



Tenth Annual Graduate Research Conference

March 3, 2023

Poster Presentations

1. **Title: Quantification of Cannabigerol among Nineteen Cannabinoids in Hemp-infused Gummies by Liquid Chromatography Ultraviolet Detection**

Principal presenter: Emmanuel Adejumo

Major: Chemistry

Other presenters or co-authors: Grant Meyer

Faculty mentor: Dr. Ligu Song

Abstract: A liquid chromatography ultraviolet detection (LC-UV) method was developed for quantification of cannabigerol (CBG) in hemp-infused gummies among nineteen cannabinoids. The quantification was achieved using external standard calibration between 0.02 and 25 µg/mL. The limits of quantitation (LOQ) were determined to be 0.008% CBG in hemp-infused gummies. To recover CBG, a sample was first uniformly dispersed into water and then extracted with methanol. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 250 µg/mL and analyzed by LC-UV. The measurement precision in triplicate was 3.1%. The method was not interfered by other compounds present in hemp-infused gummies.

2. **Title: Potency Testing of Cannabidiol in Hemp-infused Gummies among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection**

Principal presenter: Grant Meyer

Major: Chemistry

Other presenters or co-authors: Emmanuel Adejumo, co-author, chemistry, es-adejumo@wiu.edu

Faculty mentor: Dr. Ligu Song

Abstract: A liquid chromatography ultraviolet detection (LC-UV) method was developed for potency testing of cannabidiol (CBD) in hemp-infused gummies among nineteen cannabinoids. The potency testing was achieved using external standard calibration between 0.02 and 25 micrograms per mL. The limits of quantitation (LOQ) were determined to be 0.008% CBD in hemp-infused gummies. To recover CBD, a sample was first uniformly dispersed into water and then extracted with methanol. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 250 micrograms per mL and analyzed by LC-UV. The measurement precision in triplicate was 7.9%. The method was not interfered by other compounds present in hemp-infused gummies.

3. **Title: Racial Incongruity in Obesity among Adults in the United States: A Retrospective Review**

Principal presenter: Ifeoluwa Adesoye

Major: Public Health

Faculty mentor: Dr. Mei Wen

Abstract: There has been a steady rise in the burden of obesity in the United States since

1970 with major differences depending on racial group, age, sex, and socioeconomic status. By 2030, it is expected that about half of the adult population in the United States will be obese. This presentation aims to establish the difference in the prevalence of obesity among various racial groups in the United States and to examine the factors responsible for the disparities. A literature review was conducted by searching through PubMed, Embase, and National Center for Health Statistics (NCHS) Health E-Stats. Several studies that met the inclusion criteria were selected, and data were extracted and analyzed using Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.

Comprehensively, the study examined the disparities in the prevalence of obesity across different races and considered variations in lifestyle and health-seeking behaviors as some of the reasons for the differences. The highest prevalence of obesity was observed in non-Hispanic black adults (38.4%) compared to Hispanic adults (32.6%) and non-Hispanic white adults (28.6%). Dieting to lose weight was less likely in Non-Hispanic Blacks compared to Non-Hispanic Whites (OR: 0.78, 95% CI: 0.67, 0.90), the Blacks were less likely to engage in exercise compared to the Caucasians (OR: 0.83, 95% CI: 0.70, 0.99) and less likely to seek professional helps for weight loss (OR: 0.71, 95% CI: 0.52, 0.95). Mexican Americans were also less likely to seek help compared to Caucasians (OR: 0.71, 95% CI: 0.53, 0.95).

Overall, there are racial differences in the prevalence of obesity and they should be considered when designing interventional programs to reduce the burden of adult obesity in the United States.

Keywords- The United States, obesity, overweight, Body Mass Index, race, ethnicity.

4. **Title: Edge Distance-Balanced of Hamming Graphs**

Principal presenter: Hamed Karami

Major: Mathematics

Faculty mentor: Dr. Douglas Lafountain

Abstract: A graph is a collection of nodes connected by edges, and such objects are useful in modeling networks of various kinds. Hamming graphs are a special class of graphs named after Richard Hamming, an American mathematician whose work had many implications for computer engineering and telecommunications. A nonempty graph is called nicely distance-balanced, respectively, edge distance-balanced, whenever there exist positive integers γ_v and γ_E , such that for any two adjacent vertices u, v of Γ , there are exactly γ_v vertices of Γ , respectively γ_E edges of Γ , which are closer to v than u . In this poster, we show that Hamming graphs $H(n, q)$ are both nicely distance-balanced and nicely edge distance-balanced.

5. **Title: "Embrace the Suck": How the Theory of Planned Behavior and Stigma Influence Treatment-Seeking Military Service Members**

Principal presenter: Jennifer Lopez

Major: General Experimental Psychology

Faculty mentor: Dr. David Lane

Abstract: Joining the military provides many benefits to its members in different forms, such as travel, healthcare, and a way to serve one's country. While military service provides opportunities to its members, U.S. military servicemembers are at risk of developing mental health disorders. The most well-known is posttraumatic stress disorder (PTSD), but other common disorders are Major Depressive Disorder and Generalized Anxiety Disorder (Rusu et al., 2016; Stevelink et al., 2018; Taillieu et al., 2018). The best method to avoid mental health disorders is to seek preventative mental health treatment, however not every service member is equally likely to seek out help. The Theory of Planned Behavior (TPB; Ajzen, 1991) was developed from the Theory of Reasoned Action (Fishbein & Ajzen, 1975) and predicts whether a person will perform a certain behavior. TPB contains three components (attitude toward the behavior, subjective norm, and perceived behavioral control) that lead to intentions to engage in the behavior. This theory has been used to predict different behaviors, such as help-seeking behaviors. Something that could influence this theory is stigma, specifically the self-stigma of seeking help for mental illnesses. I hypothesize that military servicemembers would be less likely to seek help for a psychological problem compared to a medical problem and that they are less likely to seek help in general compared to a civilian sample. To test these hypotheses, two studies will be posted on Prolific, an online platform where individuals are given monetary compensation for completing the studies. One study will be for military service members/veterans, and the other will be for civilians. Participants will be given a trauma manipulation involving reading a car accident vignette in which they end up with symptoms of a psychological problem (PTSD) or a medical problem (traumatic brain injury). Afterwards, they are asked to fill out a survey adapted from Hyland et al.'s (2012) TPB Questionnaire and the Self-Stigma of Seeking Help (Vogel et al., 2006). A MANOVA will be used to analyze the data. The expected results are that military service members will report more negative attitudes, negative social norms, less perceived behavioral control, higher self-stigma, and lower intentions for seeking help compared to civilians, especially when they are facing a psychological problem or seeking psychological help.

6. **Title: Toxicity Evaluation of Acmella alba Crude Extracts on Zebrafish (Danio rerio) Embryos**

Principal presenter: Ogheneruno Theodora Ideh

Major: Chemistry

Other presenters or co-authors: Matthew Blankenship and Mette Soendergaard

Faculty mentor: Dr. Mette Soendergaard

Abstract: Plants of the Acmella genus are often used as medicinal plants in Africa and

South America where they are widely known as the eyeball or toothache plant. Our previous studies have shown that *Acmella Alba* extracts exhibit anticancer effects and cytotoxicity in the human ovarian adenocarcinoma cell line SKOV-3. Here, the toxicity of *A. Alba* extracts was further investigated in zebrafish (*Danio rerio*) embryos.

A. alba leaves, stems, roots, and flowers were extracted thrice with ethanol, evaporated overnight at 50°C, and dissolved in dimethyl sulfoxide (DMSO). Zebrafish eggs were harvested at 0 hours post-fertilization (hpf) and immediately incubated with 0.2 mg/mL of the *A. alba* extracts. Morphological effects of the extracts including malformation of organs, heart rate, movement, and hatching rate were recorded every 12 h for 5 days. The results showed that the leaves, stems, roots, and flower extracts all were 100% lethal at 12 hpf, whereas the DMSO vehicle resulted in no observed morphological changes. This supports the cytotoxicity of *A. alba* extracts that was previously observed in human ovarian cancer cells and emphasizes the importance of further investigating plants of the *Acmella* genus as possible sources of anticancer and cytotoxic compounds.

7. Title: Morel Plant (*Morchella esculenta*) Toxicity Studies using Zebrafish Embryo Toxicity Assay (ZET)

Principal presenter: Tolulope Bolarinwa

Major: Chemistry

Other presenters or co-authors: Dr. Mette Soendergaard and Dr. Matthew Blankenship

Faculty mentor: Dr. Mette Soendergaard

Abstract: Morel mushroom (*Morchella esculenta*) is a member of the *Morchella* genus. Among edible mushrooms, morels are a favorite that thrives in a variety of environments and has a rich, nutty flavor with an earthy scent. The species has been proven to have therapeutic effects, including anti-viral and anti-tumor effects, immune-regularity qualities, and resistance to tiredness. Traditional Chinese medicine has utilized morels to treat phlegm build-up, indigestion, and shortness of breath. Recent research studies have shown the species to have anti-cancer activity in ovarian cancer cells (SKOV-3). The SKOV-3 cell population is reduced significantly ($p < 0.001$) by all the morel extracts when compared to DMSO (control) and paclitaxel. The potent bioactive chemicals in the extracts likely caused this significant cytotoxic effect. To explore this study further, zebrafish (*Danio rerio*) is a well-known model for assessing toxicity that has medium throughput, is cost-effective, and delivers more information than cell line testing alone. Zebrafish contain 70% of human genes and they are translucent as larvae and develop outside of the mother. Zebrafish embryos and larvae readily absorb compounds from the surrounding water, which is a great advantage when it comes to determining the effects of compounds.

In this study, the morel mushroom extracts in water, ethanol, and methanol will be examined on Zebrafish embryos in accordance with the Acute Fish Toxicity (AFT) test (OECD Guideline 203) at varied concentrations (0.001, 0.0025, 0.005, 0.010, 0.025, 0.05

0.1, and 0.2 mg/mL) at 28.5°C to determine the half-maximal lethal concentration (LC₅₀). The embryos will be cultured in different ways in 5 µL of water, ethanol, and methanol morel extracts, and 495 µL of E3 medium (5 mM NaCl, 0.17 mM KCl, 0.33 mM CaCl₂·2H₂O, and 0.33 mM MgSO₄·7H₂O) are going to be administered. Dimethyl sulfoxide (DMSO) will be used as vehicle control. Every 12 hours over 5 days, the basic pattern of Zebrafish activities will be defined, and parameters such as survival rate, mortality rate, hatching period, and deformity will be observed. The purpose is to further elucidate the toxicity of the extracts. This may help eventually develop mushroom compounds into anti-cancer treatments leading to the development of anti-cancer compounds for application in cancer treatment in the future.

8. **Title: Anti-carcinogenic Activity of Acmella Extracts in Pancreatic Cancer**

Principal presenter: Gbemisola Akindeji

Major: Chemistry

Other presenters or co-authors: Dr. Mette Soendergaard

Faculty mentor: Dr. Mette Soendergaard

Abstract: Pancreatic cancer is the third leading cause of cancer death in the United States. It is estimated that close to 60,000 new cases are diagnosed each year and over 47,000 people die annually. The lifetime risk of developing the disease is 1.6%. Plants have been used for medical purposes since the beginning of human history and are the basis of modern medicine. Most chemotherapeutic drugs for cancer treatment are molecules identified and isolated from plants or their synthetic derivatives. Plants of the genus *Acmella* are utilized as medicinal herbs. Our previous work has established the cytotoxic effect of *Acmella* species on SKOV-3 cells of ovarian cancer. Therefore, the objective of this present research is to further elucidate our findings on the anti-cancer activity of *Acmella alba*, *Acmella oleracea*, and *Acmella calirrhiza* on Mia Paca-2 of human pancreatic cancer using the 3-(4,5- dimethylthiazol-2-yl)-2,5 diphenyltetrazolium bromide (MTT) cell viability assay and propidium iodide fluorescent microscopy staining.

The different parts of *Acmella* species which includes the stem, root, leave and flower have been harvested, freeze-dried, and ground into a fine powder. For analysis of cell viability, plant materials were weighed and extracted thrice using water, ethanol, and methanol and resuspended in dimethyl sulfoxide (DMSO). Next, human pancreatic cancer (Mia paca-2) cells were grown to 80% confluency and the cells were treated with 0.2 mg/mL extracts, 10 mM paclitaxel, or DMSO (vehicle) in triplicates for 48 h at 37°C, 5% CO₂. The viability of the cells was then determined using a tetrazolium reduction assay. 3-(4,5- dimethylthiazol-2-yl)-2,5 diphenyltetrazolium bromide (MTT) was incubated with the cells for 4 h after the formation of formazan crystals was observed and dissolved using DMSO. The absorbance was measured at 570 nm using a microplate reader. Cell viability of each of the extracts was carried out using ANOVA statistical analysis on Graphpad prism 9 to compare the cell viability of each extract, and paclitaxel to the vehicle (DMSO). A propidium iodide

fluorescent microscopy test will be carried out to evaluate the viability of the cell and measure the DNA content in the cycle of the cell as well as visualize the nucleus and DNA-containing organelles.

Results that will be obtained from the experiments illustrated above will be used to measure the IC₅₀ (half maximal inhibitory concentration/inhibitory concentration at 50 %) values of the extracts from the three different species using MTT assay. This will be used to construct a dose response curve and examine the effect of the different extracts on the Mia Paca-2 cell line to determine the potency of the extracts. The extract that exhibits the highest anti-cancer activity may create a novel anti-cancer drugs for the treatment of pancreatic cancer.

9. **Title: The Anti-cancer Effect of Eyeball Plant (Acmella Species) Extracts in Ovarian Cancer**

Principal presenter: Femi Egbeleke

Major: Biology

Faculty mentor: Dr. Mette Soendergaard

Abstract: Ovarian cancer is a gynecologic cancer that has been reported to be the fifth leading cause of cancer death in females in the United States of America. 19,710 new cases and 13,270 death cases have been estimated by the American Cancer Society to be reported in the year 2023. The disease often remains asymptomatic until late stages, which comes with a poor prognosis. Just like every other cancer, possible treatment options for ovarian cancer as of date are surgery, chemotherapy, radiotherapy, immunotherapy, and also combination therapy, all of which are not efficient as patients in most cases die of the disease.

This study aims to investigate the anti-cancer effect of *Acmella alba*, *Acmella oleracea*, and *Acmella calirrhiza* on the SKOV3 cell line of ovarian cancer. SKOV3 cells will be grown in McCoy's 5A medium at 37°C, 5% CO₂, and treated with dimethyl sulfoxide (DMSO), 0.2 mg/ml water, methanol, and ethanol extracts of the eyeball plant, and 10 mM paclitaxel, a chemotherapy drug as the positive control. The anti-cancer effect of the eyeball plant will be investigated by carrying out a cell viability test using 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT), which involves the reduction of MTT to formazan that will be measured at 570 nm spectrophotometrically. The result will be subjected to one-way ANOVA statistical analysis using GraphPad Prism 9 to compare the viability of cells treated with DMSO, extracts, and paclitaxel, to determine if the eyeball plant extracts exhibit anticancer activity in ovarian cancer cells.

10. **Title: Fractals of the root-finding methods**

Principal presenter: Harsha Iduruwage

Major: Mathematics

Faculty mentor: Dr. Fedor Andreev

Abstract: Fractals are among the most complicated and fascinating mathematics-based designs and the study thereof can help unfold the mystery of randomness. Most fractal designs are based on basic mathematical formulas, yet they are quite similar to natural patterns in the universe. This research describes fractals related to root-finding methods and how random patterns are generated due to each method. We explore how Newton Fractals work, why they exhibit chaotic patterns, other existing root-finding methods and how they produce random patterns, and how the roots are represented on the fractal. The points of convergence (roots) can be seen as concentrated circles, while the areas away from the roots exhibit fractal behavior. The symmetry of the underlying function can be seen in pictures. Wolfram Alpha and Mathematica are used to produce images.

11. **Title: Potency Testing of Cannabinol in Cannabinol Isolates of Hemp among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection**

Principal presenter: Keszia Fabien

Major: Chemistry

Other presenters or co-authors: Co-presenter: Grant Meyer and Faculty Mentor: Ligu Song

Faculty mentor: Dr. Ligu Song

Abstract: A liquid chromatography ultraviolet detection (LC-UV) method was developed for potency testing of cannabinal (CBN) in cannabinal isolates of hemp among nineteen cannabinoids. The potency testing was achieved using external standard calibration between 0.02 and 25 g/mL. The limits of quantitation (LOQ) were determined to be 0.08% CBN in cannabinal isolates of hemp. To recover CBN, the sample was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 25 g/mL and analyzed by LC-UV. The measurement precision in triplicate was 8.5%. The method was not interfered by other cannabinoids present in the sample.

12. **Title: EMHD Nano Fluid flow along a Porous Riga plate with Thermal Radiation**

Principal presenter: Mehetaj Parvine

Major: Mathematics

Faculty mentor: Dr. Douglas Lafountain

Abstract: Electromagnetic nanofluid flow is important in industrial manufacturing and engineering processes. We study the numerical analysis of unsteady electro-magnetohydrodynamic (EMHD) nanofluidic flow past a Riga plate of porosity criteria with thermal radiation. First, we establish the mathematical model for the nanofluid flow in the form of nonlinear coupled partial differential equations, including an analysis of the

interactions of thermophoretic and Brownian features. These governing equations are then discretized and reckoned with by the explicit finite difference method (EFDM) within their boundary settings. The flow momentum, temperature, and concentration profiles, along with shear stress, Nusselt number, and Sherwood number, are all discussed graphically for important parameters. Finally, the possible sensitivities, and criteria of solutions convergence along with stability, are demonstrated graphically and statistically.

13. **Title: Quantification of Cannabidiol in Hemp-infused Water by Ultra High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry**

Principal presenter: Zachary Dodson

Major: Chemistry

Other presenters or co-authors: Grant Meyer

Faculty mentor: Dr. Ligu Song

Abstract: An ultra high performance liquid chromatography electrospray ionization tandem mass spectrometry (UHPLC-ESI/MS/MS) method was developed for quantification of cannabidiol (CBD) among twelve cannabinoids in hemp-infused water. The quantification was achieved using internal standard calibration between 0.01 and 12.5 $\mu\text{g/mL}$ with CBD-d₃ as internal standard. The limits of quantitation (LOQ) was determined to be 0.00008% CBD in hemp-infused water. To recover CBD, hemp-infused water was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 12.5 mg/mL containing 0.5 $\mu\text{g/mL}$ CBD-d₃. The measurement precision in triplicate was 2.1%.

14. **Title: An Investigation into Extending Capabilities of Standard Quantum Error Correcting Codes to Handle Amplitude Damping Errors**

Principal presenter: Al-Maliq Adetunji

Major: Physics

Other presenters or co-authors: Dr. Kishor Kapale

Faculty mentor: Dr. Kishor Kapale

Abstract: Qubits, the building blocks of quantum computers, hold quantum states that store information. Through the operations of quantum gates, information embedded in the qubits can be manipulated. Unfortunately, the microscopic nature of qubits makes them susceptible to noise, and the gate operations they are subjected to can be erroneous themselves. These factors diminish the possibility of accurate calculations on actual quantum hardware; nevertheless, fault-tolerant quantum computing has been mathematically demonstrated. Fault-tolerant quantum computers employ qubit-controlling protocols with underlying quantum error-correcting codes (QEC) to consistently correct errors that arise due to the aforementioned factors. Predominantly, fault-tolerant protocols have been developed around QEC codes that correct a popular range of errors, namely, Pauli-errors. However, the performance of these codes is impaired by their limited

capabilities in correcting various other types of errors, such as the amplitude-damping error. In this work, we investigate the development of a framework to incorporate amplitude-damping error correction into the standard QEC codes. With this framework, we seek a higher accuracy fault-tolerance scheme against not only Pauli-based errors but amplitude-damping errors.

15. **Title: Effects of climate change on human health - A literature review**

Principal presenter: Damilola Oluwemimo

Major: Public health

Faculty mentor: Dr. Maureen Bezold

Abstract: Background

Human activities such as transportation, deforestation, agriculture, and environmental degradation have increased the global temperature by 0.7 degrees since 1970 due to the increase in greenhouse gas emissions such as carbon, methane, and nitrous oxide. This change in temperature has resulted in catastrophic events like rising sea levels, extreme weather events, and rising temperatures. Several studies and articles have reported the effects of climate change on human health. The purpose of this study is to examine the direct and indirect impacts of climate change on human health.

Keywords: Climate change; Human health; Extreme weather; Vulnerable people

Objectives: This study (a.) aims to report how extreme weather events due to climate change affect the environmental and social determinants of health. b.) thematically reviews published research and articles relevant to climate change and human health

Methods: Three major databases were explored with the help of a university reference librarian during the search process; PubMed, Google Scholar, and EBSCO. Information from government and non-government sites was also included in this study.

Results: 14 articles and reports were selected based on their relevance to the research objectives. Each one of this studies explored the relationship between climate change and/or extreme weather events and human health. One of the studies evaluated how climate change affects the environmental determinants of human health like water, air quality, food security and good housing. Five studies focused on the direct and indirect effects of climate change on human health stating morbidity and mortality as a direct effect especially from extreme weather event and stating evolution of infectious diseases as one of the indirect effects. Three of the studies emphasized on vulnerable populations; old people, children, people living with disabilities and pregnant women. All the studies and reports indicates that the climate change will have catastrophic effects on human health including mental health.

Conclusion: As our climate continue to change, more studies have focused on exploring its effects on health and major discoveries have been heat stress, infectious diseases, malnutrition, asthma, mental issues, vector borne diseases, cardiovascular diseases etc. More attention should be paid to these studies to establish policies that will help the healthcare system stay resilient towards the effects of climate change. Public health and healthcare workers should be prepared for the future of work by including climate education into higher education curriculum. The public should be encouraged to take more climate actions to help the planet attain a net zero of carbon emissions.

16. **Title: Quantification of Cannabichromene in Cannabichromene Isolates of Hemp among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection**

Principal presenter: Grace Brownlee

Major: Chemistry

Other presenters or co-authors: Emmanuel Adejumo

Faculty mentor: Dr. Ligu Song

Abstract: A liquid chromatography ultraviolet detection (LC-UV) method was developed for the quantification of cannabichromene (CBC) in cannabichromene isolates of hemp among nineteen cannabinoids. The quantification was achieved using external standard calibration between 0.02 and 25 µg/mL. The limits of quantification (LOQ) were determined to be 0.08% CBC in cannabichromene isolates of hemp. To recover CBC, the sample was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to µg/mL and analyzed by LC-UV. The measurement precision in triplicate was 8.5%. The method was not interfered by other cannabinoids present in the sample.

17. **Title: Towards the Synthesis of o-Iodoxybenzoic Acid derivatives with Biphenyl and Triphenyl Scaffolds**

Principal presenter: Okiki Quadri

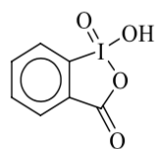
Major: Chemistry

Other presenters or co-authors: Dr. TK Vinod

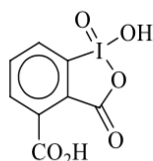
Faculty mentor: Dr. TK Vinod

Abstract: o-Iodoxybenzoic acid (IBX), **1**, an easily synthesized hypervalent iodine (V) reagent, has been hailed as a mild and effective oxidant for a wide range of synthetic transformations ranging from alcohol oxidation to amine oxidation and dithianes oxidative deprotection. Unfortunately, the IBX has certain drawbacks; the reagent is potentially explosive and insoluble in conventional and user-friendly organic solvents. Several structurally modified derivatives of IBX that still retains its selective oxidative properties have been reported in literature within the last decade and among which water-soluble derivatives **2** and **3** reported by us have received considerable attention among the synthetic community. Our continued interest in developing additional synthetically useful and easily

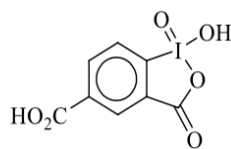
accessed derivatives of IBX has identified biphenyl and triphenyl based IBX derivatives, **4** and **5** as potential targets and our foray into the synthesis of these reagents will be presented. Tandem aryne formation-nucleophilic capture sequence first reported in Hart's laboratory at Michigan State University in the mid-1980s serves as the crucial step in assembling the biphenyl and triphenyl scaffolding in **4** and **5**. The molecular explanation for the reaction pathway of **4** and **5** will be presented.



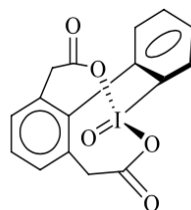
IBX, **1**



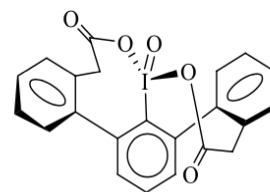
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Podium Presentations

1. Title: Estimating transmission parameters for COVID-19 in Sri Lanka

Principal presenter: Harsha Iduruwage

Major: Mathematics

Other presenters or co-authors: Dr. Dinesh Ekanayake

Faculty mentor: Dr. Dinesh Ekanayake

Abstract: COVID-19 pandemic has had a devastating impact on many societies during the past few years. As a zoonotic disease, the study of its transmission is fundamental to understanding its community spread. The basic reproduction number (R_0) is an epidemiological metric used to measure the transmissibility of infectious disease. R_0 is usually estimated from a time series of epidemiological data or using ordinary differential equation models. However, imperfect data and many uncertainties lead to inaccurate estimations. This is particularly true in third world countries, where a greater proportion of people with a mild COVID may not seek medical treatments. In this research, we investigate the community transmissibility of COVID in Sri Lanka. Assuming that the uncertainty can be modeled by a Wiener process, we use Itô stochastic differential equations to model the disease transmission. We evaluate the transmission rate, the recovery rate, and R_0 for the disease. We compare the results with the existing methods and estimates for Sri Lanka. We demonstrate that the proposed method indeed produces a better estimate using several model selection criteria.

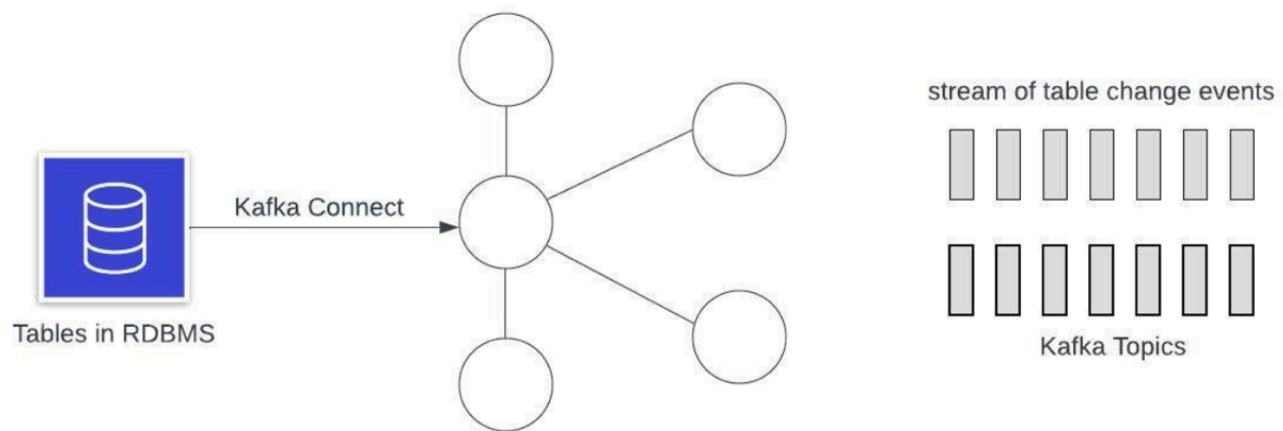
2. Title: Connecting to Apache Kafka: Kafka Connect Deep Dive - JDBC Source Connector

Principal presenters: Sai Chaitanya Thota and Amita Vishwanath

Major: Applied statistics and decision analytics

Faculty mentor: Dr. Kishore Kaple

Abstract: Many people want to use Apache Kafka® to get information from a database because databases have a lot of useful information that can be turned into events. The existing data in a database, and any changes to that data, can be streamed into a Kafka topic. From there these events can be used to drive applications, be streamed to other data stores such as search replicas or caches and streamed to storage for analytics. The JDBC connector for Kafka Connect is included with Confluent Platform and can also be installed separately from Confluent Hub. It enables us to pull data (source) from a database into Kafka, and to push data (sink) from a Kafka topic to a database. Almost all relational databases provide a JDBC driver, including Oracle, Microsoft SQL Server, DB2, MySQL and Postgres.



Incremental ingest

We've just pulled entire tables into Kafka on a scheduled basis. This is useful to get a dump of the data, but very batchy and not always so appropriate for actually integrating source database systems into the streaming world of Kafka. The JDBC connector gives you the option to stream into Kafka just the rows from a table that have changed in the period since it was last polled. It can do this based either on an incrementing column (e.g., incrementing primary key) and/or a timestamp (e.g., last updated timestamp). A common practice in schema design is to have one or both of these present.

Query-based ingest

Sometimes we may want to ingest data from an RDBMS but in a more flexible manner than just the entire table. Reasons for this could include: A wide table with many columns, from which we only want a few of them in the Kafka topic. A table with sensitive information that we do not want to include in the Kafka topic (although this can also be handled at the point of ingest by Kafka Connect, using a Single Message Transform).

Setting the Kafka message key

Kafka messages are key/value pairs, in which the value is the "payload." In the context of the JDBC connector, the value is the contents of the table row being ingested. The key in a Kafka message is important for things like partitioning and processing downstream where any joins are going to be done with the data, such as in ksqlDB. By default, the JDBC connector does not set the message key. It can easily be done though using Kafka Connect's Single Message Transform (SMT) feature.

3. **Title: Social Media Popularity: A Currency for Social Power**

Principal presenter: Emmanuel Odunfa

Major: Communication

Faculty mentor: Dr. Josh Averbeck

Abstract: The rise of social media has made it become a key player in how policies, opinions, and influence are shaped on the internet. Through these, people hold different reasons for using social media or the internet as a whole. This research explores posting

personal information and posting frequently as key motivational factors to help individuals accomplish their desire of gaining followers and social power. An online survey was conducted for this study with participants at a minimum age of 18 and mostly among college students (n=261). The study used power motive, self-disclosure, and perspective on fame as measures for determining motivational values among participants, and a correlation test was used in the analysis of the hypotheses. The results indicated that there was consistent support that posting personal information online could give individuals more followers. The results also indicated that there was inconsistency with the claim that the motivation to get social power is derived from posting frequently on social media. This study could help future findings to ascertain the real influence opinion leaders might have on their followers through social media and if the number of followers is truly a determining factor for influence or power.

Keywords: social media, social power, motivations.

4. **Title: The Toll of the Bell: Apocalyptic Messaging in Metal Music**

Principal presenter: Mark Brown

Major: English

Faculty mentor: Dr. Roberta Di Carmine

Abstract Climate change is a catastrophe- according to Luke Kemp et al- that has the potential to lead to "societal collapse or even eventual human extinction" (1). In this paper, I discuss foreboding messages discussing the end of humanity using metal music as a medium. I agree with Ariel Moniz that apocalyptic messaging has evolved over time and has always been used as a cautionary tale (Moniz). I chose the metal music style because of its roots tied to grim lyricism (Till).

Numerous bands discuss real-world problems and this paper will cover the bands Crown the Empire, Thornhill, and Bring Me The Horizon. For Crown the Empire and Thornhill, I dissect a single song from each of them; for Bring me the Horizon, I analyze several songs from an album with an apocalyptic theme. Many of the bands themselves discuss their messaging via interviews (Burch). I will analyze these bands' songs, lyrics, and videos to demonstrate the unique medium metal music is and how it is used to catalyze societal change. These artists successfully promote social change through the political excitement of their audience.

5. **Title: Modern Mini-Lessons for Literary Classics**

Principal presenter: Anne VanTieghem

Major: English

Faculty mentor: Dr. Rebekah Buchanan

Abstract: In my presentation, I am interested in discussing how to bring modern literature into the classroom. I am a high school language arts teacher and am working on my exit

option to complete my MA in English. My presentation will cover how classic literature excludes the majority of students. The common issue when wanting to do this is the time, resources, and finances to bring modern pieces into lesson plans without removing beloved classics. This is an area that needs to be expanded upon for teachers who don't have the time or access to materials.

I will examine some of the schools in the Quad City area and the texts that are currently being used while the demographic in the area is steadily changing. This will explain why my project is necessary to help teachers connect their classics in a way that helps students feel accepted and represented in the classroom.

To demonstrate my point, I will talk about a few of the pairings I've found so far that can be used in the classroom. The goal of this presentation is to show individuals how classics can be made relevant no matter what classroom one is teaching in. It also will help educators see how they can make modern connections without having to purchase whole books for their students.

6. **Title: Study of the RMG Industry's Resilience in the Aftermath of Multiple Disasters: Bangladesh Context**

Principal presenter: Md Shahedur Rahman

Major: Communication

Faculty mentor: Dr. Josh Averbek

Abstract: The ready-made garments (RMG) industry has transformed the Bangladeshi economy since its inception in the late 1970s, contributing 81.13% of export earnings, equivalent to 14% of GDP, and creating 4 million jobs. There have, however, been a number of catastrophes, including the Tazreen fashion fire and Rana Plaza disasters that killed thousands of workers, along with a low wage structure, which led to a substantial dispute among employers and employees, labor unrest, and international and national pressure. In response to the subsequent pressure, the government amended the Bangladesh labor act 2006 to include provisions favorable to trade union creation and signed an accord with the foreign buyers' corporation on "Fire and Building Safety." In accordance with local laws and ILO recommendations, Bangladesh Garment Manufacturers and Exporters Association (BGMEA), a trade association with over 3000 garment factory owners, has undertaken several social welfare projects to provide greater health and occupational safety and enforce worker rights. This is undoubtedly a landmark achievement (or a game-changer) in the fight to protect textile workers and the industry in the long run.

7. **Title: Spatial Analysis of Impact of Hurricane Ian on Wood Frame Structures in Fort Myers Florida**

Principal presenter: Taiwo Agbaje

Major: GIScience and GeoEnvironment

Faculty mentor: Dr. Sunita George

Abstract: The purpose of the research is to determine spatial ecological modeling and post-hurricane damage assessment protocols in and around Fort Myers from September 2022 to the present. My research objective is to review the body of literature to identify post-hurricane assessment practices, identify any gaps in those practices that still exist, and also to propose a data collection and assessment protocol for the ecological damage assessment process. On September 28, Storm Ian made landfall in the Fort Myers region as a Category 4 hurricane with winds of 150 mph. These awful winds sent feet of water from the Gulf of Mexico ashore, ripping up barrier islands and destroying coastal wood frame structures.

By comparing the damage of last two hurricane season, I hoped to gain a better understanding of and clarify current-day and historical attitudes in creating post hurricane building damage protocol assessment effect on ecological growth and water safety techniques.

8. **Title: COVID-19 and Loss of Employment in the Family**

Principal presenter: Mohammad Rezaul Karim

Major: Sociology

Faculty mentor: Dr. Elbert Wallace

Abstract: In recent years, the world has seen a significant number of pandemics at great loss to human life, and COVID-19 is one of these. Therefore, a sociological study will be conducted to analyze the loss of employment during the Covid-19 in the families of U.S. and economic wellbeing. From the sociological point of view, the conflict theory will guide my research question to find out relationship between loss of employment and economic condition. Increasing structural inequality limits resources consistent with conflict theory. Data is taken from the Household Pulse Survey, an "online survey studying how the coronavirus pandemic is impacting households across the country from a social and economic perspective." In the phase 3.6, The Census Bureau randomly sent 1,048,583 invitations sent to households among those, a total number of 42040 responded across the country. In my study, I will select randomly 4204 (10%) of the respondents from the Household Pulse Survey Phase 3.6. The study will examine the impacts of employment on households. The study will conclude with a recommendation that the findings may be important the policy makers, researchers, development practitioners, NGOs workers and government different countries around the world.

Key Words: COVID-19, Economic Condition, Family, U.S.

9. **Title: Levels of Relational Messages and Gender Voices on the Evaluation of AI Instructors by Students**

Principal presenter: Fanbin Zeng

Major: Education

Faculty mentor: Dr. Yager Stuart

Abstract: Despite some successful work on the implementation of AI in education, much more groundwork needs to be conducted on how machine delivery of lectures impacts student perceptions. A 2X3 experimental survey was designed and conducted, varying both the gender of AI (male or female) as well as the relational levels of the presentation (80% of relational level, 50% of relational level, and 20% of relational level). Participants (N=112) responded to an online questionnaire after watching one of six videos. The results indicated that the communication styles of AI instructors who have 80% of relational styles tend to influence students' perceptions of the credibility of the AI instructor less than those who have 20% of relational styles outstandingly. Furthermore, there is no difference between the AI instructors with male voices and female voices evaluated by students. Social presence as psychological involvement mediated the relationship between an AI instructor's relational levels of communication styles and perceptions about AI instructor-based education. The implications of the findings for applications and theory are discussed.

10. **Title: The Covert Identity: the renunciation of vivid Queer in Africa and Queer Portrayal in African Literature**

Principal presenter: Samuel Idowu

Major: English

Faculty mentor: Dr. Merrill Cole

Abstract: This presentation explores how Lesbian, gay, bisexual, and transgender (LGBT) communities in Africa have gained unparalleled prominence during the last two decades. This increased exposure is partly due to the work of LGBT rights activists, media coverage of hate crimes against LGBT people, and the language of certain African politicians. Homosexuality is seen as decadent due to westernization, which is the basis for many homophobic discourses and the brutality it encourages. While African governments strive to prevent same-sex marriage, it is evident in African history and texts by old and modern writers that homosexuality has long been practiced in African countries before colonial rulers' incursion and that gay characters have appeared in several African works of literature. In my presentation, I will briefly refer to the work of Wole Soyinka, *The Interpreters* (1965), to examine how homosexuality is treated in classic African literature. In addition, I will briefly discuss the work of Jude Dibia (*Walking With Shadows*, 2005) to illustrate how current authors have given voices to the African LGBT community. The texts analyzed in my research are written by Nigerian authors. They are selected because of Nigeria's key role in African politics and its ability to unite the continent's many cultures and religious beliefs.

11. **Title: Final Girls and Distressed Damsels: Gender in Resident Evil 3 and Resident Evil 4**

Principal presenter: Logan Volkert

Major: English

Faculty mentor: Dr. Roberta Di Carmine

Abstract: The increasing popularity and accessibility of the video game industry demands a discussion on the potential that video game characters have to perpetuate and subvert gender and sexuality norms through their aesthetic and narrative representation. Japanese game studio Capcom's long-running survival horror series, Resident Evil, contributes to this discussion by presenting two games-Resident Evil 3 (2020) and Resident Evil 4 (2005)-featuring female and male characters who disrupt the gender binary and problematically black-and-white femininity and masculinity norms.

Using Carol J. Clover's horror film theory of the "final girl," I highlight Jill Valentine of Resident Evil 3 as a gender fluid character whose masculinity does not undermine the strength in her femininity. Carlos Oliveira serves as another point of identification, as he, like Jill, bridges the gender binary. In Resident Evil 4, the supporting character Ashley Graham serves as the stereotypical "damsel-in-distress" who depends on the male hero, Leon Kennedy, to rescue her. However, Jenny Platz and her discussion of the "femme fatale," a sexualized but empowering female figure, frames Ada Wong as a character who subverts the hegemonic relationship between Leon and Ashley.

This essay, pulling from feminist horror film theory, intends to map gendered character archetypes onto the female and male characters of Resident Evil 3 and Resident Evil 4 to begin exploring and articulating how their aesthetic and narrative representation complicate the notion that gender is split between the masculine and the feminine. In doing so, I hope to establish a foundation on which to build my future research. This essay does not offer research into how these video game representations shape player identity. Instead, it offers a brief map of how Capcom's Resident Evil series is serving as an example of how video games might become more inclusive and complex in their treatment of female and male characters.

12. **Title: Does an Informal Culture That Provides Various Amenities to Its Employees Have an Effect on Employee Organizational Identification?**

Principal presenter: Md Shahedur Rahman

Major: Communication

Faculty mentor: Dr. Peter Jorgensen

Abstract: This study examines the relationship between employee perceptions of organizational culture and levels of employee identification. Building on Cheney and Tompkins' (1987) argument that organizational identification is a continuous process, the study hypothesizes that organizational culture may have an impact on employee

identification. The increasing implementation of concerted control practices in organizations and their alignment with the culture of the organization provides a basis for the relationship. The study aims to identify the cultural aspects of the organization that have the greatest impact on employee identification. By examining the connection between organizational culture and employee identification, organizational managers may better understand the importance of creating a positive and engaging workplace culture. The study also explores the impact of informal culture focusing on workplace fun on employee organizational identification.

13. **Title: Introspection: The Path Towards Redemption**

Principal presenter: Jayce Brame

Major: Public Safety Administration

Other presenters or co-authors: Charlie Janes and Jaime Marban

Faculty mentor: Dr. Anthony McBride

Abstract: The purpose of this presentation was originally a group project that implemented restorative justice helping inmates in a prison become rehabilitated, and if they learn enough maybe even have their sentence reduced. To begin, me and my co-authors created an itinerary of a 2 day conference prisoners can attend and learn about restorative justice. Rather than sitting in a jail, going over the same consecutive process, actually help the inmates learn what restorative justice is, and who they can be reintegrated into society. With the conference, it will be a summary of what me and my co-authors learned in the entire semester of the course. Teaching them specific terms that can benefit them, reenactments of criminal activity and what they learned on how to handle the situation, and other hands on training to see if they have learned, are rehabilitative, and potentially having a greater chance in reintegrating into society.

14. **Title: The Impact of Subclinical Personality Disorders on Work Productivity and Absence**

Principal presenter: Leo Ofili

Major: General Experimental Psychology

Other presenters or co-authors: Annique Vidal

Faculty mentor: Dr. Kristine Kelly

Abstract: The Impact of Subclinical Personality Disorders on Work Productivity and Absence Personality disorders are characterized by a pervasive pattern of unhealthy thinking and behaving which causes problems with an individual's interpersonal relationships and work. One meta-analysis (Yang et al., 2010) estimated that about 10% of the population suffers from personality disorders. However, the authors point out that there is an additional 30% of the population who exhibit some symptoms but are still within the "normal" range of the disorders. These subclinical personality difficulties are generally ignored by clinicians. In a review of the topic, Sansone and Sansone (2010) pointed out that emotional instability and unpleasantness were responsible for most occupational problems

in those with diagnosed personality disorders.

Workplace difficulties experienced by people with personality disorders include more sick leave (Gordon et al., 1991), greater work stress (Eliashof & Streltzer, 1992), chronic disability (Gatchel et al., 1995), poor social functioning (Newton-Howes et al., 2008), and deliberately losing one's job (Sansone & Wiederman, 2013). Much attention has been given to borderline traits, as they are the most impairing compared to the other personality disorders (Sharp et al., 2015). The purpose of this study is to investigate the relationship between subclinical personality difficulties and having problems in the workplace. It is hypothesized that personality difficulties will be associated with poor performance and absences at work, but these behaviors will be more highly correlated with impulsivity (a key borderline characteristic).

Participants were college students who completed the Inventory of Interpersonal Difficulties (IPD; Kelly, 2023) and the Lam Employment Absence and Work Productivity Scale (LEAPS; Lam, et al., 2010) as part of a larger online survey. The IPD contains 180 items and measures ten personality difficulties (Clinginess, Social Inhibition, Grandiosity, Emotionality, Impulsivity, Rebelliousness, Eccentricity, Detachment, Suspiciousness, and Conscientiousness). The LEAPS has 10 items that measure work absences and productivity.

We are currently collecting data on this study but will have all data analyses and results completed by the time of the Graduate Research Conference. Pearson's correlations will be used to examine the relationships between the ten subclinical personality disorders and work productivity and absence. Based on prior research, it is expected that people with personality difficulties will experience issues at work. Specifically, it is hypothesized that people with elevated levels of grandiosity, emotionality, and impulsivity will exhibit more poor work performance and absences than people without these symptoms.

The overall goal of this study is to advance knowledge about the relationships between subclinical personality disorders and occupational problems. It also has the potential to guide workplace interventions and support for people with these non-pathological disorders.

15. **Title: Father-Child Relationships and Non-Pathological Personality Difficulties**

Principal presenter: Quint Thompson

Major: Psychology

Faculty mentor: Dr. Kristine Kelly

Abstract: Parental Acceptance-Rejection Theory (Rohnert et al., 2008) proposes that parental behavior affects children's psychological outcomes, especially mental health issues. Parental rejection leads to anger, hostility, aggression, resentment, and emotional unresponsiveness in children. In fact, this theory predicts that perceived rejection by a

parent will likely result in some type of relationship problems. The traditional family dynamic is that children should be primarily influenced by a mother who stays home to meet household needs, while the father is generally inaccessible due to "out-of-home economic responsibilities" (Nash, 1965). However, more recent research has focused on the importance of father love (Rohner & Veneziano, 2001), finding that relationship with one's father is more strongly associated with psychological health, academic achievement, and emotional stability than relationship with one's mother. Indeed, research has shown that traits associated with Borderline Personality Disorder may be caused by a negative relationship with the father (Kaur & Sanches, 2022). Given that father-child relationships is more impactful on a child than the mother-child relationship and that parental rejection can have a strong negative affect on a child's well-being, we were interested in exploring various non-pathological personality outcomes that may be affected by father rejection. Thus, that was the purpose of the current study. Participants were undergraduate students who completed an online survey as part of a larger study. The survey consisted of two scales: The Inventory of Personality Difficulties (IPD; Kelly, 2023) and the Parental Acceptance-Rejection Questionnaire (PARQ; Rohner, 2005). The IPD contains 180 items which assess ten personality difficulties based on non-pathological levels of personality disorders outlined in the DSM-V (American Psychiatric Association, 2013): Impulsivity, Emotionality, Grandiosity, Social Inhibition, Clinginess, Conscientiousness, Suspiciousness, Detachment, Eccentricity, and Rebelliousness. The PARQ consists of 29 items measuring the amount of rejection, hostility, neglect, and warmth the respondents feel about their relationship with each parent. In this study, only the father relationship questions were used. We are currently collecting data for this study and anticipate having the full data set by the end of February. We will be conducting correlational analyses to examine relationships between the four dimensions of the father-child relationship and the ten personality difficulty scales. It is expected that father rejection will be associated with the highest levels of personality difficulties, especially for impulsivity, as that is a key symptom of Borderline Personality Disorder.

16. **Title: Resilience in Students with Personality Difficulties**

Principal presenter: Maame Esi Assafuah

Major: Psychology

Other presenters or co-authors: Nathaniel Bloom

Faculty mentor: Dr. Kristine Kelly

Abstract: Resilience, the capacity to recover from stress and adversity, has been identified as a significant indicator of mental health and happiness (Bonanno, 2012; Rutter, 2012). The growing recognition of resilience as a protective factor against mental health issues like anxiety and depression has increased research in this area (Wu et al., 2013). A review of the relevant literature revealed that symptoms of borderline, narcissistic, schizotypal and obsessive-compulsive personality disorders (Watson et. al., 2008) are associated with elevated levels of distress, difficulty with interpersonal relationships, and overall lower

quality of life (Goldstein et al., 2013). On the other hand, resilience is associated with enhanced coping and adaptation in the face of stress (Trigueros et.al 2020). In one study (Sokol et al., 2007), the researchers found that positive experiences in childhood actually decreased personality disorder symptoms in adulthood. Thus, it is likely that resilience would be a protective factor against such disorders. Additionally, few studies have examined non-pathological levels of personality disorder symptoms (which we refer to as personality difficulties). Therefore, the purpose of the present study was to examine the links between personality difficulties and resilience in college students. It is hypothesized that individuals who exhibit greater resilience will endorse fewer personality difficulties.

Participants were college students who completed the Dispositional Resilience Scale (Bartone et al., 1989) and the Personality Difficulties Scale (Kelly, 2023). The Dispositional Resilience Scale is a 15-item measure of how well people cope with stressful life circumstances. The Personality Difficulties Scale is a 180-item measure of ten subclinical personality difficulties: suspiciousness, detachment, eccentricity, rebelliousness, impulsivity, emotionality, grandiosity, social inhibition, clinginess, and conscientiousness. Participants completed both questionnaires as part of a larger online study.

We are still in the data collection phase of this study and will have the data analyzed by the time the Graduate Research Conference takes place. I will be conducting correlational analyses to examine the relationships between resilience and the 10 personality difficulties. I expect to find negative correlations overall, but I am interested to see how much the magnitude of these correlations varies among the personality difficulties.

This study emphasizes the potential importance of fostering resiliency among college students as a strategy for minimizing personality difficulties and enhancing well-being, even in individuals behaving in the "non-pathological" range of conduct. In addition, the results of this study may have implications for future interventions aimed at enhancing the mental health of college students.

17. **Title: Fluorescence study of dysprosium and praseodymium co-doped bismuth boro-tellurite glasses**

Principal presenter: A K M Ashiqur Rahman

Major: Physics

Other presenters or co-authors: Dr. P. K. Babu & Dr. Saisudha B. Mallur

Faculty mentor: Dr. Saisudha Mallur

Abstract: Glasses doped with rare earth ions show various interesting optical properties, including fluorescence, absorption, and lasing that make them an excellent optical system for practical applications. Therefore, we studied bismuth boro-tellurite glasses (Bi₂O₃:B₂O₃: TeO₂:Pr₂O₃: Dy₂O₃) co-doped with praseodymium and dysprosium. These glasses are prepared using the melt-quench method. In this study, we looked into different

optical characteristics, fluorescence, and stimulated emission cross-sections, by varying the concentration of dysprosium from 0.5% to 1.5%. We recorded the optical absorption with a Varian (Cary 5G) absorption spectrometer and used those spectra to calculate the oscillation strength, and intensity parameters. Using these results, we calculated the radiative transition probability, lifetime, and branching ratios. Fluorescence spectra are recorded using a LEOI-101 Modular Multifunctional Grating spectrometer using a 445 nm diode laser. Dy³⁺ ions can only be excited in the ultraviolet region, whereas Pr³⁺ ions can be excited at 445 nm in the visible region. In our measurements, Dy³⁺ ions were indirectly excited by exciting Pr³⁺ ions. We observed fluorescence from Dy³⁺ ions as a result of energy transfer from Pr³⁺ ions to Dy³⁺ ions. We finally determined the stimulated emission cross-section using parameters calculated from absorption data and in conjunction with fluorescence data. When we compared these values to those of singly doped bismuth boro-tellurite glasses, we observed enhanced optical parameters which make these glasses useful in optical applications.

18. **Title: Analysis of Optical Absorption of Pr³⁺ and Dy³⁺ Co-doped Bismuth Boro-Tellurite Glasses**

Principal presenter: Md Hasibul Hasan Hasib

Major: Physics

Other presenters or co-authors: Dr. P. K. Babu and Dr. Saisudha Mallur

Faculty mentor: Dr. Saisudha Mallur

Abstract: In this work we have analyzed the effect of compositional changes in bismuth boro-tellurite glasses on the optical properties of co-doped Praseodymium (Pr³⁺) and Dysprosium (Dy³⁺) ions. For preparing the glass samples, we mixed the raw materials of highly pure (99.9%) Bi₂O₃, H₃BO₃, TeO₂, Pr₂O₃, and Dy₂O₃ homogeneously to make a 20g batch for each glass samples. Bi₂O₃ content was varied with fixed 10 mol% and 20 mol% TeO₂ content. The raw materials were melted in the temperature range of 800-1000°C by using a high temperature furnace and air quenched on a metal plate. Glass samples were annealed at 350°C for 2-3 hours to reduce thermal strains. Finally, samples were polished to get proper reflecting surfaces. Refractive index measurements were carried out using a Brewster angle set up and optical absorption spectra were recorded in the wavelength range 200-2400 nm using a Varian (Cary 5G) absorption spectrometer with a resolution of ±0.2 nm. Using modified Judd-Ofelt theory, oscillator strength (area under the band) of each absorption transitions were determined. One of the absorption transitions in Pr³⁺ and Dy³⁺ is very sensitive to the environment. This is called the hypersensitive transition (HST). The variation of the peak wavelength and oscillator strength of this HST with Bi₂O₃ and TeO₂ content is discussed. Considering all the absorption transitions, intensity parameters which depend on the symmetry of the rare earth (Pr³⁺ and Dy³⁺) sites and Pr-O and Dy-O covalency are calculated by least squares analysis method. The variation in these optical parameters with changes in the base glass indicates that there are structural changes in the vicinity of Pr³⁺ and Dy³⁺ ions, and an increase in the Pr-O and

Dy-O covalency.

19. **Title: Excited NH₃ Emission From Ionized Jet Candidates**

Principal presenter: Alaric Evans

Major: Physics

Faculty mentor: Dr. Esteban Araya

Abstract: Molecular gas in high-mass star forming regions can be excited to energy levels above the ground state, which results in emission from different quantum transitions. These spectral lines carry information about the motion and physical conditions of the clouds where stars form. Sanchez-Tovar et al. (submitted) reported tentative detections of molecular lines toward a sample of high-mass star forming regions with ionized jet candidates, including detection of the (J,K) = (5,3) inversion transition of NH₃ at 21.29 GHz. We report follow-up VLA observations of this transition with higher frequency and spatial resolution than the data reported by Sanchez-Tovar et al. toward three of the ionized jet candidates in their sample: IRAS 20126+4104, IRAS 18089-1732, and G34.43+00.24. Of these sources, only IRAS 20126+4104 was not observed in Sanchez-Tovar et al., while the other sources were detected. We used resources from the National Science Foundation Advanced Cyberinfrastructure Coordination Ecosystem: Service & Support (NSF ACCESS), in particular, the data were analyzed in a virtual machine in the JetStream2 computer cluster. We used Jupyter-Lab and the Common Astronomy Software Applications (CASA)-both Python-based programs-to check the calibration and create images and spectra of the sources. Weak radio continuum was detected toward the three sources. We found weak NH₃ emission toward IRAS 20126+4104 at a velocity that corresponds to the known systemic velocity of the region and confirmed the detection toward IRAS 18089-1732. However, no line was detected toward G34.43+00.24. We found that the data may be affected by low signal from one of the antennas of the array. The next step of the project is to re-calibrate the data excluding the antenna with low signal to investigate the reason why the line toward G34.43+00.24 was not detected.

20. **Title: Continuum Imaging of Three High-Mass Star Forming Regions**

Principal presenter: Punya Paudel

Major: Physics

Other presenters or co-authors: E. D. Araya

Faculty mentor: Dr. Esteban Araya

Abstract: A key aspect of the model of high-mass star formation through disk accretion is the presence of ionized jets and molecular outflows that transfer angular momentum outwards to allow accretion. High spectral and angular resolution VLA observations at 1.3 cm of three radio continuum sources with excited methanol and ammonia lines were made by our group to investigate the kinematics of molecular gas associated with the jets and determine the nature of the emission. The observations were done in a total 17 spectral windows (SPWs), 14 with a narrow frequency bandwidth of 16 MHz (to detect spectral

lines), and the remaining 3 with a broad bandwidth of 128 MHz to detect radio continuum, i.e., the emission from ionized gas. We imaged the continuum of the three sources using one of the narrow SPWs, and we compared it to the continuum from three broadband SPWs as well as with previous continuum measurements reported by Rosero et al. (2016) to check for consistency in the flux density calibration. The radio continuum from the narrow SPWs were found to agree with the continuum measurements from Rosero et al. (2016) for all three sources. We also found that the radio continuum measurements reported by Rosero et al. (2016) were consistent with our measurements from the broad-band SPWs for two sources, IRAS 20126+4104 and G34.43+00.24, but inconsistent for IRAS 18089-1732. We are exploring whether calibration errors or the extended nature of the radio emission is responsible for this discrepancy.

21. **Title: Finding the Optimal Spectral Resolution for Analysis of Molecular Line Observations of a Sample of High-Mass Star Forming Regions**

Principal presenter: Amisha Rane

Major: Physics

Other presenters or co-authors: E. D. Araya

Faculty mentor: Dr. Esteban Araya

Abstract: A key aspect of the model of high-mass star formation is how ionized jets and molecular outflows relate to the accretion process, in particular whether molecular outflows exhibit rotation as expected from dissipation of angular momentum. Observations of molecular lines with radio telescopes is the main tool to study the motion of gas in outflows. Sanchez-Tovar et al. (submitted) reported detection of CH₃OH and NH₃ in a sample of young high-mass stellar objects based on broadband VLA continuum observations. In this project, we present results of follow-up observations of three regions from Sanchez-Tovar et al. (IRAS 20126+4104, IRAS 18089-1732 and G34.43+00.24) to study the nature of the lines. The data consist of 17 spectral windows, tuned to detect CH₃OH, NH₃ and radio continuum at microwave wavelengths. Data reduction and analysis was done using virtual machines from the high performance computer cluster of the National Radio Astronomy Observatory in New Mexico. We use the CASA (Common Astronomy Software Applications) package to image and analyze the observations of the three sources. Our follow-up observations confirm most of the detections reported by Sanchez-Tovar et al. (submitted). In addition, our observations were conducted with greater spectral resolution, and therefore, a main component of the work was to optimize the velocity resolution (channel width) to maximize signal-to-noise ratio while keeping the velocity information of the spectral profiles. For each source IRAS20126+4104, IRAS18089-1732 and G34.43+00.24, the optimal channel widths for one spectral window were found to be 20 channels (2.47 km/s), 10 channels (1.23 km/s) and 20 channels (2.47 km/s), respectively, and these values were used to generate the spectra of the other molecular lines. Our higher spectral and angular resolution data revealed the possible detection of outflows traced by methanol in G34.43+00.24 and IRAS20126+4104.

22. **Title: Does Menstrual Stress Contribute to Stress Experienced by Female International Students? A Study For Policy Level Intervention.**

Principal presenter: Yetunde Olaniran

Major: Public Health

Faculty mentor: Dr. Maureen Bezold

Abstract: Stress is a well-known risk factor for poor health outcomes. Female respondents in previous research have reported higher levels of depression, anxiety, and stress when they are compared to their male counterparts. Also, several studies have made it known that the adjustment of international students to studying abroad, experiencing an array of academic and personal development opportunities not otherwise available to them in their home country, and learning a new culture may be overwhelming for them. Therefore, female international students are exposed to more stress than domestic female students. International female student distress can have a negative impact on professional development and academic performance.

Menstrual disorder is a source of stress for females, and it can be so severe that it makes it difficult to get through the day. In addition to menstrual stress, there are other forms of stress that could be affecting females, especially international female students, such as academic, financial, sociocultural, and COVID-19, because of the new challenges they are exposed to in a new country. The stress level and mental health needs of a female international student may be misinterpreted if all the unique circumstances of being a non-domestic student are not considered. Promotion of good mental health in younger generations with and without mental disorders has attracted little experimental attention from the researchers, and interventions for enhancing young people's mental health are not well established.

The aim of this thesis is to determine the extent to which menstrual stress affects the overall stress levels of female international students and to propose an appropriate intervention initiative for female international students that could be incorporated into the school policy.

There are a few studies in the literature on the prevalence of menstrual problems and their relationship with stress levels and mental health among women, but they do not focus on female international students, who are one of the overlooked minorities, and these studies do not investigate how much menstruation contributes to the stress level. As a result, this study is intended to fill this void.

The entire population of female international students at Western Illinois University will be recruited for the study with informed consent, and data will be collected through an anonymous self-completed questionnaire. Multiple regression analysis will be used to identify the contributions of each area stressor-menstrual disorder, academic, financial,

cultural, and COVID 19-on overall stress.

The result and conclusion will be ready before the conference day.

23. **Title: Reversing Raj: Hindu Nationalist's (Re) Imagination of Rishi Sunak**

Principal presenter: Anna Lucken

Major: Liberal Arts and Sciences

Faculty mentor: Dr. Sarah Haynes

Abstract: On October 25, 2022, Rishi Sunak became the Prime Minister of the United Kingdom. The British-born Hindu quickly garnered attention from Hindu nationalists within India and the diaspora. The entire rhetoric of the Hindutva movement has set up the conditions necessary for Rishi Sunak to be seen as the person who takes back what Britain stole. Beginning before this appointment was confirmed, Hindu nationalists took to social media to praise the lion of India who would right the wrongs done to India under British colonialism. I have analyzed hours of videos, social media posts, and other mass media productions by Hindu nationalists that laud Rishi Sunak as a secret operative for the movement. By tracing the origins of Hindu nationalism from its beginning to the present day, I explore how the Indian diaspora has played a role in the creation and proliferation of Hindutva ideals. This research is ongoing as new memes and posts are created daily, while Rishi Sunak has yet to address the Hindu nationalist claims leveraged against him. I continue to observe the online community of Hindu nationalists as they praise Sunak for actions and behaviors he has all but rejected.

24. **Title: Diverse Influences in Minority Poetry**

Principal presenter: Emily Woods

Major: English

Faculty mentor: Dr. Daniel Malachuk

Abstract: This research paper aims to contribute scholarship to the currently limited discourse on the idea of Imagining Multiracial Democracy; it was written as the final paper for Dr. Dan Malachuk's similarly titled English 400G course this past Summer 2022 semester. Multiple institutionalizations of racism can be critiqued by analyzing how the American poet Langston Hughes and the 2019 United States Poet Laureate Joy Harjo respectively use Black and indigenous Americans' historic influences on jazz, blues, and oral musical practices to experiment with stylistic conventions in their twentieth and twenty-first century poetry. The exemplified connections and conclusions suggest the political importance of including minority voices (and writings) in the re-examination of American society's efforts toward genuine diversity.

This critical essay will also be presented at the annual convention of the Sigma Tau Delta English honor society.

25. **Title: The Secret of Resistance: Bilal VS Sisyphus**

Principal presenter: Saly Zwairi

Major: English

Faculty mentor: Dr. Roberta Di Carmine

Abstract: In literature and cinema, we often see heroes and heroines who must resist challenges, temptations, and forces directed toward them or distracting their ambitions. But in reality, the need for resistance creates a major dilemma that leaves people wondering whether this oppositional behavior is a life need or not. For this study, the focus is to discuss the nonfiction story of Bilal illustrated in the first feature-length animated film Bilal: A New Breed of Hero, directed in 2015 by Khurram Alavi and Ayman Jamal; and the ancient Greek Myth of Sisyphus to achieve freedom. The movie represents a black man who resists slavery. He overcomes numerous challenges and tortures of having a heavy rock placed on his chest. Whereas, Sisyphus is a king who deceives gods to escape death and is punished for it. He has to push a rock on the top of the mountain for eternity. This paper investigates and analyzes the secret of resistance suggested in the two works from a psychological perspective. Freud, as the father of psychoanalysis, provides an understanding of the peculiarities of repression and the causes that impact its emergence. Using descriptive qualitative research methods, his theories of the conscious and unconscious, and the psychic representation of an "I" are used to better understand how the brain works when facing repression in both pieces of literature. By applying Freud's theories to the film and the myth of Sisyphus, it is possible to understand the psychology of heroes and the symbolism they evoke, and how they relate to today's reality, by showing two different cultural contexts and providing an interpretation of how struggle can lead to peace.

26. **Title: Compounds from *Morchella esculenta* as potential inhibitors of RNA-binding protein La in ovarian cancer: A molecular modeling and quantum mechanics approach**

Principal presenter: Gbenga Dairo

Major: Biology

Faculty mentor: Dr. Mette Soendergaard

Abstract: Ovarian cancer (OC) is implicated in most gynecological cancer-related deaths. Currently, the primary treatments for ovarian cancer are surgery and chemotherapy using platinum-based drugs to induce remission. However, OC recurs in 70-80% of patients within two years. Studies have shown that 80% of patients respond well to the first round of treatment with platinum drugs; however, almost all patients develop drug resistance, which usually results in the death of most ovarian cancer patients.

La protein is significantly expressed in various malignant tumors, including ovarian cancer. Previous studies reported that ovarian cancer patients have significantly higher levels of La protein expression in their serum than healthy individuals, which is related to the poor

response to platinum-based chemotherapy. Furthermore, when the expression of La was reduced using RNAi in A2780 and SKOV3 cells, it impaired cell growth, which suggests that it promotes apoptosis and inhibits the invasion and migration of ovarian cancer cells. Importantly, inhibiting La protein could control the expression of the potential downstream genes involved in promoting proliferation, invasion, migration, and chemotherapy resistance to ovarian cancer, which could serve as a good therapeutic intervention in treating ovarian cancer.

Extract from *Morchella esculenta* (Morel mushroom) has been reported to contain anti-cancer properties, but no study has reported the interaction of its bioactive compounds with La protein in ovarian cancer.

This study examines the interaction of La protein with some bioactive compounds of *Morchella esculenta*, as well as their pharmacokinetics and thermochemical properties using structural bioinformatics and advanced theoretical chemistry techniques. This study gives insight into Morel mushroom's bioactive compound's therapeutic potential in treating ovarian cancer.

From the library of 12 compounds identified from *Morchella esculenta*, which undergoes virtual screening with the human La protein crystal structure, beta carotene, p-hydroxybenzoic acid, alpha-tocopherol, gamma-tocopherol, protocatechuic acid, and delta-tocopherol showed a higher binding affinity of -10.7, -8.2, -7.9, -7.8, -7.5, and -7.4 Kcal/mol respectively than gemcitabine (FDA-approved drug), which showed a binding affinity of -6.4 Kcal/mol. However, the top four lead compounds were selected for further analysis.

To improve docked poses because of the inaccuracy of docking scores. The binding free energy of the lead compounds was calculated using MMGBSA, and the result showed that they have higher binding affinity than the control. Furthermore, the stability of the lead compounds to the target receptor was examined using molecular dynamics simulation for 100 ns, and the result showed acceptable stability to the receptor.

The lead compounds' pharmacokinetic profiles were examined using the Lipinski rule of five and the ADMET study to determine drugability. The compounds are considered drugable because they did not violate the Lipinski rule of five and did not serve as an inhibitor or substrate to the CYP450 enzymes. Also, the compounds showed better physicochemical properties than the control following LRC-DFA.

This study showed that lead compounds of *Morchella esculenta* could serve as a therapeutic intervention in treating drug-resistant ovarian cancer.

27. **Title: Pancreatic Cancer Specificity of Phage Display-Selected Peptide MCA1**

Principal presenter: Funmilola Anjorin

Major: Chemistry

Other presenters or co-authors: Dr. Mette Soendergaard

Faculty mentor: Dr. Mette Soendergaard

Abstract: Pancreatic cancer accounts for about 7% of all cancer deaths. The ability for aggressive metastatic progression as well as the asymptomatic disease development and a lack of inadequate detection methods result in a low survival rate of about 3%. However, peptides with high affinity and specificity show promise as radiolabeled imaging agents for both detection and therapy.

Previously, we used phage display technology to identify a peptide, MCA1, that binds to the human ductal adenocarcinoma pancreatic cell line, Mia Paca-2 while showing no binding to other cancerous and non-cancerous cell lines (LNCaP, HEK293, hTERT-HPNE, and SKOV-3). Here, the pancreatic cancer cell line specificity of MCA1 was further elucidated. A dose-response assay using a modified ELISA was used to determine the EC₅₀-values of MCA1 to Mia Paca-2, metastatic ductal adenocarcinoma (CFPAC-1), primary adenocarcinoma (Panc 10.05), and ascitic adenocarcinoma (HPAF-II) cells. The EC₅₀-values were calculated to be 299.0 nM (248.3-359.7 nM; 95% confidence interval; CI), 1.24 μM (0.167-73.93 μM 95% CI), 51.69 μM (1.28 μM -undetermined 95% CI), and 24.22 μM (3.00-275 μM 95% CI), respectively. The R²-values for the sigmoidal dose-response curves were 0.9376, 0.2172, 0.5663, and 0.3096 for Mia paca-2, CFPAC-1, Panc 10.05, and HPAF-II cells, respectively.

These results show that MCA1 exhibits the highest affinity to the original target cell line (Mia Paca-2) and shows comparatively low binding with wide 95% CI and low R²-values to the other cell lines. This indicates that the peptide is specific for the Mia Paca-2 cells and may target a biomarker that is not expressed in CFPAC-1, Panc 10.05, and HPAF-II cells. Thus, MCA1 may be further developed as a specific ligand of subtypes of pancreatic ductal adenocarcinoma.

28. **Title: The Flavonoid Content of Morchella esculenta (Morel) Extracts**

Principal presenter: Joyce Ayodeji

Major: Biology

Faculty mentor: Dr. Mette Soendergaard

Abstract: One of the major factors that influences cancer development is the presence of reactive oxygen species (ROS) within the tumor environment. ROS can be scavenged by the binding action of antioxidants which gives free electrons to free radicals, thus preventing further oxidation of cellular molecules. Flavonoids are powerful antioxidants produced by natural products such as plants and fungi for their defense and they have been utilized in the pharmaceutical industries due to their health benefits. Previous research

shows that extract from *Morchella esculenta* has an anti-proliferative effect on an ovarian cancer cell (SKOV 3), however, its flavonoid content is unknown. This experiment aims to determine the total flavonoid content and the radical scavenging activity of these morel extracts using the Aluminum Chloride Assay (ACA) and the 2,4-Dinitrophenylhydrazine Assay (DNPH). The extract was prepared by weighing 100mg of powdered morels into 1 ml of extract solution (200 μ L 12 M HCl, 16.8 mL 90% methanol, 3 mL dd H₂O).

The ACA will be done by dissolving 10 mg of quercetin in 100 μ L 80% aqueous ethanol to make a stock concentration of 100 mg/mL. The stock solution will be diluted serially using 80% aqueous ethanol into standard solutions of 100, 50, 25, 10, 5, 2, 1, and 0 μ g/mL of quercetin. The absorbance of the standards will then be measured at 415nm by mixing 25 μ L of each standard solution with 75 μ L 95% ethanol, 5 μ L 10% aluminum chloride, 5 μ L 1M potassium acetate, and 140 μ L ddH₂O in a 96-well plate and incubated in the dark for 30 mins.

The DNPH assay will be done by dissolving 20 mg of naringenin in 100 μ L 80% aqueous ethanol to make a 200 mg/mL stock solution. A serial dilution from the stock solution will be used to prepare standard solutions of 2, 1, 0.5, 0.2, 0.1, 0.05, 0.025, and 0 mg/mL. Thereafter, 100 μ L of each standard solution will be mixed with 200 μ L of 1% 2,4-dinitrophenylhydrazine reagent and 200 μ L of 80% aqueous ethanol at 50°C for 50 min. The samples will be cooled to room temperature, mixed with 500 μ L of 1% potassium hydroxide in 80% aqueous ethanol, and incubated at room temperature for 2 mins. 100 μ L of the resulting mixture will be transferred to a fresh tube containing 500 μ L 80% aqueous ethanol. This will be centrifuged at 100 xg for 10 min and the supernatant will be transferred into a fresh tube. 100 μ L of the supernatant will be pipetted in triplicates to a 96-well plate and its absorbance will be read at 495 nm.

For both assays, the absorbance value obtained will be used to plot a standard curve that will be used to determine the concentration of flavonoid in the morel extract after its absorbance has been determined using the method described in each assay. The presence of flavonoids in the morel extract, if discovered, may provide a cheaper and safer alternative cancer treatment option.