INSPIRE
INTERACTIVE NASA SPACE PHYSICS
IONOSPHERE RADIO EXPERIMENTS

The INSPIRE Journal

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Contents

COVER IMAGE: Illustration depicting Mars Helicopter Ingenuity during a test flight. Ingenuity was taken to Mars strapped to the belly of the Perseverance rover (seen in the background). NASA's Jet Propulsion Laboratory built and managed operations of Perseverance and Ingenuity for the agency. Caltech in Pasadena, California manages JPL for NASA.
Image credit: NASA/JPL-Caltech

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INSPIRE'S LEGACY
Dr. William (Bill) W. L. Taylor was a leader in the field of space science education and public outreach. He co-founded and was president of INSPIRE, one of the pioneering successes in NASA Sun Earth Connection Education. NASA Goddard Space Flight Center honored the late William W. L. Taylor with an *Excellence in Outreach in Science* Award for his accomplishments.

IN MEMORIAM
Kathleen Franzen, President 2005 – 2010
Jack Reed, INSPIRE Board Member 1992 – 2009
Jim Ericson, INSPIRE 1st Vice President 1981 – 2006

MISSION
The INSPIRE Project Inc. is a non-profit scientific, educational corporation whose objective is to bring the excitement of observing natural and manmade radio waves in the audio region to high school students. Underlying this objective is the conviction that science and technology are the underpinnings of our modern society, and that only with an understanding of science and technology can people make correct decisions in their lives, public, professional, and private. Stimulating students to learn and understand science and technology is key to them fulfilling their potential in the best interests of our society. INSPIRE also is an innovative, unique opportunity for students to actively gather data that might be used in a basic research project.

– *William W. L. Taylor and William E. Pine, Co-Founders*

In 2009, The INSPIRE Project expanded its STEM educational programs to provide scholarships and internships to educators, middle/high school students, and university students to ensure the next generation of space science and technology explorers.

2021 NASA DC Space Grant Consortium Student Research Competition

This competition held in March 2021 was sponsored by the NASA District of Columbia Space Grant Consortium (DCSGC), one of 52 members of a national network known as "Space Grant," which encompasses more than 1,200 universities and organizations in every state, the District of Columbia, and Puerto Rico. The Space Grant Program is administered by NASA. The DCSGC offers DC university students opportunities for internships, fellowships and scholarships, as well as research opportunities. It's all part of NASA's overarching mission to increase public knowledge, support educators, and attract and retain students to pursue STEM advanced degrees and careers. "For American University which serves as the lead institution of the Consortium in the District of Columbia, it provides opportunities to students to have authentic research experiences while supporting NASA missions in science and space technology," says Nathan Harshman, AU Professor of Physics and DCSGC Director. "One goal of the program is to broaden the pipeline of students prepared for joining the NASA workforce. The DCSGC also provides matching support to professional development activities to outreach and education projects and programs that build community and excitement around NASA missions. This year, students presented their research posters remotely by making videos and posting them on YouTube. "We are very proud and highly impressed at both the caliber and depth of research our Space Grant-supported students are conducting," says Eric Day, Program Manager of the DCSGC.

The INSPIRE Project is an affiliate member of the DC Space Grant Consortium which helps to fund many of INSPIRE's educational STEM programs. Program Manager Eva Kloostra served as a judge for the competition and was so impressed that INSPIRE invited students who competed to submit their research for publication in The INSPIRE Journal. Below are some of the exciting research projects students are working on at DC colleges and universities.

>> FIRST PLACE: Annotation and Homology Modeling of the Multidrug Transport Protein P-glycoprotein (ABCB1) of Equus caballus

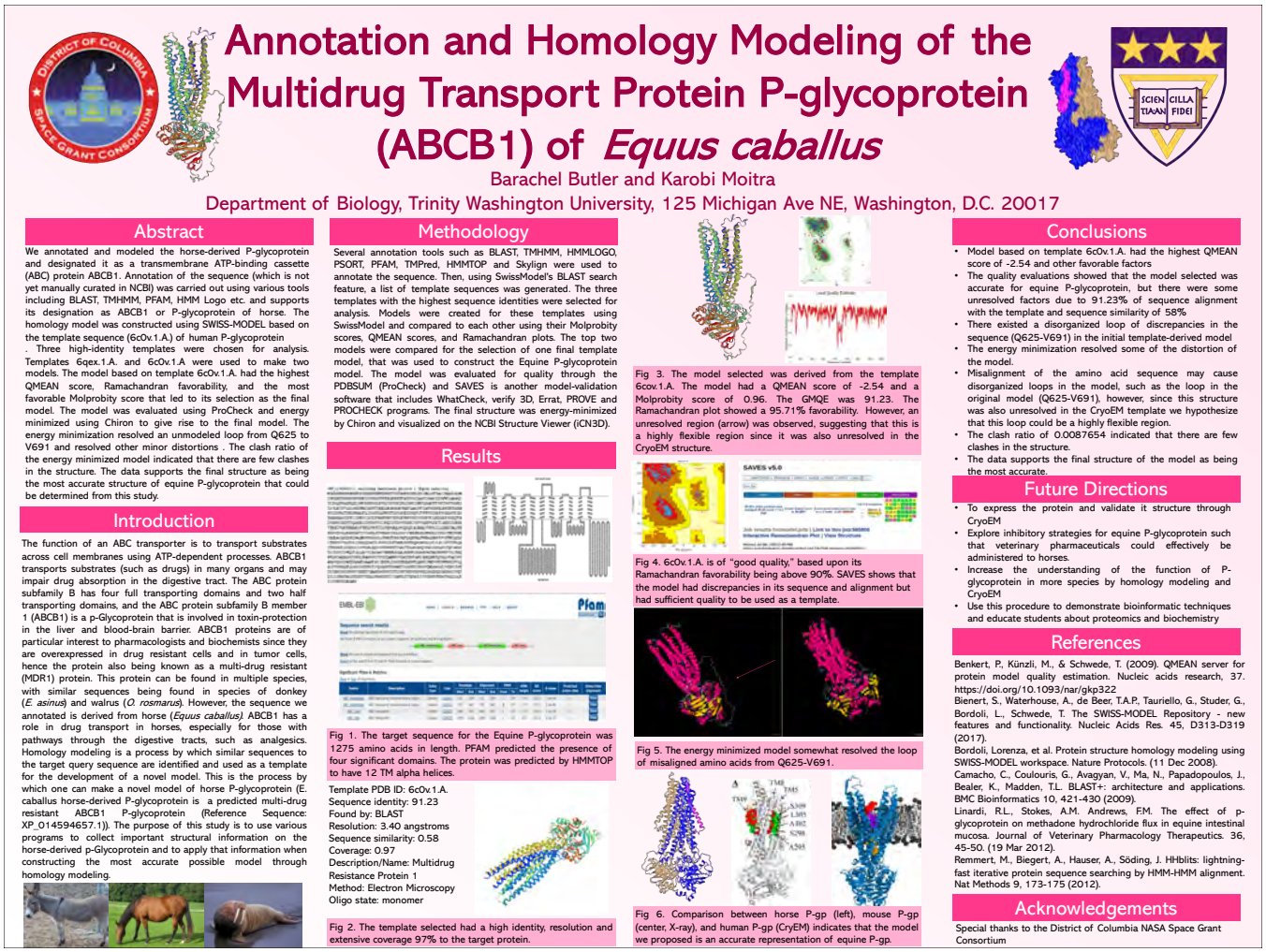
Barachel Butler, Trinity Washington University (Junior)

As a forensic science student, it was indeed serendipitous to embark on a project that was slightly outside of my prior experience and interest. With COVID-19, the ability to complete the NASA Grant internship was in question, but thanks to the creativity and resourcefulness of my mentor, Dr. Karobi Moitra, and that of the other professors and advisors involved, I and my fellow interns were able to do our own research completely virtually. So when my project turned out to be about proteomics and bioinformatics rather than forensic DNA analysis, I had to learn and adapt quickly. That was in the summer of 2020, almost one year ago.

This year, I am able to enjoy the success of my research, which was to build a novel model of horse P-glycoprotein using homology modeling through SWISS Model software. The model was based on the BLAST template 6c0v.1.A., a human P-glycoprotein that was similar enough in structure to base a model of the horse P-glycoprotein on. This template had the highest QMEAN score of -2.54 and other favorable factors. The quality evaluations showed that the model selected was accurate for horse P-glycoprotein, but there were some unresolved factors due to 91.23% of sequence alignment with the template and a sequence similarity of 58%. There existed a disorganized loop of discrepancies in the sequence (Q625-V691) in the initial template-derived model.

The energy minimization, which uses the online program Chiron to produce a more stable model, resolved some of the distortion of the model. Misalignment of the amino acid sequence will cause disorganized loops in the model, such as the loop in the original model (Q625-V691), however, since this structure was also unresolved in the CryoEM template, it was hypothesized that this loop could be a highly flexible region. The clash ratio of 0.0087654 indicated that there are few clashes (discrepancies) between the structure of the model and the actual protein sequence of P-glycoprotein. The data supports the final structure of the model as being the most accurate.

In the future, I hope for the expansion of this research to include the expression of the protein through CryoEM to validate its modeled structure and to explore inhibitory strategies for equine P-glycoprotein such that veterinary pharmaceuticals could effectively be administered to horses. Increasing the understanding of the function of P-glycoprotein in more species by homology modeling and CryoEM is another important endeavor that can further contribute to proteomic literature.



Barachel Butler's poster from the 2021 NASA Space Grant Competition

I was so thankful for the opportunities to present my research in both the ABRCMS Virtual Research Fair, as well as in the NASA Space Grant Consortium presentation contest, in which I won first place. I am currently working on an article that I hope to publish in an undergraduate research journal, and I look forward to continuing my education after graduating from Trinity Washington University. Thank you INSPIRE for allowing me to share my experience!
To view Barachel's presentation, visit: https://youtu.be/DUFUENbZBuk

SECOND PLACE: The Influence of Human Mobility and Meteorology on PM2.5 Using Crowdsourced PurpleAir Sensors

Joseph Minnich, American University (Senior)

I'm a senior Computational Physics major from American University and I've been researching air quality over the past two years with Valentina Aquila. Valentina and I discovered Low-Cost Air Quality Sensors (LCAQS) in 2019, a relatively new way of detecting the concentration of fine particulate matter in the air (also called PM2.5). The introduction of LCAQS has democratized air quality monitoring, providing an alternative to expensive regulatory monitors. We became interested in the devices because their low cost makes it feasible to deploy dense sensor arrays and investigate new problems.

In early 2020, we deployed 10 sensors around American University, intending to measure air pollution across campus from winter into summer. Our goal was to quantify the improvement in air quality-related to deciduous trees growing leaves. However, not long after the initial deployment, COVID-19 restrictions went into place making maintaining the network of sensors unfeasible. Back at home, I spent lots of time brainstorming how we could turn this problem into a possibility.

Luckily, PurpleAir sensors are wifi-connectable meaning data was available to me from hundreds of sensors across the world. This got me thinking about what I could do using solely free, open data. Not long after, I discovered SafeGraph's COVID-19 data consortium which provides academic researchers access to anonymized cellphone mobility metrics. Then it dawned on me, COVID-19 stay-at-home orders have created a unique scenario where automobile usage suddenly plummeted, creating a perfect opportunity to study how human mobility is related to PM2.5.

With a great research question in mind, I set out to find a statistical model that fit my needs. I considered using 10s of different models but none were exactly what I was looking for. I needed a model that was suitable for highly complex big data problems but gave results that are easily human-readable. On the one hand, you have linear models which give highly-interpretable results at the cost of low predictability. On the other hand, you have neural networks and deep learning which have remarkable predictive power, but the results can be a bit of a black box. I needed to find a balance, and that's when I learned about the Generalized Additive Model (GAM). The GAM assumes an additive relationship between the independent variables and the dependent variable. The GAM fits so-called factor functions to each independent variable which allows us to analyze how that variable contributes to the dependent variable. Under the hood, GAMs work by fitting a finite sum of splines using a smoothing penalty. Although it may seem trivial, this approach allows us to fit factor functions that look nonlinear using linear methods. Essentially this means a GAM is just a fancy generalized linear model, and therefore we can use confidence intervals, feature selection with p values, fast cross-validation, and more! GAMs are great because they can be fit very quickly, and are very flexible being useful in many different applications.

Because PM2.5 is extremely complex and multivariate I began building a dataset of potentially significant variables. This included NOAA ground weather observations for factors like rainfall and wind speed, SafeGraph's human mobility metrics, and PurpleAir PM2.5 measurements as the dependent variable. We could keep adding variables to our dataset, however, obviously, not all variables are relevant in modeling PM2.5 variation. For this reason, I implemented a variable selection algorithm from Barmpadimos et al to detect variables of interest.

As a test, I compiled a dataset for the Grand Junction Colorado area from March 2019 to April 2020. Chosen for its dense arrangement of PurpleAir sensors near an airport (where NOAA weather observations are taken). All datasources were grouped on the county block group level (*see Figure 1*).

After running the variable selection algorithm with many different fitting parameters, what we found was that in our strict models, weather variables outshined the effect of reduced human mobility. With the more lax models, we found some evidence of statistical significance of human mobility, as the variable was deemed relevant for one county block group.

While working on this project, I watched PurpleAir's network grow substantially. Events such as the California wildfires have gotten everyday people interested in air quality, buying the low cost sensors for themselves and deploying them at their homes.

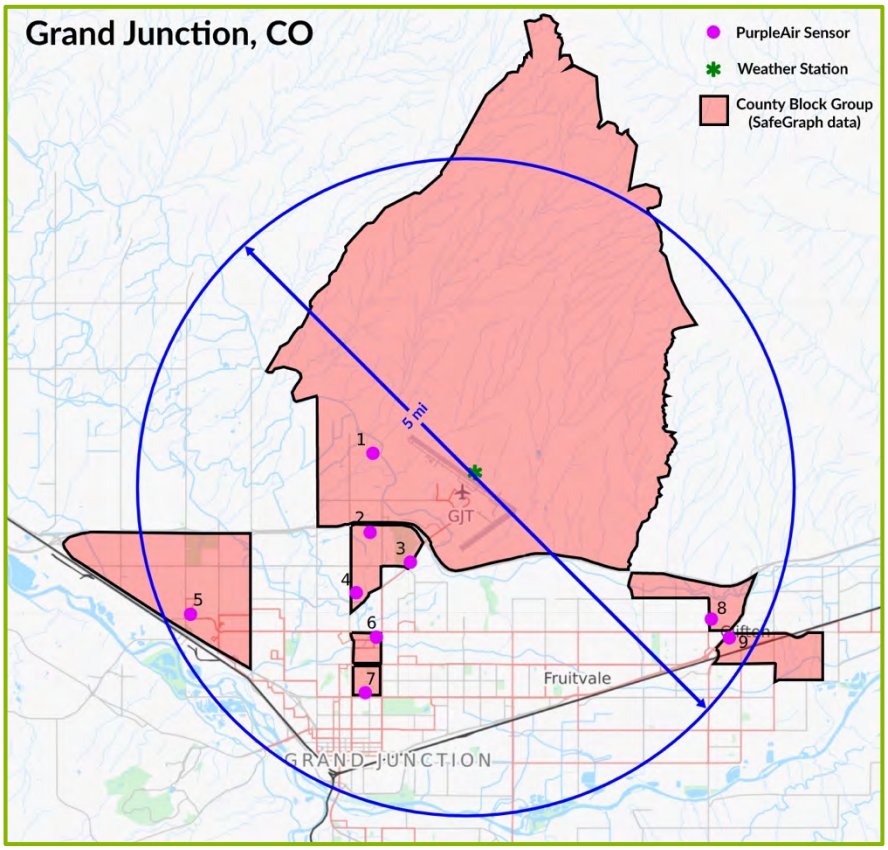


Figure 1: Sketch of Grand Junction, CO setup. PurpleAir sensors are represented by fuchsia dots, ground weather station is represented by a green asterisk, and the CBG corresponding to each PurpleAir sensor is shaded light red.

This constantly improving spatial density of the PurpleAir network is extremely exciting for my approach because it means that it may be applicable to more and more places over time. Another great benefit of my approach is that it can potentially be expanded by the internet-of-things. The internet of things is the concept that an ever-increasing amount of "things" are being embedded with sensors and connected online. As more and more everyday-devices come online, we can potentially get access to more data that could be useful in modeling PM2.5 variations. For instance imagine a future where cars themselves are connected to the internet, giving us data on carbon emissions of individual vehicles. Consider thermostats, grills, lawnmowers, any device that causes increased PM2.5. Because the GAM is an additive approach, the more relevant data sources we supply the model,

the better its overall fit. For this reason, we believe GAMs may be particularly useful in the future internet of things. I am still working on this project, trying to build GAMs which explain PM2.5 variation, especially ones which incorporate human mobility metrics.

In the future, I want to experiment with building GAMs with multivariate factor functions. My goal is to continue improving my dataset, learning how and why different variables relate to PM2.5. I hope that my work can serve as a reference to future researchers, wanting to model PM2.5.

I learned a lot about myself and what it means to be a researcher over the course of this project. I learned that fear of failure severely limits the ability to succeed. To be a successful researcher one must embrace failure with open arms. One must fail spectacularly and often. If your research question can be answered without any failures, it probably isn't a very interesting research question. Additionally, I learned that as counter-intuitive as it sounds, sometimes the most productive move is taking a step away from your project and getting some exercise. Maintaining a balanced lifestyle is key for productivity. Most of all, this project has hammered home the concept that doing good research isn't related to the accuracy or timeliness of a solution, rather it's about asking the right questions.

If you are interested in learning more about my methods and results you can read my capstone final report on my website: http://josephminnich.com/capstone

Joseph next to a PurpleAir sensor installed at American University

To view Joseph's presentation, visit: https://youtu.be/JjCYF1_kNMU

THIRD PLACE: Machine Learning to Map the U.S. Power Grid

Joey Lamborn, American University (Junior)

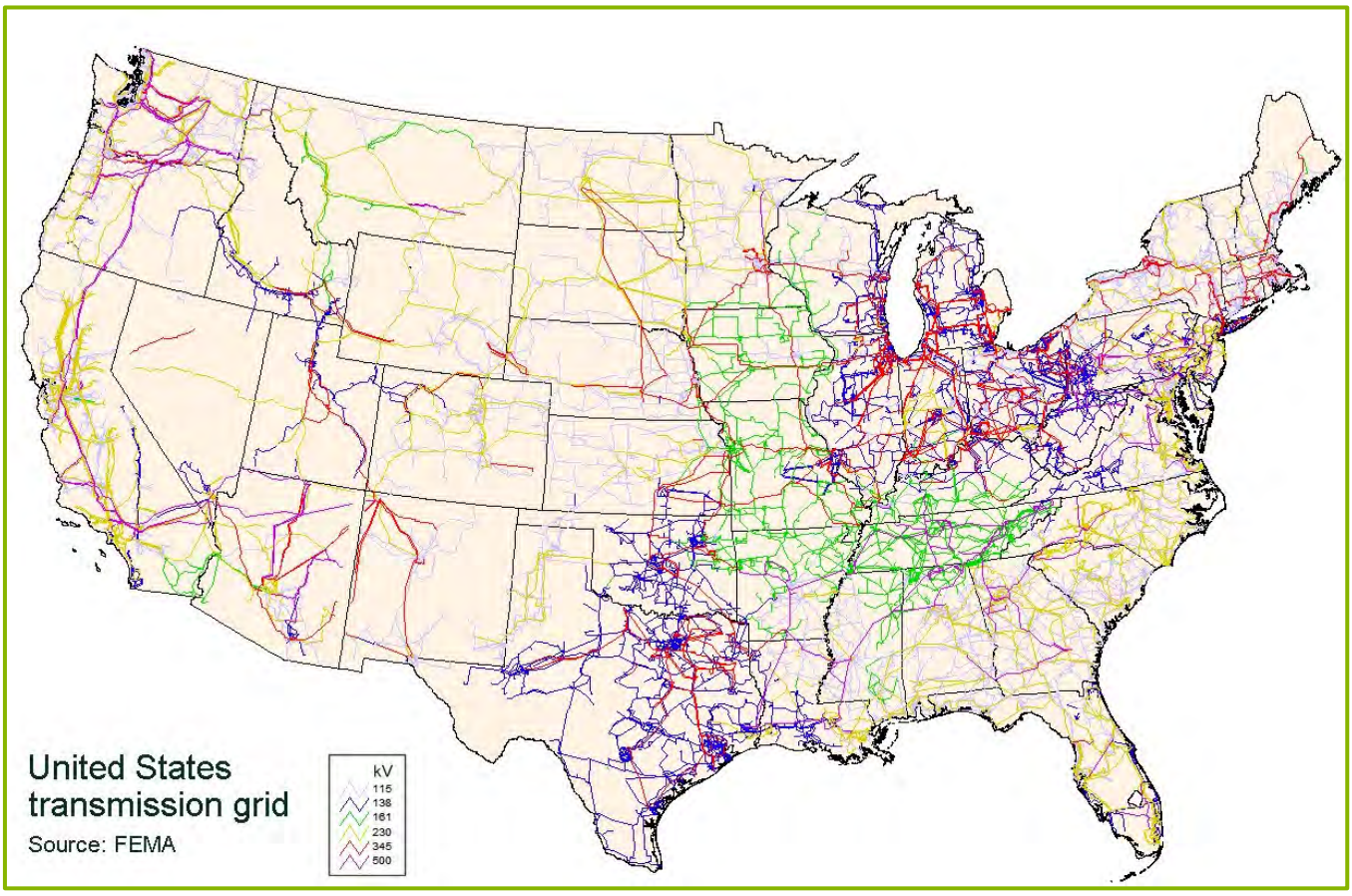


Figure 1: The U.S. power grid is made of 160,000 miles of high-voltage power lines and millions more miles of low-voltage distribution lines

If you asked me a couple years ago what I'd be doing, I would have never guessed interning at NASA! I came to American University studying political science, but once I took my first physics course, I was hooked. The semester after my introductory physics class, I switched my major and began looking for ways to get hands on experience. Thanks to the NASA DC Space Grant Consortium, I was able to work on a research project at the NASA Goddard Space Flight Center (GSFC), and thanks to my mentors and hard work, I was able to turn this opportunity into a full-time internship.

My research task was to develop machine learning tools to automate the mapping of the U.S. power grid. The power grid is vulnerable to large-scale solar events, and because the power grid is classified as critical infrastructure, it is key that these vulnerabilities are understood and explored. Unfortunately, solar physicists at NASA GSFC do not have access to a comprehensive map of the power grid, and therefore have limited ability to simulate the effects of solar events. Additionally, the U.S. power grid contains millions of miles of power lines, so mapping it by hand is by no means a feasible solution. Machine learning, on the other hand, has the power to automate tasks like this. Machine learning is a method of data analysis in which you use large amounts of data to build a model that can automate a task. For example, Netflix uses machine learning to recommend shows to you based on your viewing history. Machine learning is also particularly good at detecting objects in images, so I set out to build machine learning tools to automate the mapping of the U.S. power grid.

Due to COVID, Joey's team held virtual meetings this year

When I started my research, I had very limited experience with machine learning but a drive to learn more. I was lucky to have a team of wonderful mentors, Drs. Peter Schuck, Sean Blake, and Silvina Guidoni, who guided me through the learning process and helped me succeed. We started by building basic machine learning models to solve basic tasks, and our first accomplishment was building a machine learning model to detect Santa Claus in images. From there, we set out to build more complex models to do more advanced detection. Through this process, I learned the fundamentals of building machine learning solutions and became proficient in a range of data science techniques and tools.

While I gained valuable technical skills from my time at NASA, the most important skills I learned were from my mentors. They challenged me to never stop learning and to be creative in my problem-solving. There were many points where I thought I didn't have the skills or experience to continue my research, but my team was always there to remind me I could do it. My research experience at NASA Goddard Space Flight Center has inspired me to use machine learning technology to change the world. In an attempt to apply my experiences, a couple students and I have founded a company, 17minds, which uses data science to improve autism care. The technical skills I gained at NASA as well as the lessons I learned from my mentors have been invaluable in this endeavor, and I hope my research experience inspires others to pursue positions within NASA.

To view Joey's presentation, visit:
https://www.youtube.com/watch?v=KjIS6JJbm0Q

>> HONORABLE MENTION: Effect of Formaldehyde Based Embalming Fluids on the Chemical Composition of Drugs

Jaylan Pratt, Trinity Washington University (Graduate)

I am a proud graduate of Trinity Washington University. I graduated with a degree in Forensic Science with a minor in Forensic Psychology in 2020. I had the privilege of conducting research through the National Aeronautical and Space Administration (NASA) DC Space Grant Internship program from summer 2020 to spring 2021.

EFFECTS OF FORMALDEHYDE-BASED EMBALMING FLUIDS ON THE CHEMICAL COMPOSITION OF DRUGS

JAYLAN PRATT AND ANETTE CASIANO-NEGRONI
Trinity Washington University, Washington DC

RESEARCH QUESTION, HYPOTHESIS, GOAL

Formaldehyde is the primary preservative used in modern day embalming fluids. In some forensic cases where foul play is not considered, samples for toxicological analysis are not taken. However, if a later suspicion of foul play arises the corpse may be exhumed for toxicological tests. Our research aims to develop a method to study how the use of formalin affects the chemical composition of drugs post embalming. We hypothesized that all the drugs will react with the formalin, thus making detection more difficult. Our goal for this research is to characterize the structure of the drugs post-formaldehyde and formaldehyde-embalming fluid exposure.

BACKGROUND

Embalming is one of humankind's oldest techniques, which practices artificially preserving human or animal remains. Modern day embalming consists of various chemicals (preservatives, germicides, buffers, perfumes, dyes, etc) being injected into the deceased body for funeral proposes, transportations, and or further research. Formaldehyde, is one of the main components of modern embalming fluids acting as a preservative. In some cases where foul play is not considered, samples for toxicological analysis are not collected at the time of the autopsy (pre-embalming). However, if a later suspicion of foul play arises the corpse may be exhumed for toxicological tests. At this point, the body has been embalmed typically with a formaldehyde-based embalming fluid.

It has been shown that formaldehyde can affect different drugs structurally and cause chemical reactions, decreasing the concentration of the drug in the body preventing its detection. Such alterations can reduce the chances of drug detection post-embalming.

METHODOLOGY

- We reviewed literature to analyze 115 drugs to see if they have been studied in the presence of formalin following the chart below.

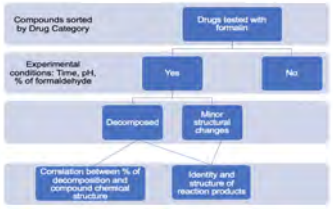


Table 1: List of the drugs studied in formalin solutions.

Alprazolam	Imipramine	Methamphetamine	Bupropion
Flunitrazepam	Nortriptyline	Fenfluramine	Olanzapine
Flurazepam	Cocaine	Benzoylecgonine	Chlorpromazine
Midazolam	Methamphetamine	Morphine (heroin)	Phenytoin
Oxazepam	MDMA	Fentanyl	Phenytoin
Triazolam	Amitriptyline	Tetramine	Paraquat
Chlordiazepoxide	Toluene	Pethidine or meperidine	Phenobarbital
Prazepam	Desipramine	Cyanide	
Lorazepam	Lidocaine	Sertraline	
Estazolam	Chloroform	Fluoxetine	

RESULTS

Figure 1: Drug Categories. The drugs analyzed in this study were categorized by drug type and if they were studied in formalin.

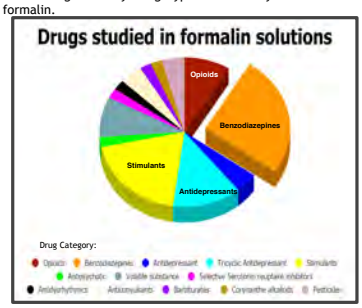


Figure 2: Drug Decomposition. Results for drugs in each category once in the presence of formalin at different experimental conditions.

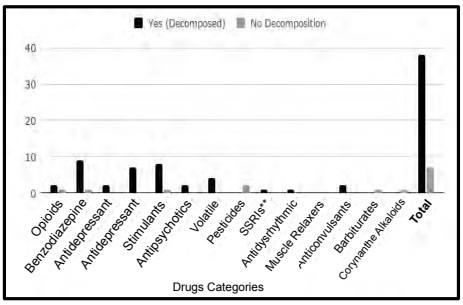


Figure 3: Percentage of decomposition of drugs in formalin solutions. Each drug category had drugs with varying decomposition percentages.

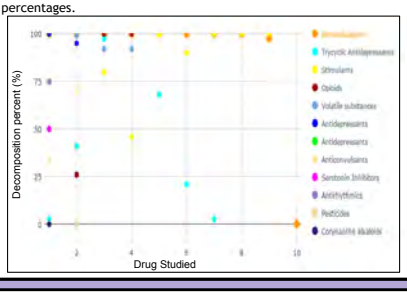
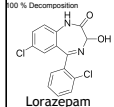
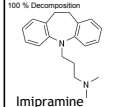
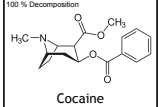
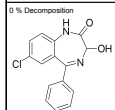
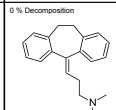
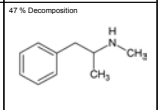


Table 2: Highlights of the chemical structure of some of the drugs. Correlation of structural features and percent of decomposition in formalin solutions

Benzodiazepine	Antidepressant	Stimulants
100 % Decomposition  Lorazepam	100 % Decomposition  Imipramine	100 % Decomposition  Cocaine
0 % Decomposition  Oxazepam	0 % Decomposition  Amitriptyline	47 % Decomposition  Methamphetamine

CONCLUSIONS

- Our results underscore that formaldehyde-embalming fluids affects the stability and chemical compositions of different substances making it difficult to be detected post-embalming.
- Only 37 of the 115 drugs have been studied in formalin and 78% of them have lost stability or decomposed at high pH (9.5) and high percentage (20%) of formalin. The identity of the decomposition products for most structures have not been determined.
- There is not a clear correlation between the drug structures and the percent of decomposition and its reaction with formaldehyde or other components in embalming fluids.

FUTURE DIRECTIONS

We are currently designing an experimental methodology to characterize the structure of the drugs pre- and post- formaldehyde exposure using a combination of Chromatography-Mass Spectrometry (GCMS) and Nuclear magnetic Resonance (NMR).

Lorazepam and Oxazepam will be study to gain insights on (1) structural changes, (2) type of chemical reactions taking place and (3) how functional groups in Benzodiazepines relate to the percentage of decomposition.

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ACKNOWLEDGEMENTS

I would like to thank the DC Space Grant for funding this summer internship opportunity along with my academic advisor Dr. Shizuka Hsieh. I would like to give a special thanks to my research mentor Dr. Anette Casiano-Negroni.

Jaylan Pratt's poster from the 2021 NASA Space Grant Competition

My research mentor Dr. Anette Casiano-Negroni and I began researching the effects of formaldehyde based embalming fluids on the chemical composition of drugs. Formaldehyde is the primary preservative used in modern day embalming fluids. Formaldehyde-based embalming fluids can affect different drugs and cause chemical reactions. Our research aims to develop a method to characterize the chemical composition and concentration of the parent drug and its metabolites in the presence of

formaldehyde. We conducted a literature data analysis of 122 drugs and other substances ranging from opioids, illicit drugs, antidepressants, pesticides, among others that have been shown to be involve in foul play. Our study revealed that 51 of these 122 substances have been studied in formaldehyde solutions at different pH and temperature conditions using High Performance Liquid Chromatography (HPLC) or Gas Chromatography-Mass Spectrometry (GCMS). Of these 51 drugs, 78% lost stability and the drugs within the same category had similar decomposition rates. Our preliminary results underscore that formaldehyde-embalming fluids affects the stability and chemical compositions of different drugs, making post-embalming identification difficult. We are currently moving towards finishing our experimental methodology to characterize the drugs and any metabolites resulting from the decomposition reactions.

Today, I am a thriving researcher in part due to my experience with this internship. I have gained a new appreciation for chemistry, along with an in-depth understanding of postmortem forensic toxicology. My sincere gratitude to the NASA DC Space Grant Consortium for the financial support and thanks to Trinity Washington University and my mentors Dr. Anette Casiano-Negroni, Dr. Shizuka Hsieh, and Dr. Patrice Moss for your guidance and leadership. Thank you, INSPIRE!
To view Jaylan's presentation, visit: https://youtu.be/UPeHE9ylUe4

Using Carbon Fiber Microelectrodes to Detect Dopamine

Michelle Hadad, American University (Junior)

I am a Health Promotion major from McLean, Virginia. This summer I received a scholarship from DC Space Grant Consortium and had the opportunity to continue research in the Zestos Lab in the Chemistry Department at AU. The goal of my project was to gain familiarity with Fast Scan Cyclic Voltammetry (FSCV), detect dopamine using Carbon Fiber Microelectrodes (CFMEs) and collect data using fast scan cyclic voltammogram (FSCV) through the High Definition Cyclic Voltammetry (HDCV) software.

Dopamine is an important neurotransmitter to study due its role in diseases such as Alzheimer's and Schizophrenia. FSCV is a popular tool to use because it can quickly detect changes of biomolecule concentration; therefore, it can quickly detect changes in neurotransmitters in the brain. By using CFMEs' (Figure 1), which are highly sensitive since they have surface oxide groups that absorb cations like dopamine, I was able to measure different concentrations of dopamine from 1μM to 100μM (Figure 2). Electrodes had to be cut under the microscope to a protruding length of approximately 100 microns before FSCV testing with dopamine (Figure 3). Different measurements of concentrations were collected on an analysis software where CV graphs, I vs T graphs and color plots were recorded and compared. It was concluded that due to an increase of concentration (ex. 1 μM → 5 μM), there is an increase in current, and this pattern is consistent for dopamine. During my 8 weeks, I attended weekly conference meetings which have furthered my curiosity in the STEM field. Overall, my summer has been impactful with the support of my lab group and the funding for my project. I wish to further my experience with FSCV this year with detection of cortisol. Cortisol is a major stress hormone and it has a lasting effect with the development of several chronic illnesses. I am very appreciative of the opportunity that I have been given to understand this aspect of research and to develop further interests with the detection neurochemicals. *To view Michelle's presentation, visit: https://www.youtube.com/watch?v=c7-XwRxHwU8*

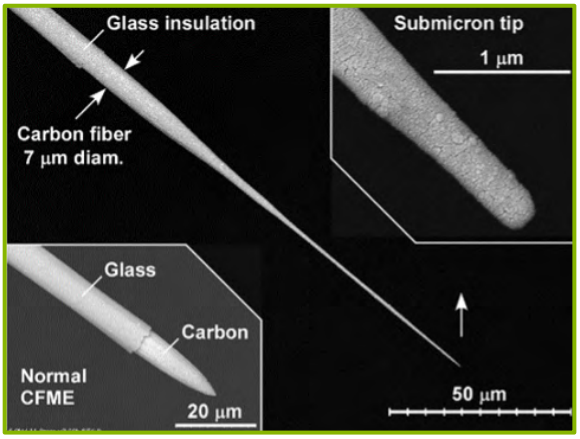


Figure 1: Scanning Electron Microscope (SEM) image of a carbon electrode under high magnification

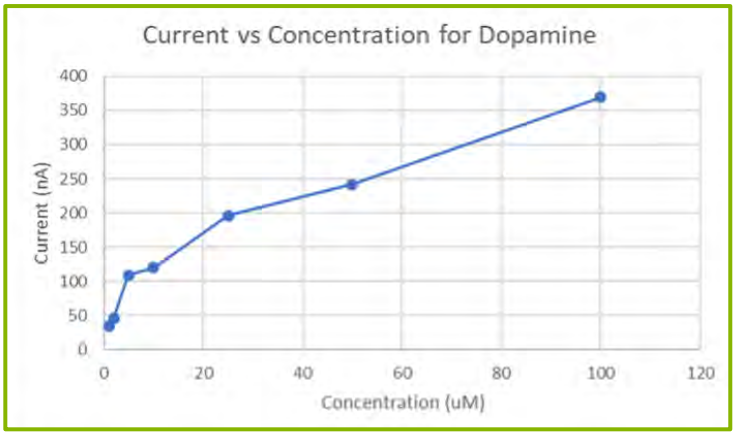
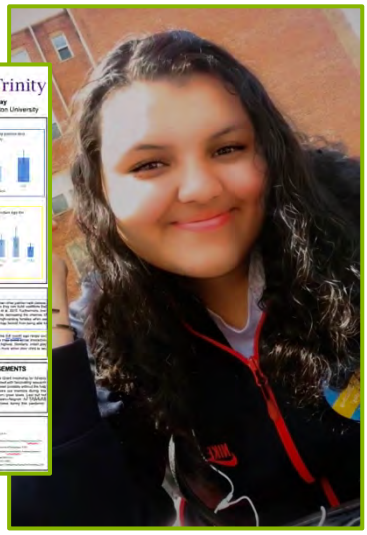


Figure 2: Current vs. Concentration Curve. Graph plotting concentration vs. peak oxidative current for the FSCV detection of dopamine

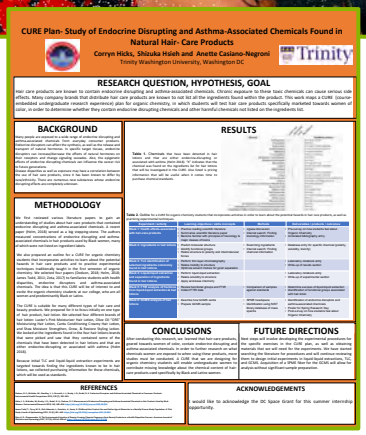

Figure 3: Electrode preparation – Michelle cutting carbon fiber microelectrode under the microscope

>> Wild Chimpanzees Correlations in Dominance Rank, Infanticide Risk, and Maternal Social Strategies



Yasmin Marcia, Trinity Washington University (Sophomore)

I am a sophomore at Trinity Washington University. For the summer of 2020, I had the amazing opportunity to do a 6-week paid internship funded by the NASA DC Space Grant. Working alongside my mentor Dr. Wellens and my partner Xena Portillo was such a great experience. We collaborated with researchers at The George Washington University to examine the female social relationships in wild chimpanzees. The data we worked with was collected from 25 years at Gombe National Park in Tanzania. Working with this data was especially enjoyable because Jane Goodall, a famous female STEM researcher, started and worked in-person at this same site. We even got to look at data from the same chimpanzees she knew and followed! Through this experience, I was able to get hands on practice working through the entire scientific process — we came up with a question, formed hypotheses and predictions, and used data analytic techniques to answer our questions. In the 6-weeks of trying to complete our research poster, I felt that I was improving my leadership and communication skills making my experience unforgettable. I got to share my ideas with other scientists and just being able to talk about our research gave me more insight into science research and also gave me new confidence. I always knew internship opportunities were a great opportunity to explore and discover new research and I am thankful I got to share it for the first time with the NASA DC Space Grant. Thank you INSPIRE, for sharing my 6-week internship journey which was incredible. *To view Yasmin's presentation, visit: https://youtu.be/jzzWYf8t7Ak*



CURE Plan – Study of Endocrine Disrupting and Asthma-Associated Chemicals Found in Natural Hair Care Products <<

Corryn Hicks, Trinity Washington University (Senior)

I am majoring in Biology as well as minoring in Chemistry. I am currently finishing up my senior year at Trinity Washington University. My research focused on endocrine disrupting and asthma-associated chemicals, often found in natural hair care products. My project was to begin designing a CURE (course-embedded undergraduate research experience) plan for organic chemistry, in which students will test hair care products specifically marketed towards women of color, in order to determine whether they contain endocrine disrupting chemicals and other harmful chemicals not listed on the ingredients list. I started my research by reviewing the literature and creating an annotated bibliography of previous studies that have detected chemicals in hair care products that are either endocrine-disrupting or associated with asthma. The CURE will enable undergraduate women to contribute additional knowledge about the chemical content of hair-care products, with a focus on those used specifically by Black and Latino women. We developed a CURE outline that incorporates activities to learn about the potential hazards in hair products and to practice experimental techniques traditionally taught in the first semester of organic chemistry, including spectroscopy and chemical separation methods. We decided to focus initially on one type of hair product, hair lotion, in which we selected four different brands. To prepare for initial experiments, I generated a list of chemicals that we would expect to find in the selected hair lotions. The plan also includes a student survey, before and after conducting the CURE in order to get a better understanding as to how they feel about Organic Chemistry and also in hopes to get them excited about this CURE. I would also like to shine light on the Annual Biomedical Research Conference for Minority Students (ABRCMS), which I had the pleasure in attending and presenting my research, I was awarded a Presentation Award in the Chemistry category.

This was a very meaningful experience within my six weeks of undergraduate research supported by the DC Space Grant Consortium. This experience has helped me to gain a better perspective about research. I am so thankful to be able to experience this amazing opportunity, in which has brought tremendous value to my life as a student in the STEM field. I also want to thank my mentors at Trinity for making this a great experience as well. Without their kindness, knowledge, and devotion this research would not had been as impactful as it is to me now. In the near future, I hope to conduct further research on natural hair care products. *To view Corryn's presentation, visit: https://youtu.be/SsVcpysB4CI*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Tony Bateman (Finland)

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