

Participant Abstracts

EMU Academic and Creative Excellence Festival 2023

Listings are in alphabetical order by the last name of the presenter. In the case of group projects, the entry is alphabetized under the name of the student who submitted the entry.

Posters and Projects

Copper soil level

David Adjei-Darteh with Eli Longacher

Faculty Mentor: Matthew Siderhurst

Copper is a vital micronutrient for plants, but excessive amounts can lead to toxicity. The concentration of copper in soil is influenced by various factors, including the acidity of the soil. In this abstract, the effects of three different concentrations of hydrochloric acid (0.15 M, 1.5 M, and 3 M) on the solubility and availability of copper in soil are discussed. Acidification of soil with HCl resulted in an increase in copper solubility, with higher concentrations of HCl leading to greater copper extraction. However, the effects of HCl concentration on the bioavailability of copper to plants are less clear, and further research is needed to fully understand the impact of soil acidity on plant copper uptake. Overall, this research suggests that the concentration of HCl used for soil extraction can significantly affect the measurement of copper in soil and should be carefully considered when conducting soil analysis.

VR Gets Virtual

Seth Andreas with Noah Swartzentruber

Faculty Mentor: Stefano Colafranceschi

This project is a Virtual Reality (VR) game designed in Unity game engine. The user will be playing disc golf on a course modeled after the Nathan Longenecker Memorial Disc Golf Course on EMU hill. The user will be able to interact with elements in the game through touch and physical motions. They will be able to move around in the physical environment, pick up discs, and throw them. This project may open the doors for more people to discover disc golf as a sport, and will promote the EMU disc golf team, helping it to grow and develop.

Toy Project - Shape Sorting Tub

Cassidy Armstrong

Faculty Mentor: Audrey Myers

This toy was created to focus on the child's developmental stages. At this age the child is heading towards toddlerhood and has made rapid progression in their first year of life. 1 year olds are usually able to stand alone, start walking (maybe with some assistance like furniture, toys, or caregiver) and they should move from sit to standing. Infants in this age will also partake in interactive games like peek-a-boo, or surprise toys like jack in the box. They are also using communication skills such as saying mama and dada and understanding commands like no. Part

of cognitive development is the concept of object permanence, which is when the child acknowledges that something continues to exist even when out of sight. So when the child puts the shape through its corresponding hole and they can no longer see the shape they have an understanding that the shape is in the container and they can reach into the tub to retrieve their shape. This concept starts to develop around 8-12 months. This toy also helps the child grow their fine motor skills by placing the shapes through the hole and using their pincer grasp to grab the shapes. The tub itself is light and easy to maneuver and to push or carry. Socially children in this age category partake in solitary play which is when the child plays alone and is not quite interested in playing with others. This toy is easy for the child to sit and play with by themselves. The parents or caregivers can participate by naming shapes, colors, or helping the child manipulate the shapes into the hole. This will help the child connect colors and shapes as well as the social interaction will enhance play.

Analysis of the physiological and cognitive effects of listening to music.

Will Blosser with Hannah Dellinger

Faculty Mentor: Kristopher Schmidt

Within the last twenty years, listening to music has become a socially-ubiquitous activity that can occur anywhere, at any time. The advent of mobile phones and music streaming services have created an environment wherein many people spend numerous hours a week listening to music, with some of this time occurring in the classroom setting. In this project, we aim to test the physiological and cognitive effects of listening to music, with a focus on how listening to music may help or hamper students.

To carry out this project, we will divide participants into 5 primary groups. Groups 1 and 2 will be positive and negative controls respectively, and these students will be subjected to 3 minutes of either silence or white noise. Groups 3 through 5 will be subjected to 3 minutes of music from fundamentally different genres of music- a potential spread of these genres may be Heavy Metal, Hip Hop, and Classical. During the 3 minute listening period we will measure their respiration rate (RR), heart rate (HR), brain activity, and cognitive function. The RR, HR, and brain activity data sets will be collected utilizing EMU's instruments and Lab Tutor software, whereas the cognitive function test will take the form of a simple math quiz.

We expect that the music will have a novel effect on one or more of these data sets, and we expect that effect to differ between the genres of music provided in the experiment. Namely, we expect a music genre with a higher beat per minute (BPM) count will elicit higher RR and HR data than a slower genre counterpart.

Cu²⁺ Phytoremediation in radishes

Seungmin Cha with Mayra Cruz

Faculty Mentor: Matthew Siderhurst

The purpose of this study is to determine the ability of radish to phytoremediate in various copper concentrations. Copper was mixed into the soil and then seeds were planted and left to observe and test copper concentrations.

Effective Coaching Styles in Collegiate Sports

Ben Childers with Walter Spurlock

Faculty Mentor: Joohyun Lee

Coaching styles are critical to collegiate sports teams' performance. Effective coaches have a substantial influence on their athletes' motivation, performance, and development. The goal of this research is to look at the most successful collegiate coaching styles.

For starters, authoritarian coaching styles are prevalent in competitive sports. Coaches are the main decision-makers in this style, which emphasizes strict discipline and high expectations. This strategy, however, may result in a lack of athlete independence and decreased motivation, ultimately resulting in burnout and poor performance.

The democratic coaching approach, on the other hand, encourages athlete participation in decision-making, resulting in greater athlete autonomy and motivation. Coaches who use this approach encourage open communication and place a high value on athlete feedback. This strategy has the potential to increase athlete satisfaction by making athletes feel more invested in their development.

Finally, the transformational coaching style emphasizes the athlete's personal and professional development, emphasizing the value of mentorship and emotional intelligence. This coaching style prioritizes athlete growth, with an emphasis on developing strong relationships with their athletes. This strategy can boost athletes' confidence and self-efficacy, eventually improving overall performance.

Overall, the most successful coaching style in collegiate sports is determined by the needs of the athlete and the objectives of the team. Coaches who emphasize athlete development and create a positive and motivating atmosphere, on the other hand, are more likely to succeed. The best coaches can adapt their coaching style to suit the requirements of their athletes while encouraging growth and success.

Characterization of Antibiotic Resistance

Erin Clayton

Faculty Mentor: Jeffrey Copeland

In the past two decades, there has been a rapid increase in the number of antibiotic-resistant infections (Agnese et al). The rapid evolution of bacteria in response to antibiotic use has resulted in decreased efficiency of antibiotics in treating a multitude of infections, and has revealed the need to understand the mechanism of antibiotic resistance and learn to identify it in common strains of bacteria. This project characterized the resistance of an strain of bacteria designed to be resistant to tetracycline. Several different tests were used, including the Kirby-Bauer test, to provide an understanding of antibiotic resistance.

Effectiveness of multiple approaches for inquiry-based lab education in undergraduate chemistry

Laura Craft

Faculty Mentor: Laurie Yoder

Inquiry-based labs benefit the self-exploration and learning of chemistry students (Pickering 1985), specifically to reinforce concepts built upon in other lessons or chemistry classes. Previous research shows that students in an active learning environment are more likely to pass their STEM courses (Freeman et al, 2014) and are more likely to retain the knowledge they are gaining when completing self-guided activities (Branan & Morgan, 2010). We focused on the foundational chemical concept of solution concentrations and dilutions, a frequent source of misconceptions held by General Chemistry students. The goal of this work was to determine the most effective classroom and lab activities and delivery order through inquiry-based “mini-labs,” active participation in lectures, problem-solving practice, and student-led laboratory. The main question we addressed with this research was the best order of instruction for complicated concepts and whether student understanding and scores improved through self-guided practice and activities. Students were given pre-and post-assessments, completed an inquiry-based lab, and attended lectures on serial dilutions. One group of students attended the lecture first, then completed the pre-assessment, attended lab, and completed the post-assessment. The second group of students completed the pre-assessment and lab first, attended the lecture, then completed the post-assessment. All students received the same contact time and materials and were expected to meet the same course objectives. Data analysis included the collection of pre and post-assessment grades, lab grades, exam grades, and survey results regarding the students’ views of their understanding of serial dilutions. The results of this research will shape future teaching of dilution in this course, as well as design activities to enhance learning in other General Chemistry concepts. Additional goals include improving overall retention through new learning methods and increased preparation for entering the world of STEM.

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<https://pubs.acs.org/doi/pdf/10.1021/ed8000073>

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H. & Wenderoth, M.P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, 111(23), 8410-8415.

<https://doi.org/10.1073/pnas.1319030111>

Pickering, M. (1985). Lab is a puzzle, not an illustration. *Journal of Chemical Education*, 62(10).

<https://pubs.acs.org/doi/pdf/10.1021/ed062p874>

Toy Project (Champion Car)

Hollie Creasey

Faculty Mentor: Audrey Myers

When you go to buy a toy for a child, you often see an age range on the box, why is that? Well, when a child is developing and growing, they can play with certain things in their developmental stage along with safety for the age range. You give a 1-year-old a car, they aren't going to know how to use it properly, to roll it. So, you must get toys that they are developmentally able to use. At the age of 3 they have the developmental skill to push and pull, build with blocks, throw a ball, and scribble. So here I have a push-pull toy for the age of 3, The Champion Car. This car has a handle for the child to either push it or pull it back to them, while playing with it. The champion car is red with a handle and 4 wheels, along with a first-place plaque. It is lightweight easy for the child to carry or pick up. It is all in one piece, no choking or safety hazards, except if it was broken. If it was to break it has a couple small pieces that could become a choking hazard and should be taken from the child. This toy meets the motor, social, and cognitive skill level of a 3-year-old. The 3-year-old has the skills to roll the car back and forth like it is supposed to and understand that's what it does. It allows the child to meet the social skill of associate play, with playing with other children, but maybe playing with their own toy. Lastly, it challenges their ability to know how to use it. The cognitive development to know what to do with a car.

The phytoremediation of Corn at Different Concentration of Copper

Logan Darrow with Andrew Arledge

Faculty Mentor: Matthew Sidderhurst

We will look at the ability of phytoremediation of Cu^{2+} in corn at different concentrations of Cu^{2+} , 200 mg/kg, 100 mg/kg, and 0mg/kg. We will measure the copper in the soil after the corn grows and the growth of the corn itself.

Fish, Act, Solve!

Alexis DiVenere

Faculty Mentor: Audrey Myers

This was a toy project for nursing care of children. The toy was made for a child around the age of 6, and helps them to work on their fine motor, gross motor, cognitive, and social skills. The child is able to work on their dexterity, participate in physical activity, solve problems using critical thinking, and interact with whoever else is playing the game with them. The toy can be made using materials found in the home, and is very easy to make and play. Using craft materials, you make a "fish bowl", create fish with equations and letters written on the back and velcro on the top, and a "fishing pole" out of a small wooden stick and velcro attached to the end. The child uses this to pick up the fish, read the back of the card, and either act out an activity or solve an equation. This game is both fun and challenging for a six year old!

Pediatric Toy Project: Cart

Sheila Escalante-Lopez

Faculty Mentor: Audrey Myers

I will be presenting my pediatric toy project which is a cart. My pediatric toy project is targeted for a 12 month old to use. The toy cart consisted of multiple ways a 12 month old can learn and practice their physical and cognitive skills. My toy project has multi sided colors that were made from construction paper to appeal to a 12 months old mind. To the right side of the cart it has a whiteboard made out of a cover slip which can be used by parents to teach their 12 month old multisyllabic words, color, or the ABC's. A 12 month old can practice how to hold a marker and scribble with parental supervision because dry erase markers can be toxic. At the top of the cart there are a variety of shape spaces. The cart comes with multiple shapes which a 12 month old can practice by learning about shapes and their appropriate section. Each shape has its own figure and comes in different colors. A 12 month old can practice holding different shapes and seeing different colors. The side of the cart there's a table to the side. The cart comes with stackable blocks that can be used on the table. They can also have a snack on the table like cheerios which helps with the fine motor skills. The cart comes with detachable wheels which can be taken off to keep the toy in place which helps a 12 month old that can not walk stay stable because they like to use furniture to stand up. If they can walk the cart can move with the wheels on. This toy was designed with the most safety precautions like soft plastic and toys big enough that a 12 month old can not place it into their mouth.

Pheromone for Fruit Spotting Bug

Abigail Forrest with Evan Kauffman, Kate Krabill, Sarah Deputy

Faculty Mentor: Matthew Sidderhurst

The invasive fruit spotting bug (fsb) has devastating effects on agriculture and crop yield. Underdeveloped countries built on farming economies are at a higher risk of disturbance by this insect. Using organic chemical techniques and knowledge of this insects behaviors, osamine epoxide was formed, a pheromone specific to the fruit spotting bug. We intend for this product to be used to control the fsb to litigate economic and agricultural depression brought on by this creature's invasion.

Eastern Mennonite University weight room safety

Grace Fravel with Virginia Zelaya

Faculty Mentor: Joohyun Lee

Physical fitness provides many benefits to college students' mental and physical health. It's important for colleges to provide students with a safe weight room. Key factors that affect the perception of safety in EMU's weight room are potential injury risks, up-keep sanitation standards, and providing appropriate temperatures regarding air quality. Students are paying to attend college and having a high-quality weight room that is safe can be attractive to students. It can also be a reason they choose to stay at the university. The level of cleanliness needs to be examined and satisfy students' expectations. High temperatures in the weight room can be dangerous for students if not maintained. Providing safe equipment may also factor into the

perceived satisfaction of students. The purpose of this study is to determine if the EMU weight room is perceived as safe by the students at the university. The research method consisted of convenience sampling among EMU students by a questionnaire. The questionnaire consisted of measures of safety based on Likert and nominal scale questions. The link was available through the campus group chat and by a QR code posted around the campus. The sample size consists of 54 respondents used for statistical analysis. The results suggest that roughly 40% of the students consider the safety of the weight room equipment most concerning and, about 22% of the students felt that room temperature was most concerning in the weight room. If these variables are taken into consideration and better monitored, students may perceive the EMU weight room to be safer. The implementation of safer equipment and room temperature can be beneficial for EMU students' perception of the safety of the EMU weight room.

Why students prefer apple products

Ann Ghally with Juliana Ghally

Faculty Mentor: Joo Hyun Lee

The Apple brand has become one of the most popular and recognizable brands globally, and millions of students are among its loyal customers. One of the primary reasons why students prefer Apple products is the user experience. Apple products are designed to be user-friendly, making them ideal for students new to technology. Apple products are also aesthetically pleasing and have various features that make them attractive to students. Apple's products are compatible with other applications, allowing students to share files and collaborate with peers. Moreover, Apple products are often compatible with other Apple products, allowing students to sync data between their iPhones, iPad, and MacBook. The methodology used to conduct this research study was an exploratory approach using a questionnaire. The sample frame for this research consisted of students enrolled at Eastern Mennonite University. The results of the study showed that students prefer Apple products for a variety of reasons.

Copper Reducing Crops

Maggie Groetsch with Dulce Shenk Zeager, Roumany Sefin

Faculty Mentor: Matthew Sidderhurst

In our experiment we measured how well four different crops reduced the levels of copper in soil. The crops examined were golden bantam sweet corn, silver queen sweet corn, summer squash, and sunflower. The application of this research can be used to determine which crops are best at reducing copper in agricultural land and which crops may absorb the most of this heavy metal from growing in contaminated soil.

Does the Concentration of Copper and EDTA in soil makes a difference on the Growth of Radishes?

Graci Hall with Amber Bonds, Amaya Hinds

Faculty Mentor: Matthew Siderhurst

Our research is surrounded around how the the concentration of EDTA and copper makes a difference between the growth of radishes. We are trying to find out if copper or EDTA make a

difference on the growth. Along with what radishes grow more and how they respond to the chemicals in the soil.

Does colored background or colored text enhance memory more effectively?

Casey Hartman

Faculty Mentor: Allison Wilck

This study aims to provide insight into how color affects our ability to recall information. We use color every day for attention grabbing tactics in advertising, instructions, and even within our own designing choices. In educational settings, we have established that there are a variety of different learning styles, but we have not broken down the visual learning process into what effectively helps us learn. By integrating color into lectures, testing, and general atmosphere we could potentially reframe the standards of teaching to increase memory. What is important is to determine what type of color exposure gains the most effective recall results.

18 MONTH OLD SHAPE SORTER TOY

Nutifafa Havi

Faculty Mentor: Audrey Myers

This is a toy project for 18 month olds. It is a color and shape puzzle from cardboard. I stapled two cardboards together, drew out shapes on one of the cardboard, cut them out and colored them.

An 18 month old usually understands more than they're able to put in words. They are walking, using basic words, getting familiar with shapes and colors. At this age, the love to explore. They begin using cups, spoons, and picking up things. The skill my project addresses is strengthening and using their muscles, especially their hands.

They are able to differentiate between shapes and colors, as well as being familiar with a shape sorter. This is one of the ways to encourage cognitive development. As a result, by 18 months, they are usually familiar with common forms like squares, circles, and triangles. They can associate objects with shapes, such as a slice of cheese being a square.

Colors and shapes are fundamental building blocks for higher-level logic skills such as "similar" and "different." Learning to count, identifying letters and numbers, and improving analytical skills are all important skills to have. Children learn to distinguish colors and organize visual information based on the shape of an object.

This activity will be placed on a table that matches the height of the child, or on the floor, allowing them to sit or stand if on a table. It will help with balancing, strength, and muscle endurance as they move. This activity can also involve parents, siblings, or friends at daycare, developing their social skills and interactions with others. It will also help the child learn new vocabularies, problem solving skills, learning to understand new concepts such as fitting the right shape into the right space and being able to differentiate colors.

Toddler Slide

Kylie Heatwole

Faculty Mentor: Audrey Myers

For this project I had to design a toy for a 24 month old. In order to accomplish this I had to look at the developmental level of a two year old. At this age, toddlers should be at a stage where they can build a tower of 4 blocks, scribble on paper, throw a ball, run, push/pull toys, throw tantrums, imitate others, manage stairs, and speak in phrases.

Using the idea that by the age of 2, your toddler is walking, climbing, jumping, running, and bursting with energy I created this climbing ramp and slide to engage their gross motor skills. I designed a ramp with a step-like ladder that helps the 24 month old strengthen their gross motor skills by climbing to the top and then pulling themselves down.

In order to also engage with the child's fine motor skills, There is an addition at the base of the slide that can be manipulated by the toddler on the ground. There are loops around a string that can be slid back and forth, helping the child focus on their hand coordination and precision.

This toy also stimulate a child's social development because at the age of 2, toddlers begin to start engaging in play with other children. The slide portion of this toy only allows for one user at a time, providing a good social learning interaction, teaching the child about the importance of taking turns and thinking about other people.

This toy also enhances the toddler's cognitive development and skills. The rainbow on the ramp can be used to strengthen the learning of colors. On the side here around the rings there are velcro shapes. These shapes are also color coordinated which allows for the child to not only practice matching colors but also different shapes.

Characterizing Drug Resistance in E. aerogenes Bacterial Strain

Luz Hernandez Rosario with Cindi Boyer

Faculty Mentor: Jeffrey Copeland

Drug-resistant bacteria is a growing concern, investigating the ability of a bacteria's resistance is especially important in the medical field in order to determine an accurate and successful medical treatment. To understand the physical consequences that occur within a drug-resistant bacteria, we used a tetracycline resistant strain of E.aerogenes. We analyzed the strength and whether our bacterial strain was tetracycline resistant. Data gathered from this research includes minimum antibiotic concentration needed to inhibit bacteria, the growth curve to determine number of cells, and the length of resistance which shows when and for how long bacteria is resistant.

Cardiovascular Response in Frogs to Exposure to Nicotine in Vape Pen

Belen Hernandez Rosario with Adesola Johnson, Eli Longacre

Faculty Mentor: Kristopher Schmidt

The use of vapes is a major growing concern because it can lead users to a dramatic increased risk in developing health issues, specifically in the heart. Purpose of study is to observe how the cardiovascular system responds to the nicotine contained in a vape pen. We observed the response of the heart and muscles when exposed daily to these chemicals. In our experiment we

used frogs to model a control and an experimental group, due to the similarities between frog and human hearts, to observe responses between exposures to nicotine. Data collected included heart rate & heart rhythm with the use of an electrocardiogram, and muscle contraction rate & strength with the use of an electromyograph. We compared blood vessel differences between both groups and the meaning of the changes in size.

The relationship between dream qualities and personality

Veronica Horst with Aliyyah Haggard, Anahi Ramirez

Faculty Mentor: Allison Wilck

The purpose of this study is to investigate connections between factors of one's personality and their experiences of dreaming by examining their dream recall and vividness, personality traits, and attitudes towards dreams. The Mannheim Dream Questionnaire, the Big Five Personality Questionnaire (BFI-10), and the MADRE questionnaire are all included in a questionnaire that was used to gather data on dream-related characteristics. The findings demonstrated a correlation between personality traits of thin boundary structures and both a higher frequency of dream recall and a belief that dreams had personal importance. Existing research looks into the possibility of dreams correlating with personality using various forms of personality measurement. The aim of this study is to provide further research on dream psychology and theories of dreaming.

The Z_q forcing number for some graph families

Caleb Hostetler with Jorge Blanco (Yale), Stephanie Einstein (Mount Holyoke), Daniel Ogbe (Massachusetts Institute of Technology)

Faculty Mentor: Juergen Krietschgau (Carnegie Mellon University)

The Z_q forcing game was created as a combinatorial bound on the maximum nullity of a family of matrices that respect the structure of a given graph with specific inertia restrictions. This summer research project conducted at Carnegie Mellon University as part of the SUAMI institute focused on creating game-theoretic proofs for upper and lower bounds for specific families of graphs.

The Effect of Drug Inoculation on Gallus domesticus Embryonic Development: A Comparative Study

Dean Huber with Christos Dimitriou, Austin Black

Faculty Mentor: Kristopher Schmidt

The purpose of this experiment was to evaluate the impact of drug addition on Gallus domesticus embryonic development. Fertilized Gallus domesticus eggs were injected with either norepinephrine, acetylcholine, or alcohol 72 hours after fertilization. Embryonic development was monitored and compared to a control group, which had no inoculation. The study found that the injection of drugs under any concentration resulted in significant developmental changes, including cardiovascular differences and structural abnormalities. These findings serve as a basis for the investigation of how different drugs affect the ability of an embryo to form normally.

Impacts of Social Media on Consumer Behavior

Grace Hunsberger with Valentina Barahona

Faculty Mentor: Joohyun Lee

The purpose of this study is to investigate how consumer decision-making is influenced by social media and consumer consumption. The research objective is to determine the connection between social media usage and consumption behavior, as well as how it affects consumers' decision-making process. The research methodology involved surveying 55 college students from Eastern Mennonite University to collect data on their social media usage and its influence on their purchasing behavior. Our results showed that social media impacts and impulses people to buy what they might see through different social media platforms. The study aims to learn more about how social media affects consumer behavior. The information gained can be useful for marketers and business since it will help within the development of efficient marketing strategies. The findings will provide insights into the potential benefits and drawbacks of social media use for businesses and consumers.

Athlete Satisfaction Found Within Athletic Training Staff

Karson Jennings with Brendon Barrett

Faculty Mentor: Joohyun Lee

Athletic trainers are a huge part of student athletes day to day success and wellbeing. Because the athletic trainers are something me and Brendon both utilize, we decided to conduct a research study to get a better understanding of how other student athlete's feel about the overall care they receive. We have conducted this survey through a series of questions that pinpoint specific duties or details that are in the mainframe of how athletic trainers prioritize time and quality of work.

Our data has come from 51 respondents, mostly being on the varsity baseball team here at Eastern Mennonite University. These questions were asked through an online survey using Qualtrics.com. Previous studies showed many biases within specific sports teams and genders, so our information will more so cover the basis of one sport.

When it comes to major findings of this experiment, the most important one was how accessible athletes felt the trainers were based on students' schedules. With the athletic training staff being at EMU most of the day, accessibility was the biggest dissatisfaction factor found in this study. In conclusion, mostly everyone is at least "somewhat satisfied" with the athletic training staff. Some people utilize this resource more than others, which could result in a mixed review of scores. I believe that this study has opened my eyes to the fact that some people think very highly of this staff, while others do not find them useful at all.

Tree of Heaven Compound

Adesola Johnson with Desmone Logan, Ruth Abera, Belen Hernandez Rosario

Faculty Mentor: Matthew Siderhurst

The purpose of our research is to determine the composition of the Tree of heaven compound (ToH), and determine why it attracts the spotted lantern fly group. The spotted lanternfly is an invasive species that is now found in areas in Virginia. They are able to destroy fruit farms and feed on different agricultural produce. These fly species are primarily attracted to the Tree of heaven. Our research will focus largely on being able to produce and identify an enantiomer of the tree of heaven compound. This will be done through many synthesis processes making use of Aldol reactions.

Water Quality Impacts of a Developing Riparian Buffer at a local Cattle Farm

Clayton Kauffman

Faculty Mentor: Doug Graber Neufeld

In this project impacts of a new riparian buffer on the stream at Professor Peter Dula's farm over a year are measured. Results will be provided to Peter Dula in order to help him measure the effectiveness of his efforts. This buffer includes an electric fence that keeps cattle completely out of the stream, as well as saplings planted at the tail of the stream. Measurements in this project are taken at five different sites and include nutrient, sediment load, pH, conductivity, and bacteria measurements. They are taken to help determine water quality. After a year the water quality at this location is found to be improved minorly. Nitrate and Phosphate levels tended to lower slightly at each site with the exception of the West Linville site which is the river that the stream flows into. Notable decreases in fecal coliforms indicating the presence of E-coli is also found. Both of these are good signs since excess nutrients and fecal coliforms are bad for stream ecosystem health. Most of the measurements remained above impaired classification levels. Ultimately, this data is useful in determining the initial impaired state of this creek and shows slight improvements of water quality. However, more research will be needed to measure the full impacts of the riparian buffer as it matures.

Applying a quantitative genomics approach to understand the role of unc-53/Nav2 in innate immunity

Abby Kaufman

Faculty Mentor: Kristopher Schmidt

Innate immunity is an essential part of the immune system, responsible for the elimination of pathogens and the initiation of the adaptive immune response. While nonspecific to individual pathogens, the innate immune system is generally considered the first responder to a wide variety of infections and diseases such as cancer. Our study looked at the role of the gene unc-53 in *Caenorhabditis elegans* (*C. elegans*), a well-understood model organism, and its functional role in innate immunity. While it is hypothesized that unc-53 plays a role in the inflammatory response and the production of antimicrobial peptides, its function in immunity is still unknown. In order to determine the role of unc-53 in innate immunity, we used RNA-sequencing (RNA-seq) to compare the expression profiles of wild-type *C. elegans* and unc-53 mutants when exposed to either *E. coli* (their primary food source) or *P. aeruginosa* PA14, a human and nematode pathogen. RNA-seq was done using a third-party, and is now available as FASTQ files. Our current objective is to identify the differentially expressed genes between our treatment and control groups. FASTQ files were subjected to FASTQC analysis followed by their alignment to the *C.*

elegans reference genome using the Cuffdiff software. Cuffdiff calculates differential expression between samples using biological replicates to test the statistical significance of each observed change in expression. These files contain statistical outputs such as fold change, raw and multiple testing P values, and gene-related attributes such as common name, location in the genome, and gene ontology. These analyses will allow us to develop novel hypotheses about the role of unc-53 in innate immunity.

The Impact of Covid-19 on EMU's Carbon and Nitrogen Footprint

Catherine Kirby

Faculty Mentor: Jim Yoder

The concept of carbon and nitrogen footprints are an effective tool to see how organizations contribute to carbon and nitrogen emissions. EMU has been tracking Carbon and Nitrogen footprint since 2010 (carbon) and 2015 (nitrogen). The data that was collected before and after covid are compared to the time periods affected by covid. By utilizing the data from the fiscal year 2019-2020, 2020-2021, and 2021-2022, a significant change in carbon and nitrogen footprint has been observed due to the impacts of Covid-19.

2-D Mr. Potato Head Toy Project

Kara Kornhaus

Faculty Mentor: Audrey Myers

This is a toy project in which a toy that was appropriate for a three-year-old was created. The toy utilizes the fine and gross motor skills that a three-year-old should have and also uses their social and cognitive skills. This toy is a 2-D version of Mr. Potato's head. The idea is that the toddler can make the toy and play with it, as at this age they are generally able to use a pair of child scissors. Then, after cutting out the body, arms, legs, shoes, eyes, mouth, ears, hat, and other accessories, the three-year-old can assemble the toy.

The benefits of this toy are that it is machine washable and costs no money as the material can be made from old socks or other scraps of cloth. Overall, it is a cheap and easy toy for three-year-olds that also tests their developmental abilities.

Exploring the Relationship Between Exercise, Blood Pressure, and RAAS Deactivation: Implications for Increased Urine Output

Jill Lang with Amarea Witt, Kent Keane

Faculty Mentor: Kristopher Schmidt

Homeostasis is a crucial self-regulating mechanism that helps maintain a stable environment to promote the survival of human life. One vital example of homeostasis is maintaining constant blood pressure within the human body which is maintained by the kidneys. The kidneys work as a long-term control by means of the Renin-angiotensin-aldosterone system (RAAS). RAAS is typically activated due to a response to a decrease in blood pressure, which increases water and electrolyte reabsorption in the kidneys leading to decreased urine output and effectively increasing blood pressure. In this project, we aim to investigate how different levels of exercise

elevate blood pressure leading to the potential deactivation of RAAS, resulting in increased levels of urine output. To carry out this project, 12 participants will be placed into one of three groups: control, moderate exercise, or high exercise. Before beginning any exercise, baseline urine output, and blood pressure will be measured. Then all participants will drink 500ml of water, wait 10 minutes, and perform group-specific exercises. The control group will not perform any exercise. The moderate-exercise group will be asked to walk and the high-exercise group will be asked to jog along a 20ft wall for 2 minutes. After participants have completed their group-specific exercise, their urine output and blood pressure will be measured again. We expect that our control group, which has completed no exercise, would have low urine output. Our moderate exercise group would have a slightly increased amount of urine output compared to our control group. Lastly, our high-exercise group would have the highest urine output compared to all groups after completing their exercise. This project will provide an understanding of the physiological effects of exercise on urine output and illustrate the implications of RAAS regulating blood pressure.

Analyzing spearmint and peppermint volatiles using gas mass spectrometry and eNose technology

Meredith Lehman with Skylar Lacks, Anne Hoover, Will Bartel

Faculty Mentor: Matthew Siderhurst

This study aims to distinguish the volatile profiles of spearmint and peppermint teas through gas mass spectrometry and electronic nose (eNose) technology.

Cat tails and copper

Maria Longenecker with Ethan Neufeld

Faculty Mentor: Matthew Siderhurst

For this project we tested the affect of copper (Cu^{2+}) concentration on cattail growth. We harvested the cat tails from the EMU pond. The aim of the project is to explore ways that cat tails could be used for phytoremediation, when plants are used to filter out toxins in the environment. This technique, if studied more, has the potential to help with many contaminants in our environment.

Student Satisfaction Levels with the Royal's Den

Joshua Maloney with Max Poilo, Bryson Hunter

Faculty Mentor: Joohyun Lee

This study aimed to determine satisfaction levels with the Royal's Den. The questionnaire consisted of 5 aspects of satisfaction with the Den. They were food and beverage, service, facilities and atmosphere, prices. Additionally, questions about transfer meals, and the Den vs. the EMU cafeteria were included in the questionnaire. 54% of students were neither satisfied nor dissatisfied with the number of food options or somewhat dissatisfied, and another 39% of students were only somewhat satisfied. 42% of students were at least somewhat satisfied with the taste of den food with the rest being neither satisfied nor dissatisfied or somewhat dissatisfied. 51% of students were at least somewhat satisfied with the number of drink options

at the den, with the rest being neither satisfied nor dissatisfied or somewhat dissatisfied. The majority (51%) of students were unsatisfied with the number of nutritious food options at the Den. The majority of students (58%) said their Den food wasn't always cooked entirely through. Respondents were overall fairly satisfied with the staff's friendliness and speed of service. Students were satisfied with the cleanliness of the Den, but the majority (64%) believe improvements should probably be made to the Den facility. 69% of students do not utilize the TVs and video game consoles in the Den, but those who do don't not use them frequently. 51% of respondents believe that students are not given a sufficient amount of transfer meals and most believe that students with a meal plan should be given an unlimited amount. The majority of students did believe, however, that the amount of Den dollars students receive is sufficient. 48% of students think the Den prices are fine and 39% think they are too high. 54% of the students said they only eat at the cafeteria 1-2 times a week. Finally, 24% of the students prefer the Den to the cafeteria, 30% prefer the cafeteria to the Den, and 36% do not prefer one to the other.

Uncovering the Effect of Type and Tempo of Music on Physiology of Cardiac Activity

Dhruv Mandal with Amaya Hinds

Faculty Mentor: Kristopher Schmidt

The aim of this project is to better understand the relationship between music and cardiac activity. Music possesses a certain ubiquity in current society: most often, individuals commonly utilize different types of music for aesthetic, entertainment, and culturally-affirming purposes. A more contemporary use of music, which has evolved with increased artist variety and accessibility to music sharing, has been as a physiological tool: i.e. many individuals listen to calming music to counter anxiety, while others listen to louder music to get excited, both of which are related to cardiac function. Is this a purely cultural practice or is there genuine scientific merit behind this? This study aims to elucidate if there is a significant effect of type of music on physiological pathways within the body related to cardiac activity. To carry out this project, individuals randomly sourced from the EMU campus will be subjected to equal-length recordings of contemporary music from the following genre-delineated categories: Rap/Hip Hop, R&B, Pop/Modern Rock, and Christian/Soul. Following each listen, the participant will receive two diagnostics tests. The first test is a blood pressure reading, as there is research that loud, emphatic music can cause short-term spikes in blood pressure. The second test is an ECG, as some studies have shown that more stressful noises can produce ST-segment depressions on ECG traces, or momentary inefficiencies in blood-pumping. We expect to observe less emphatic emotional responses as a result of more acceptably-soothing genres of music like Pop and R&B, and we expect tempo to be positively correlated with intensity emotional response and cardiac activity.

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Gen Z on Religion

Liana Martynyuk

Faculty Mentor: Joohyun Lee

Christianity has been deeply embedded into the families of Americans in previous centuries. In the past, all the events of the year centered around the church. With the absence of technology and the inability to be connected, many communities revolved around the church. We see now that it is rare for the community of an individual to revolve around the church. Adults have constant access to any resources, media, speakers etc. No doubt the life of an average young adult in this decade has greatly changed in comparison to our ancestors. Now, adults are leaving the church and claiming to be disaffiliated at record speeds. We want to discover if Gen Z is leaving the church and if so why is that, for what reason? We want to survey specifically the group of Gen Z that was raised in a christian household. Along with that we want to ask Gen Z's who stayed in the church why they choose to do so.

The student satisfaction rates of the EMU weight room

Logan Mason with Elizabeth Rhodes, Hunter Sturgeon

Faculty Mentor: Joohyun Lee

The purpose of this study is to look at the satisfaction rates of Eastern Mennonite University students, in regard to the weight room and fitness center. Many students feel that the weight room is not what it should be, considering the amount of tuition students pay to the school. Most EMU students are student-athletes, so Ralph said “We have some sports that are really strained for contact and collisions like lacrosse or hockey, and then you’ve got other sports like swimming or cross country, which are going to have a very different experience in the weight room” (Bates, 2020). EMU should have equipment that accommodates the different needs of all the different sports.

Our research objective is to determine the overall student satisfaction rates of the EMU weight room based on different aspects of the weight room. These aspects include the cleanliness of the weight room, the hours of operation of the weight room, the privacy of the weight room, the equipment provided to students, and how quickly broken equipment gets fixed or replaced in the weight room. We conducted this study by asking a series of questions on a survey that we made using Qualtrics. We distributed the survey via email to the students and it was based on a scale of 1 - 5.

51 respondents took the survey. Of the 51 respondents 36 were male, 13 were female, and 2 prefer not to say, where 88% of them were athletes. The results showed that the respondents

were most satisfied with the cleanliness of the weight room and equipment, the service of the workers in the weight room, and the comfortability of the weight room. The respondents were most dissatisfied with the equipment, the timeframe of broken equipment getting replaced, and the space and size of the weight room. The respondents were pretty neutral on the hours of operation of the weight room.

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The Effect of Feed Forward Mechanism on Cardiac Output in Runners Versus Non-runners.

Stephanie McCarthy with Aaron Moyer

Faculty Mentor: Kristopher Schmidt

During exercise, the heart beats faster and harder to meet the demands of the tissues. When the heart is frequently required to work hard, like going for a run, the heart will adapt in order to enhance its ability to circulate blood and decrease the workload. The project will investigate the hypothesis that a feed-forward mechanism, a response to an anticipatory cue prior to a change in the internal environment, prepares the heart and body for exercise by increasing cardiac output. Additionally, it will analyze if the intensity of this mechanism is different between endurance athletes and non-runners. The EMU student participants in the two groups, runners and non-runners, will have their heart rate and blood pressure taken at rest. The participants will then be told that they are going to be running a mile and need to come back for repeat measurements in 15 minutes before they run. The heart rate and blood pressure measurements will be used to get an estimated cardiac output using the equation: $\text{cardiac output} = (\text{pulse pressure} / (\text{systolic blood pressure} + \text{diastolic blood pressure})) * \text{heart rate}$ (Koenig et al. 2015). We expect to find that the cardiac output of non-runners will increase more than the cardiac output of runners when anticipating exercise. By researching feed-forward mechanisms, there can be a better understanding of how cardiac function changes as a result of long-term exercise.

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Growth Capacity of Sunflowers in Copper Contaminated Soil

Sierra McVey with Daniella Reyes

Faculty Mentor: Matthew Siderhurst

Copper concentration in sunflower seed growth will be the main focus in our poster. We measured out different concentrations of copper to put into different pots of soil and planted sunflower seeds. The growth rate and changes in the sunflowers will be observed over time in each pot. The purpose of this experiment is to address the issue of copper contaminated soil to test to see how long and much a plant can survive and grow in copper contaminated soil. Phytoremediation has been an ecofriendly method of accumulating toxic metals and has

been contaminating soil. Conducting this experiment will allow others to see how much a plant can or cannot thrive in copper contaminated soil. We are going to do three trials of three different concentrations of copper including a control. The averages of these will be determined and compared to see which plant has grown the most and looks the healthiest. Six to ten seeds were planted in each pot to get a variety of growth. The amount of copper was calculated specifically for each pot to get the same ratio of copper for each concentration. The growth capacity of sunflowers with different concentrations of copper contaminated soil will be the focus of our poster to help gather a better understanding of how plants survive in copper contaminated soil due to phytoremediation.

My First Guitar

Ashley Mellinger

Faculty Mentor: Audrey Myers

In my Nursing Care of Children class, we were asked to make a toy for a child based on our assigned ages. I was assigned to make a toy for a six-year-old. The toy had to be made of household materials, should not take more than five hours to build, and we should not have spent money on the project. My toy took me about 10 minutes to complete, minus the time it took to allow the paint to dry. I used materials from my apartment, including rubber bands and an empty tissue box, and borrowed paint and paintbrushes from CAC.

The toy had to touch on four different skills: fine and gross motor skills, social skills, and cognitive skills. The homemade guitar can help a child exercise their gross motor skills because all of these items are typically found within the home of a six-year-old or a kindergarten/first-grade classroom, where a six-year-old spends most of their day Monday through Friday. The child can also exercise their fine motor skills with this toy because they have to play the guitar themselves to get the desired sounds and because the tissue box can be painted, either with fingers or with paintbrushes. This toy then can be a great thing to present in show and tell or a group of kids can make a little band together. This toy guitar also helps with cognitive skills as the child figures out which type of rubber band makes the desired sound.

The Effects of Social Media on EMU Student Purchasing Patterns

Mariah Miller with Lizzy Kirkton, Manuela Marín

Faculty Mentor: Joohyun Lee

.The purpose of this research is to investigate the impact that social media have on the online purchasing behavior of Eastern Mennonite University (EMU) students. The study will implement different methods to identify the most used social media by EMU students for online purchasing. The research also determines factors that drive students to engage in online shopping through social media, and evaluate the potential effect of demographics on the behavior of consumers. Research performed and described in a journal by Wallace et al. (2011) investigated the influence of word-of-mouth and social network advertisements on the purchasing behavior of college students. The results of the study found that both forms had a significant effect on online purchasing behaviors and that personal recommendations had the most significant impact. Another study performed and published by Forbes and Vespoli (2013) investigated social media

recommendations and online purchasing behavior. Specifically, our findings reveal that Instagram has a significant impact on the online purchasing behavior of students and that they are more influenced by something going viral or word of mouth when making online purchases. Our study provides insights for marketers or educators on how to effectively engage with EMU students through social media to promote online purchases.

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Characterization of multi- drug resistance of E.aerogene.

Elaine Miranda Perez with Helen Melenciano
Faculty Mentor: Jeffrey Copeland

Drug resistance by pathogenic microbes is a phenomenon of growing concern in various industries. "human behavior, such as patient non-adherence to treatment, and physician over-prescription of antibiotics have served to foster drug resistance". (Boslaugh, 2017). Understanding the nature of multiple drug resistance is a fundamental part of counteracting its effects and trying to find a solution. With the realization of this project we intend to use the tetracycline-resistant strain of the bacterium E. aerogenes to model resistance to drugs and determine the minimum inhibitory concentrations in the presence of different antibiotics. The effect of the gene that grants resistance was studied in the reproduction of the bacterium through the analysis of the growth curve, as well as the length of the resistance through different generations.

TOY PROJECT: 1 YEAR OLD WALKER WITH BOARD GAME

Aween Mohammed

Faculty Mentor: Audrey Myers

A walker designed using wood and paint found around the student's house for a toy project in the nursing care of children course. The idea of the project is to create a toy appropriate for a 1-year-old child to play with that would help them and challenge them to grow developmentally. The four different aspects that I had to apply to the toy were areas of development for a 1-year-old which include gross motor skills, fine motor skills, social development, and cognitive development, as well as safety considerations. Children at one can take their first independent steps with or without support, which is considered a gross motor skill which is what the walker is for. Speak a few words and imitate sounds, which is considered a fine motor skill. The board part with the objects and colors is made to meet those needs. They prefer some toys over others and some people over others, which is considered social development. The walker and board can be used to meet those social development needs. Their cognitive development includes Exploring

objects in many different ways, like shaking, banging, throwing, and dropping. The beads are made to meet that requirement. The safety considerations for a 1-year-old are falls, the walker has four wheels for balance, and it is low, so the child does not get injured when falling while they use the walker.

College major choice and its influences

Levi Myers

Faculty Mentor: Joohyun Lee

Picking a college major to pursue is one of the most important decisions those seeking higher education make. The decision may seem straightforward for many students, but their choices are influenced by various factors. Examples of these factors include parental guidance, environmental effects, and internal beliefs and values. Previous research has identified the significance of future revenue streams and environmental exposure to careers and the work done in said career fields. The environmental exposure was specifically shown in the case of STEM majors, but it can be inferred that this would stand true for other fields. This study uses data collected from 67 students from Eastern Mennonite University via a convenience sample. The surveys asked questions related to the effect that parents, environment, and beliefs and values had on the students' choice of major to pursue. The study found that environment and education had the greatest influence on choice of major, while parents had the least influence. Other significant findings were how different a student's experience was based upon the major they wished to pursue and their gender.

Toy Project For 18-month-old: Sorting Buckets

Brooke Myers

Faculty Mentor: Audrey Myers

I was given to task to create a toy for an 18-month-old that fit their developmental task and skills for their given age. With a focus on fine and gross motor skills, safety, cognitive development, and social development of an 18-month-old, I created a toy to enhance each of these skills. At 18 months, a child begins to grasp the idea of colors and shapes. My toy allows children at 18 months to begin enhancing this skill by using their ability to differentiate between colors and shapes to begin sorting them. I included the three primary colors, red, yellow, and blue, to prevent confusion in sorting between colors like blue and purple. For shapes, I included a circle, square, and triangle, to prevent confusion between sorting a square and a rectangle. All of my pieces are able to be manipulated by a child at 18 months and create an environment in which they are able to socially interact with a parent or guardian while sorting.

Organized Sports and Mental Health

Arianna Nixon with Kendra Oguamena, Katherine Gutierrez

Faculty Mentor: Allison Wilck

Mental health can have a large impact on students athletes. A significant part of our life is our mental wellbeing. Some people have different views on the possible effects mental health can

have, especially on students. Everything relies on how sports are perceived. Some people might think sports are just a waste of time, or a activity where we could get injured. But being part of a organized sport team can bring individuals together who they most probably have never met before. Some individuals may grow closer to each other and become like family. This is because when you're with your teammates and engaged in an enjoyable activity, you feel at peace. Being part of a organized sport can have significant impacts on our mental health.

Copper Phytoremediation in Radish Plants as Affected by pH

Jenna Oostland with Kate Stutzman

Faculty Mentor: Matthew Siderhurst

Phytoremediation is the process in which plants remove toxins from soil. In an effort to test this process, we added copper into the soil of radish plants and are monitoring their growth. Further, to test the effects of pH on the matter, we used gardening supplements to change the pH of the soil. We are testing three pH levels, one basic, one acidic, and one neutral. We are currently still monitoring the growth of each radish plant, but after sufficient growth, we will measure copper concentration in the soil using either BCA or atomic absorbance spectroscopy.

Binoculars

Claiborne Poston

Faculty Mentor: Audrey Myers

This is a toy for the age group of 3 years old. This toy was made for a project in pediatric nursing. This toy is ideal of a child of the age of three because this age group participates primarily in imaginative play! These binoculars give the children an avenue to imagine anything through the lens of their toy!

Does background music influence scores on a reading comprehension task?

Rayn Robinson with Amanda Gilbert, Skylar Coffey

Faculty Mentor: Allison Wilck

Background music is commonly played in multiple work environments where people are required to complete tasks, therefore, creating divided attention. There are discrepancies found within the literature on whether or not background music (BGM) increases or decreases performance on cognitive tasks. Attention, arousal and mood hypothesis, cognitive capacity hypothesis, and reading comprehension play a role in whether or not BGM is beneficial while performing reading comprehension tasks. Psychology undergraduate students at Eastern Mennonite University were assigned to listen to a song with lyrics, without lyrics, or a silence condition while they read a passage and then answered questions related to the passage. This study was conducted to test whether music would place too much stress on someone's cognitive load using the framework of the cognitive capacity hypothesis or if music would help people reach optimal arousal in light of the arousal and mood hypothesis. The findings of this study are important to contribute more research on the implications of background music due to its

prevalence of it. These findings will hopefully help influence an individual's decision on whether or not BGM will be beneficial in their lives while performing cognitively demanding tasks.

Characterization of Antibiotic-Resistant Bacteria and the Effects on Vulnerable Patient Populations

Amy Roy with Abby Kaufman

Faculty Mentor: Jeffrey Copeland

Antibiotic resistance is steadily rising globally, inhibiting our ability to treat common infections previously resolvable. It has become imperative for healthcare practitioners and infection control entities to regulate appropriate antibiotic use to avoid resistance in vulnerable patient populations. This study used tetracycline-resistant and tetracycline-sensitive strains of *Enterobacter aerogenes* (*E. aerogenes*) to model drug resistance and to determine the physical trade-offs of such drug resistance. To evaluate the characteristics of this bacteria, several tests were run, including but not limited to a minimum inhibitory concentration test (MIC), a growth curve, and length of resistance. This testing found that the drug-resistant bacteria had a higher minimum inhibitory concentration and a slower growth curve than the drug-sensitive bacteria.

Frightful, Delightful, and Insightful; A physiological and cognitive response to imagery

Amy Roy with Hunter McWilliams

Faculty Mentor: Kristopher Schmidt

In this project, we will examine how a sympathetic nervous response to a negative emotion-evoking stimulus affects cognitive control and working memory. Past projects have shown that increased sympathetic activity decreases working memory and cognitive control. For this project, we will use human participants, specifically students at EMU.

Prior to coming to the lab, participants will first take a survey to determine their baseline level of arousal prior to arrival (such as previous traumatic events/exposure). Upon arrival at the lab, a baseline assessment will be taken of their heart rate, respiratory rate, and blood pressure. A series of pictures, either negative emotion-evoking, positive emotion-evoking, or neutral emotion-evoking, will be displayed. The participants will then complete the operation span task. While the images are being viewed and the task performed, recordings of the participant's brain waves in all four lobes of the brain with an EEG machine will be observed while simultaneously recording heart rate, blood pressure, and respiration rate.

We expect that those who are shown negative emotion-evoking pictures will increase sympathetic activity (an increase in heart rate, respiration rate, and blood pressure), affecting a change in brain waves and a lower operation span task score. This means that they have decreased working memory and lower cognitive control due to the heightened sympathetic response.

This project will provide a better understanding of how physiological effects, specifically sympathetic response, impact our working memory and cognitive control. It will also show if negative emotion-evoking pictures can elicit a sympathetic response large enough to affect cognition.

18 month old: Toy project

Ruth Seyoum

Faculty Mentor: Audrey Myers

Abstract: 18 month old toy project

Purpose: The purpose of this toy project is to create a simple toy that is suitable for an 18 month toddler using easily accessible tools, such as cardboard, colored markers, and balls. The toy puts into consideration the developmental stage of the toddler as well as the safety concerns that are present while playing this game. According to Erikson, toddlers in this age are in the autonomy vs shame/doubt stage, and according to Piaget toddlers in this stage are in the sensorimotor stage where they develop their sensory and motor skills. They learn through their senses and actions and develop an understanding of cause-and-effect relationships.

Methods: I used cardboard, wooden blocks, balls, and markers to craft this toy. I cut up multiple circles and block shaped holes into the cardboard and outlined the outside with various colors. The toddler plays with this toy by picking up the right object and placing it into the respective cut up shape as well as matching the color of the balls/blocks to that of the outlined cardboard color. Toddlers at this age have gross motor skills that include sitting, standing, and walking so they are able to easily play with this toy by choosing to use any of their large muscles to either sit or stand. This toy involves the toddler picking up objects to place into the cardboard box which uses their fine motor skills.

Significance: It is important for children to have access to several toys as they grow up so as to develop their gross and fine motor skills, social skills, as well as cognitive development. That said, it has been proven that raising a child is very expensive in and of itself so if parents are introduced to creative toy projects, such as this, they are able to meet the needs of their toddler while still maintaining their finances.

Childhood Maltreatment and Social Functioning in Young Adults

Kylie Smith

Faculty Mentor: Allison Wilck

In previous research, it has been found that childhood maltreatment (physical, sexual, or emotional abuse or neglect before the age of 18) is correlated internationally with higher likelihood of discomfort with physical touch or close interpersonal distance. The purpose of this study is to connect previous research on childhood maltreatment to a new measure of social functioning (measured in social alienation/isolation, defectiveness/shame, emotional deprivation, and abandonment/instability). The study will be using an internationally established questionnaire called the ACE-IQ, or adverse childhood experiences- international questionnaire. This is used to objectively study childhood adverse experiences. This study will be using the questionnaire as a scale to measure 100 participants' experiences of childhood adversity or traumatic experiences. After this, correlation will be used against a new questionnaire written by the research team to measure the levels of social functioning based on surveys for interpersonal schemas. The hypothesis is that childhood adverse experiences will be inversely correlated with social functioning skills. This is important to the field of psychology and the treatment of trauma,

because it can affect a person's ability to connect socially with family and friends to get support in times of need.

Lysochrome staining of abnormal droplets in *Caenorhabditis elegans* exposed to *Elizabethkingia anophelis*

Isaac Spicher with Helen Melenciano

Faculty Mentor: Kristopher Schmidt

Abnormal droplets have been observed in the bodies of *Caenorhabditis elegans* after exposure to the emergent pathogen *Elizabethkingia anophelis*. Understanding the macromolecule composition of these droplets is an important first step in determining the physiological processes involved in their formation. A high concentration of lipids in the droplets might suggest that *E. anophelis* pathogenesis causes changes in lipid dynamics in *C. elegans*. This project seeks to determine whether high concentrations of lipids are present in these droplets through use of substrate-specific color staining. A lysochrome diazo dye, Oil Red O, will be used to stain pathogen-exposed and non-exposed *C. elegans*. Comparative qualitative and quantitative analysis of visual results will be carried out to assess any significant differences in red-stained regions between the groups.

Differential gene expression in the pathogenic response of *Caenorhabditis elegans* to *Elizabethkingia anophelis*

Isaac Spicher with Emilio Fajardo, Hannah Giagnocavo, Wesam Albayati

Faculty Mentor: Kristopher Schmidt

The bacterial genus *Elizabethkingia* is associated with neonatal sepsis and life-threatening infections in immunocompromised individuals of all ages. While these infections were originally believed to be caused by the species *E. meningoseptica*, a 2014 genomic study by Jeanette Tao and colleagues suggests that another species of the same genus, *E. anophelis*, is found in the same hospital environments and could be causing similar infections. No model systems exist for the study of *E. anophelis* pathogenesis. This project examines how gene expression in the nematode *C. elegans* changes in response to *E. anophelis* exposure. Whole-genome RNA sequencing was carried out in worms exposed to *E. anophelis*, and a bioinformatics workflow is being conducted with the resultant gene expression data.

FASTQ files containing raw sequence data from the pathogen-exposed worms have been aligned to an existing *C. elegans* reference genome, Wbcel235, using the alignment software TopHat2. The aligned reads were run through Cuffdiff, a software which calculates the differential expression and statistical significance between two sets of quantitative gene expression data. The results from Cuffdiff include a list of the specific differentially expressed genes and their location within the genome. For each identified DEG, a 2kbp upstream sequence was extracted directly upstream of the gene. Current bioinformatics work on this project includes the isolation of known transcription factor binding sites from these 2kbp upstream sequences to identify potential drivers of the various changes in gene expression observed.

HOOPS ON A ROPE

Gefania Springer

Faculty Mentor: Audrey Myers

Hoops on a rope is a pediatrics toy for 9 month old children and above. This toy was created specifically for 9 month olds. At this stage in development, they can; crawl on their hands and knees, scoot, pull to stand, and cruise (taking steps holding on to a structure such as a chair), and visual sites are more focused. In terms of playing at this age, 9-month-olds can stack items, place objects into other objects, and move them from hand to hand. Hoops on a rope is a toy that allows 9 month olds to place different size balls through the different size hoops. This helps this age group to begin differentiating between size differences. Since the balls are assorted sizes, this improves motor skills. This toy is also safe for young children because it is made with soft material, short thick rope, which prevents tangling, wrapping, and strangulation. To play with this toy the 9 month olds can play individually, with a sibling, or parent. The toy can be placed in front of the child on a flat surface. Then give the child the three different size balls and allow them time to place in the corresponding hoop. The lights on the hoops flash when the correct ball has gone through the hoop. (lights are the small buttons on the hoops, but they do not work). To play with multiple people someone can hold the hoops and allow the child to drop the balls in the correct hoop. If I had the technology this toy would speak and have little phrases for when the balls are matched correctly to the hoop, and phrases for when they do not match the balls correctly.

Toddler puzzle

Reagan Stone

Faculty Mentor: Audrey Myers

The puzzle uses pattern block as well as printouts in order to create a puzzle for the child to put together. This uses fine motor skills of picking up the blocks and lining them up with the printout. This also starts the process of color matching in a 24 month old. As the child grows, parents can expand the puzzle by asking to name the colors, count the blocks, and name the shapes. This puzzle also starts expanding their creativeness.

Do Different Decisions Require Different Decision Making Strategies? And Its Effect On Life Quality

Fatimah Subhi

Faculty Mentor: Allison Wilck

Life satisfaction can be highly influenced by the decisions we make; whether it is choosing what to eat for breakfast or what school to attend, individuals spend a lot of time making decisions. On average people spend around 46% of their time thinking, and decision making is the majority of the time we spend thinking. It is important to understand how different strategies of decision-making impact the quality of life. Research has shown a variety of decision-making processes, and recent literature expands the understanding of this complex process. In the literature there is missing information regarding the effect of decision making on life quality and satisfaction. This gap in the literature influenced the purpose of the current research to measure the influence of decision on the quality of life.

What Attracts Fruit Flies to Beer Waste?

Ray Ray Taylor with Meredith Lehman, Bethel Abiy, Elaine Miranda Perez

Faculty Mentor: Matthew Siderhurst

The purpose of this project was to research and try to identify what components from beer waste, specifically solulys and torula waste, attracts fruit flies. This was accomplished by setting up volatile collections for solulys and torula yeast and running those collections in the GC Mass Spec to identify the components.

World hunger and robotics

Zavion Taylor with Nardos Melka

Faculty Mentor: Stefano Colafranceschi

The Botanical robot is a robot with the goal of ending world hunger. The robot is capable of independently digging holes, and planting seeds. As well as watering the seeds, and checking the soil moisture. World hunger doesn't exist because there's not enough food, it exists because there's a lack of access to food for various reasons. Which is why the end goal of the project is for the robots to plant fruits and vegetables everywhere. The research is centered around improving the process of growing fruits and vegetables with robotics. I will grow 1 batch of plants manually as a control group. Another batch will be planted and grown with a robot. The plants will be measured and data will be collected through a time period.

Toy project

Jack VonGunten

Faculty Mentor: Audrey Myers

I was assigned to design a toy that a three year old could play with in terms of development. I made a toy that with the developmental standards and motor skills of a three year old

Mind & Body: Physiological Responses to Unexpected and Expected Fear Stimuli

Julie Weaver with Abby Kaufman

Faculty Mentor: Kristopher Schmidt

Fear is a emotion that many people experience, and when experienced chronically can lead to the development of mental health disorders such as anxiety. Understanding the physiological response to fear helps us gain a greater understanding of the mind-body connection and how emotions can affect the physical body. In our study, human participants will be presented with an unexpected fear stimulus while being monitored for various physiological responses. Some of these monitoring systems include measuring heart rate variability, respiratory rate, and physical motor movement. We expect our fear stimulus to initiate a response, often called the fight or flight response, which can lead to a higher heart rate and blood pressure, more rapid breathing, and potentially tensed muscles. As a part of the experiment, we will also monitor how long it take to recover from the fear stimulus, and if the participant has a different response a second

time once they know the fear stimulus is coming. The findings of this study will help further the understanding of the fight-or-flight response and how the body responds to fear.

The Effect of Tea on the Heart of *Lithobates catesbeianus*

Kenneth Wesbey with Baelin Watson

Faculty Mentor: Kristopher Schmidt

We will be using a *Lithobates catesbeianus* frog to test the effect of caffeine on cardiac output. Tea companies often sell a marketed caffeine free version of their tea, much like coffee companies. However, there is normally just a vastly reduced amount of caffeine in the product. This experiment will test the affect and look for a noticeable difference in heart performance between types of tea including: caffeinated, decaffeinated, and sweet tea. We will use an EKG to measure heart electrical function and a stretch sensor to measure the heart stretch as functions of stimulation and Starling's Law, respectively. The studied factors will be heart rate, heart stretch, and electrical strength. We expect to see an increase in heart rate when using caffeine and sugar accompanied by a slight increase under decaffeinated procedure, which would suggest a slight caffeine content.

Serotonin transport in *Drosophila melanogaster*

Aden Weybright with Nati Seifu, Abigail Forrest

Faculty Mentor: Jeffrey Copeland

Serotonin is a neurotransmitter that is implicated in neurodevelopment, behavior and several other mechanisms with important medical implications. In order to get a better understanding of the mechanism of serotonin activity in the synapse, *Drosophila melanogaster* was used as a model organism, as they share an ortholog with humans for the serotonin transporter. CRISPR was used to create a deletion allele of the serotonin transporter gene (SerT), and PCR confirmed the removal of a 3.9 kb section in the sert(2.2) allele. Removal of the serotonin transporter caused an early developmental lethality, which was restored with the reintroduction of the SerT only in serotonin neurons. Further studies investigating the specific activity of serotonin in the synapses will enhance understanding of the serotonin mechanism in the synapse.

Bridging Communities

Luke Wheeler with Ethan Spicher

Mariana Acosta

Faculty Mentor: Esther Tian

From West Virginia to Bolivia, natural disasters effect many people each year. Through work with JZ Engineering, Mennonite Disaster Service, and Engineers in Action, EMU engineering students were able to help to span the disasters that impact these communities.

Reducing Cheating Behavior on Online Exams

Brynn Yoder with Ethan McGee

Faculty Mentor: Allison Wilck

The purpose of this study is to evaluate academic integrity when it comes to online examinations at Eastern Mennonite university. Through the literature review, it has been found that there are many reasons why students undergo cheating and that there has always been an issue with this. One can infer that with the Covid-19 pandemic and heavy use of online examinations, that students underwent cheating behaviors more than usual. Even with the pandemic technically ended, there are still many classes that still use these methods to conduct examinations, making it easier than ever before for students to cheat. Our rationale for the study is to see how common the cheating rates are among the student body at Eastern Mennonite University, and why do students continue to cheat.