

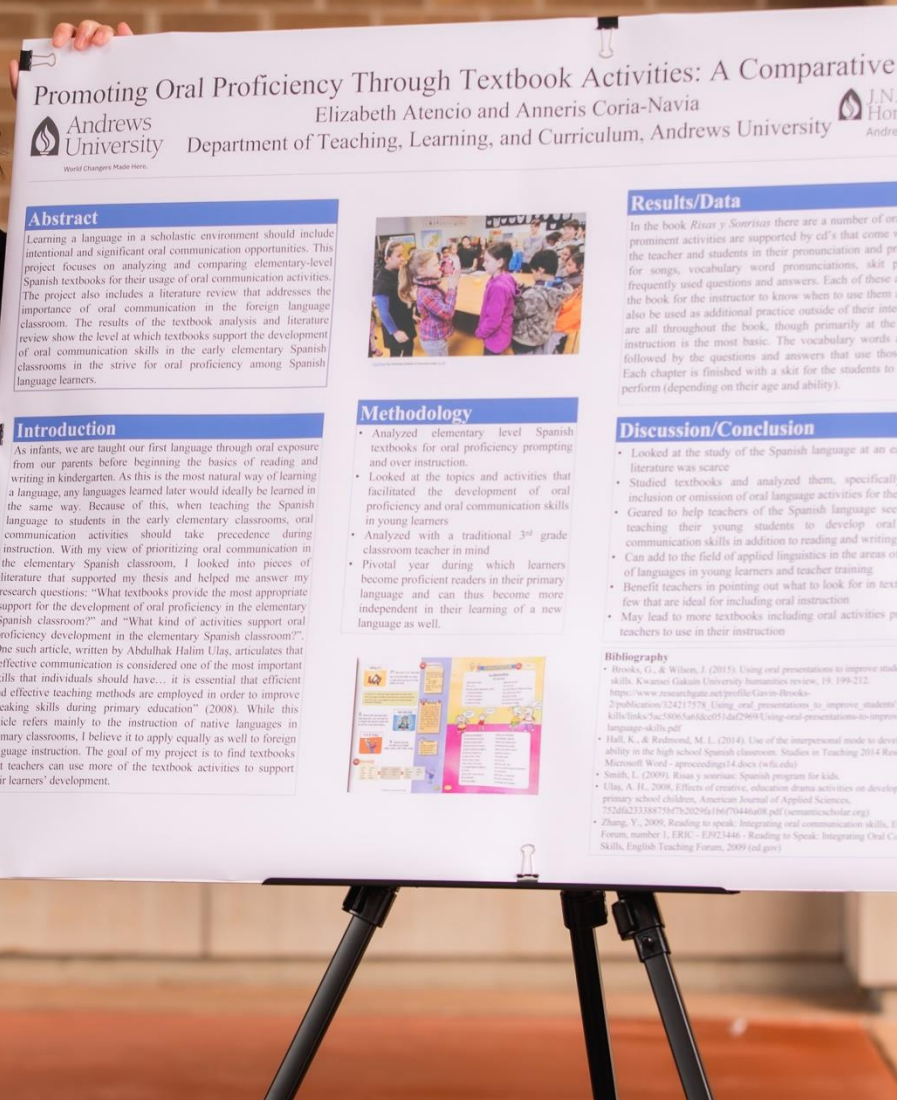
The background of the image is a dark, monochromatic photograph showing the silhouettes of a large group of people, likely graduates, celebrating. Many individuals are seen from the chest up, with their arms raised high, holding and throwing their black graduation caps into the air. The scene is filled with a sense of movement and joy, though the lighting is low, creating a dramatic and celebratory atmosphere. The text is overlaid on this background in a clean, white font.

Congratulations Honors Scholars & Graduates 2022



J.N. Andrews
Honors Program
Andrews University





- BSELED Elementary Education, Spanish for K-12 Education
- Minor: Mathematics Education
- Teaching in Thompsonville, Illinois as the 1st -5th grade teacher

- BSELED Elementary Education, Spanish for K-12 Education
- Minor: Mathematics Education
- Teaching in Thompsonville, Illinois as the 1st -5th grade teacher



Western Heritage
Banquet



Alec Bofetiado

- Medical Laboratory Science
- Will work for a few years as a Med Tech, then go to medical school

Andrews University
J.N. Andrews Honors Program

Alec Bofetiado, Melissa Poua, Desmond H. Murray, Department of Medical Laboratory Sciences

Attempted Synthesis & Antibacterial Properties of APT-6K Against NDM-1 *K. pneumoniae*

Abstract

NDM-1 *K. pneumoniae* is a highly resistant bacterial organism that is capable of causing debilitating nosocomial infections in immunocompromised patients. Only "last-resort" antibiotics—such as colistin—work against this organism. Therefore, new antibiotics are needed to help fight against these types of infections. APT-6K is a novel compound that was demonstrated to be effective against MDRSA with nanomolar concentrations in a prior study. Novel methods of APT-6K synthesis and its testing for antibiotic effects against NDM-1 *K. pneumoniae* were attempted in this research. However, APT-6K synthesis was unsuccessful. Commercially prepared APT-6K also did not demonstrate growth inhibition against NDM-1 *K. pneumoniae* nor against a wild-type *K. pneumoniae*. Suggestions for future research are discussed.

Methodology

Synthesis of APT-6K and Analogs: In order to synthesize APT-6K and analogs, the plan would be to first adamantylate the 3-N position of either 3-nitropyrazole or 3-aminopyrazole. If adamantylation of 3-nitropyrazole occurs, the nitro group would be reduced by using 10% palladium on carbon to create 1-(adamantan-1-yl)-3H-pyrazol-3-amine. Adamantylation of 3-aminopyrazole would yield 1-(adamantan-1-yl)-3H-pyrazol-3-amine. Therefore no reduction step would be required. From there, 1-(adamantan-1-yl)-3H-pyrazol-3-amine would be reacted with isothiocyanate derivatives to create the thioureas APT-6K and analogous compounds. The reduction and thiourea synthesis steps are the easiest parts of APT-6K and analog synthesis. However, the adamantylation step is less characterized in the literature. Therefore, this study focused on the adamantylation of 3-nitropyrazole or 3-aminopyrazole. An example of an experiment that was attempted was inspired by Huang et al. (2017) on Figure 1. Here, K_2CO_3 and DMSO work together to create a "super basic" medium that strips off the 3-H on the pyrazole ring, allowing electrons from the 3-N to nucleophilically attack the adamantyl cation once bromide is liberated from the adamantyl group.

MIC Assay for Wild-type and NDM-1 *K. pneumoniae*: Our methodology was inspired by Crawford et al. (2020)'s methodology.

Preparation: A stock solution of 50 μ M APT-6K in 2% DMSO was prepared and two-fold serial dilutions were made in each test well. A stock solution of 1000 μ M copper(II) sulfate pentahydrate in sterile deionized H_2O was created and then diluted to 800 μ M. From there, two-fold serial dilutions of the 800 μ M copper(II) sulfate pentahydrate solution were created. 10 μ L of each dilution were placed in each test row in order to create concentration corresponding to the figure below. *K. pneumoniae* was subsequently inoculated into Mueller-Hinton broth and diluted to a concentration of 5,555,555 CFU/mL. 180 μ L of *K. pneumoniae* broth were manually titrated into each well, concentrated to a concentration of 5×10^6 CFU/mL. In total, 200 μ L comprising of APT-6K solution, Cu^{2+} solution, and Mueller-Hinton broth were in each well. Growth and sterility control wells were also prepared. Each well plate was covered with parafilm to prevent evaporation of well solutions and incubated at 37°C for 18-24 hours. Triplicates were performed.

Data Collection: After incubation, parafilm was removed from the well plate and read on our Accurus™ SmartReader 96 (Model 1418600) microplate absorbance reader. Each well was read using 630 nm wavelength of light, allowing us to get OD_{630} measurements in each well plate. From previous calibration, our OD_{630} to CFU/mL conversion equation was $8.85 \times 10^6 (OD_{630}) + 3.84 \times 10^7$ with a linearity that ranged from 0.004 to 0.512. Therefore, any OD_{630} measurements that were above 0.512 were diluted by a fourth. After the diluted value was converted to CFU/mL, the product was multiplied by the dilution factor 4 to derive the approximate CFU/mL in each well.

Results

Attempted Synthesis of APT-6K and Analogs: Synthesis was unsuccessful. Therefore, APT-6K was purchased from a chemical supplier and used in MIC assays against wild-type and NDM-1 *K. pneumoniae*.

Effect of APT-6K and Cu^{2+} on Wild-type *K. pneumoniae*: Varying concentration combinations of APT-6K and Cu^{2+} did not seem to demonstrate any effect on the growth of wild-type *K. pneumoniae* in accordance to Figure 3. Each combination of APT-6K and Cu^{2+} seemed to keep the relative growth at around 100%, with the exception of an anomalous spike at 0.007 μ M APT-6K and 40 μ M Cu^{2+} demonstrating a relative growth of approximately 170%.

Effect of APT-6K and Cu^{2+} on NDM-1 *K. pneumoniae*: According to Figure 4, varying concentration combinations of APT-6K and Cu^{2+} also did not seem to demonstrate any effect on the growth of NDM-1 *K. pneumoniae*. Each combination of APT-6K and Cu^{2+} seemed to keep the relative growth at around 100%.

Figure 3: Wild-type *K. pneumoniae* vs. APT-6K

Figure 3 shows the effects of different concentration combinations of APT-6K and Cu^{2+} on the growth of wild-type *K. pneumoniae*. APT-6K concentrations (μ M) were plotted on the x-axis, while Cu^{2+} concentrations (μ M) were differentiated by a different color for Cu^{2+} concentrations, blue is 0, red is 0.5, yellow is 1, green is 2, orange is 40, and cyan is 80.

Figure 4: NDM-1 *K. pneumoniae*

Figure 4 shows the effects of different concentration combinations of APT-6K and Cu^{2+} on the growth of NDM-1 *K. pneumoniae*. APT-6K concentrations (μ M) were plotted on the x-axis, while Cu^{2+} concentrations (μ M) were differentiated by a different color for Cu^{2+} concentrations, blue is 0, red is 0.5, yellow is 1, green is 2, orange is 40, and cyan is 80.

Acknowledgments

I would like to thank Professor Melissa Pina for purchasing the APT-6K, and guiding me through the synthesis process. Dr. Karen Reiner for helping me with the MIC assays. Dr. Desmond H. Murray for being my second advisor. Department of Medical Laboratory Sciences at Andrews University for allowing me to use the Research & Creative Scholarship of Andrew Scholar Award scholarship for helping to fund my research.

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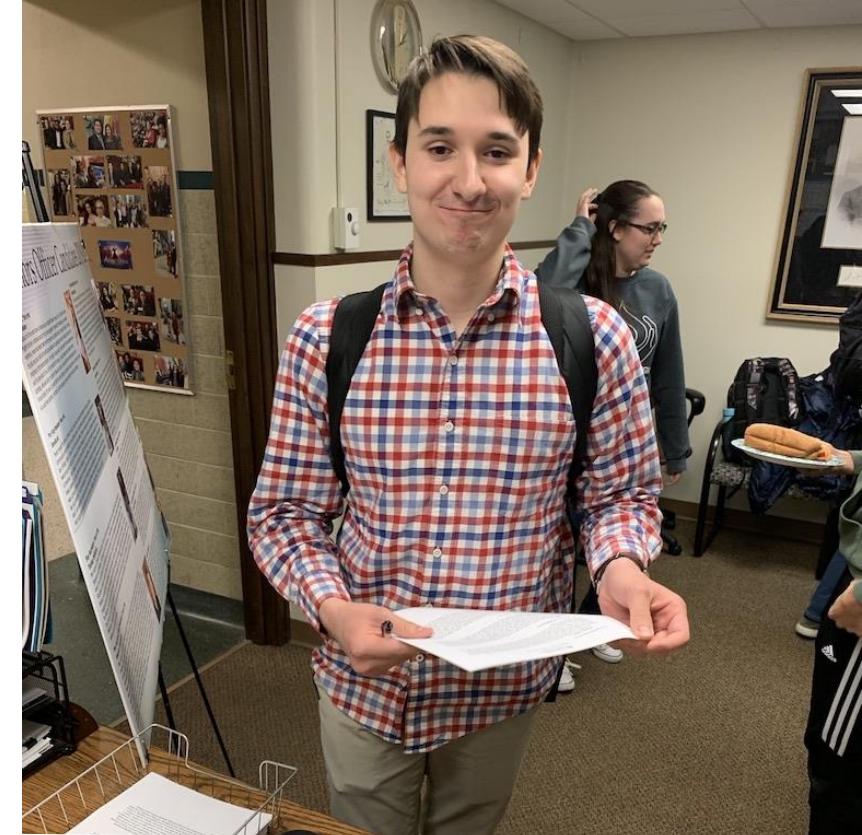
Huang, A., Wu, K., Lin, S., Y. C. Koelsch, N., C. Norman, N. J., & Zhang, S. L. (2017, Sep 13). Ring Crystallographic Analysis of N1-Substituted Pyrazoles. *ChemMedChem*, 12(17), 8864-8872. <https://doi.org/10.1002/cmdc.201700872>



Tyler Braithwaite

- Computer Science and Mathematics
- Taking a gap year before pursuing employment or graduate training



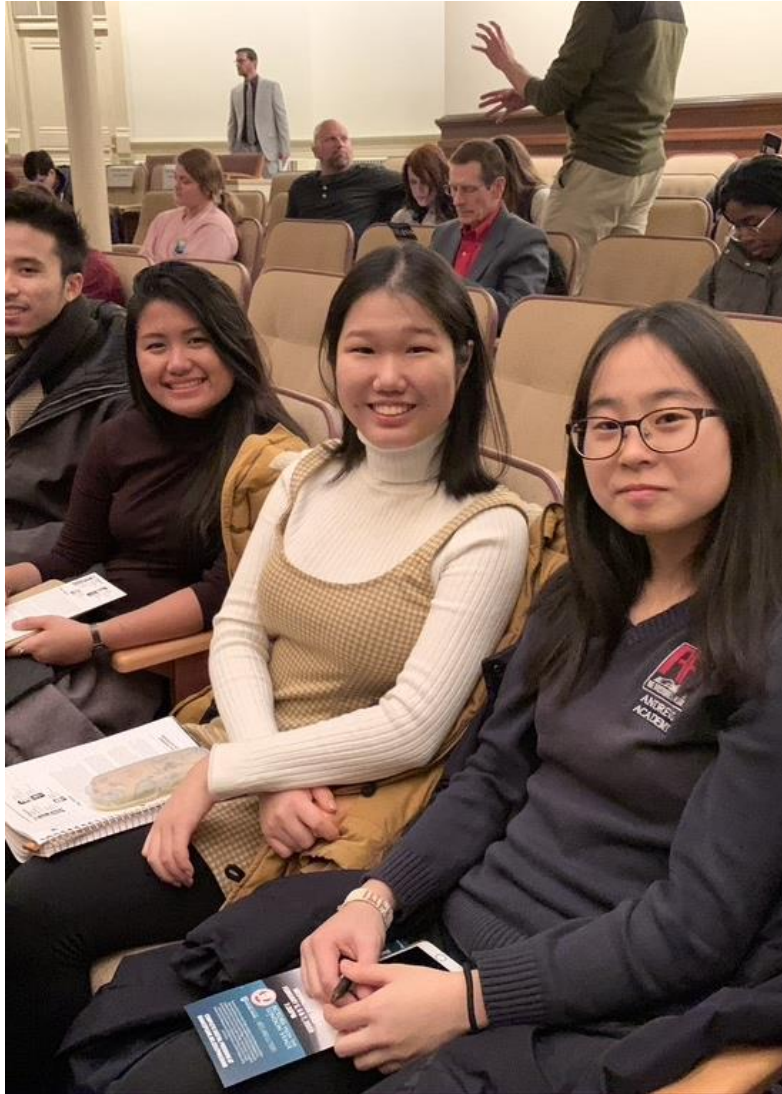


Hoagie Fest

- Digital Communication

- Digital Communication

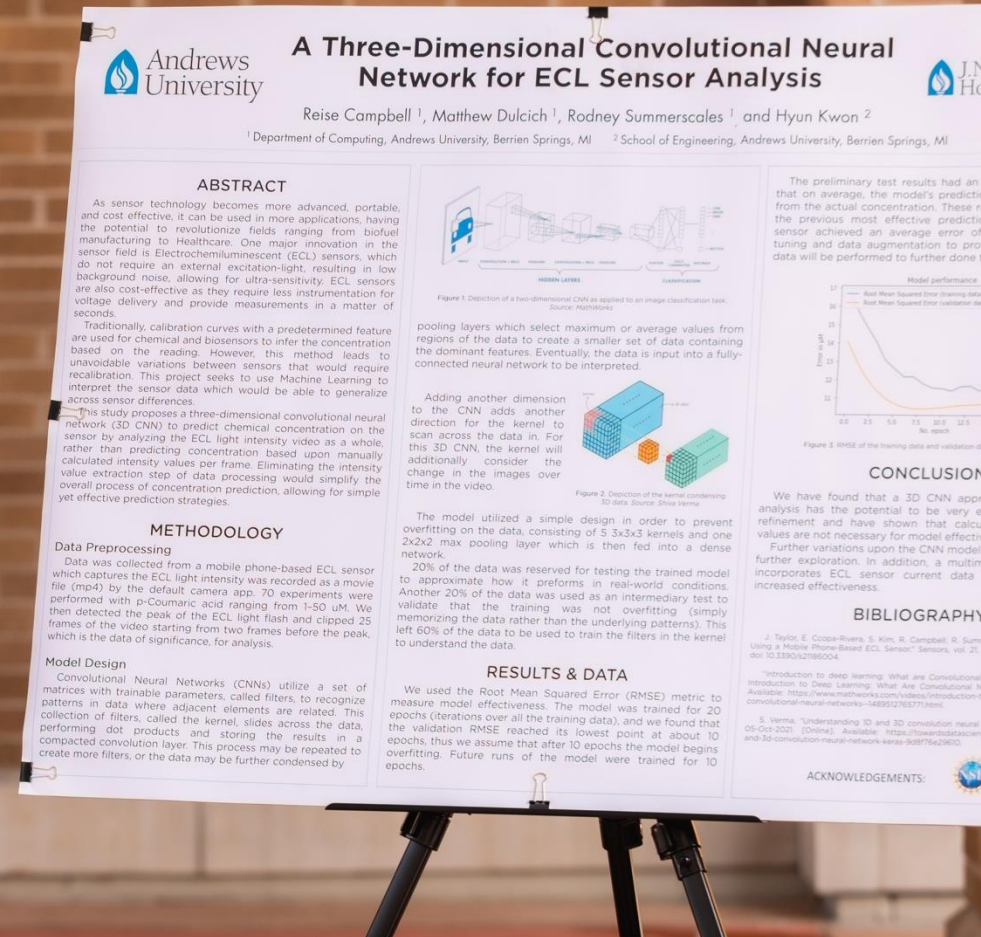




Agape Feast and Theater Outings

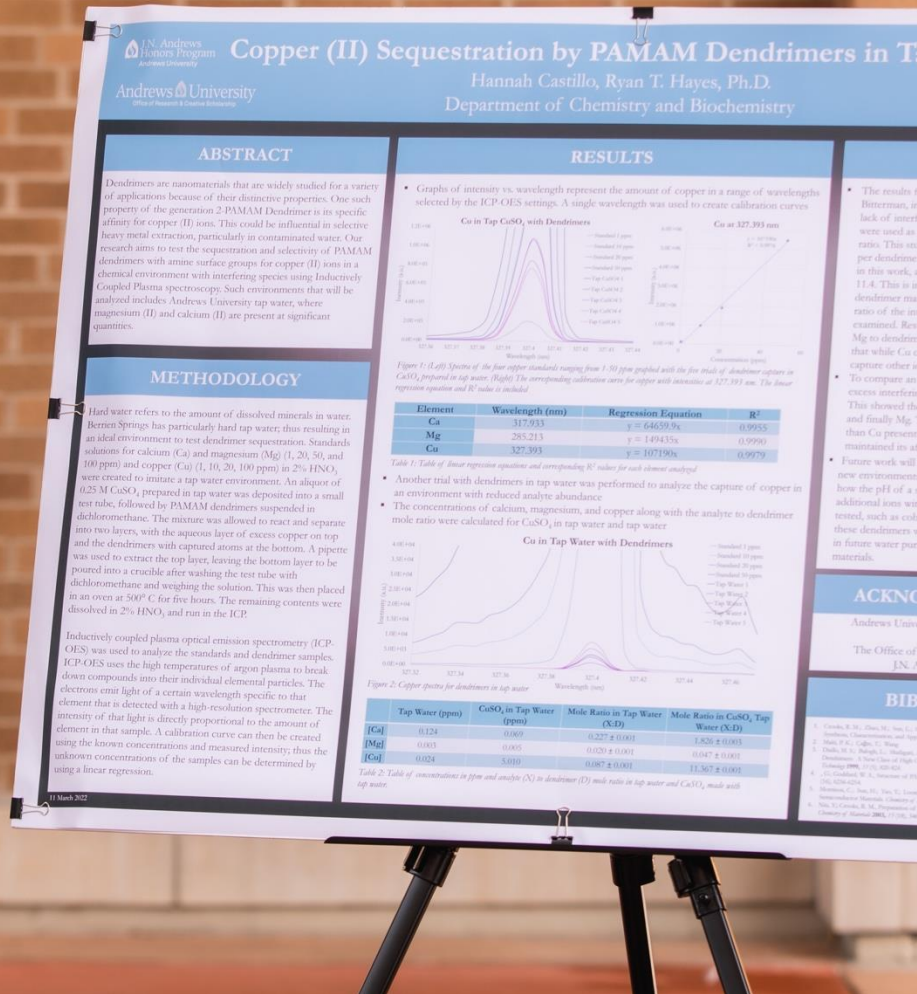
Reise Campbell

- Computer Science, Mathematics, and Religion
- Working as a software engineer at Vistaprint





Cultural Outings



Hannah Castillo

- Chemistry
- Minor: Mathematics
- Pursuing a fully funded PhD in physical chemistry at Yale University

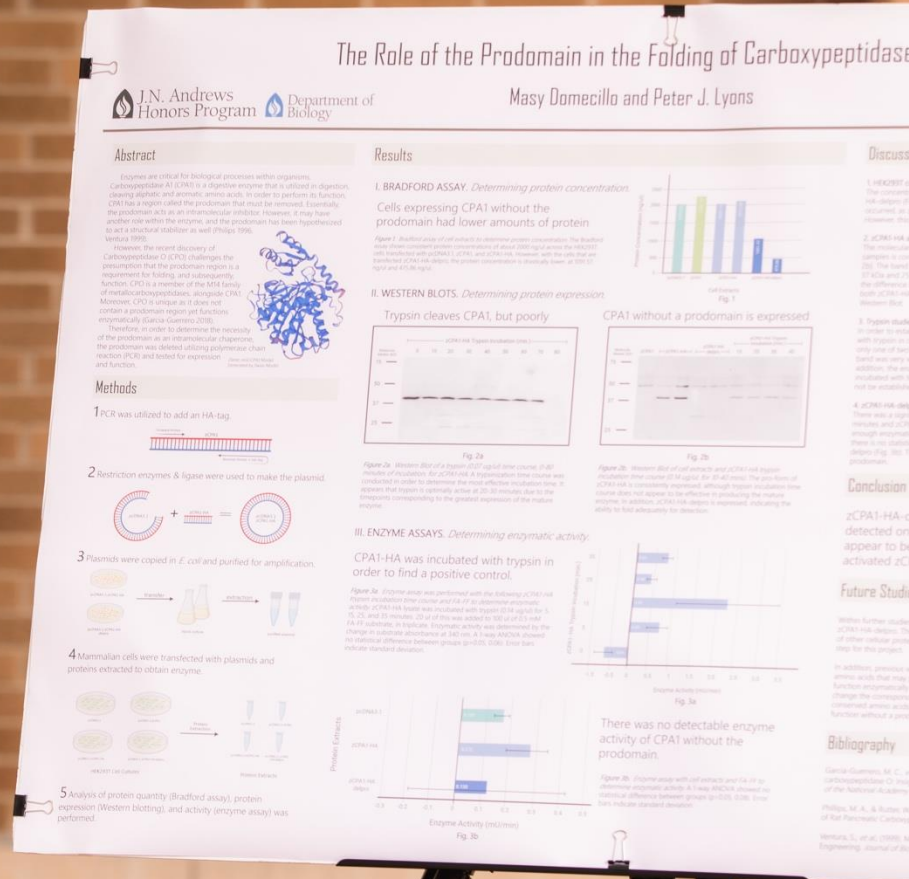


Chicago Outings



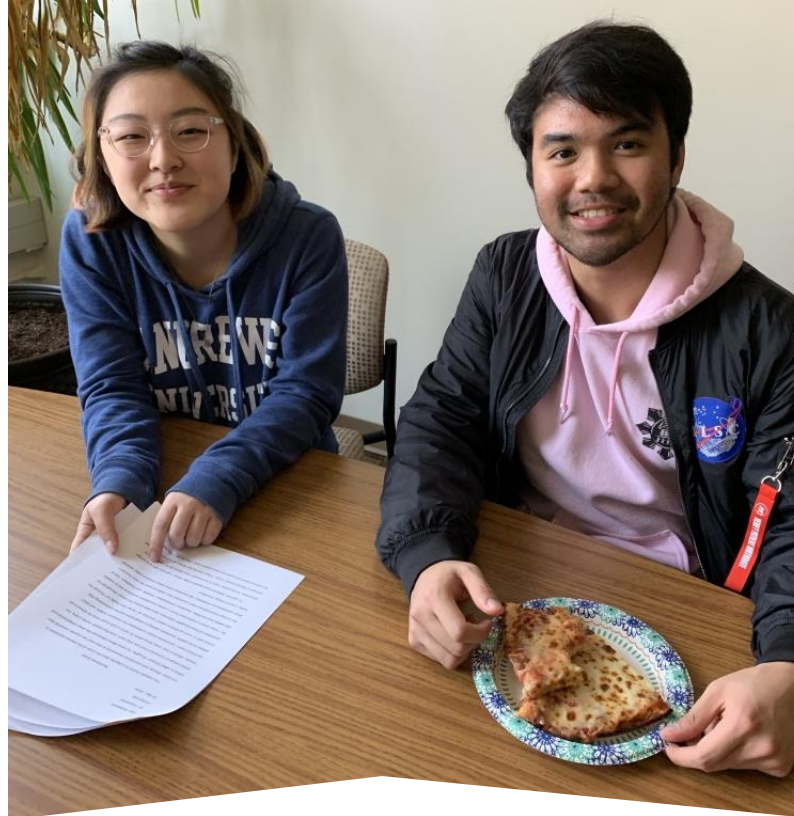
Isabelle Dias

- Speech-Language Pathology and Audiology
- Minor: Psychology
- Pursuing her graduate degree at Andrews University in SPLAD



Masy Domecillo

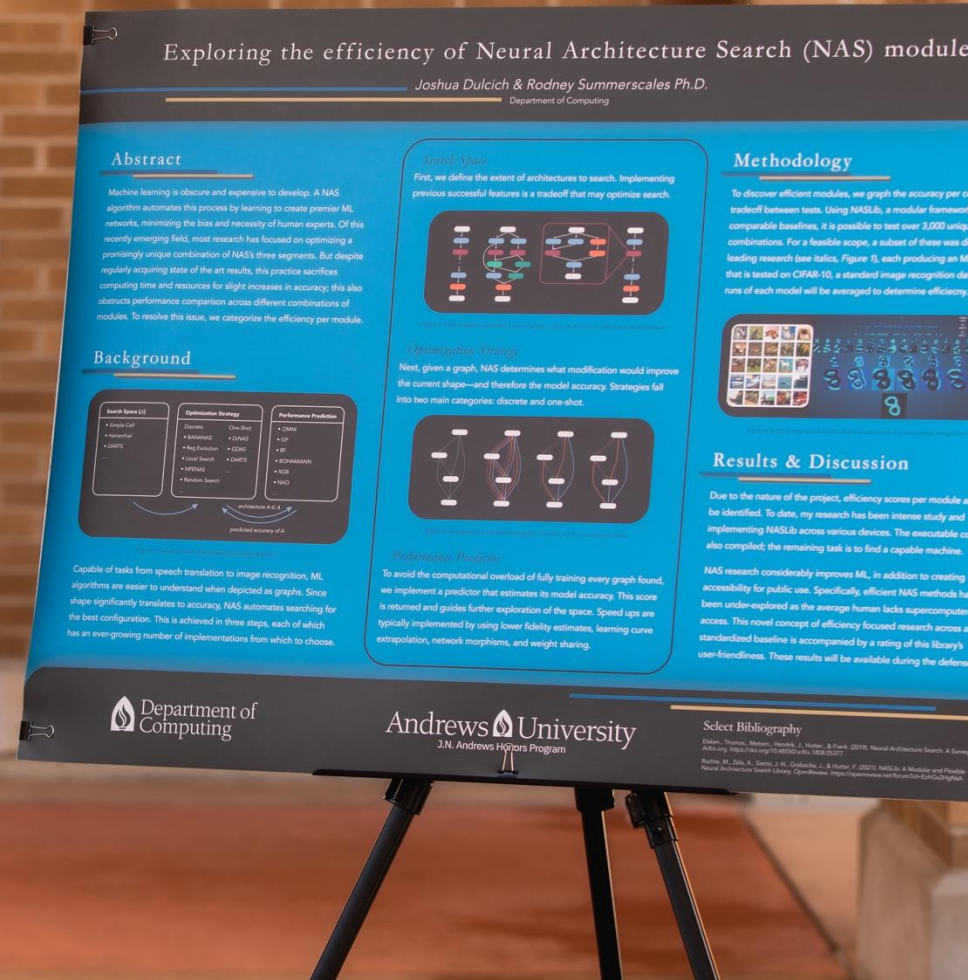
- Biology
- Minor: Chemistry
- Working in a biology research lab as a research assistant

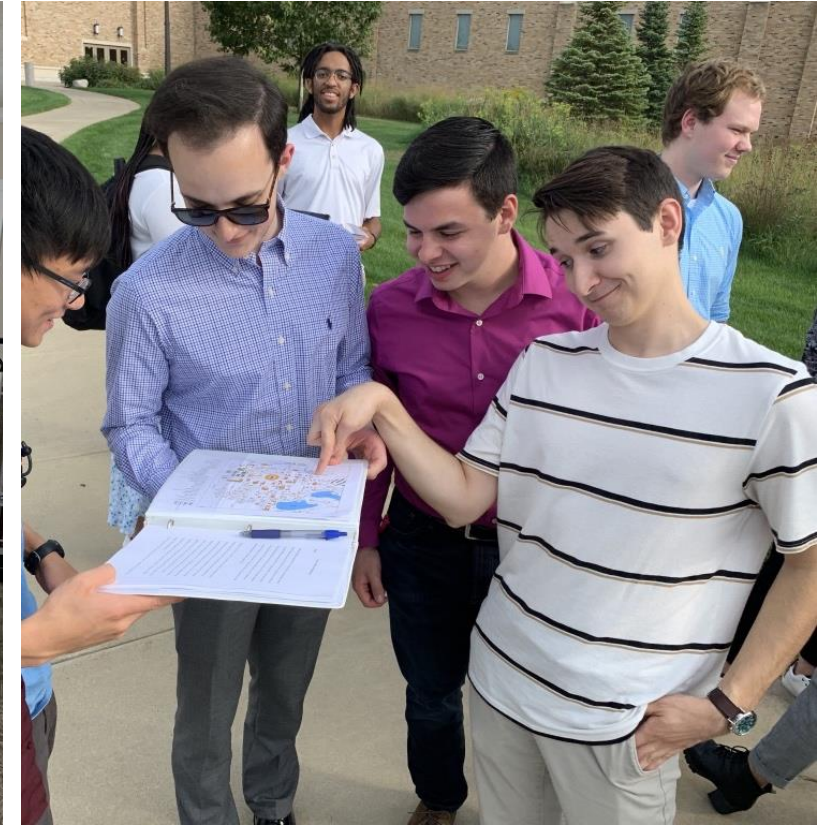


Worldview Extravaganza

Joshua Dulcich

- Computer Science, Math Studies
- Minors: Graphic Design, Engineering, Innovation & Entrepreneurship
- Launched a startup company





Sophomore Year Adventures

Matthew Dulcich

- Computer Science
- Minor: Mathematics
- Get a job in machine learning



Conditional Variational Autoencoder (cVAE) for Augmentation of ECL Biosensor Data
Matthew Dulcich, Rodney Summerscales Ph.D. & Hyun Kwon Ph.D.
Department of Computing & School of Engineering

Andrews University
21st Andrews Honors Program

Abstract

Machine Learning (ML) is vastly improving the world, from computer vision to fully self-driving cars, we are now able to accomplish objectives that were thought to only be dreams. To train ML models accurately, they require mountains of information to work with, but sometimes it becomes impossible to collect the data needed, so we turn to data augmentation. In this project we use a conditional variational autoencoder to supplement the original video electrochemiluminescence (ECL) biosensor dataset, in order to increase the accuracy of a future classification model. In other words, using a cVAE we will create unique realistic videos to combine with the original dataset.

Background and Data

The data used is taken from a previous project by Dr. Kwon et al. Electrochemiluminescence (ECL) sensors are used to detect phenol-based compounds such as dopamine or phenolic acids using their quenching properties. Currently, commercial ECL sensors are very large and expensive, so to make them more accessible and easier to transport, Dr. Kwon et al. have developed a smartphone based ECL sensor which uses a video classification model. The problem with developing this model is the deficiency of data. There are two ways to get more accurate data: take more samples or generate it.

Sample of the data: `data\c12_pC4a08t1.mp4`

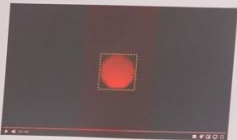


Figure 1 - The area in the dashed line is checked for the intensity value and used to standardize video lengths to 15 frames

Methodology

- We cut the videos to 15 frames each, starting 2 frames before peak brightness.
- We then binned the data into the different concentrations and used a stratified split to create a training and testing set.
- Then we insert the data into separate tensors and run them through the VAE.
- For each video run through the VAE, the corresponding concentration is inserted into the encoder and decoder.
- Once we train and tune the model, we can specify what data to generate.
- Then we check to see if the generated data is accurate by checking the ELBO loss function (Equation 1) and by using a 3D-CNN to see if it correctly classifies videos to the correct concentration.

Model

An autoencoder is constructed with two parts, the encoder and decoder. Encoders compress data into fundamental representations and decoders reconstruct them into the original data. Variational describes the encoder condensing the data into probability distributions which is sampled to generate new data. As seen in Figure 2, this model has a concentration branch as an input to both the encoder and decoder, which makes this model conditional. This allows us to specify the data we want to generate.

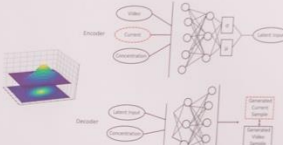


Figure 2 - Diagram of a multimodal conditional variational autoencoder (cVAE)

Relevance & Future Work

Because the quality changes from sensor to sensor, brightness does not correlate directly with concentration categories. So, a machine learning model learns the patterns in the data negating the effect of those variations. While we used this model for the generation of a specific dataset, this model can be used for general data augmentation. This can help increase the size of any dataset as well as reducing the costs of collecting and labeling data. The next step is to use the generated data to help improve the computer vision recognition model. In the future we would like to make this a multimodal model, which means there would be multiple inputs and outputs. In this way, we can see this would be the current branch. This would allow us to generate current data corresponding to a generated video for a specified concentration.

$$\log p(x) \geq \text{ELBO} = \mathbb{E}_{q(z|x)} \left[\log \frac{p(x, z)}{q(z|x)} \right]$$

Equation 1 - ELBO

Selected Bibliography

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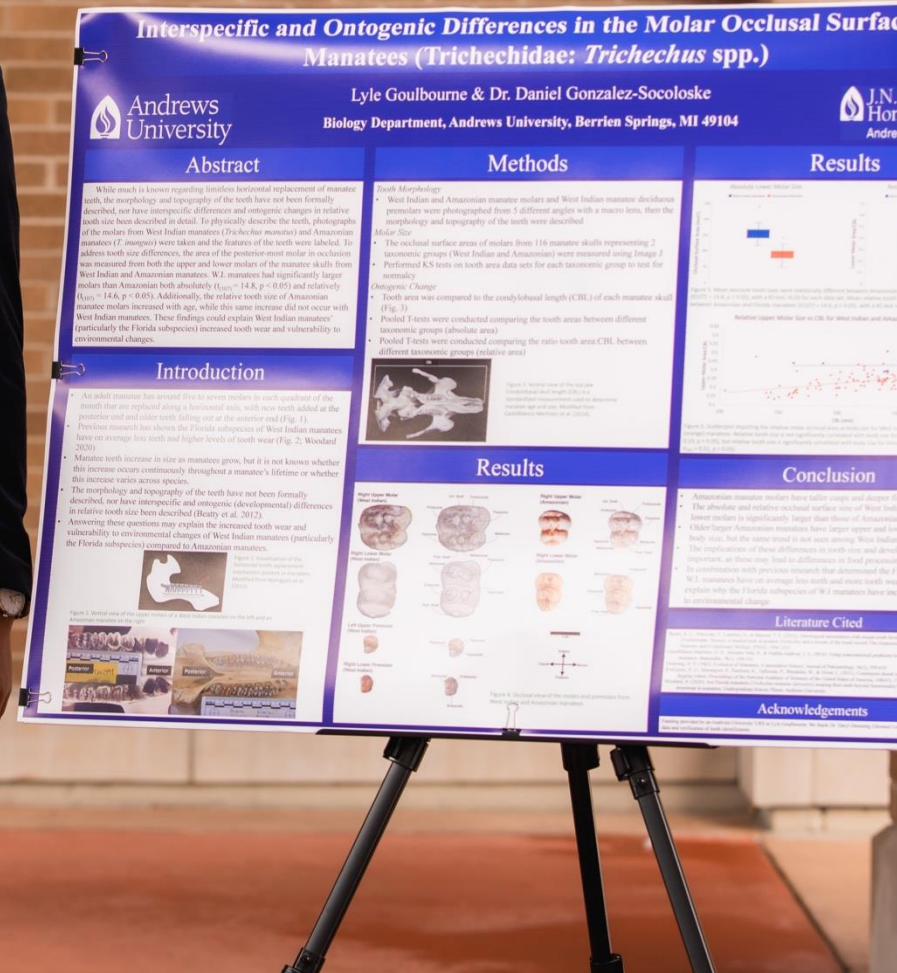
Faculty Grant - Office of Scholarly Research



Western Heritage at Art Institute of Chicago

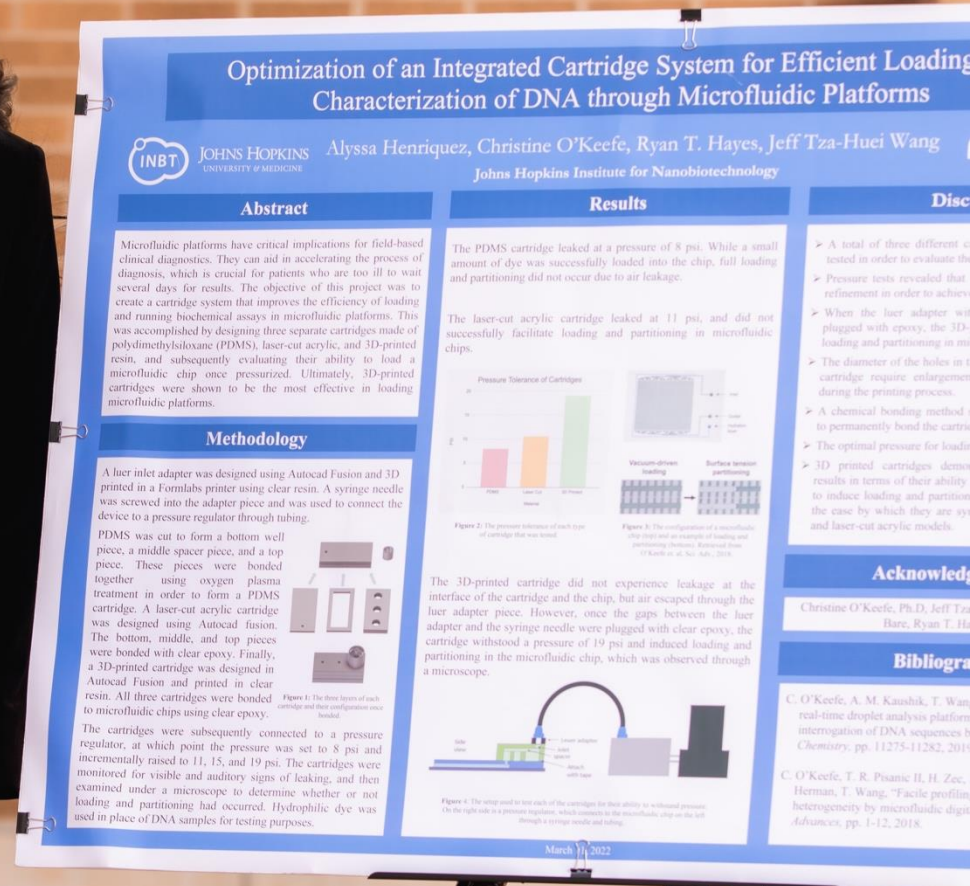
Lyle Goulbourne

- Biology
- Minor: Chemistry
- Scribing then medical school



Alyssa Henriquez

- Biochemistry and English
- Attending Duke University School of Medicine





Surviving the Pandemic Together



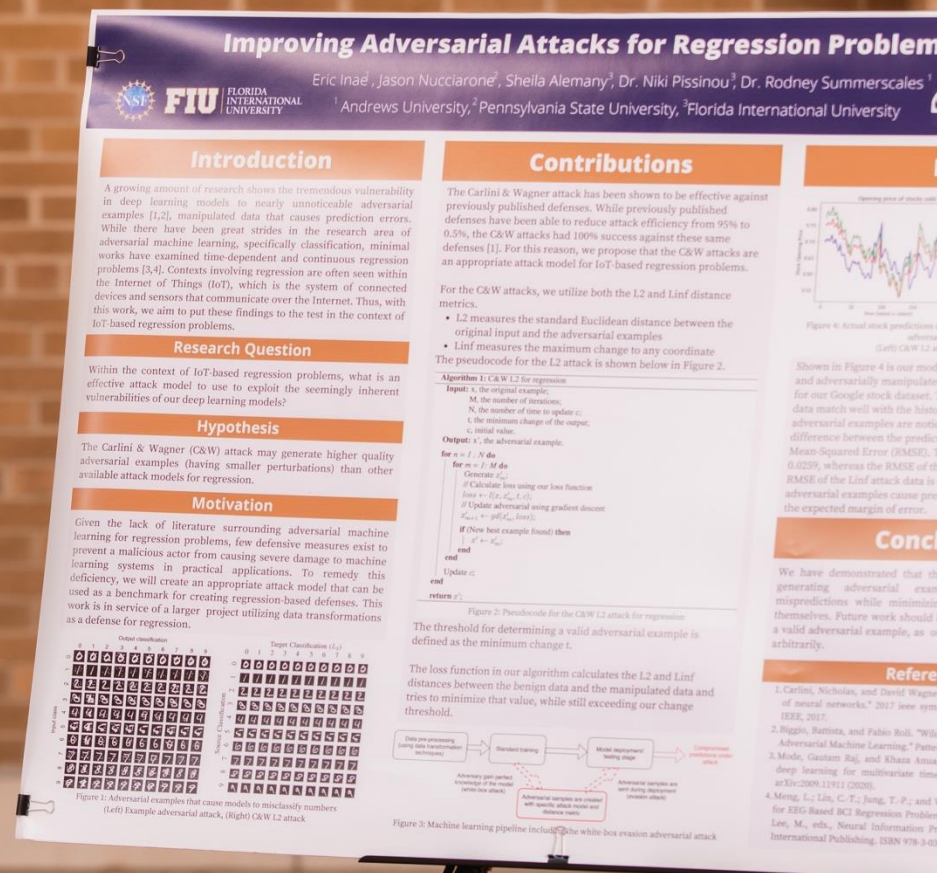
Jonathan Homan

- Mathematics and Physics
- Pursuing a funded PhD in Applied Math at CU Boulder





Worldview Extravaganza



Eric Inae

- Computer Science and Mathematics
- Fully funded PhD in Computer Science at Notre Dame University



Serving as Honors Buddies



Identifying Persistent Misconceptions of Linear Equations
Lisa Johnston, Lynelle Weldon
Department of Mathematics, Andrews University

Abstract

Every student at Andrews University who does not have a satisfactory math placement needs to review or learn prior math concepts before taking general education math courses. The math review course at Andrews, MATH 001, uses an online program called ALEKS to customize instruction, as well as several paper/pencil exams created by the department that serve as indicators of student comprehension.

In Summer 2018, we began exploratory research on student examinations from the MATH 001 course. Our current research seeks to answer which misconceptions are most prevalent in linear equation questions on these exams. We hope our results will guide us as we make substantive and positive changes to the remedial math curriculum here at Andrews, with the ultimate goal of maximizing student comprehension while still maintaining a level of individualized learning.

Methodology

Sample Preparation

The exams being analyzed had been administered over a period of a decade, along with alternate versions of each exam. Over the years, the exam content had been revised as the course underwent changes. Since our analysis sought to reference the conceptual notions behind each question, we needed to align exam questions on the various exams with the concepts they tested. This involved sorting and codifying the exams by eras of similar versions and identifying the question types on each set of exams. Finally, we gathered a random sample of 600 exams to analyze.

Creating a Framework

In order to get a sense of student performance, we initially created a table that recorded the frequency of correct and incorrect responses to each question type on all 600 exams. Based on results from this initial frequency table, we selected several questions to further analyze based on the frequency of wrong answers, connections to linear concepts, and an interest in checking intuition from in-class observations and experiences. Below are the questions, with their respective tallies:

| Question Type | Totals | R | W | S |
|-----------------|--------|-----|-----|----|
| Monocorbable | 599 | 75% | 24% | 1% |
| Slope | 502 | 63% | 31% | 4% |
| Slope-intercept | 560 | 67% | 28% | 5% |
| Standard | 599 | 65% | 32% | 4% |
| Slope and Y-int | 594 | 73% | 19% | 6% |
| Slope and Point | 565 | 72% | 22% | 6% |
| Two points | 599 | 59% | 39% | 1% |

We then listed individual identifiable misconceptions on these questions. From this information, we constructed a framework for data collection that would identify common and persistent misconceptions.

In-depth Analysis

To complete the in-depth analysis, we used the framework we created to gather data on our selected subset of questions. For each of these questions, we analyzed student responses. From our analysis of student work, we identified which misconception caused the errors present, and recorded the frequency of evidence for each misconception in our framework.

Results

We tallied the percentages of occurrence within question type in performance before taking the exam, identify the most persistent misconception need for alternative modes of learning.

Below is an example of our results gained from the following problem:

What is the slope of this line?

Misconception:

- slope sign
- slope meaning
- slope notation

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J.N. Andrews Honors Program
Andrews University

Lisa Johnston

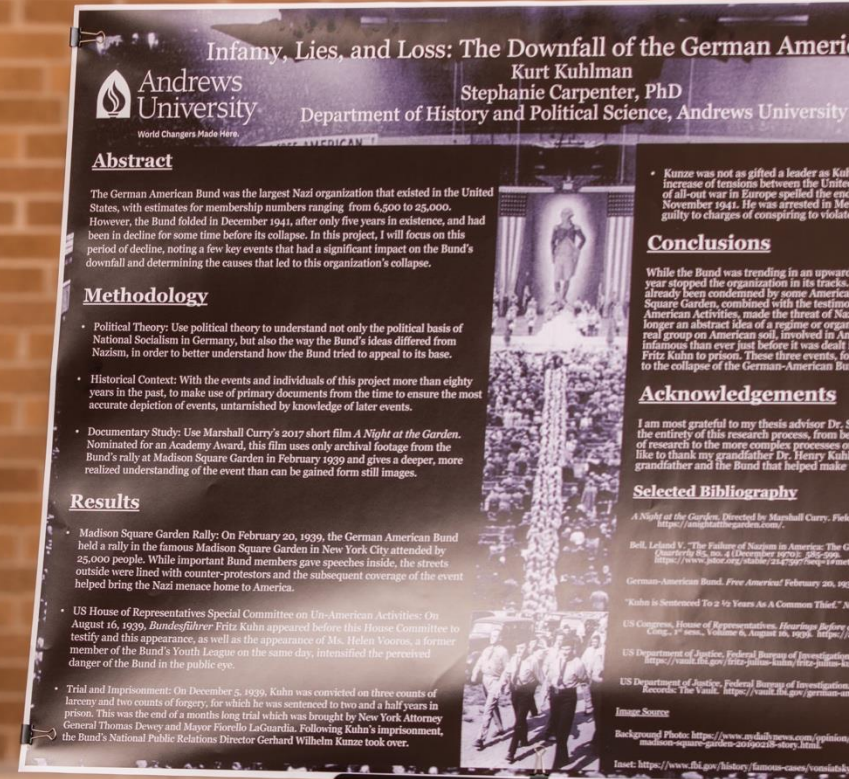
- Mathematics and Physics
- Looking for a data science job, or going into graduate school for a mathematics PhD



Hoagie Fest

Kurt Kuhlman

- Political Science
- Minor: Spanish
- Attending University of Tennessee - Knoxville to pursue a fully funded PhD in Political Science





The Impact of Technology on the Developing Visual and/or Auditory Memory in School Aged Children

Cameron Mayer, Dr. Cole-White, PhD, CCC-SLP

Abstract:

This study aimed to determine whether time spent on technology impacts the developing auditory or visual memory in school aged children. A survey was completed by the child participants to acquire a catalog of time spent on both technology devices and non-technological activities. Tests to hold a visual and auditory memory assessment adapted from the Preschool Language Scales Fifth Edition (PLS-5). The subjects were expanded upon in order to incorporate an auditory and visual memory task and that there was no significant between time spent on technology and visual and auditory memory scores. This was likely caused by the small sample size. However, the researchers did find that the auditory mean scores were significantly different from the visual mean scores across the participant's age range. Consequently, the researchers believe that this area of research could benefit from a similar study with a larger sample size, for specifically the technology element, that continues to assess how auditory and visual memory compare across this age range.

Questions and Hypotheses:

- Research Question 1: Is there a relationship between the participant's use of technology and performance on the visual and auditory memory task?
- Research Question 2: How does a child's visual memory compare to their auditory memory during their school aged years?
- Hypothesis 1: If the child spends more time on technology devices than on non-technology tasks, then the child will have increased visual memory skills as well as decreased auditory memory skills.
- Hypothesis 2: The participants will perform with better visual memory scores than auditory memory scores across this age range.

Methodology:

- Participant Children aged six to ten were asked to participate and did so only if they had a signed parent consent form, were able to acknowledge their own consent, and were not receiving special education services.
- Survey A survey was completed with the child and asked questions involving the amount of time he or she spends on technology devices and non-technology activities. The results were quantified.
- Visual Test: The child was asked to look at a page with one picture. Next, they were shown a new page with the same picture and a new picture. The child was then asked to point to the picture that they saw previously. The test continued to increase incrementally until the child was unable to answer 50% or more correctly or they reached the end of the test, which was 10 images out of a field of 20. Practice trials were provided.
- Auditory Test: The child was asked to repeat a spoken word back to the researcher. Next, they were asked to repeat two words back to the researcher and so on. The test continued to increase incrementally until the child was unable to answer 50% or more correctly or they reached the end of the test, which was 10 words that must be repeated back to the researcher. Practice trials were provided.
- Reliability: In these tests, participants completed tasks that were adapted and expanded upon from the Preschool Language Scales Fifth Edition (PLS-5). This standardized test is designed to measure preschooler's auditory comprehension ability and is used for identifying children who may need additional testing in their speech and language abilities (Zimmerman, 2003).
- Quantitative Analysis: The amount of time spent on technology devices was correlated with the visual test scores and the auditory test scores using a Spearman Rank Order Correlation Coefficient (rho test). The visual and auditory scores were correlated with each other using an Independent Samples Kruskal-Wallis test. Post-Hoc tests were introduced to analyze pairwise comparisons and further investigate age range differences and scores for both the auditory and visual tasks.

Results:

Question 1: A Spearman Rank Order Correlation Coefficient (rho test) was conducted to show the relationship between time spent using technology and participants' performance on visual and auditory tasks. Based on the results, there was no association between the participants' time spent on technology and their performance on visual memory tasks, $r_s = .418$, $p = .121$, and their performance on auditory memory tasks, $r_s = .042$, $p = .881$. See Table 1 (Spearman's rho Correlation).

| Test/Task | Correlation Coefficient | Visual Test | Auditory Test |
|---------------|-------------------------|-------------|---------------|
| Visual Test | 0.418 | 0.121 | 0.881 |
| Auditory Test | 0.042 | 0.881 | 0.121 |

Question 2: An Independent Samples Kruskal-Wallis test was conducted to show a difference in the participants' scores on the auditory and visual memory tasks by age. There was no significant difference of means on the visual memory task ($H = 1.074$, $p = .215$). However, there was a significant difference of means on the auditory memory task ($H = 6.809$, $p = .033$). See Figures 1 & 2 (Independent Samples Kruskal-Wallis Test, Table 2 & 3 (Kruskal-Wallis Test Summary)).

Conclusions:

- For Question 1 the results found in Figure 1 and 2 (Independent Samples Kruskal-Wallis Test and Table 2 and 3 (Kruskal-Wallis Test Summary)) indicated that no significant difference between means for the visual test, but there was difference between means for the auditory test. Thus, the researchers are hypothesis that visual scores will be better than auditory scores across this age range.
- For Question 2 the results found in Figure 1 and 2 (Independent Samples Kruskal-Wallis Test and Table 2 and 3 (Kruskal-Wallis Test Summary)) indicated that no significant difference between means for the visual test, but there was difference between means for the auditory test. Thus, the researchers are hypothesis that visual scores will be better than auditory scores across this age range.
- The results found in Figure 3 (Pairwise Comparisons of Age Range) and 4 (Average Rank of Age Range), which attempted to further investigate age differences and scores on both the auditory and visual tasks, demonstrated that there was a significant difference across this age range. The youngest group's 6th scores were significantly different from the oldest group's 10 and 11 years. However, there was no significant difference between both the youngest group (6) and 8 year-olds and the young group and the oldest group further suggest that the researchers hypothesis for their second research should be accepted.
- Technology did not prove to have significant in this study, but the result that age does have an influence on both auditory and visual memory. The researchers believe that this area of research is important for understanding auditory memory development at this age, and that technology could still factor in childhood development.

Limitations:

- The sample size was small, from one location, and one a diverse population, environment and upbringing.
- The child participants' understanding of time, when reporting how long the technology, may not be accurate.
- Both the auditory and visual tests are not standardized and therefore their reliability cannot be confirmed.
- More information could have been collected regarding English as a second language.
- The questions regarding the type of technology should be formatted to ask types of technology or only focus on specific kinds of technology to create research methods design.

Selected References:

Bell, P. (2014). The impact of technology on the developing visual and/or auditory memory in school aged children. *Journal of Speech, Language, and Hearing Research*, 57(1), 1-10. <https://doi.org/10.1016/j.jslhr.2014.01.001>

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LeMay, S. (2019, November 6, 2019). *How does time spent on technology impact the developing visual and/or auditory memory in school aged children?* [Unpublished manuscript]. Andrews University, Department of Health and Human Services.

Rodriguez, J. & Smith, J. (2014, November 1). *Media and Young Minds*. Pasadena, CA: iCivics. <https://www.icivics.org/media-and-young-minds/>

Cameron Mayer

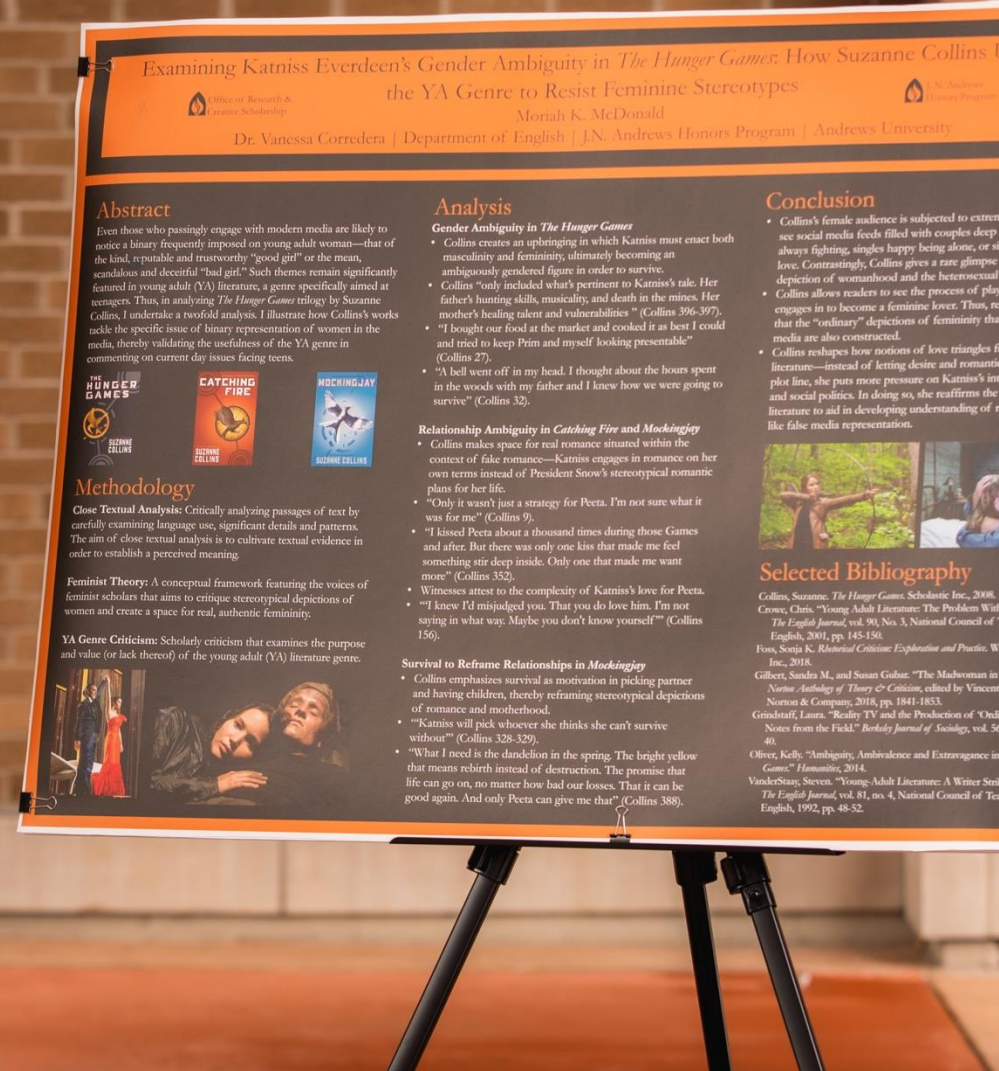
- Speech-Language Pathology and Audiology
- Minor: Spanish
- Pursuing her graduate degree at Andrews University in SPLAD

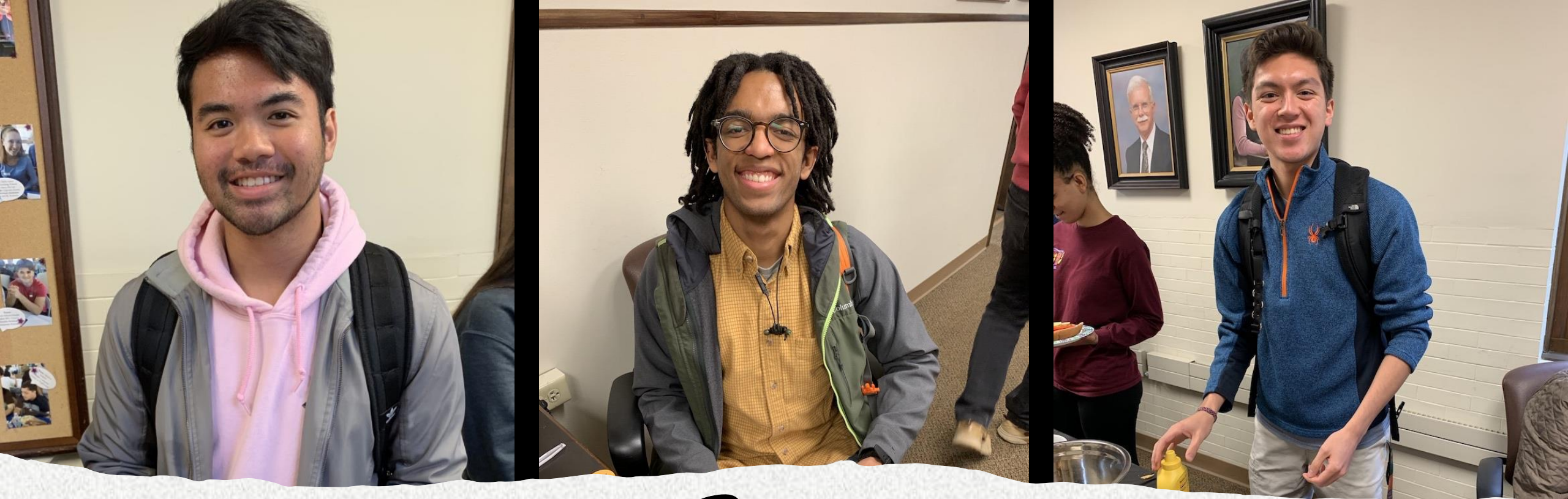


Hoagie Fest

Moriah McDonald

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- Minor: Communication Studies
- Pursuing a fully funded Masters in Journalism at the University of Missouri

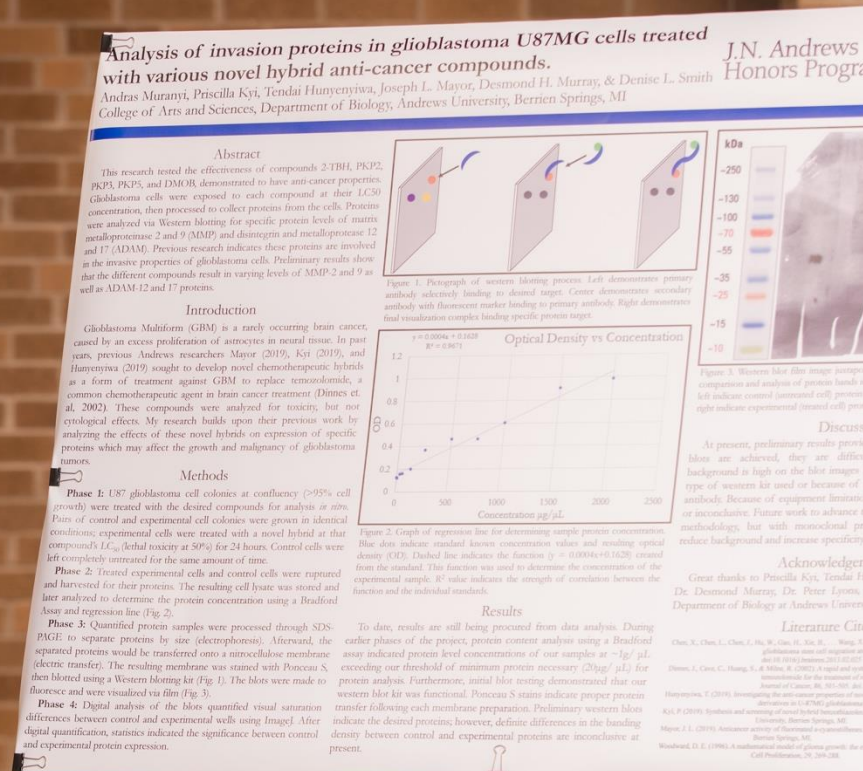




Hoagie Fest

Andras Muranyi

- Biology
- Minor: Chemistry
- Attending Medical School at Loma Linda University





Honors Church and the CSO



Jewel Murray

- Pre-Physical Therapy
- Beginning DPT graduate studies at Andrews University's Physical Therapy program

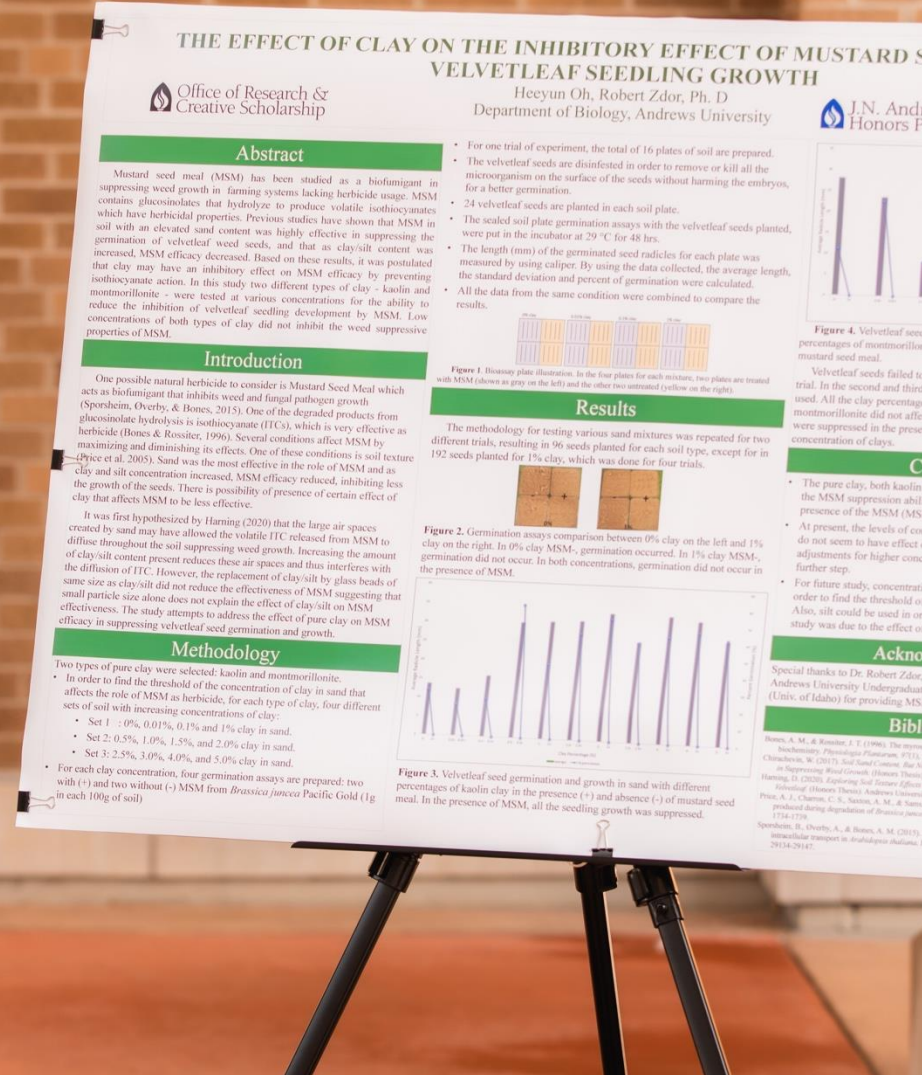


University Preview Worship and CSO Outings



Heeyun Oh

- Biology
- Minor: Chemistry
- Taking a gap year-mission trip, and/or internship in Korea





Joshua Pak

- Biochemistry
- Minor: Management
- Working in a biopharmaceutical or biotech company within the Boston/Cambridge area
- Considering offers from Pfizer and the Broad Institute
- Hoping to earn an MBA after a couple of years in the industry to lead research within these sectors

The Chemical Challenge of Fixing Nitrogen

Joshua Pak, Ryan T. Hayes, Ph.D.; Chemistry and Biochemistry Department, J.N. Andrews Honors Program, Andrews University

Abstract
Breaking the triple bond of dinitrogen is chemically challenging, requiring high temperatures, high pressures, special iron catalysts, and carefully engineered systems to "fix" dinitrogen and make it usable as ammonia. Fixing dinitrogen is critical to the survival of all life on Earth. The enzyme nitrogenase, found in nitrogen-fixing organisms, can fix nitrogen at ambient temperatures and pressures. This research explores whether chemo-biological evolution can adequately explain nitrogenase's emergence or whether there exist critical chemical barriers that suggest the intentional involvement of intelligence. Our methodology uses primary scientific research to understand nitrogenase's cellular mechanism, chemical structure, and reaction mechanism alongside genetic ancestral phylogeny of diazotrophs.

Methodology
The theory of Irreducible Complexity asserts that there exist certain biochemical systems in nature that contain and operate with components that are too well integrated, similar to a mousetrap, Figure 1, and specific to be products of evolution. This is the Intelligent Design lens that will be used throughout the research.

Figure 1: The mousetrap embodies the concept of Intelligent Design in which many parts only function when placed together simultaneously.

With the use of primary sources from over thirty peer-reviewed journals, the first goal was to assemble a thorough background of nitrogenase's mechanism and regulation. This entailed reviewing experiments that seek to look at the structure of this enzyme and how the components work together to break this triple bond. Furthermore, an understanding of the nitrogen fixation process that human industries utilize, mainly the Haber-Bosch process, was also explored to illustrate the challenge to fix nitrogen. Can the parts needed for nitrogenase to function arrive at independent times in evolutionary history to bring about one of nature's engineering marvels or does the many interdependent parts require foresight, coordination, and simultaneous implementation which is the hallmark of intelligence.

Results
One of the strongest bonds in chemistry must be broken to make usable nitrogen for life.

$$\text{N} \equiv \text{N}$$

Very little usable nitrogen is available for life in the soil and air. It is a **LIMITING** reagent.

Nitrogen-fixing bacteria (diazotrophs) are one of the few living organisms that can break one of chemistry's toughest connections: the triple bond in dinitrogen. Plants and animals **cannot** do this. These bacteria are equipped with nitrogenase, an enzyme that is designed to change/fix dinitrogen (N_2) into ammonia (NH_3) which plants can utilize for the production of amino acids. Nitrogenase requires large amounts of ATP energy which can only come from partnering with an equally complex system called photosynthesis.

Figure 2: Simplified engineering diagram and chemical reaction of the nitrogenase operation illustrating high energy input (16 ATP), complex metal-base active sites, and coordinated chemical inputs to produce ammonia which plants can use.

$$\text{N}_2 + 8\text{H}^+ + 8\text{e}^- + 16\text{ATP} \rightarrow 2\text{NH}_3 + \text{H}_2 + 16\text{ADP} + 16\text{P}_i$$

The mechanism of nitrogenase, Figure 2, can be analogous to the workings of a factory. The first floor contains the Fe-S cluster machine that binds to available ATP created in photosynthesis which provides the necessary energy to transfer electrons to the second floor. This floor contains two machines, the P-Cluster and the FeMo cofactor. The P-Cluster transfers the received electrons to the FeMo cofactor, which utilizes an **eight step mechanism** to break dinitrogen bonds and create two ammonia molecules from a single dinitrogen molecule.

Table 1: Comparison of nitrogenase's requirements to fix N_2 versus humanity's best, sustainable attempt. About half the nitrogen in humans comes from Haber-Bosch process.

| Factors | Diazotrophs | Haber-Bosch |
|-------------|-------------------|------------------------|
| Temperature | 15-35°C | 400-600°C |
| Pressure | 0.78 atm | 200-400 atm |
| Energy | ATP | 1-2% Global Energy |
| Waste | safe H_2 | 1.44% Global Emissions |
| Yield | 100% | 15% → 98% |

Discussion
Nitrogenase needs ATP from photosynthesis. Photosynthesis needs fixed nitrogen from the photosystems and make ATP. This is a chicken-and-egg scenario. If nature's chemical engineering feat to efficient system had to evolve early simultaneously with photosynthesis to fix nitrogen for life as ATP is not degraded quickly. Usable nitrogen in nature is scarce and needs constant production. There are no credible explanations how this system evolved through time and natural forces.

References
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• ...

Andrews University
J.N. Andrews Honors Program

Department of Chemistry & Biochemistry

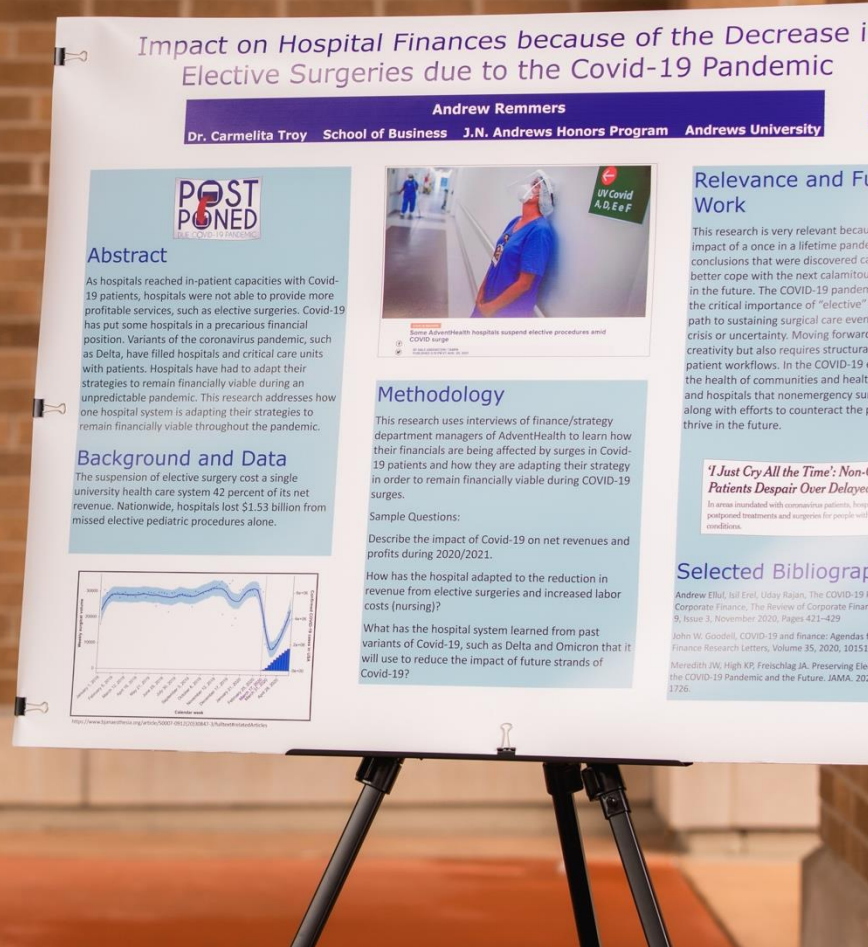


Cosmos and Theater Outings



Andrew Remmers

- Finance and Accounting
- AdventHealth Leadership Residency with a business expertise in corporate finance





CSO Outings

Marvin Schatzschneider

- Finance and Accounting
- Work at Houlihan Lokey



27

The Positive Relationship Between Stock Price of Technology Firms and ROA, EBITDA margin, Bond ratings, and Current Ratio

Andrews University
A Division of Andrews University

Marvin Schatzschneider
Dr. Kirkpatrick and Dr. Sabas
Department of Accounting, Economics, and Finance
School of Business Administration, Andrews University

Introduction

Within the field of finance, there exists evidence that stock price is not only related to stock price but also to stock price. However, the relationship between stock price and stock price has not been studied in detail. The main goal of this research is to explore the strength of financial ratios in relation to stock price of technology firms. Indeed, the hypothesis exists that technology firms often become valued based on their innovation and have an intangible value. Furthermore, current investors may not be paying specific attention to financial indicators. Instead, relying on their own intuition and are drawn towards the allure of the stock price to increase the stock price in the current market and within the technology sector specifically.

Methodology

Andrews University conducted a research study in January 2018. The study was conducted by Marvin Schatzschneider, Dr. Kirkpatrick, and Dr. Sabas. The study was conducted by Marvin Schatzschneider, Dr. Kirkpatrick, and Dr. Sabas. The study was conducted by Marvin Schatzschneider, Dr. Kirkpatrick, and Dr. Sabas.

Model

$$P_t = \alpha_0 + \alpha_1 ROA_t + \alpha_2 EBITDA_t + \alpha_3 BondRating_t + \alpha_4 CurrentRatio_t + \epsilon_t$$

$$R^2 = 0.10$$

Select Citations

Andrews University. (2018). The Positive Relationship Between Stock Price of Technology Firms and ROA, EBITDA margin, Bond ratings, and Current Ratio. Andrews University.

Abstract

This research updates expanding literature in the financial field on the relationship between stock price and financial performance indicators - return on equity, debt to assets, net margin, return on assets, EBITDA margin, bond rating, and current ratio. Specifically, stock prices of year-end 2018 were examined to 2017 year-end financial data. The hypothesis developed is that financial performance explanatory variables were tested for their significance to price. Return on equity, debt to assets, net margin, and current ratio proved to be statistically significant.

Results

| | All Technology | Software Service | Other Technology |
|------------------|----------------------|----------------------|-----------------------|
| ROE | 8.768 (1.805) * | 3.453 (0.707) | 14.716 (0.673) |
| Net Margin | 68.736 (1.422) ** | 168.50 (2.289) * | 118.769 (1.485) ** |
| Debt to Asset | 16.325 (0.793) | 50.031 (1.531) ** | 109.29 (0.035) |
| Bond Rating | 10.124 (0.968) | 11.805 (0.923) | 20.802 (1.461) ** |
| R-Squared | 0.656 | 0.604 | 0.590 |
| No. Observations | 142 | 70 | 72 |

*Significant at the 10% level
**Significant at the 5% level

Key Formulas

$$Return\ on\ Equity = \frac{Net\ Income}{Total\ Equity}$$

$$Current\ Ratio = \frac{Current\ Assets}{Current\ Liabilities}$$

$$Debt\ to\ Assets = \frac{Total\ Debt}{Total\ Assets}$$

$$Net\ Margin = \frac{Net\ Income}{Total\ Revenue}$$

Conclusions

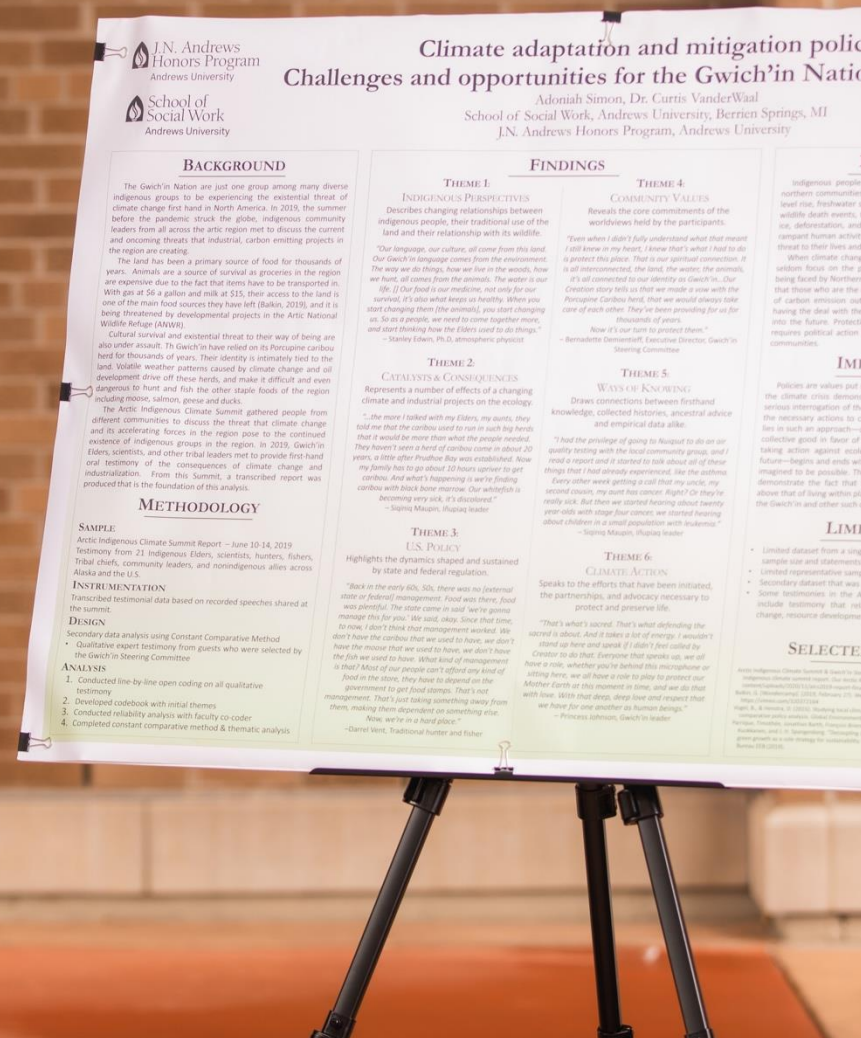
Overall, Net Margin appears to be significant to investors across technology services at the 10% level of significance.
 Return on Equity (ROE) is statistically significant across All Technology companies at the 5% level of significance.
 Positive coefficients demonstrate a positive correlation between explanatory variables and stock price which is consistent with expectations.
 Investors may not view financial leverage as critical to analysis due to the variations in significance across the sectors on the financial indicators of Bond Rating, and Debt to Asset.
 It appears the market loosely examines financial indicators with respect to the technology sector as understood by the lower R-squared.
 Further Analysis:
 Does Net Margin correlate strongly with firms with higher financial leverage?
 How the value of the coefficients substantially impacts the stock price?
 The degree of statistical significance for Return on Equity for Software Service and Other Technology requires further research on the business model and the impact on stock price.



Cultural Outings, Agape Feasts, and More

Adoniah Simon

- Social Work
- Minor: Spanish
- Traveling in Central America and Europe, then begin a new job in August
- At the start of Fall 2023, begin graduate program in social work





Serving as Honors
Buddies

Elianna Srikureja

- English Literature
- Minor: Chemistry
- Attending Loma Linda University School of Dentistry



“A Woman’s Lot is to Suffer”: Recognizing the Intersectionality of Oppression and Resistance in Min Jin Lee’s *Pachinko*

Andrews University
Elianna Srikureja
Dr. Vanessa Corredera | Department of English | J.N. Andrews Honors Program | Andrews University

Abstract
Min Jin Lee’s novel *Pachinko* (2017) portrays the historically based lives of a displaced Korean family during Japan’s colonization of Korea from 1905-1945. The novel’s attention to the ways that colonial endeavors complicate Confucian family and national structures exemplifies the interrelation between gender and racial oppression facing Lee’s Korean women in both the public and private domain. However, by centering female voices all too often silenced, Lee also depicts resistance modes that subvert such oppression. Using feminist and postcolonial theory, historical analysis, and close reading analysis, this project examines both the construction of oppression and the subversive resistance measures taken by Korean women, ultimately arguing for the necessity of articulating local specificities instead of universalizing and homogenizing the experience of women worldwide.

Methodology
Gender Theory
Academic discourse that informs the expectations and tensions within the social construction of gender roles, masculinity and femininity, and sexuality. Specifically, this project employs gender theory to define and analyze intersectionality and compulsory heterosexuality in the women’s lives.
Intersectionality: the acknowledgement of overlapping forms of oppression women face, like gender and race, which create a nexus of oppression and interact in ways “greater than the sum of racism and sexism” (Crenshaw 140).
Compulsory Heterosexuality: the assumption and enforcement of heterosexuality which works to “surfeit male sexual access to women” (Rich 1523).
Postcolonial Theory
Academic discourse preoccupied with noticing and dismantling the power dynamics of colonialism and imperialism, which I consider in light of Korea’s colonization by Japan.
Close-Textual Reading
Analyzing the specific rhetoric choices of the text and attending to literary devices like word choice, repetitions, setting, and allusions.
Discourse Analysis
Noting the discussions and critiques surrounding the novel by paying attention to repeated themes, language used (or not used), and its overall reception.
Historical Context Analysis
Considering the social, religious, political and gender concerns of the specific era and location in which Lee sets her novel.

Analysis
Confucian Construction of Oppression in the Private Sphere
• Portrays women into domestic, silent, passive roles while insisting on their labor.
• Based on the Confucian family structure in which men hold authority and sexual power while “girls are socialized into filiality, deference, and independence” (Greenhalgh 301).
• “Sunja ya, a woman’s life is endless work and suffering. There is suffering and more suffering” (27).
• “Sunja started to cry quietly, and he pulled her toward him and held her...as he did what he wanted” (44).
• “the ideal wife juggl[e] the double burden of waged and domestic work” (Jackson 13).

Confucian Construction of Oppression in the Public Sphere
• Nexus of Japanese racial violence and anti-colonial nationalism that capitalizes on controlling the female body.
• “men on both sides of the colonial divide... collaborated when it came to the domination of women” (Lumina 166).
• Korean Comfort Women: “I hear that the girls who went to work in factories were taken somewhere else” (238).
• “at the heart of [strengthening the Korean nation] were the mothers of the nation” (Yoo 163).
• Compulsory heterosexuality and enforced motherhood.
• “mothers as sexual vessels of fertility” (Kim and Choi 4).
• “a man in his situation could’ve thrown me out for not having a son” (129).

Intersectional Resistance Measures
• Reconnects the Korean woman’s experience and sexuality.
• “It was not Hanu that she missed, or even Suk. What she was seeing again in her dreams was her youth, her beginning, and her wishes—so this was how she became a woman” (476-77).
• “No, no, no. He was my son. Mine” (422).
• Encourages and showcases diverse female experiences.
• The “recognition that ‘race,’ social class and sexuality differentiated women’s experiences has disrupted the notion of a homogeneous category ‘woman’” (Brah and Phoenix 82).

Conclusion
• Contrary to popular discourse, this project also identifies resistance available to such women.
• Instead of participating in the sexualities, and experiences, this Confucian patriarchy, Japanese nationalism created a nexus of Asian women’s survival.
• By focusing on the specific women, this project also identifies resistance available to such women.
• My analysis of the novel emphasizes intersectional examples of female homogenizing definition of femininity.

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Surviving the
Pandemic
Together

Emma Tennyson

- Psychology (Brain & Cognition)
- Minors: Chemistry, Spanish
- Attending Loma Linda School of Medicine





Pandemic Socializing



Isabella Tessalee

- Biochemistry
- Minor: Biology
- Attending Loma Linda University School of Medicine for the MMS Program

Synthesis of Hybrid Anticancer Molecule Containing Isoxazoline: A Model Synthesis

Isabella Tessalee, Dr. Lisa Ahlberg
Department of Chemistry and Biochemistry, J.N. Honors Program, Andrews University

Background Information: Cancer

There are many reasons why cancer arises. Just as there are many causes there are many mechanisms in which cancer can be treated. One type of treatment is chemotherapy. The synthesis of novel anticancer molecules can help target cancer cells. Stopping the proliferation of cancer cells can be achieved by the induction of apoptosis. Normally, the body can detect cell malfunction and eliminate the cell, but in cancer patients sometimes this process is avoided. One way to induce apoptosis is by creating an ion gradient across the mitochondrial membrane of cancer cells. The activation of TSPO induces the ion gradient (through its interaction with the ion permeability pore) and signals the cell to undergo apoptosis.

Previous Work

The main mechanism was studied using PK11195, a known antagonist to TSPO. One paper, uses the results of the interaction of PK11195 and AC-3216 (an agonist) with the TSPO receptor, and compares these results to that of a carcinogen, cigarette smoke (2).

Literature Compound(s) and Novel Molecule Comparison

Their structures can be compared to Dibenzylfentanyl. Rosanne previously worked to synthesize Dibenzylfentanyl. Through modification of Dibenzylfentanyl there can be an addition of an isoxazoline ring creating the *Target Molecule*. Theoretically increasing bioactivity and binding that will activate TSPO (3).

Synthetic Scheme

Step 1: Oxime Synthesis
Step 2: Isoxazoline ring precursor
Step 3: Isoxazoline ethered product

Gas Chromatography Mass Spectrometry

Molecules are split apart with high energy electrons. Each unique spectrum that can be analyzed. Once broken apart the changing magnetic field (separates our fragments by bending them of different masses) and these ions are electronically detected shown on the x-axis and the relative abundance is shown in the y-axis.

Analysis

Methodology Modification: Step 1

| Grindstone Synthesis (4) | Reflux Synthesis (Base Catalyst) | Stirring Synthesis (Acid Catalyst) |
|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Reagents: • 4-Chlorobenzaldehyde • Hydroxylamine hydrochloride • Boronate Oxide | Reagents: • 4-Chlorobenzaldehyde • Hydroxylamine hydrochloride • Boronate Oxide or Sodium hydroxide | Reagents: • 4-Chlorobenzaldehyde • Hydroxylamine hydrochloride • Hydrochloric acid |
| Solvent: N/A | Solvent: water and ethanol | Solvent: ethanol |
| Run Time: 2 to 15 minutes | Run Time: 1 to >17 hours | Run time: 1 hour 30 minutes |
| Unsuccessful | Unsuccessful | Successful |

Future Work

- Confirm of model product structure.
- Synthesis of the Target Molecule and confirmation of its structure.
- Test the Target Molecule for anticancer properties.

Acknowledgments

- Dr. Lisa Ahlberg
- Rosanne Thornhill
- Andrews University Chemistry and Biochemistry Department
- Andrews University Undergraduate Research Scholarship

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Honors Church



Taylor Uphus

- English- Literature Emphasis
- Minor: Business Administration
- Studying for the LSAT and working on law school applications
- Working at Crowe, LLP in the Contracts Management unit



Honors Church

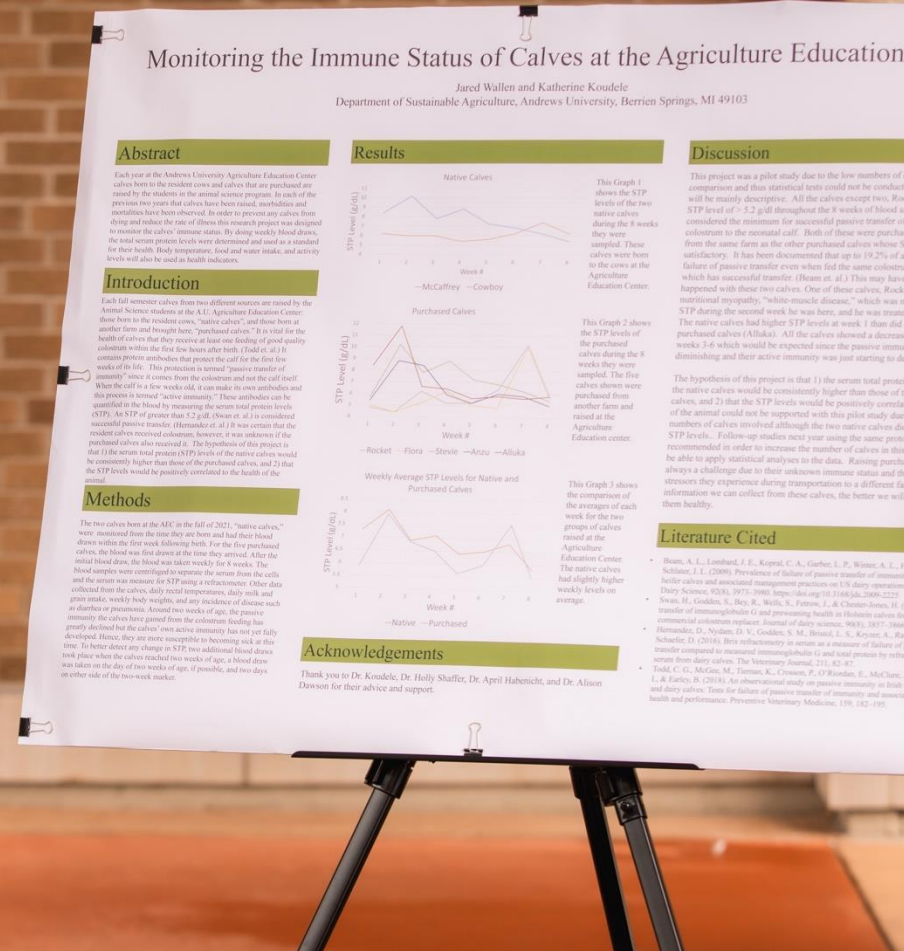


Surviving the Pandemic Together



Jared Wallen

- Animal Science
- Minor: Chemistry
- Attend Veterinary School



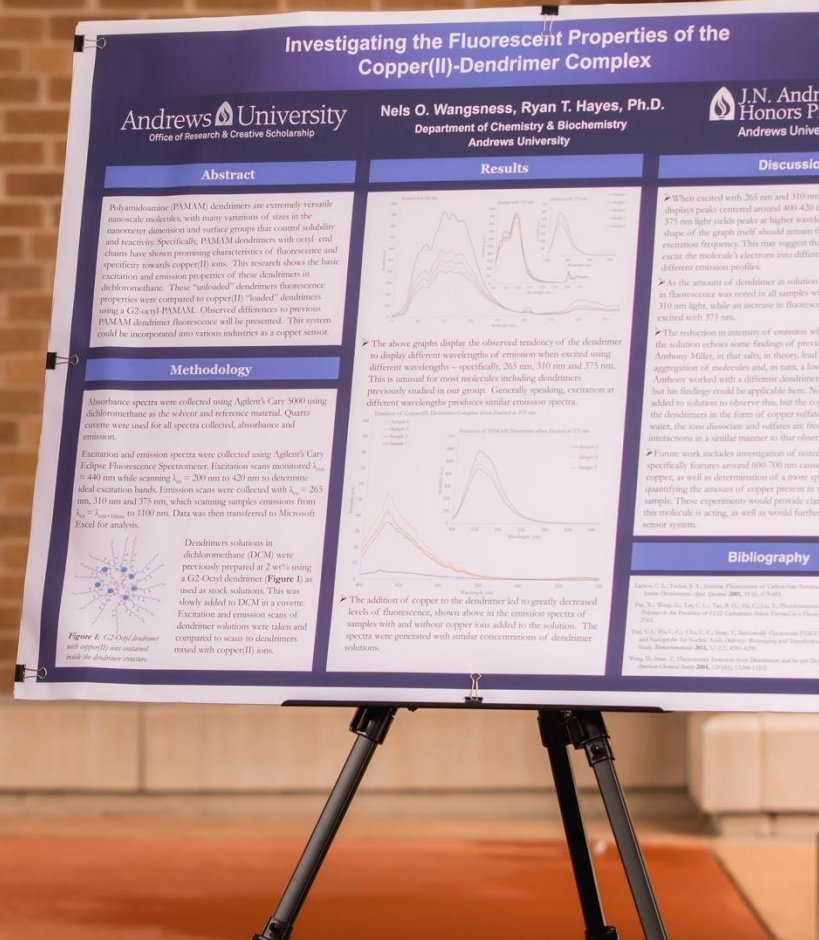


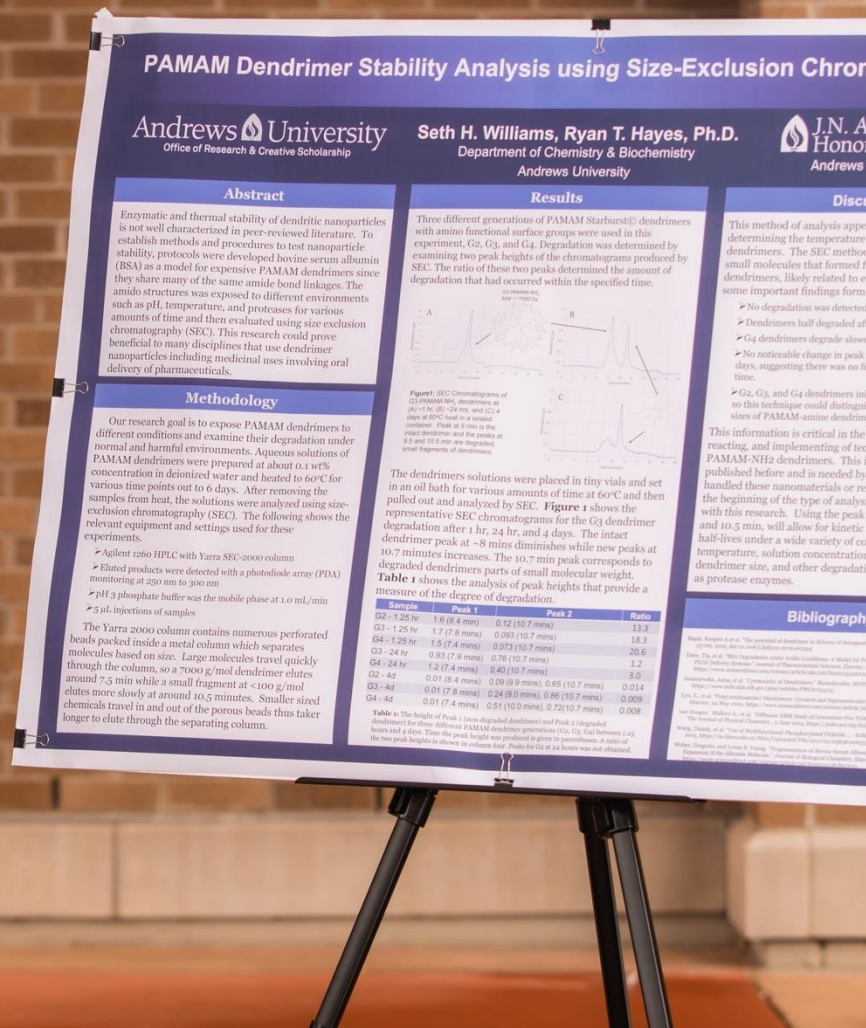
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Nels Wangsness

- Biochemistry
- Business Management internship with Centura Health
- Prep for MCAT





Seth Williams

- Biology
- Minor: Chemistry
- Pursuing MS in Chemistry at the University of Texas, Arlington

- Digital Communication: Media Production
- Doing a bit of travelling—including Iceland
- Scouting out professional opportunities





Michael Lee

- Computer Science and Mathematical Studies



Steven Mann-Rojas

- Computing:
Computer Science
- Continuing work
as a Systems
Development
Manager at
Polywood



Surviving the Pandemic
Together