders from one generation to the next using Markov Chains. The genetic disorders discussed include colorblindness, sickle cell disease, cystic fibrosis, Hemophilia, and Factor V Leiden. We begin by defining the genetic disorders discussed and the way they are passed down genetically. This is followed with an explanation of how Markov Chains work and why their application is useful in this context. These genetic disorders are passed on with different probabilities based on various factors. Some of these disorders require multiple matrices to account for important details. By representing the passing on of these disorders with transition matrices, we are able to determine long term steady states for each. These long-term steady states show us the expected proportion of the population that will consistently have these disorders in the future.

BIOCHEMISTRY & MOLECULAR BIOLOGY

POSTER 5

Gonadal Absence of *ceh-22*: Degradation of CEH-22 in the Gonads of *Caenorhabditis elegans*

Andrey White / awhite4@bellarmine.edu / Faculty Mentor: Mary Kroetz

The reproductive system of *Caenorhabditis elegans* (*C. elegans*) comprises two gonadal arms, each with a terminating distal tip cell (DTC), connected by a common uterus. The DTC has two functions: leader and niche. The leader function controls gonad elongation, while the niche function prevents germ cells from entering meiosis and allows germline stem cells to divide continually. In *C. elegans*, *ceh-22/nkx2.5* has been found to work together with Wnt signaling to determine the fates of the DTC (Lam et al., 2006). Our research aims to better understand the specific function of *ceh-22* in the gonad of both male and hermaphrodite *C. elegans*. This will be accomplished by observing the effect of the removal of CEH-22 protein from the tissue. However, since *ceh-22* is also essential for various aspects of the development of *C. elegans*, deletion of the gene would result in the death of the animals. To avoid this, we utilize a Degron toolkit to target GFP-tagged proteins for ubiquitination and degradation, but the GFP-fused protein will only be targeted in the gonad. In a previous project completed by students of the spring 2023 Bellarmine University Genetics Lab, CRISPR-Cas9 gene editing technology was used to tag *ceh-22* with green fluorescent protein (GFP). We have successfully performed a cross between these *ceh-22::GFP* worms and a separate strain of *him-8* male *C. elegans* that contain the degron strand (ZIF-1) fused with GFP nanobody. The triple mutant strain generated from the cross results in *C. elegans* that have a functioning *ceh-22* in all tissues except the gonad. Our next steps are to observe the phenotype and behavior of the triple mutant strain compared to *ceh-22::GFP* worms lacking the Degron toolkit—taking note of differences in reproductive abilities and the physical appearance of the gonad.

Presented at the Kentucky INBRE Annual Research Conference (ARC) 2024

POSTER 6

Investigating the Therapeutic Potential of *Xanthorhiza simplicissima*

Nichole Diaz / ndiaz@bellarmine.edu / Faculty Mentor: Savita Chaurasia

This cohort study aims to address the increasing prevalence of diabetes and oxidative stress-related conditions by examining the phytochemicals of *Xanthorhiza simplicissima*, commonly known as Yellowroot. Yellowroot, indigenous to the Appalachia region, has a rich history of traditional use by Native Americans, African Americans, and early European settlers for treating ailments including colds, diabetes, hypertension, jaundice, and cancer. The plant extract was obtained using Soxhlet extraction method. The phytochemical profile of Yellowroot included alkaloids, cardiac glycosides, flavonoids, phenols, steroids, and terpenoids. Additionally, the total phenolic and flavonoid content were quantified to investigate antioxidant potential. Further investigation will focus on the elucidation of the antidiabetic and antioxidant properties, continuing to bridge the gap between contemporary and traditional medicine.

Recipient of the Student Government Association Research Grant Award

POSTER 7

Investigating the Effect of *Eriodictyon californicum* on HCT-116 Cells in Vitro

Elena Stoughton / estoughton@bellarmine.edu / Faculty Mentor: Savita Chaurasia

Eriodictyon californicum, an herb traditionally used by Native Americans to treat illnesses, holds promise in addressing modern diseases like diabetes and cancer, which still lack definitive cures. *E. californicum* has been shown to have chemo active and anti-tumor properties in past studies and long-term *E. californicum* research could be vital in the search for a cure. Previous research in this lab has tested four different *E. californicum* extracts to assess their antioxidant content. This study aims to evaluate the effects of *E. californicum* extract on human HCT-116 cells in a controlled laboratory environment to test the effects of plant extracts on protein targets associated with cancer and diabetes. The focus will be on observing cell recovery rates and changes in HCT-116 cells when exposed to *E. californicum* extract, providing valuable insights into how this herb interacts with human cells at a cellular level. The crude *E. californicum* extract will be used to test the effect on these protein targets in HCT-116 cells and eventually the four fractions will be tested as

well. So far, an MTS assay has shown that crude *E. californicum* does inhibit HCT-116 cell viability which goes along with previous research of *E. californicum* showing chemo active properties. Further testing to be done will be a scratch assay and a clonogenic assay to test how *E. californicum* affects HCT-116 migration and colony formation. More research must be done to further test *E. californicum* but there are promising results so far.

Recipient of the Student Government Association Research Grant Award

POSTER 8

Investigation of the Anticancer Activity of phenylbismuthbis (4-carboxychalcone)

Megan Baker / mbaker10@bellarmine.edu / Faculty Mentor: Amanda Krzysiak

Cancer is currently the second leading cause of death in the US. While much progress has been made, there is still a significant need for novel therapies. Chalcones are privileged, natural products that have shown cytotoxic activity and potential as chemotherapeutics in multiple cancerous cell lines. Additionally, bismuth complexes of small organic molecules have been shown to have anti-tumor activity. The anti-proliferative activity of phenylbismuthbis(4-carboxychalcone), a bismuth coordinated chalcone was assessed in multiple cancer cell lines using MTS assays. The compound demonstrated micromolecular inhibition. Additionally, mechanism of action studies was performed to assess if the anti-proliferative activity seen is due to an induction of apoptosis. Western blotting suggests drug treatment with phenylbismuthbis(4-carboxychalcone) results in the activation of apoptotic cascades.

Accepted at the American Chemical Society Spring 2024 Conference
Recipient of the Joe and Angela Schmidt Award and the Clariant Endowment

POSTER 9

Gonadal Absence of pig-1: Exploration of pig-1 in the Gonad of *Caenorhabditis elegans*

Winston Bennah / wbennah@bellarmine.edu / Faculty Mentor: Mary Kroetz

Caenorhabditis elegans are model organisms frequently studied to better understand biological processes. They have short life spans and produce a large number of progeny. Additionally, many of their molecular development processes can be found in human, providing insight into cell death and cell fate. In this project, our research aims to create a

triple mutant strain to test the importance of the *pig-1* gene in the gonad of *C. elegans*. This strain carries the following alleles: *ckb-3::degron*; *him-8*; *gfp::pig-1*. The *pig-1* gene has been previously studied in neuroblast cells in *C. elegans* and is required for asymmetrical division, resulting in one neural precursor and one apoptotic cell. The *gfp::pig-1* strain was made by a previous undergraduate student in the Kroetz lab, Peyton Young. The *him-8* gene, when mutant, leads to males making up approximately ~30% of the population. In comparison, males are approximately 0.2%-0.5% of the wild-type population. mRNA transcripts of the *pig-1* gene have previously been shown to be enriched in the male gonads. Therefore, the *him-8* mutant allele will allow us to phenotypically study the gonads of the male animals. Finally, *ckb-3::degron* is used to degrade GFP and proteins fused to it. The *ckb-3::degron* gene allows for the degradation of only gonadal *gfp* by ubiquitination because the *ckb-3* promoter drives the *degron* to only be expressed in the gonad. The *pig-1* gene is essential for the viability of the animal in other tissues and would lead to the animal's death if removed from the whole animal. The triple mutant strain will allow us to observe what will happen to gonad development and function if *pig-1* is removed from the gonad in both male and hermaphrodite worms. Therefore, I will analyze the triple mutant worm to see how the gonad is affected by the absence of the PIG-1 protein. This will be done by observing the triple mutant worms and noting any physical or behavioral abnormalities compared to worms containing *gfp::pig-1*, but not the *ckb-3::degron*.

BIOLOGY

POSTER 10

A Sense of Place: Corridor Connection and South Fork Beargrass Creek, Louisville, Kentucky

Meghan Kotic / mkotic@bellarmine.edu / Faculty Mentor: Martha Carlson Mazur

Waterways have been intrinsically linked to the development of society, often to the stream's detriment through channelization, pollution, and other human impacts. A direct connection of the community to their waterways can help mitigate these impacts, but access to streams is often severed when they are used more like a drainage ditch, which proliferates poor stewardship within the community. Particularly, in Louisville, KY, the impact of human activity is apparent when examining water quality parameters and changes to the Beargrass Creek's course over time. Despite its history being intertwined with the development of Louisville, the stream has been neglected and lacks a comprehensive, central

site to learn of its past, present, and future. Using a section of South Fork Beargrass Creek as a case study, a public resource was developed based on scientific and historical information to better inform people on stewardship and connect them to their local waterways.

Presented at the Southern Regional Honors Conference

POSTER 11

RNAi “Flexon” Approach to Gonad Gene knockdown in *C. elegans*

Sofia Douglas / sdouglas3@bellarmine.edu / Faculty Mentor: Mary Kroetz

All living things require some form of genetic regulation so that gene products are correctly produced and maintained. One significant form of post-transcriptional gene expression is RNA silencing, a biological mechanism in which double stranded RNA molecules inhibit gene expression by blocking translation of targeted mRNA molecules. Due to its extensive applications in biotechnology, it’s been adapted as an experimental technique referred to as RNAi. This technique is temporary, transient, and easy to use. A new form of RNAi, referred to as the “Flexon” technique is a novel approach that provides a method for post-transcriptional gene regulation that allows for tissue specific RNAi in the gonads of nematodes. In *C. elegans*, the Flexon cassette is inserted into the genome along with a Cre driver, allowing for the study of genes essential for viability but also are suspected to have a significant role in gonadogenesis when Cre-recombinase is expressed. When expressed, excision of the Flexon results, causing the restoration of RNAi in the gonads. The Flexon cassette can also be utilized for tissues beyond the gonad in RNAi. To assess the efficacy of this technique, we generated a new strain of *C. elegans* that contains the Flexon cassette, a Cre driver, and a *him-8* nondisjunction mutation. This results in the generation of male *C. elegans* containing the Flexon and the gonad specific Cre driver. Using this strain, the efficacy of the Flexon technique will be evaluated through inhibition of a gene known to play a role in the development of the male gonad of *C. elegans* that is also important for embryonic and larval viability. The gene, known as *hnd-1*, will be inhibited in male *C. elegans*, and we will observe for visually apparent deformities in the gonad but in other tissues in the animal. Afterwards, additional genes will be tested.

Presented at the KY INBRE Annual Research Conference

POSTER 12

An exploration of the effectiveness of *Xanthorrhiza simplicissima* and its secondary alkaloids as antibiotics against *Staphylococcus aureus* with the use of Reserpine

Donald Bothe / dbothe@bellarmine.edu / Faculty Mentor: Savita Chaurasia

Xanthorrhiza simplicissima is a plant that is steeped in medical history. It has been used for hundreds of years by the Native Americans, and later by the Europeans, of Appalachia for its medicinal properties. One of the most useful medical applications of this plant are its antibiotic properties. This plant was often used as a tea that was drunk to treat mouth sores. This is due to some of its secondary alkaloids such as berberine, liriodenine, oxyacanthine, and magnoflorine. These compounds have been found in other plants and they have had their antimicrobial properties researched. However, oxyacanthine and magnoflorine have not been researched in tandem with the use of efflux pump inhibitors. Neither has the *X. simplicissima* extract itself. Efflux pumps allow bacteria to exude antibiotics and other cytotoxic molecules out of their cells. The disabling of these pumps has been shown to greatly increase the effectiveness of antibiotics and antimicrobial compounds. This study examines the effect of efflux pump inhibitor reserpine on the antimicrobial effectiveness of magnoflorine, oxyacanthine, and the *X. simplicissima* extract against *Staphylococcus aureus*. Norfloxacin is the control antibiotic in this trial. The Yellowroot extract and its two secondary alkaloids have been found to inhibit *S. aureus* growth. Reserpine alone did not show good inhibitory against *S. aureus*. However, reserpine being an efflux pump inhibitor, exhibited great synergistic effects with oxyacanthine, magnoflorine, and the yellowroot extract, either halving their MICs or making them more effective at lower concentrations.

Presented at the Mid-east Honors Association Regional Conference
Recipient of the Joe and Angela Schmidt Award

Utilization of *Eriodictyon californicum* natural products in PRL3 drug discovery

Chase Yost / cyost@bellarmine.edu / Faculty Mentor: Savita Chaurasia

Phosphatase of regenerating liver 3 (PRL3), an established oncogene has gained increased interest in recent years. Overexpression of PRL3 has been linked to metastasis, cell proliferation, and migration. Furthermore, various studies have shown that in melanomas, breast, lung, and colorectal cancers PRL3 is overexpressed. Despite this clear therapeutic target, there is a pressing need for clinically efficacious PRL3 inhibitors. Traditionally used medicinal plants present a promising route for drug discovery. The secondary metabolites present in medical plants have been shown to be effective in drug discovery through their complex and synergistic effects to inhibit difficult targets, such as phosphatases, more effectively. *Eriodictyon californicum*, also known as Yerba Santa, is a shrub native to southwest North America. It was traditionally and still used by Native Americans for its various medicinal effects, however, yerba santa is currently underrepresented in the reported literature. We have previously characterized the antioxidant potential of yerba santa as well as its inhibitory effect on another phosphatase implicated in cancer and metabolic disorders. However, in the present study, we present a phytochemical analysis of yerba santa through LC-MS analysis to identify its most prominent components. This analysis further elucidates the active components of our extract towards identifying the phytochemicals responsible for its apparent biological effects. Additionally, we present a preliminary analysis of the inhibitory effect of yerba santa on PRL3. This study aims to address this important therapeutic target through the utilization of a traditionally used medicinal plant coupled with a more thorough phytochemical assessment to identify potential drugs. This work builds upon and provides a scaffold for the use of medicinal plants in phosphatase drug discovery as a whole.

Recipient of the Student Government Association Research Grant Award and the Kentucky Academy of Science Special Research Award

POSTER 14

Optimizing western blot quantification methods using tissues from the sea urchin *Lytechinus variegatus*

Samantha Lyerla / slyerla@bellarmine.edu / Faculty Mentor: Roberta Challener

Western blot analysis is a multiple step process used to quantify specific proteins from a tissue sample. It is ideal to have an optimized method for a particular species or tissue type. Prior to probing a western blot with a specific antibody, it is recommended to quantify the number of total proteins that have been transferred from the gel to the blot membrane. There have been few studies done on quantifying the proteins of sea urchin tissues during the transfer process from a gel to a membrane, therefore there is no standard protocol available. The objective of this work was to develop a successful protocol that maximized total protein transfer. Temperature of heating prior to gel electrophoresis (95C vs 100C) and time of transfer (10 vs 30 vs 45 minutes) were manipulated. Total protein quantities were obtained to determine optimal protocols.

Recipient of the Student Government Association Research Grant Award

CHEMISTRY

POSTER 15

Synthesis of Trisubstituted Bismuth Complexes for Future Research

Cassidy Belk / cbelk@bellarmine.edu / Faculty Mentor: Anna Christianson

Bismuth, a relatively inexpensive heavy metal with low toxicity, has the potential to be used in medicines and anticancer drugs. This project is exploring bismuth complexes with ligands based on chalcones, which are a type of small organic molecules with known anticancer qualities. Preliminary results on a bismuth-chalcone complex indicate that substituted aryl bismuth complexes have better anticancer activity than triphenylbismuth or the chalcone ligand on its own. A series of trisubstituted bismuth molecules were synthesized using a BiCl₃ Grignard reaction under a nitrogen atmosphere with different substituents to provide electron donating groups, electron withdrawing groups or bulk. X-ray Crystallography was used to characterize the crystalized products and show the helical chirality with both delta and lambda enantiomers appearing in a racemic mixture. Crystal structures also showed close to 90° C-Bi-C bond angles resulting in an exaggerated trigonal pyramidal geometry

unique to heavy main group element bonding. The series of molecules is to be used in future research to determine if the substituent on the bismuth impacts the anticancer qualities of the bismuth-chalcone molecule.

Presented at the American Chemical Society Spring National Conference

Recipient of the Joe and Angela Schmidt Award

POSTER 16

Observing Solubility and How it is Affected by Differing Concentrations

Jaelyn Walker / jwalker7@bellarmine.edu / Faculty Mentor: Anna Christianson

Solubility is a topic heavily focused on within introductory chemistry classes, whether that is at the high school or college level. This work is a research project that dives deeper into the world of solubility and allows students the opportunity to apply what they learn in class to their laboratory work. Differing concentrations of FeSO_4 are added to Na_2CO_3 solutions of constant concentrations and the resultant precipitate is observed. Precipitate appears in four of the five beakers of solutions upon addition of the FeSO_4 to the Na_2CO_3 , with the two highest resulting in the highest amounts of precipitate as one would expect. An alteration to this experiment can also be made by altering the pH of the solution through dropwise addition of HCl. The solutions containing the higher concentrated FeSO_4 additions started at a lower pH and resultingly took less HCl to reach the targeted pH range of 4.0 – 5.0. From observations it appeared that there was a buffer region present in the pH range of 5.5 – 6.0. This experiment is a great laboratory exercise for introductory chemistry students to learn about how differing concentrations affect precipitation, along with the application of observing changes in pH.

COMPUTER SCIENCE

POSTER 17

RealOrder: A Relative Ordering Algorithm for Autonomous Vehicles

Mina Brown / wbrown@bellarmine.edu / Faculty Mentor: Nathan Johnson

In the future, with autonomous vehicles, cars and trucks will be required to communicate and negotiate all sorts of maneuvers including intersections, lane changes and mergers. Therefore, it is critical that autonomous vehicles know their location and the location of vehicles in proximity to them. Global Positioning System, GPS, hardware, and software provide location data. However, consumer-grade GPS isn't very precise. Because of this, raw GPS data can't be used to map out, for example, the sequence of vehicles traveling next to one another to a traffic stop. This project suggests a relative ordering algorithm, RealOrder, for using imprecise GPS data to determine the relative location of vehicles. The algorithm was developed and tested using three Raspberry Pi 4Bs equipped with commodity GPS modules.

Partially funded by the Computer Science Department

POSTER 18

FreeSearch - A Word Search Generator

Christina Porter / cporter@bellarmine.edu / Faculty Mentor: Nathan Johnson

Word search puzzles have been an entertaining way to exercise the mind since they were published in 1968 by Norman E. Gibat as the "Word Cross" puzzle. The puzzles show improvement across memory access, attention, and reasoning; however, the availability of the puzzles is limited in retail stores and print versions can't be customized for specific purposes. FreeSearch uses stored topics and associated words to generate unique puzzles on request. FreeSearch allows users to access a webpage and create puzzles by choosing a topic and difficulty level for the puzzle they would like to display. The puzzle is rendered using React, a component-based JavaScript library, and hosted on Vercel, a free hosting website using Amazon Web Services. The underlying logic is implemented using JavaScript, which checks the topic and word entries, and uploads them to a MongoDB database. The stored topics are then cross referenced with associated words using ExpressJS, a JavaScript application programming interface, and implemented in React using Axios.

POSTER 19

StatMapSecure

Morgan Hardin / mhardin5@bellarmine.edu / Faculty Mentor: Nathan Johnson

StatMapSecure is an application anyone can use to check for security vulnerabilities on a computer. The software allows the user to access valuable security tools like Netstat and Nmap. Typically, these commands are run through the command line and require expertise to use and interpret. StatMapSecure is a simple-to-use interface that allows users to benefit from sophisticated security tools. Netstat displays all the connections to a user's computer and Nmap returns all the open ports for specific IP addresses. The user can click a button labeled "Scan using Netstat" or "Scan using Nmap" and the commands will run based on the user's decision. The commands are run behind the scenes using the Python language and the results of the scans are interpreted on the user interface in a clear format. The results are stored in text files so they can be displayed and used again in the future to track previous scans. This allows the user to get the necessary information they need to check for hosts and open ports on a network. The user interface is built using HTML, CSS, JavaScript, and Bootstrap with Python in the backend. The user interface and processing modules are connected with Flask, a web application framework written in Python. StatMapSecure allows any user to scan a target system to find IP Addresses and open ports with a click of a button.

POSTER 20

Stushop

Joshua Domzalski / jdomzalski@bellarmine.edu / Faculty Mentor: Nathan Johnson

Stushop is an online marketplace that allows students to buy and sell items with other students who go to their school. The Stushop verification process ensures that each new user is registering with a legitimate college email address. When a student logs in, Stushop displays their unique school page containing various items students are selling. In addition to seeing the products that are already for sale, students can fill out a request form and sell their own products. By ensuring that users all attend the same school, Stushop provides users with a safe online shopping experience and minimizes delivery time and costs. Stushop is built using React, a JavaScript library, and utilizes React components and CSS files to provide the functionality and styling of the site. Stushop relies on Google's Firebase service

to create users and store data about users and products. The payment processing portion of the site is handled through Stripe, a commercial credit and debit card payment processor.

POSTER 21

CalCount

Saaki Vishnumolakala / svishnumolakala@bellarmine.edu / Faculty Mentor: Nathan Johnson

CalCount is a comprehensive web application made to help users take control of their dietary habits and achieve their fitness and health objectives. The software offers a user-friendly, web-based platform with features for daily macronutrients and calorie tracking, food, and meal logging. Users may search for and add foods to their daily intake by signing in and accessing a large database of foods and meals. Once a user signs in, they are prompted to enter their measurements (height and weight) and intended goal (losing, gaining, or maintaining weight). Based on the user input, the software suggests protein and calorie goals. Users track and optimize their nutritional intake during the day with the help of the app, which calculates and shows real-time nutritional information including calories and macronutrients. CalCount uses JavaScript react and the FoodData Central API from the U.S. Department of Agriculture. HTML and CSS are also incorporated for styling and visual purposes. The program is written in Visual Studio Code on Virtual Box. The server is built using Node.js and Nest.js is used to streamline development. MongoDB is used to store user information, food data, and logs.

POSTER 22

SplitScheduler

Tyler Cambron / tcambron@bellarmine.edu / Faculty Mentor: Nathan Johnson

SplitScheduler is a web application designed to allow diverse organizations to design and manage scheduling workflows. Organizations have many options for designing schedules for clients, employees, and managers. SplitScheduler is unique in that managers can create multiple schedules for a single business or for multiple business models such as barber shops, restaurants, or other services. The schedule interface makes the multiple schedules easy to manage and view. To use SplitScheduler, a manager, for example, adds a schedule, labels it and displays the schedule. Users who want to book a time on the schedule select a start-time, end-time, given name, and contact information (e-mail or phone number). When the schedule day and time approaches, the application sends a reminder. Employees and

managers who have proper permissions see a monthly calendar view displaying each day and the number of schedule entries as well as a detailed daily view. SplitScheduler is hosted on Amazon Web Services (AWS). All user and schedule data will be hosted using a relational database. The web application is built using JavaScript, node.js and the react.js library. Twilio, cloud communications company, provides e-mail or SMS services through their JavaScript API.

POSTER 23

Improving Local Connections through Social Media: The BlockParty Project

Adeline Roberts / aroberts4@bellarmine.edu / Faculty Mentor: Nathan Johnson

Meeting new people and forming social relationships can be difficult - especially when moving into a new community or entering adolescence or old age. It's often easier to form close bonds when attending an event or joining a group activity. BlockParty is a social media program that lets users find and host social gatherings in their area, including things like neighborhood cookouts, book clubs, and other social activities. BlockParty is a Java program, created with the help of React Native, a Javascript library. BlockParty runs on IOS and Android devices and allows users to create "event postings" within their area. The posts contain a description of the event as well as the event's location and date. Events can be public or private; public events have all of the event's details available to anyone viewing the post, while private events only provide the information to guests if approved by the original poster. By promoting small events within a town or region, BlockParty users can integrate themselves into a local community and form connections with their neighbors over similar interests.

POSTER 24

Developing Local Connections Through Social Media: The BlockParty Project

Adeline Roberts / aroberts4@bellarmine.edu / Faculty Mentor: Nathan Johnson

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program that lets users find and host social gatherings in their area, including things like neighborhood cookouts, book clubs, and other social activities. BlockParty is a Java program, created with the help of React Native, a Javascript library. BlockParty runs on IOS and Android devices and allows users to create “event postings” within their area. The posts contain a description of the event as well as the event’s location and date. Events can be public or private; public events have all of the event’s details available to anyone viewing the post, while private events only provide the information to guests if approved by the original poster. By promoting small events within a town or region, BlockParty users can integrate themselves into a local community and form connections with their neighbors over similar interests.

DATA SCIENCE

POSTER 25

Predictive Analytics in Advanced eSports

Connor Broyles / cgoodman2@bellarmine.edu / Faculty Mentor: Robert Kelley

Utilizing a comprehensive dataset, including player statistics and team performance metrics, I constructed a decision tree classifier to forecast win-loss results. My objective was to gather the predictive accuracy of the model and its potential utility for players and fantasy league players in strategizing and improving gameplay and understanding. The model showed me that the model can be useful in predicting win/losses of games via stats, offering insights that could transform competitive play and decision-making processes in esports and fantasy leagues for all players.

POSTER 26

Fire Department Response Time Predictive Analysis

Jackson Gawarecki / jgawarecki2@bellarmine.edu / Faculty Mentor: Robert Kelley

In emergency response, every second counts. This project aimed to create a robust model able to predict the response times of fire departments in the Louisville Metro and surrounding areas using a dataset from Louisville Metro Open Data. The analysis used decision tree regression to obtain a model with a relatively low root mean squared error. The average response time calculated for each event can be used to create city-wide benchmarks and allow decision-makers to re-evaluate how to approach emergency

management. To combat potential overfitting or statistical issues, other models will be used in further analysis.

POSTER 27

Forecasting Adjusted Closing Price Utilizing ARIMA

Jalin Roberts / jroberts12@bellarmine.edu / Faculty Mentor: Robert Kelley

This project focused on forecasting stock prices using the ARIMA model, specifically targeting the Adjusted Closing Price. The data was collected from Citadel LLC, one of the largest United States hedge funds. I identified 10 stocks in total, 5 of Citadel's largest portfolio holdings, and 5 random stocks from Citadel's 2023 portfolio. This data spans from 2018 to 2023. I ran 10 different ARIMA models, one for each stock. The results show that the Root Mean Squared Error varied from 0.38 to 7.117. The Mean Absolute Percentage Errors varied between 0.66% and 2.55%.

POSTER 28

Predictive Churn Analysis

Ashley Ridley / aridley@bellarmine.edu / Faculty Mentor: Robert Kelley

In today's highly competitive banking industry, retaining customers is crucial for sustainable growth and profitability. In this project I developed a prediction model for customer bank churn from a dataset containing customer demographic information and interaction patterns. Using the two algorithms, Decision Tree's and KKN, the prediction model was proven to be successful with an accuracy score of 80 and 76%. Unfortunately, the gender column had an imbalance of data, but the model was still able to have a high prediction percentage.

POSTER 29

Predicting Credit Risk

Caleb Puckett / cpuckett@bellarmine.edu / Faculty Mentor: Robert Kelley

A credit score communicates the likelihood of defaulting on a loan; this project used predictive analytics to analyze factors not used as typical determinants of this score. The current factors of credit score have been chosen for good reason, but in this project, an

attempt was made to link credit risk with more general indicators of one's situation. This could help remove the high bar to entry to obtain a good credit score.

POSTER 30

Dazzling Data: The Sparkling Science of Diamond Pricing

Keegan Henderson / khenderson5@bellarmine.edu / Faculty Mentor: Robert Kelley

My first interaction with diamond pricing had me hooked on learning more about what truly was important to their value. Discovering this dataset on Kaggle allowed me to begin this project. Throughout my research I found that the models (Linear Regression, Decision Tree, & Decision Tree boosted by Bagging) were able to strongly predict diamond prices by just a couple variables; with the strongest model: Decision Tree Boosted by Bagging, achieving an accuracy score of 97.7%. Which Encouraged me to research further into additional models and analysis of the diamond industry.

POSTER 31

Predicting NFL Outcomes Using Machine Learning

Nicholas Romano / nromano@bellarmine.edu / Faculty Mentor: Robert Kelley

In recent years, there has been a rise in the use of sports analytics alongside an increase in volume of available data in the NFL. This project's goal is to develop a predictive analytics model that predicts the results of upcoming NFL games by training a K-Nearest Neighbor Model on team statistics of previous games. The Kaggle dataset that was used for this project consisted of game data that was pulled from ESPN and includes a wide variety of team statistics for both the home and away team for each NFL game since 2002. Statistics included range from third down and fourth down efficiencies to passing yards gained, rushing yards gained, and offensive time of possession. For this project, Python was used for the data manipulation, visualization, and modeling stages. The model for this project provided accuracy scores of 62% and 60%.

POSTER 32

Is Data Science still the sexist job of the 21st Century?

Michael Zelaya / mzelaya@bellarmine.edu / Faculty Mentor: Robert Kelley

The project aimed to develop a model that predicted salaries in the data industry based on variables like experience level, employment type, work setting, company size, and country

category (U.S. or not), and data was cleaned and analyzed using Python and Tableau to achieve this. The accuracy score of the preliminary results for both linear regression and K-nearest neighbor was around 33%, with $k = 44$ out of 50 having the best RMSE. The validation data for the K-nearest neighbor improved the accuracy to 53%—the project goal was to provide valuable insights into the data field job market.

POSTER 33

Furry Futures: Predictive Analytics for Adoption Outcomes in Animal Shelters

Tess Anderson / tanderson4@bellarmine.edu / Faculty Mentors: Robert Kelley

This project delved into the realm of predictive analytics to enhance the operational efficiency and welfare outcomes of a no-kill animal shelter. Leveraging a dataset encompassing over 28,000 records of cats from the Austin Animal Shelter, this study employed a Random Forest model to predict the outcomes of sheltered cats with a commendable accuracy of nearly 73%. By scrutinizing various features such as age, breed, sex, and spay/neuter status, the model aided in foreseeing potential outcomes including adoption and transfer. The insights gleaned from this predictive model empower shelter administrators to allocate resources judiciously, optimize strategic decision-making processes, and ultimately bolster the prospects of finding permanent homes for cats, thereby fostering a more humane and sustainable approach to animal welfare.

POSTER 34

Assessing Predictive Models for Cardiovascular Disease: A Data-Driven Approach

Ty Johnson / tjohnson@bellarmine.edu / Faculty Mentor: Robert Kelley

Cardiovascular disease (CVD) is the leading cause of death worldwide and in our country. This project explored the disease group and sought to understand the main factors that contribute to them. Several predictive analytic models were created and assessed to determine how well the models could accurately determine the presence of a cardiovascular disease in a patient, employing various machine learning algorithms. In addition to model building, exploratory data analysis techniques were utilized to answer several key questions related to the factors causing cardiovascular disease. The initial k-nearest neighbor model

achieved 72% accuracy, indicating that although the model isn't the least effective, there remains significant scope for enhancement. Further refinement and the incorporation of other models will look to improve predictive accuracy.

POSTER 35

The Role and Expression of pros-1 in the C. elegans Gonad

Brandon W. Thomas / bthomas@bellarmine.edu / Faculty Mentors: Mary B. Kroetz

The nematode *C. elegans*, formally known as *Caenorhabditis elegans*, has served as a pivotal model organism in understanding fundamental biological processes, including those governed by conserved genes like *pros-1*. *pros-1* is partially responsible for the formation of tubular structures within the organism. Glial cells and excretory canals are both examples of tubular structures governed by *pros-1* in *C. elegans*. *pros-1* orchestrates the embryonic development of these cell types by modulating cell proliferation and differentiation, thus ensuring proper morphogenesis and organogenesis. Its regulatory influence extends beyond embryogenesis, encompassing larval growth, molting, and reproductive processes. Furthermore, the evolutionary conservation of *pros-1* underscores its significance across species. Comparative analyses with orthologs in other organisms elucidate conserved functions and regulatory networks governed by *pros-1*, facilitating the extrapolation of findings to other organisms.

To better understand the role and expression of *pros-1* in the *C. elegans* gonad, a genetic cross will be performed between a *pros-1::gfp* hermaphrodite and *ckb-3::degron; him-8* male, thus creating a system in which the *pros-1* gonad specific protein will be degraded, leaving the other proteins expressed by *pros-1* elsewhere in the organism unaffected and functioning normally. The *ckb-3::degron; him-8* strain was generated by past Bellarmine students and provides a disproportionate number of males which are vital to the goals of this research where both male and hermaphrodite gonads will be studied. The *him-8* gene causes an increased incidence of nondisjunction within *C. elegans*, creating a greater number of males with sex chromosomes (XO) as opposed to the female hermaphrodite (XX).

The gonadal PROS-1 protein degradation system will mark the GFP fused PROS-1 protein with the regulatory protein, ubiquitin, signaling the fused protein to be taken to the proteasome where it will subsequently be degraded. This system allows for the phenotypic study of *pros-1* through the loss of PROS-1 in the gonad.

Presented at the KY INBRE 2024 Annual Conference

POSTER 36

Predicting Future Stock Returns Through Ratio Analysis and XG Boost Regression

Eric Schneider / eschneider@bellarmine.edu / Faculty Mentor: Robert Kelly

This project utilizes XG Boosting Regression and ratio analysis to predict future stock returns based on current financial statement information. The model uses the YFinance, Pandas, SciKitLearn, and XGBoost packages in python to create a model capable of multiple regression for non-normally distributed, non-correlated financial data.

ENVIROMENTAL SCIENCE

POSTER 37

Leveraging Community Engagement in Louisville, KY

Tori Nugent / vnugent@bellarmine.edu / Faculty Mentor: Michele Abee

This research project explores the dynamic relationship between Geographic Information Systems (GIS) technology and community engagement programs. By employing spatial analysis techniques, the study aims to enhance the understanding of how GIS can facilitate community engagement initiatives and opportunities in Louisville, KY. The methodology involves geocoding and other spatial analysis tools. The project examines the location of community engagement opportunities within a 2-mile radius of Bellarmine University's campus. Through geovisualization, the research seeks to identify opportunities for fostering inclusive and sustainable community engagement practices. The findings of this research contribute to advancing knowledge on the relationship between GIS and community engagement, offering insights for the Bellarmine student body.

POSTER 38

Importance of University Teaching Collections in Paleontology Education

Rhys Henning / rhenning@bellarmine.edu / Faculty Mentor: Kate Bulinski

Paleontological museum collections are a treasure trove of knowledge, providing insight into the convoluted history of our planet and the organisms that once inhabited it. The preservation of this knowledge is crucial for both scientists and the general public alike, although it can be difficult to properly convey this information to those not within the field of paleontology. Bellarmine University's environmental studies department houses an impressive collection of fossils and rocks that are tended to by Dr. Kate Bulinski, our resident invertebrate paleontologist.

The aim of this project was to assess and improve the paleontology teaching collection at Bellarmine to prepare it for future use inside and outside the classroom. A secondary goal was to make paleontological information more accessible on campus to those not well-versed in the field. Two days each week were spent in Miles Hall, where the collection is housed. Both old and new specimens were identified, labeled, and organized before being input into the online database that serves as a reference for information about each specimen in the collection. A binder was also created to serve as a reference for the Waldron Shale collection, a prominent geological formation in the area around Louisville. Specimens from the Waldron Shale were also selected to be put on display in two glass cases located in Miles Hall. Specimens selected for display were organized in the cases and had labels created to accompany them. As an outcome of this project, the reference materials and data collected will be available for future users of the teaching collection to aid in education or further research.

POSTER 39

Bellie Stream Habitat Assessment

McKenzie Masters / mmasters@bellarmine.edu / Faculty Mentor: Martha Carlson Mazur

As cities have developed, plants along streams have been removed for development or aesthetics. Plants along stream banks are riparian vegetation and provide many benefits to stream health such as bank stabilization and water quality protection. The absence of this vegetation along our streams in urban environments leaves them vulnerable to urban stream syndrome, the ecological degradation of streams draining urban land, leading to

unpredictable flows, bank erosion, and elevated concentrations of nutrients and contaminants. Water quality data collection and site observations at a headwater stream on Bellarmine University's campus in Spring of 2023 suggested that this stream may be experiencing urban stream syndrome. Further investigation in 2024 examined water-quality data, site observations, and bank angle measurements to assess the current severity of urban stream syndrome that the stream along Bellarmine Boulevard is experiencing. Water-quality sampling included pH, temperature (°C), specific conductance (µS/cm), dissolved oxygen (mg/L), and alkalinity (mg/L CaCO₃). Site observations included stream substrate and bank descriptions. Sampling events were done at three locations along the stream in mid-February, mid-March, and mid-April to gain an understanding of the water-quality over time. The data will be used to assess the state of the stream ecosystem and provide documentation of current conditions of the stream and banks to inform a remediation plan.

Recipient of the Student Government Association Research Grant Award

POSTER 40

Culinary Mushroom Farming and Fungi Education

Olivia Gamsky / ogamsky@bellarmine.edu / Faculty Mentor: Kate Bulinski

Fungi are an integral aspect of human health and culture; many of the most used antibiotics come from these organisms and countless food and beverage products are made using various fungi. Additionally, they have been and continue to be key actors in shaping Earth's terrestrial ecosystems. Despite their importance, a severe lack of knowledge surrounding what fungi are and how they function remains both in academia and the general population. Therefore, the goal of this project is to help make education surrounding fungi more accessible in the local community. To do this, the log culture method of mushroom cultivation was used to start growing Shiitake (*Lentinula edodes*) and Chicken of the Woods (*Laetiporus sulphureus*) mushrooms in one of the greenhouses at the Passionist Earth and Spirit Center. Once ready to harvest, these mushrooms will be dried and sold to support the campus farm effort. An event was held to inoculate the logs where students and community members helped move logs, drill holes, insert plug spawn, and cover the plugged holes with beeswax. Additional aspects of this project included the creation of educational posters along with a guide to log cultivation. The posters are intended for students in sixth grade or above and give a general overview of what fungi are, how they live, and some basic cultivation techniques. The guide to log cultivation is an easy-to-read document outlining

the inoculation process and is aimed at future Bellarmine students who are interested in continuing this work. Partnerships with the Earth and Spirit Center and Olmstead Parks Conservancy made this project possible.

Partially funded by the Environmental Sciences Department

POSTER 41

Sediment & Water Quality in Urban Wetlands

Kaylie Malloy / kmalloy@bellarmine.edu / Faculty Advisor: Martha Carlson Mazur

Wetlands provide a wide variety of ecosystem services, such as flooding control and water purification, that uniquely benefit the surrounding biotic community. Through varying land-use practices in the surrounding landscape, humans have impacted the health of remaining wetlands in Kentucky. This study investigated the relationship between hydrological routing—by surface flow and by groundwater flow—and water quality of two urban wetlands at the Passionist Earth & Spirit Center in Louisville, KY. To investigate this relationship, water quality was measured using a YSI Pro-DSS for dissolved oxygen (mg/L), nitrate (mg/L), pH, temperature (°C), conductivity ($\mu\text{S}/\text{cm}$). Alkalinity (mg/L CaCO_3) and phosphorus (mg/L) were measured on site using a Hach kit. Additionally, soil samples were collected from each wetland and analyzed for bulk density (g/cm^3) and organic matter content of soil (%). The data were collected over several field visits in February through April 2024. Statistical analyses were conducted to compare means using a two-tailed t-test for difference in means using SPSS. Findings included decreased bulk density and an increase in organic matter over time. Additionally, the study found the pH, conductivity, and alkalinity greater in Wetland 2 than 1, with Wetland 1 showing higher dissolved oxygen than Wetland 2. The findings of the study suggest a reduction in fertilization and deicing salts used on the property given the increased levels of conductivity and nitrates. This study can be used as grounds for further research of urban wetlands in Louisville.

POSTER 42

Comparative Analysis of Macroinvertebrate Biodiversity with Water Quality Components to Assess Health in Two Wetlands at the Passionist Earth and Spirit Center in Louisville, KY

Emily Donahue, McKenzie Masters, Kaylie Malloy / edonahue2@bellarmine.edu, mmasters@bellarmine.edu, kmalloy@bellarmine.edu / Faculty Mentor: Martha Carlson Mazur

Aquatic macroinvertebrate biodiversity is an indicator of water quality in wetlands. Research has shown the importance of healthy wetlands in urban environments, as they protect surrounding ecosystems. Concurrently, human activity impacts the landscape of wetlands and their health. To investigate these dynamics, this study aimed to characterize aquatic macroinvertebrate biodiversity and their relationship with water quality by comparing two wetland locations in the Passionist Earth and Spirit Center in Louisville, KY. We recorded data with a YSI pro, Hach kit, and D-frame net equipment, and analyzed data through t-test and graphical analysis. We measured pH, temperature (C°), specific conductance (µS/cm), turbidity (FNU), nitrate (mg/L), dissolved oxygen (mg/L), orthophosphate (mg/L), and alkalinity (mg/L CaCO₂). Aquatic macroinvertebrate data was collected with D-frame nets and identified to the family level to assess biodiversity. Both wetlands showed signs of human impacts, such as lawn fertilizers and road de-icing salts, but one wetland showed greater biodiversity and abundance than the other. Understanding the connections between water quality and macroinvertebrate diversity allows insight into pollution, runoff, and other changing environmental factors in wetlands which guides restoration and improves outcomes supporting these important landscape aquatic features.

POSTER 43

Spatial Analysis of Atmospheric Arsenic and Its Relationship with Greenness and Socioeconomic Status

Aniseya E. White / awhite@bellarmine.edu / Faculty Mentor: Lyndsey K. Blair

Arsenic is a metalloid that naturally occurs in water and soil (CDC). Continuous or prolonged exposure to arsenic in polluted drinking water, cigarettes, food, industry, working environment, and air can lead to chronic health outcomes such as cancer (NIH). Little research emphasizes the presence of atmospheric arsenic, and the impact of greenness

on the presence of atmospheric arsenic. This research aims to achieve three primary objectives: (1) examining the spatial distribution of atmospheric arsenic in Kentucky and Tennessee, (2) evaluating the association between greenness and the prevalence of atmospheric arsenic, and (3) investigating the relationship between atmospheric arsenic and socioeconomic status.

Data was collected from the Landsat Normalized Difference Vegetation Index (NDVI), Kentucky Hazardous Air Pollutants (HAPS), and the U.S. Census data sets. The analysis involve hotspot and logistic regression analysis. Atmospheric arsenic concentration, greenness, and socioeconomic status are mapped using Arc Geographic Information System (ArcGIS) software.

Recipient of the Student Government Association Research Grant Award

FOREIGN LANGUAGE AND INTERNATIONAL STUDIES

POSTER 44

Labor Unions and Language: The Impacts on Work Culture

Meghan Straub / mstraub@bellarmine.edu / Faculty Mentor: Frank Hutchins

Since the peak of labor union membership in the 1950s United States, there have been drastic changes in communication methods and language, such as the creation and widespread use of social media and natural shifts in common vocabulary. This is followed by a growing knowledge gap that ignores the social realities of modern workplaces and unionization. This paper aims to explore the impacts of language on unions and local companies, and the subsequent effects of union conversations on work culture through a series of ethnographic research methods, such as surveys, interviews, and text analyses, focused on observations of and social responses to verbal, written, and body language. This research may provide unions, employers, and employees with information that could be used to improve work culture, relationships, and well-being. It is also my goal as a researcher and student that the results of this study assist in facilitating important conversations about how language both shapes and is shaped by the way people imagine themselves and others, especially in the context of their workplace and labor unions. I find that there is a use of “othering”, community-driven, and symbolic language present in the

workplace during the unionization process that has both positive and negative effects on the workplace, creating stronger bonds between those who agree with each other and further dividing those who disagree with each other.

Presented at the Society for Applied Anthropology Annual Meeting

Recipient of the Student Government Association Research Grant Award

HISTORY

POSTER 45

The Aesthetic of Identity: -Core Subcultures and Digital Subcultural Engagement

Lindsea Eggen / leggen@bellarmine.edu / Faculty Mentor: Frank Hutchins

Culture has a significant role in identity formation and lifestyle, and historically, culture has been primarily shaped by communities in locales. With the rise of the digital age, however, culture has become less about place, and more focused on space. The online spaces that one can occupy are not so strictly limited by their means, location, family, or other immediate influences as the physical places that one can be. Most social media apps are free, and anyone with a phone and access to Wi-Fi can browse through them to their heart's content. This research aims to examine the way that free-flowing access to cultures that cross global boundaries has changed the way that young people identify with subcultures.

Social media has irreversibly altered the relationship between subculture and identity. The rise of -core movements and their manifestation on and offline show the dynamics of digital communities and how they have become integral to identity formation. Insight into the transformative impact of social media on subcultural movements will enrich our understanding of identity and the future of subcultural landscapes.

Presented at the Society for Applied Anthropology Annual Meeting

MATHEMATICS

POSTER 46

Deep Dive into Pascal's Triangle

Shealyn Arthur / sarthur2@bellarmine.edu / Faculty Mentor: William Fenton

What is Pascal's Triangle? How does it work? Is it still relevant today? This research project focuses on what Pascal's Triangle is and how it works. By explaining some of its different properties that are hidden within the triangle, such as paths, diagonals, Fibonacci sequences, prime numbers, binomial expansions, etc. We will then be able to explore what some of the different applications are and how they can be used today. Finally, we can then conclude whether Pascal's Triangle is still relevant or useful in today's mathematical world.

POSTER 47

Connecting Dots: Navigating The Traveling Salesman Problem and Real-World Applications

Jim Farese / jfarese@bellarmine.edu / Faculty Mentor: William Fenton

This project systematically explores the Traveling Salesman Problem and its intersection with practical fields. The introduction provides an overview, emphasizing the Traveling Salesman Problem's critical role in route optimization and tracing its historical significance. It uses images from historical uses of Traveling Salesman Problems. Route optimization and time complexity are scrutinized, emphasizing the challenges of brute force methods for varying Traveling Salesman Problems sizes. Real world applications are used and images of time charts for real world situations like drone delivery and warehouse operations are presented. The poster showcases the time complexities associated with various aspects of the Traveling Salesman Problem, including Brute Force methods, demonstrating that as the number of nodes increases, the computational time required escalates significantly.

POSTER 48

Mathematics of Roller Coasters

William Baxter / wbaxter@bellarmine.edu / Faculty Mentor: William Fenton

Who doesn't appreciate a good thrill? The anticipation and excitement felt on a roller coaster are present among many amusement park goers around the world today. At

sometimes unbelievable speeds and heights, riders are taken up and down steep hills, and are turned upside down by going through loops, corkscrews, barrel rolls, and several other types of inversions. Roller coaster manufacturers continue to design sometimes unimaginable products to share with amusement park enthusiasts. Amid all the excitement and fear that roller coasters instill in their riders, amusement park goers may be oblivious to all the work that engineers go through to create thrilling but safe roller coasters. The goal of this paper is to dive deeper into the behind-the-scenes mathematics and physics of the design and construction of roller coasters. How tall should the first hill be to ensure the train runs through its cycle successfully? How much potential energy is needed to produce the necessary kinetic energy of the train? How are loops designed to meet the comfort needs of riders? The answers to these questions, as well as those of several more questions, will be answered in this paper through a detailed explanation of the mathematics and physics behind the components that together create the fun and thrilling experiences that roller coaster enthusiasts experience today.

MEDICAL LABORATORY SCIENCE

POSTER 49

Blood Bank goes Molecular: The use of molecular characterization in a case of alloimmunization

Emily Fautz, Lauren Beecham / efautz@bellarmine.edu, lbeecham@bellarmine.edu /
Faculty Mentor: Karen Golemboski

A 50-year-old female presented to the ER with an infection at her recent surgical site. Previously diagnosed with systemic lupus erythematosus (SLE, an autoimmune inflammatory disorder), this patient underwent multiple operations from 2005 to present, 2 of which required blood transfusions. Each pre-op preparation requires the patient's blood to be typed and screened (TS) in case a blood transfusion is necessary. During this admittance, another TS was performed before wound debridement. TS's determine a patient's blood type and detect any unexpected antibodies in an attempt to prevent transfusion reactions. Between her last surgery and this debridement, she developed new antibodies through alloimmunization as a reaction to receiving an incompatible blood unit issued through computer crossmatch. Alloimmunization occurs when foreign blood antigens (usually through transfusion or pregnancy) interact with the patient's blood and trigger antibody production to attack the foreign blood cells. In this case, the available antibody

panels failed to identify her new antibodies. Further antigen and antibody testing was performed by the Red Cross, reporting the presence of an antibody that did not correlate with the patient's cellular antigens. The Red Cross suggested molecular testing to identify the blood components. This molecular characterization would provide information unavailable from standard blood bank testing, including the specific genetic variation of the patient's unknown antibodies. This information would allow laboratory professionals to provide this patient with the antigen-specific blood she will require for transfusions moving forward.

POSTER 50

Baby vs Bacteria: Salmonella Meningitis

Gracie Spalding, Parker Hibbard / gspalding@bellarmine.edu, phibbard@bellarmine.edu /
Faculty Mentor: Karen Golemboski

Salmonella is a widely known bacterium that often infects a person through consumption of raw or undercooked chicken and/or eggs – foods ranging from chicken breast and wings to raw cookie dough. However, most people do not associate these foods with the diet of a 16-day-old newborn. This case involves a newborn originally admitted to the hospital for difficulty feeding due to a respiratory infection (with Parainfluenza Virus 4; PV4) that also was discovered to have a severe infection of Salmonella in both the spinal fluid and bloodstream. Newborn babies are constantly growing and developing, including in their immune systems to fight off illness. Due to this, the newborn body's ability to detect and trigger an attack against a disease or illness is not as effective as an adult's, making it much easier for this population to get sick. This case demonstrates how a newborn patient can lead to more unusual presentations and severe illnesses. Thus, the healthcare professionals must approach this demographic differently with respect to diagnosis and treatment.

POSTER 51

When Blood Backfires: Hyperhemolysis Syndrome in a Patient with Hemoglobin SC Disease

Erin Davis, Anthony Tingle / edavis6@bellarmine.edu, atingle@bellarmine.edu / Faculty
Mentor: Karen Golemboski

This is a case study of a 42-year-old African American female, with a history of a sickling disease (Hemoglobin SC disease) who presented to the emergency department with chest

pain and headache. Lab results and chest radiographs were unremarkable, but the patient was admitted due to uncontrolled pain even after the administration of pain medications. The patient remained in the hospital for a few days, during which her hemoglobin dropped steadily. Physicians decided to give her a blood transfusion due to the declining hemoglobin levels. In a typical case, a blood transfusion should cause hemoglobin to increase, however, in this case there was a critical drop in hemoglobin post transfusion. The patient was diagnosed with Hyperhemolysis Syndrome, a rare condition which mainly affects those with abnormal hemoglobin. In this condition, a reaction takes place posttransfusion in which both the recipient and donor red blood cells are destroyed. Massive amounts of hemolysis lead to decreased tissue oxygenation, hemoglobinuria, possible jaundice, acute kidney injury (AKI), and potentially death. In this patient's case, she did end up with an AKI but recovered with medical intervention.

PHYSICS PROGRAM DEMONSTRATION

Rover the Robo-Dog

Samia Mahmood / smahmood@bellarmine.edu / Faculty Mentor: Akhtar Mahmood

I will showcase the functions and the features of the Robo-Dog, named Rover. Rover has been calibrated and programmed to perform several activities and tasks – such as, walking alongside humans, turning, sitting, stretching, perform a heart shaped gesture with the front two paws, and shake hands with one of the paws. Additionally, Rover can help with carrying a small load on its back.

Funded by the Physics Program

Fun and Exotic Physics Demos

Justin Harlow, Samia Mahmood / jharlow3@bellarmine.edu, smahmood@bellarmine.edu / Faculty Mentor: Akhtar Mahmood

I will present several fun and intriguing Physics demos and explain using Physics, how these devices work. These demos are - magnetic levitation, floating light bulb, perpetual motion, hologram, electric field globe, electric arc with Tesla coil, electric arc from sound and vibration, and particle acceleration with magnetic field.

Fully Autonomous Programmable Humanoid Robot, Robotic Arms and a 3D-Printed Robotic (Bionic) Hand

Firstene Badua, Samia Mahmood / fbadua@bellarmine.edu, smahmood@bellarmine.edu / Faculty Mentor: Akhtar Mahmood

AI-based robotics technology has seen big advances in the past few years. We will demonstrate the capabilities of the Physics Program's fully-autonomous AI-humanoid robot, called NAO, a 3-D printed robotic hand that can be powered by cell phone power bank, a robotic arm that can be controlled by a joystick to pick up objects, and another robotic arm that has been programmed to demonstrate how an object can be placed at fixed locations based on the arc length and the law of cosines. The NAO humanoid robot has the ability to detect the surroundings, walk/move, hear, sense/detect touch, and respond to commands and communicate. NAO has senses for natural interactions and can carry out natural conversations with humans. NAO's inertial unit enables him to maintain his balance. NAO is controlled by a specialized Linux-based OS to interpret and understand data received by its sensors.

PSYCHOLOGY

POSTER 52

The Effect of State Health Anxiety on Vaccine Intentions

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Increases in COVID-19 cases make it imperative to understand participation in prevention methods. Momentary increases in health anxiety, or anxiety surrounding one's physical wellness in the moment, may increase individuals' intentions to vaccinate against COVID-19. Trait health anxiety, or a person's everyday level anxiety about their health, as well as political affiliation, also predict vaccine intentions. Therefore, trait health anxiety and political affiliation may impact the relationship between state healthcare anxiety and vaccine intentions. US adults (N=189) reported their trait levels of health anxiety and their political affiliation, then were randomly assigned to either a health anxiety induction or a control condition. Participants then indicated their state levels of health anxiety and their intentions to receive the COVID-19 vaccine. The experimental group reported higher state health anxiety, but only in participants with high trait health anxiety. In the experimental group, vaccine intentions increased for conservative participants with high health anxiety.

Recipient of the Student Government Association Research Grant Award

POSTER 53

Associations Among Body Image Rumination, Sleep Quality, and Health: A Novel Investigation

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Sleep is a key factor in how humans function, and poor sleep quality negatively impacts physical health. Sleep may be disrupted by rumination or thinking about negative events that have already happened. Rumination could be about anything from school, work, or social relationships, but little research has examined rumination about body image. Body image rumination involves rehashing negative events in which we've felt badly about our bodies. As poor body image is linked to poor health, body image rumination may be tied to poor health. And, as any kind of rumination can impact sleep, poor sleep quality may mediate this relationship. To test this, undergraduate and community (Prolific) participants completed a 10-minute survey. As expected, body image rumination was negatively related to physical health outcomes, and that relationship was mediated by poor sleep quality. This study fills the gap in literature regarding body image rumination and physical health outcomes.

Recipient of the Student Government Association Research Grant Award

THEOLOGY AND RELIGIOUS STUDIES

POSTER 54

Schism, Synodality, and Communion in the Contemporary American Catholic Church

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In a reflection of the schism afflicting the contemporary American Catholic Church, the United States Conference of Catholic Bishops in their document "The Mystery of the Eucharist" has pushed American Catholics who dissent from the moral teachings of the Catholic hierarchy to the margins of the Church. In response to this document, I argue that the ideas of Pope Francis on synodality, which is the "journeying together" of the Church through processes of mutual listening, can be the basis for a theology of dissent that welcomes every voice to the table.

Presented at the Kentucky Honors Roundtable

GRADUATE STUDENTS

BUSINESS ADMINISTRATION

POSTER 55

The Business and Societal Impact of Mental Health on Mothers Post COVID-19

Brooklynn Merrifield / bmerrifield@bellarmine.edu / Faculty Mentors: Haleh Karimi, Amy Lein

The COVID-19 pandemic was a global health crisis that affected billions of people worldwide. During COVID-19, families and mothers experienced adverse effects on their mental health, financial stability, childcare and school schedules, stress levels, and receipt of personal and familial support. Due to the important role played by mothers in the upbringing of children whose formative years contained the traumatic events of COVID-19, it's important to research and learn about the continued experiences and long-term effects of the COVID-19 pandemic on mothers. The goal of this study is to analyze the experiences and views of mothers surrounding mental health, childcare and schooling, financial situations, stress and burnout, and outside support factors to better understand the attitudes and effects of these factors in a post-COVID world.

To conduct this study, we recruited participants who are mothers who had children under the age of 18 at the start of the COVID-19 pandemic on March 11, 2020. The study was conducted through a 36-question questionnaire in Survey Monkey containing 34 multiple choice questions and two short-answer questions. The questionnaire was distributed through recruitment emails, social media, and word of mouth. We collected 163 completed responses and will analyze the quantitative and qualitative response data using Max QDA. By understanding current attitudes and situations about topics included in the questionnaire, we can analyze how society can mitigate potential negative, long-term societal and economic impacts of COVID-19.

Recipient of the Provost Research Grant Award

EDUCATION AND SOCIAL CHANGE

POSTER 56

Rural, Gifted Student Experiences in Appalachian Kentucky

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Current literature shows that gifted students' experiences often differ from their nongifted peers. Similarly, research shows that rural students' experiences are unique when compared to nonrural peers. This study hopes to address the gap in literature on the experiences of students who are at the intersection of giftedness and rurality by addressing the question: How do rural, gifted students in Appalachian Kentucky experience and perceive K-12 schooling? Rural, gifted students exist in the overlap between two unique groups of students. Using a multi-case study design, participants came from three separate school districts in a specific region of Appalachian Kentucky, with each district being a separate case. Data collection included multiple observations and interviews of participants across three separate school-based settings. Data was analyzed within cases to start, and then compared across cases. Initial analysis points to themes of students appreciating the small community feel and support network, students being involved in many extracurriculars across a variety of topics and skills, students feeling as if they fit in socially, and students relying heavily on online and outsourced coursework to provide challenge or appropriate curriculum. These preliminary discoveries contradict some of the literature on rural gifted students to date and indicate that technological advances provided an opportunity for rural districts to meet some of the academic needs for students with high abilities. Future studies could focus on student satisfaction with online and virtual programming, as well as success rates for these virtual options compared to in-person differentiation in rural communities.

Recipient of the Provost Research Grant Award

POSTER 57

Empowering Students with Differing Abilities: Enhancing Academic and Social Success through Facilitation

Esther Akafia / eakafia@bellarmine.edu / Faculty Mentor: Amy Lein

Pioneers International Academy (Pioneers) is an inclusive private K12 school in Dawhenya, Ghana. Private schools in Ghana refrain from admitting students with disabilities or special

needs students in their regular programs because of a lack of resources including teachers, training materials, and government support. At Pioneers, students with disabilities can be admitted if needed support can be provided. This includes the parent either paying for or serving as a facilitator, who sits in the class of the student and assists the student under the supervision of the teacher. If the parent cannot serve as facilitator, the school cannot admit the student. The goal of this qualitative study is to assess the impact of a grant funded and trained facilitator on a current student with behavior issues. In addition to considering the impact of the facilitator on student outcomes, teacher, parent, and student perceptions will be examined.

Recipient of the Provost Research Grant Award

POSTER 58

Teaching with V.I.S.I.O.N.

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This qualitative case study explored how those matriculating through a teacher education program can develop a critical consciousness of K-12 students experiencing homelessness or high mobility using the Teaching with V.I.S.I.O.N workshop model. This acronym stands for valuing the lived experiences of students reflected in the classroom, implications of bias on teaching and learning, study scenarios using the equity literacy case analysis approach (Gorski, 2018), increasing the number of texts that reflect diverse lived experiences, on-going reflections of current policies and practices, and new awareness and continual development of a critical consciousness. The aim of the study was to increase the awareness of those completing a teacher education program regarding federal resources that are available to these students and move participants from the place of awareness to action. Preliminary findings indicate that through the workshop's completion, all participants increased in their knowledge of ways to support K-12 students experiencing homelessness or high mobility. Additionally, through semi-structured interviews, participants emphasized the impact of knowing resources available to support students experiencing homelessness and high mobility.

Recipient of the Provost Research Grant Award

HEALTH PROFESSIONS

POSTER 59

Interprofessional Simulation and the Development of Professional Identity Using Asynchronous Teaching Methods

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This study aimed to explore whether virtual, asynchronous interprofessional education (IPE) improve interprofessional attitudes as defined by the Interprofessional Education Collaborative (IPEC) core competencies and develop student professional identity. Healthcare professionals are highly specialized providers that often interact and overlap with other providers to help treat patients. Literature shows that stressful environments and a lack of understanding of roles can lead to conflict, but successful interprofessional collaboration leads to improved patient care. This study used a mixed method approach, creating a virtual, asynchronous viewing of a simulation within the school's education platform Moodle as the intervention. The video was of a nurse, physical therapist, and a respiratory therapist in an intensive care unit setting and was followed by asynchronous debriefing. 15 students, 10 nursing students and 5 Doctorate of Physical Therapy (DPT) program, participated in the study. Interprofessional attitudes were measured with the DOW IPEC questionnaire, while professional identity used the Macleod Clark Professional Identity Scale (MCPIS), each given pre- and post-simulation. The study also included interviews for qualitative data. The study found this IPE improved interprofessional attitudes in healthcare students, but failed to significantly improve professional identity as the study was formed. The study was limited by the small sample and future studies should expand on looking at the differences in the progression of a program, whether more hands-on simulation would improve professional identity development, and the exploration of other settings.

Recipient of the Provost Research Grant Award

MEDICAL LABORATORY SCIENCE

POSTER 60

Patient Safety Indicator Monitoring in the Laboratory

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Analysis of patient safety indicators has previously been conducted in the pre-analytical phase of the laboratory testing process. As monitoring patient safety throughout the testing process becomes established, expanding the laboratory role is imperative. Medical Laboratory Science (MLS) graduate students have been collaborating with the American Society for Clinical Laboratory Science (ASCLS) to implement the data collection and analysis of patient safety indicators utilizing a preliminary benchmarking project. The beta test aims to create standards allowing for peer comparison, which is the basis of laboratory performance. Laboratories have been hesitant to participate in the project due to required time, effort, and lack of knowledge. To improve laboratory participation, MLS graduate students have implemented multi-pronged marketing projects such as e-mail distribution, re-naming the project, and graphic design to increase knowledge and encourage laboratory participation. Future projects may include expanding the targeted audience to improve awareness and contribution. Different social media platforms such as TikTok, podcast, YouTube, etc. may be utilized to expand the audience as well as publication in ASCLS Today or the creation of continuing education credits.

PHYSICAL THERAPY

POSTER 61

How do thoracic mobility exercises affect spirometric values, spinal range of motion, and perceived effort of singing in college vocalists?

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Mentor: Elizabeth Levay

Background: Sound production while singing requires cooperation and coordination of various body systems including the respiratory and musculoskeletal system. In vocalists, the thoracolumbar spine must be able to move freely to allow for mobility of the thoracic cage

and expansion of the respiratory diaphragm. Additionally, singing requires forceful expiration with the use of respiratory muscles such as the rectus abdominus, internal and external obliques, and the transverse abdominus. While the importance of good posture in musicians is widely accepted, no studies have examined the impact of a home exercise program focused solely on spinal mobility in college vocalists.

Recipient of the Provost Research Grant Award

POSTER 62

Bridging the Gap: Implementation of evidence-based physical therapy practice for patients living with Huntington's disease in long-term care.

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Background. As Huntington's disease (HD) progresses, many patients move to long-term nursing facilities nationwide, oftentimes at a relatively young age. The average age of diagnosis with HD is 40 years old, and the life expectancy is typically 10-30 years post-diagnosis. With these demographics, individuals with HD are significantly younger than other nursing home residents nationwide and are typically residing in these homes for a longer period of time. Prior research focuses on the physical therapy treatment of patients with HD in outpatient and community-based settings, but development of an understanding of the role of evidence-based practice in to provide skilled physical therapy services to patients with HD in long-term care settings is needed. A local group of physical therapist and student volunteers have regularly led a bimonthly group exercise class at a nursing facility in Hanover, IN with a wing specific to patients with HD. With the various patient presentations and the rotating list of volunteers, a consistent and evidence-based exercise regimen is needed to ensure optimal patient care.

Objective. The objective of this project is to cultivate and offer individuals who are willing to contribute their time and expertise a formal recommendation grounded in evidence-based practice concerning exercise guidelines for patients with HD in the long-term care setting.

Methods. A literature review was completed to obtain research regarding the demographics of patients with HD in nursing homes nationwide, their diverse clinical needs, and the

evidence surrounding recommended interventions. Through this evidence and first-hand experience with patients in the nursing facility, an exercise program was holistically developed. The feasibility and success of this program will be qualitatively assessed.

Findings. All three components of evidence-based practice were utilized: clinician expertise, patient preference, and best evidence. The exercise program is group-based to promote social interaction and increase motivation and participation; all exercises are to be completed in a seated position for safety and to allow for participation of patients with diverse levels of physical ability. The program consisted of exercises targeting the following key components: breathing, flexibility, coordination and attention, motor control, reciprocal movements, and strengthening. Each session is targeted to last about 45 minutes, with the physical therapist volunteers providing demonstration and verbal cues as needed for optimal form and participation. The goal is that all participants can engage in the recommended exercises, with slight modifications made at the discretion of the physical therapist with use of the provided exercise progressions and regressions.

Conclusion. The evidence regarding physical therapy and formal exercise recommendations for late-stage HD and those in long-term care settings is limited; a better understanding of this patient population is needed. Due to the variety of HD presentations and physical abilities, it can be difficult to individualize and prescribe group exercise in this setting. It is the hope that this project will guide physical therapists in the selection of their interventions, provide potential modifications and progression of each exercise to meet the needs of all patients, increase the participants' carryover of learning between exercise classes, and improve activity tolerance and quality of life.

Recipient of the Provost Research Grant Award

POSTER 63

Utilization of UprightVR in Individuals with Brain Injuries and Dizziness: A Case Series

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Purpose/Hypothesis: This case series compared standard balance and fall risk assessment tools with the UprightVR™ balance and fall risk technology in adults with dizziness. We hypothesize that the evaluation of fall risk using UprightVR™ may provide more meaningful data than standard fall risk assessments in patients with dizziness. SafetyNet™ by UprightVR™ is an immersive virtual reality assessment tool including a series of tests

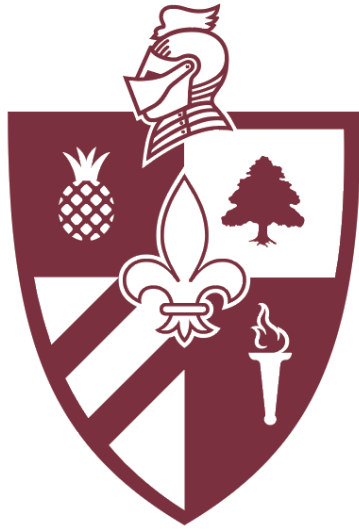
performed with eyes open and closed on firm and foam surfaces which computes percentages in the categories of somatosensory ratio, visual ratio, vestibular ratio, sensory weighting preference, and visual-vestibular mismatch [6]. The Tinetti assesses an individual's balance, gait, and fall risk while the Timed Up and Go test (TUG) assesses an individual's mobility, balance, walking ability, and fall risk with a cut off score of 12 seconds [7,8]

Number of Participants: This case series included three adult participants (one male and two females) who all receive skilled therapy services at NeuroRestorative in Louisville, KY. All participants in this study have reported numerous falls in past 6 months and reports of dizziness for multiple years. Along with dizziness, participants in this study have either traumatic or other acquired brain injury.

Materials/Methods: This case series utilized the Upright VRTM Sensory Integration in Balance (SIB) assessment tool and compared the results to those gathered from Tinetti and TUG. Testing was completed during participant's regular skilled physical therapy session at Neurorestorative's clinic in the following order, Upright VRTM, Tinetti, and TUG. The participants also completed Dizziness Handicap Inventory (DHI) at a later date to gather data on how they feel their dizziness affects their daily lives.

Results: Participant one had a total score of 10/28 on Tinetti, 10.59 sec on TUG, and scored within normal limits (WNL) on SIB components except vestibular ratio with Upright VRTM. Participant two had total score of 25/28 on Tinetti, 13.32 sec on TUG, and scored WNL on SIB with Upright VRTM. Participant three had a total score of 16/28 on Tinetti, 12.57 sec on TUG, and scored WNL on SIB components except vestibular ratio with Upright VRTM. DHI score for participant one indicated mild handicap (32), participant two's score indicated severe handicap (82), and participant three's score indicated mild handicap (56).

Conclusions/Clinical Relevance: Comparing the use of Virtual Reality assessments to standard methods may provide more specific and/or additional information about an individual's risk of falling. SafetyNet™ by UprightVR™ concluded that participants one and three had impaired vestibular processing due to decreased percentage in vestibular component. While on the other hand, the TUG and Tinetti determined fall risk based on time to complete and scoring of balance and gait components. Knowing what sensory system may be impacting fall risk determined by use of UprightVR™ may allow practitioners to prescribe more specific treatment, such as focusing on visual or vestibular systems to reduce fall risk.



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