National Nuclear Security Administration Minority-Serving Institution Partnership Program

High School Interns September 2021





Brooklyn Arroyo



Experience

- High School Student
- Minority-Serving Institution Partnership Program - High School

Accomplishments

- Served as student leader host of the Dude, Be Nice Event.
- Founder of the Chiawana High School's Staff for an Inclusive Culture, the Squawk-Discussion and Empowerment Group, and the Riverhawk Project.
- Member of National Junior Honor Society, Natural Helpers, and Web Crew.
- Annual Hispanic Academic Achievers
 Program Award winner.

- Intern, CH2M HILL Plateau Remediation Company STEM Bioethics Internship
- Founding Member, Association of Washington Student Leaders Student Equity Cohort
- President, Natural Helpers
- Student Member, Pasco School District Equity, Diversity, and Inclusion Planning Committee
- Participated in the Leadership Association of Student Councils Leadership Conference.
- Volunteered at Special Olympics Washington.
- Served as judge and competitor at FCCLA State Leadership Conference.



Brooklyn Arroyo

Chiawana High School

Dive into Diversity, Equity, and Inclusion through Data Analysis



Overview

Working alongside many professionals managing recruitment of National Nuclear Security Administration Graduate Fellowship Program and PNNL divisions under Data Analytics, I engaged in a research assignment with a focus for laboratory-wide demographics and the impacts demographics have on a workplace.

Outcomes

The project began with a broad focus on the general idea of Diversity, Equity, and Inclusion (DEI) within professional workplaces and, more specifically, laboratories. Overtime, specific demographical trends in gender, race, and workplace comfortability were observed.





- Pillar #1: Diversity Demographics (Quantitative)
 Pillar #2: Indusion Demographics (Quantitative)
 Pillar #3: Development Demographics (Quatitative)
- = Pillar #4: Environmental Feedback (Mixed Method)

The diagram developed to better organize means of important DEI demographics

The conclusions showed a lack of uniform data collection and evaluation, making it easy for misleading statistics and a lack of legitimate good change in DEI. A workplace DEI Index is to be made and proposed, most effectively, through a white paper.

"This internship provided me with new experiences, knowledge, and understanding. I gained these through the lens of something I am passionate about, DEI, and learned you can be technically prepared for critical conversations."



Brooklyn Arroyo Chiawana High School

PNNL Mentors:

Melanie Godinez Christian Perry

pnnl.gov/msipp-nnsa PNNL-SA-165862

Jared Doran



Experience

- High School Student
- Minority-Serving Institution Partnership Program - High School

Accomplishments

- Strong interest in industrial and systems engineering and renewable energy engineering.
- Served as a volunteer for the blood drive, ensuring people's attendance.
- Maintained high grades while providing service for the community, including serving as a tutor for students after school.

- National Honor Society, Hanford High School
- Key Club, Hanford High School
- Spikeball, Hanford High School
- Eastside Sustainable Farm, Blueberry Farm

- Community outreach includes working as a server for the Richland Easter Egg Hunt, raising money for UNICEF, assisting with activities for Lee Elementary Students at after-school events, and volunteering at the Mid-Columbia Ballet Nutcracker.
- Served as Vice President for the Hanford High School Spikeball Club, organizing the club and rules along with ensuring safety of members. Taught a variety of students a new sport. Guaranteed a safe, competitive environment for all players.



Jared Doran

Hanford High School Class of 2021

Researching and Arranging Chemical Warfare Agents and their Surrogates



Overview

Context: Chemical warfare agents (CWAs) are easy to produce, highly toxic compounds that can be used to create weapons of mass destruction.

Objective: Create a spreadsheet with information that links CWAs and their surrogates. This will be used as part of a sponsor's lexicon.

Method: Use a variety of databases to obtain information on CWAs/surrogates and then transcribe the data into an Excel spreadsheet

Outcomes

- Chemist and scientific advisor review of data and clarification of terms and processes
- Librarian meeting, enhanced research results and introduced EndNote 20
- Understanding and applying Tidy Data formatting
- The creation of a fundamental resource needed to create an adaptable database
- Detailed Excel spreadsheet containing CWA's and surrogates
- Document ready for sponsor delivery



"This internship gave me the opportunity to enhance my data management and research skills. Through a plethora of self-improving resources and workshops I was able to advance my professional knowledge and network with others."



High School Degree Hanford High School University of Washington (Fall)

PNNL Mentors: Lead)

Cheslan Simpson Leesa Duckworth (Team

pnnl.gov/msipp-nnsa PNNL-SA-165644

Dylan Lai



Experience

- High School Student
- Minority-Serving Institution Partnership Program – High School

Accomplishments

- Participated in service-learning opportunities through volunteering projects that serve the community and school.
- Cooperated with club officers to plan, organize, and lead service projects, such as a food/hygiene drive for food banks/wellness centers and a craft night to send masks/cards to frontline workers/healthcare providers.
- Attended a summer academic program that held 6-hour seminars and college prep classes 5 days per week for around 2 months and followup meetings regarding college prep throughout junior year of high school.

- Club Secretary, National Honors Society Club
- Club Cabinet Member, Health Occupations for Students of America Club
- Participant, University of Washington Math Science Upward Bound Program
- Club Historian, Vietnamese Student Association Club
- For Vietnamese Student Association, communicated and taught Vietnamese culture, history, and traditions to club members monthly.
- Cooperated with fellow club officers in planning and organizing meetings and presentations for the club via post-meeting virtual calls.
- Fluent in Vietnamese.
- Participated in competitions regarding healthcare professions to practice being in those professions.



Dylan Lai

Cleveland STEM High School Class of 2022

VitalTag Waveform Algorithms



Overview

VitalTag reimagines physiological sensors for mass casualty events. It allows for monitoring of vital signs in a cost-effective package. It supports EMTs and improves outcomes by providing remote access to real-time vital signs and alerts to critical changes in any patient's condition. I identified and classified physiological waveforms of patients with circulatory diseases to train VitalTag to identify and evaluate these unique patients.

Outcomes

Through this internship, I developed basic computer science skills, learned numerous physiological algorithms, and was introduced, through literature reviews, to circulatory diseases, such as atherosclerosis. I focused on how these diseases affected the circulatory system and related vital signs. This work supported the project in the initial identification and classification of abnormal waveforms.



A model of the VitalTag device

My internship work has supported the enhancement of the VitalTag system, which will ensure EMTs efficiently use resources in mass casualty events to treat more patients through more informed triage and treatment. "This internship has given me an amazing opportunity to learn about how computer and data science is used with medical and biological sciences. This has furthered my understanding and interest in both fields."



Dylan Lai Cleveland High School

PNNL Mentor:

Jonathan Barr



Renee White



Experience

- High School Student
- Minority-Serving Institution Partnership Program - High School

Accomplishments

- Participated in two-week program on Java programming with University of Washington.
- Attended selective week-long leadership and college preparation program through Hispanic Scholarship Fund.
- Participated in computer and technology workshops and related activities at DigiGirlz High Tech Camp.
- Participated in the Robotics Club at Mercer Island High School, which competes in VEX robotics in the fall, and the First Robotics Competition in the spring. Advanced to District-level Competition in 2019.

- DMA Java Programming Academy, University of Washington
- Youth Leadership Institute, University of Southern California
- DigiGirlz High Tech Camp, Microsoft Corporation
- Robotics Club and Destination Imagination, Mercer Island High School
- Participated in Destination Imagination, an academic competition that tests skills in fields including creativity, engineering, math, and art. Placed second in 2019 world competition, won 2019 state Renaissance Award.
- Completed 300+ hours of volunteering, including through VOICE (Volunteer Outreach in Communities Everywhere) and at El Centro de la Raza legal clinics.



Renee White

Mercer Island High School Class of 2021

Ethical Autonomous/Intelligent Systems as Applied to Nuclear Safeguards



Overview

I worked on a project involving the intersection of nuclear safeguards and artificial intelligence. My work included surveying the current literature and subject matter experts to elicit a set of possible use cases to apply ethical autonomous/intelligent system (A/IS) principles.

Outcomes

We applied our understanding of International Atomic Energy Agency (IAEA) general constraints about A/IS adoption and use along with the dimensions of the Ethics Certification Program for Autonomous and Intelligent Systems framework in order to develop two robust use cases to support expert elicitation. In addition, we developed a related set of ethical A/IS and A/IS assurance questions. This work will allow for informed development and adoption of A/IS in nuclear safeguards, increasing the performance of the IAEA.



Example Use Case: AI Power Estimation of Nuclear

"This internship gave me great insight into what working at a national laboratory is like and the applications of A/IS to nuclear safeguards and the IAEA. I learned how to intentionally network and discovered the steps I need to take to achieve my long-term goals."



Renee White

High School Graduate Mercer Island High School Stanford University (Fall)

PNNL Mentor:

Jonathan Barr

pnnl.gov/msipp-nnsa PNNL-SA-165715

Map showing location of Oak Ridge National Laboratory High Flux Isotope Reactor. Google Earth, earth google.com/web/.

National Nuclear Security Administration Minority-Serving Institution Partnership Program

Undergraduate Interns September 2021





Camille Aguilar



Experience

- Intern
- Minority-Serving Institution Partnership Program
- National Nuclear Security Administration

Accomplishments

- Produced 50-page research reports on STEM topics including nuclear disarmament and cybersecurity. Assembled briefs mapping political corruption in developing nations and UN-defined rights of protestors.
- Designed website to highlight unmet need for public-sector bilingual attorneys at New Mexico's border, showcasing graphics quantifying demands of and resources for immigrants.
- Fluent in Spanish, conversational in French, beginner Italian.

- Assistant Publisher, Picture This Post Magazine
- General Manager, Changing Leads Farm
- Waterfront Director, Leadership Development Director, Culture Coordinator, YMCA of the Pines Inc.
- Member at Large, Model United Nations
 of the University of Chicago
- Produced task management and training material for all levels of magazine staff in response to COVID-19 communication issues.
- Edited and published 50 pieces, authored nine; content ranged from interviews to event advertising.
- Managed inbound customer requests and transitioned Changing Leads from paper to online invoicing. Generated \$4,000 in cost savings through supplier negotiations and productivity initiatives.



Camille Aguilar

B.A. English and Creative Writing University of Chicago

Understanding the Impact of the Secondary Market on Proliferation



Overview

In 2019, PNNL conducted an initial assessment which identified WMD dual-use commodities that are at a higher risk for resale in secondary markets. As a follow-on action, PNNL is conducting deep-dive analysis of six high-interest commodities identified in the initial assessment. I produced a report on machine tools, a high interest commodity group commonly used for numerically controlled, precision machining.

Outcomes

Produced Report on Machine Tools

Machine tools are very common on the secondary market due to their high resale price and reusability.

I performed literature review, quantitative analysis of trade data, and prepared an interview with a subject matter expert.

2005 HAAS MODEL VF-3B CNC VERTICAL MACHINING CENTER; S/N 42047, HAAS CNC in taplat Equipment to the Contrung Operation.



HAAS CNC Vertical Machining Center ("Bidspotter," 2017)

This report will help create a profile of the machine tool industry that will aid U.S. policymakers, export licensing, and enforcement agencies.

"This internship has presented endless opportunities for personal and professional growth."



Camille Aguilar

B.A. English Language and Literature, and Creative Writing University of Chicago



Amanda Sayre Research Analyst

PNNL Mentor:



Jaidyn Bryant



Experience

- Tech Student 3
- Minority-Serving Institution Partnership
 Program

Accomplishments

- Member of the City of NOLA Medical Reserve Corps, Alpha Lambda Delta Honor Society, MAX Homework Clinic, Debate Club, and Biomedical Honor Corps.
- Awarded the Xavier Presidential Scholarship and 100 Black Men Black History Challenge Scholarship.

- Volunteer, Data Collection and Patient Education, NOLA Ready Medical Reserve Corps
- Thrive@GA YAs of Color Facilitator, Unitarian Universalist Association
- Research Intern, PNNL
- Volunteered in data collection and patient education for the NOLA Ready Medical Reserve Corps.
- Conducted research in emission spectroscopic analysis of femtosecond laser-produced LiAIO2 plasma.



Jaidyn Bryant

B.S. Biology Pre-Med Minors, Chemistry and Spanish

Increased Accessibility in Utilizing the Chemical Weapons Convention



Overview

The Chemical Weapons Convention (CWC) contains a set of schedules that list various chemical weapons related substances. It stands as one of the many bridges between science an international law. The schedules use words to denote chemical structures. However, given the trillions of possible chemical structures, finding whether a chemical is scheduled can be an onerous task for non-chemists. This project aims to create a system that streamlines the classification process.

Outcomes

I focused primarily on International Union of Pure and Applied Chemistry nomenclature as it includes syllables, prefixes, roots, and suffixes of the chemical name to denote structure. I worked with a partner, Atharva Chopde, to by produce potential rules that could classify the chemicals into different schedules. I made rules that essentially go from most general to most specific to a certain schedule within the CWC. These rules were then converted into a flowchart tool that translates the components of the chemical name into features of the chemical structure to help classify it into a schedule.



"The Scheduling Stone" graphic by A. Chopde (left) A "word cloud" to represent the prevalence of different components of scheduled chemical names (right)

With further research, we can use this system with machine learning to streamline the process even further from an analog flowchart to an automated system. It will be of great benefit to the people charged with implementing the CWC.

During the internship I also worked on multiple other projects including supporting a 4-part webinar with Libyan scientists by creating a list of alternate neutralization agents and co-delivering a presentation about the bioeconomy for the Global Security, Technology, and Policy group at PNNL. "During this internship, I was exposed to the vast network of scientists and knowledge within PNNL. I was able to gain insight about the procedures and culture of this national laboratory and learn technical skills that will greatly benefit my career."



Jaidyn Bryant B.S. Biology pre-med Xavier University of Louisiana



Project Mentor: Jonathan Forman



Grady Clopton



Experience

- Intern
- Minority-Serving Institution Partnership Program
- Energy Sciences: Experimental and Modeling Consortium

Accomplishments

- Studied a new synthetic method for fluorinated aromatic ketones by crosscoupling reaction between fluorine substituted potassium aryltrifluoroborates and aroyl chlorides in the presence of PdCl2(Ph3P)2 catalyst system under microwave heating.
- Co-authored "Efficient Cross-Coupling Reaction of Aryltrifluoroborates and Aroyl Chlorides for the Synthesis of Fluorine Substituted Aromatic Ketones," published in *International Journal of Organic Chemistry*, 9, 67-72. doi: 10.4236/ijoc.2019.9100.

- Research Assistant, Tennessee State
 University
- Research Intern, Vanderbilt University Medical Center

- Used computational tools and methods to develop models and simulations of materials, which can be used to predict emergent properties.
- Studied chemical biology of vertebrate development, which entailed the discovery of small molecules that selectively modulate signaling pathways involved in embryogenesis.
- Member of the American Chemical Society and American Heart Association.



Grady Clopton

B.S. Chemistry Computational Chemistry Tennessee State University

Determination of the Equilibrium Concentrations of $(HF)_m(H_2O)_n$ Clusters in the Gas Phase

Overview

Because elevated Hydrogen Fluoride (HF) levels pose significant risks to the environment, the capability to accurately measure atmospheric HF levels is essential for environmental management and control. However, even with the best instruments currently available, remote sensing of HF is a significant challenge. This is due the relatively weak absorption signatures produced by HF. In this study, we investigate a novel FTIR technique for measuring atmospheric HF levels.

Outcomes

For the first time, we examined the equilibria of $(HF)_m(H_2O)_n$ clusters larger than m,n = 2, which were obtained from theoretical calculations at the PBE0/aug-cc-pVTZ level of theory. In doing so, we hope to establish a connection between individual cluster configurations and their corresponding vibrational spectra. These results will be compared to those obtained experimentally through use of a new FTIR technique.



Examples of $(HF)_m(H_2O)_n$ clusters (top) and generalized chemical reaction and the expression for its associated equilibrium constant (bottom)

These efforts will help improve our understanding of the atmospheric chemistry of HF clusters and ultimately, the impact of elevated HF levels on the environment. "This internship has given me the opportunity to work with cutting-edge computational chemistry tools. In applying these tools to solve problems, I have learned skills that will be indispensable as I move forward in my career."

Pacific Northwes



Grady Clopton

B.S. Chemistry Computational Chemistry Tennessee State University



PNNL Mentor: Neil Henson

Margareth Mbea



Experience

- Intern
- Minority-Serving Institution Partnership Program
- National Nuclear Security
 Administration

Accomplishments

- Delivered excellent customer service including worked the front desk, answering inbound phone calls, managing inventory, and delivering messages.
- Served as student advocate, speaking at hearings, protesting for alma mater, and supporting Africa is Bleeding social media campaign.

- · Crew Member, Sankofa Bookstore and Café
- Secretary of After-School Affairs, Bruce Monroe Elementary School
- Student Advocate, Washington DC NOLA

- Experienced with Microsoft Office, PowerPoint, and Excel.
- Member of the African Student Union, Chemistry Club, and American Chemical Society.
- Public relation E-board member of the Chemistry Club and X-press You.



Margareth Mbea

Chemistry Major, Math Minor Xavier University of New Orleans

Analyzing the Reactivity of a Manganese Metal Complex for Ammonia Oxidation



Overview

Through the process of being oxidized electrocatalytically into nitrogen, protons, and electrons, Ammonia (NH_3) can release stored electricity from renewable sources, using a transition metal complex that favors an efficient reaction pathway to oxidize NH_3 into N_2 .

Outcomes



Homolytic N-H bond cleavage reaction pathways for the Oxidation of $\rm NH_3$ into $\rm N_2.$



Key Impacts of the project:

- Renewable energy can be transportable and more easily accessible.
- Can aid in reversing damage in the Earth's Ozone layer.

"This internship gave me the opportunity to be critical and analytical all while being exposed to different computational methods. It also gave me the chance to be a published researcher."

Margareth Mbea

Chemistry Major, Math Minor Xavier University of New Orleans

PNNL Mentor: Melissa Barona



Fatou Ndiaye



Experience

- Tech Student 3
- Minority-Serving Institution Partnership Program

Accomplishments

- Volunteered with AmeriCorps Jumpstart Program, creating targeted lesson plans for preschool students that resulted in increased performance by 20 percent.
- Participated in Howard University IRISE Program and a series of online workshops aimed at success in the sciences.
- Acquired knowledge in the ethics of scientific research and professionalism.

- Secretary, National Council of Negro Women
- Corps Member, AmeriCorps Jumpstart
 Program
- Participant, Howard University IRISE Program
- Member, Howard University Climate Change, People, and Environment Club
- Participated in the DC mayor's office "Adopt-a-Park" and "Adopt-a-Block initiatives." Acquired negotiation skills when determining where the project should be focused.
- As former Secretary of the Howard University Climate Change Club, assisted in facilitating group meetings and organizing events. Acquired collaborative skills through communication with other members.



Fatou Ndiaye

B.S. Biology Howard University Class of 2023

Bioinks for 3D Bioprinting



Overview

The applications of 3D bioprinting are the future of medicine. For example, with the increasing need for advancements in medical care, 3D bioprinting offers an effective and personalized solution to the growing need for organs and tissues. Bioinks, the materials used to create these 3D-printed structures, are the focus of this research project as they play a key role in the printing process.

Outcomes





3D-printed structure created using ArtSea inks, a seaweed-based polymer "doped" with pearlescent mica powder (Photo Credit: Andrea Starr | PNNL)

For this project, I was tasked with gathering information on bioinks using the parameters in the diagram to the left. The goal is to eventually create more advanced bioinks that can be viable for longer periods of time. "This internship has given me the opportunity to learn about 3D bioprinting and its potential applications in the future. I also gained valuable networking skills and experiences that I will be able to apply in my future career."



Fatou Ndiaye B.S. Biology Howard University Class of 2023

PNNL Mentors:

Karen Taylor Karen Wahl Janine Hutchison Anne Arnold

pnnl.gov/msipp-nnsa PNNL-SA-165698

Andria Thomas



Experience

- Intern
- Minority-Serving Institution Partnership Program
- National Nuclear Security Administration

Accomplishments

- Competed in the NASA-sponsored engineering program. The annual competition mandates teams to design, build, and launch a rocket to take a scientific payload to an altitude of exactly one mile.
- Participated in the Tennessee Louis Stokes Alliance for Minority Participation, a collaborative effort sustained by a coalition of 10 colleges and universities in the State of Tennessee.

- Student, Tennessee State Louis Stoke Alliance Program
- Student, GEM Grad Lab
- Participant, Fisk University Rocket
 Team
- As GEM Grad Lab participant, attended several conferences at Oak Ridge National Laboratory.
- Engaged in the Increasing Women and Minorities in Engineering Careers and Integrative Space Additive Manufacturing, sponsored by Vanderbilt, and presented by the University of Alabama.



Andria Thomas

B.S. Physics Fisk University

Comparison of Handheld Radioisotope Identification Devices

Overview

Goal:

- To understand the response of radioisotope detectors.
- Compare different units of the same models of detectors (12 of same detectors).

Method:

- Measure all 12 LaBr3 detectors.
- Conduct PeakEasy analysis and spectra of each radionuclide then saved as *.csv files.
- Extract data and put in a large table on Excel.
- Apply Tidy Data to the table.
- Use Python to analyze the data.





Outcomes

- Tidy Data used to organize the spreadsheet.
- Total efficiency of the detectors are the same.
- Absolute efficiency of each detector tested falls within a narrow range of values.
- Method can be used to quickly determine if a detector's performance is "normal."
- Large set of data for comparison to other detectors.



Andria Thomas **B.S.** Physics **Fisk University**

PNNL Mentors:

Cheslan Simpson Leesa Duckworth (Team lead)

pnnl.gov/msipp-nnsa PNNL-SA-165640

Data



"This internship gave me the

this process, I gained a better

understanding of Python while

learning spectral analysis. What I

learned will be useful in the future "

opportunity to learn PeakEasy and

how to use Tidy Data. Throughout

Elijah Tomlin

Experience

- Intern
- Minority-Serving Institution Partnership Program
- National Nuclear Security Administration

Accomplishments

- Business proficient in Python, i2 Analyst Notebook, Microsoft Word, PowerPoint, and Excel.
- Conducted open-source intelligence analysis.
- Proficient in verbal presentations and presenting technical information to a nontechnical audience, analysis, strength / weakness / opportunity / threat analysis, and generation and assessment of alternative hypotheses.
- Organized and implemented safe, fun, and entertaining activities and games for children between the ages of three months to 11 years old in the Kids Academy.
- Oversaw the university fitness center, helped participants navigate the fitness areas, and implemented policies to ensure participant safety.
- Experienced with systems thinking and problem solving.





Elijah Tomlin

B.S. Intelligence Analysis James Madison University

Domestic Extremism and Insider Threat Mitigation



Overview

I worked on projects regarding domestic extremism and insider threat mitigation for both the Office of Radiological Security and the Program for International Nuclear Security.

Outcomes

The research I conducted on domestic extremism highlighted the need for collaboration efforts across organizations worldwide to combat extremism. My work on case study research regarding incidents of stolen radiological and nuclear materials is helping organizations understand and combat the insider threat.



Extremism Word Cloud, McGill University

The projects that I assisted on emphasized the need for a common definition of the term 'domestic extremism' and other terms in the same domain, as well as the dangers of the insider threat. This work also helped me build my analysis and open-source intelligence research skills. "This internship helped me sharpen my analyst skills and improve my research skills. It has also helped me understand the importance of nuclear security and is allowing me to venture into different possible careers."



Elijah Tomlin

B.S. Intelligence Analysis James Madison University

PNNL Mentor:

Dr. Christine Noonan

pnnl.gov/msipp-nnsa PNNL-SA-165390.

Yarelis Rivera



Experience

- Intern
- Minority-Serving Institution Partnership Program
- Energy Sciences: Experimental and Modeling Consortium (ESEM)

Accomplishments

- Worked with "Microalgae as Bioenergy Factories: Coupling Production of Oil and Biogas from Microalgae" and with Fish Environmental DNA.
- Presented my research based on the innovations in biogas production in microalgae biofuel process at an ESEM Symposium.

- Undergraduate Research Student for the Consortium of Hybrid Resilient Energy Systems (CHRES), Ana G. Méndez University of Puerto Rico, Gurabo
- Undergraduate Research Student for the National Science Foundation-Funded Research on Environmental DNA at Inter American University of Puerto Rico, Barranquitas
- Presented my research based on the innovation in biogas production in microalgae biofuel process at the CHRES Symposium.
- Completed a detailed presentation based on my research on Environmental DNA and later presented to my peers.



Yarelis Rivera B.S. Biology Minor, Chemistry Inter American University of Puerto Rico, San Germán Campus

Energy Application with Artificial Enzymes



Overview

In this internship we worked on a series of tasks to calculate infrared (IR) spectra of a molecule used to build an artificial enzyme. We read a series of articles related to energy application with artificial enzymes and worked with the platforms, Avogadro and MobaXterm. We used the MobaXterm platform to interface with high-performance computers, where we ran calculations using NWChem computational chemistry codes to optimize the molecular structure and calculate the IR spectra.

Outcomes

In this internship we worked with MobaXterm; an ultimate toolbox for remote computer. This platform allowed me to access high-performance computing platforms to perform calculations for our research.

We used NWChem computational chemistry code. I learn the code and how to use it to obtain the calculations. Using the calculations obtained from NWChem, we were able to determine an IR signature for the molecule.

Having the opportunity to develop part of my research with these platforms allowed me to acquire new skills.



I worked with Avogadro to build a molecular catalysts that is used as an active site in an artificial enzyme. Avogadro is an advanced molecule editor and visualizer designed for use in computational chemistry, molecular modeling, bioinformatics, and material science. I learn how to place and join the atoms to build the molecule.

The expertise I acquire using this platform will contribute to my academic and professional development.

"This internship offered me experience in computer science, a field in which I had no knowledge. It offered me the opportunity to diversify, to develop techniques that can contribute on a large scale to my career goals."



Yarelis Rivera

B.S. Biology Inter American University of Puerto Rico, San Germán

PNNL Mentor:

Bojana Ginovska

Campus

National Nuclear Security Administration Minority-Serving Institution Partnership Program

Graduate Interns September 2021





Corlisa Awino



Experience

- Intern
- Minority-Serving Institution Partnership Program
- National Nuclear Security Administration

Accomplishments

- Conducting master's thesis research in X-ray radiation effects on the electronic properties of polymer carbon nanotube thin-film composite devices; using conjugated polymers to improve arrangement in polymer thin-film.
- Synthesized fluorescent, uniform diameter, surface functionalized silica nanoparticles and covalently attached single-stranded DNA for applications in DNA diagnostics; analyzed particle sizes; analyzed compositional analysis with Energy Dispersive Spectroscopy.
- Utilized x-ray diffraction to structurally analyze phospholipid-drug interactions and support a hypothesized physical mechanism of non-steroidal antiinflammatory drug-induced gastrointestinal ailments.

- Graduate Research Assistant, Prairie View A&M University
- Senior Researcher, Johns Hopkins University
- · Research Intern, University of Houston
- Undergraduate Research Assistant, Johns Hopkins, University
- · Research Intern, Baylor College of Medicine
- Research and Technical Sales Associate, Synthecon, Incorporated
- Quantitatively characterized the thermodynamic properties of membrane protein dimerization processes using western blotting techniques; utilized analysis software to quantify protein activity indicative of protein-protein interactions.
- Studied the efficacy of gene transfection using cationic liposomes for targeted delivery of nonviral gene therapeutics; liposomes were functionalized with peptidomimetic molecules to target cell surface receptors.



Corlisa Awino

Master's Intern Electrical Engineering Prairie View A&M University

Toward Data-Driven Methods for Accelerating Materials Development and Characterization with Bismuth Telluride and Aluminum Alloy 7075



Overview

To accelerate the development and characterization of special interest materials, PNNL is using data sciencedriven tools to characterize materials based on their processing, microstructure, and properties.

To contribute to these efforts, we:

- Developed simulation tools for x-ray diffraction (XRD) characterization of Bismuth Telluride (Bi₂Te₃).
- Cataloged published data on AA 7075 processing.

Outcomes

Generated simulated Bi₂Te₃ XRD patterns using python scripts and XRD analysis software

- BiTe is a thermoelectric material useful for radioisotopic thermoelectric generators (spacecraft, satellites).
- XRD analysis is used to characterize material structure.
- Python script uses Bi₂Te₃ structure-defined parameters to generate large numbers of configurations used to generate corresponding simulated diffraction patterns.
- Simulated XRD patterns were generated through XRD analysis software.



Prepared a catalog of AA 7075 processing-microstructure-properties data

- AA 7075 is high-performance material (lightweight, high strength) used in aerospace industry.
- Published experimental AA 7075 processing parameters, and the resulting microstructures and performance properties were cataloged.
- These data can supplement training data for machine learning models for AA 7075 characterization.

"I greatly benefited from this internship by gaining new skills in using data science tools, improving my technical communication skills though workshops and writing opportunities, and through networking.

My experience at PNNL has also helped deepen my interest in a technical career in national security."



Corlisa Awino

Master's Intern Electrical Engineering Prairie View A&M University

pnnl.gov/msipp-nnsa

PNNL Mentors

Eric Smith Anne Chaka Mohammad Taufique Aaron Luttman Lucas Sweet

Bayasgalan Batsaikhan



Experience

- Intern
- Minority-Serving Institution Partnership Program
- National Nuclear Security Administration

Accomplishments

- Constructed an art show over the course of six weeks using multiple funding resources from organizations and peers with 100 percent attendance of participants and their family from the community.
- Designed the first department of dance for the Coach For College program in Vietnam.
- Experienced with Microsoft, Stata, Wix platform Python, Needles, Docker, Azure, BPMN, ERP, SAP, Microsoft Teams, AWS, Google Display Ads, Adobe Audition, Adobe Photoshop, Adobe Lightroom, video editing, and Final Cut Pro.

- Graduate Assistant, Kelley School of Business
 Information Technology
- · Legal Assistant Intern, Ken Nunn Law Office
- Project Organizer/Designer, Baitul Ansaar Child Care Center, 100 Homes Project
- Freelance Web Designer
- Delivered process improvements to School of Business Information Technology, optimizing client calls through preparation of 2-3+ technical solutions from personal research to reduce downtime and increase integrity of the office.
- As legal assistant intern, improved the efficiency of completing clients' balance sheets by contacting multiple clients' providers simultaneously, allowing the completion of 30 balance sheets faster than the typical two-week deadlines.



Bayasgalan Batsaikhan

M.S. Information Systems Kelley School of Business Indiana University

Developing the Nuclear Smuggling Detection and Deterrence Sustainability Planning Tool

Overview

This talk will review my work to develop effective and efficient tools for national security at our nation's borders and nuclear detection around the globe. In particular, I will review the support I provided to develop the Sustainability Planning Tool for the National Nuclear Security Administration's Office of Nuclear Smuggling Detection and Deterrence (NSDD).

Outcomes

The NSDD Sustainability Planning Tool has been in the works since the beginning of the summer to create a more efficient and effective system to manage and successfully sustain NSDD's overseas program for nuclear detection. I supported the implementation and updates on structural components of the tool to further progress it to be user-friendly based on early user feedback. My goal was to improve user-friendliness and simplicity in appearance.



Radiation and nuclear detection portal monitors at the borders of Vienna, Austria

Along with the NSDD Sustainability Planning Tool, I helped with the Airport Risk Assessment Model symposium, further developments in Customs and Border Protection, progression of scoring metrics for Cybersecurity and Infrastructure Security Agency and furthered my knowledge with the Consortium for Enabling Technologies and Innovation. The efforts by myself and my colleagues helped to improve security using tools. "My internship exemplified the true meaning of teamwork and using diverse skills to further progress. The experience of working at the national laboratory showed the structures and processes of evolvements made toward diverse projects and programs."

Pacific Northwes



Bayasgalan Batsaikhan

M.S. Information Systems Kelley School of Business Indiana University

PNNL Mentor: Dr. Robert Brigantic

pnnl.gov/msipp-nnsa PNNL-SA-165765

Atharva Chopde



Experience

- Intern
- Minority-Serving Institution Partnership Program
- National Nuclear Security Administration

Accomplishments

- Designed and conducted experiments in multiple psycho/neuro-linguistic labs; used eye-tracking software to collect data on syntactic processing.
- Interned at the Language and Cognitive Development Lab at University of California, Berkeley, headed by Dr. Mahesh Srinivasan; ran a behavioral study on math conception in children aged 5-7.

- Undergraduate Researcher, University of Florida
- Research Intern, University of California, Berkeley

- Designed and implemented a syntactic parser in Python for the language of Wolof with two classmates; averaged 93% accuracy, outperforming low-cost generic language parsing models.
- Designed and conducted study on the effects of tVNS on sustained attention; presented posters at the Florida Psycholinguistics Conference and Florida Linguistics Yearly Meetings.



Atharva Chopde

M.S. Computational Linguistics University of Washington

Streamlining Chemical Weapons Convention Schedule Classification

Pacific Northwest

Overview

The Chemical Weapons Convention (CWC) describes dangerous chemicals by text-based descriptions of molecular structures, rather than an explicit list of controlled substances. This makes it time consuming–even for chemists–to categorize unfamiliar chemicals. I worked on a tool to help facilitate this classifying process for these unfamiliar chemicals.

Outcomes

I broke down the CWC schedules into their fundamental molecular features and searched for commonalities and differences. I used these to create a flowchart that walks through the molecular structural features and/or syllables, prefixes, roots, and suffixes of the chemical name (using systematic chemical nomenclature) to lead to the Schedule classification. This logic can also potentially be used for automating the classification process. THE Scheduling STONE Chemical Weapons KEY TO DECIPHERING CONVENTION SCHEdules WITH THE SAME Chemical in 3 SCRIPTS



My work translates the varied languages of chemical nomenclature

I also supported many smaller events that I found to be very informative. These events included a course for Nigerian scientists, law enforcement, security, and government officials about chemical threat analysis and incident investigation and the development and submission of a Quickstarter proposal. "The skills I developed in this internship will surely help me not only realize the goals and aspirations that I have, but also figure out what exactly those goals and aspirations are. Many new technical fields I never knew existed are now potentially viable career paths, and for that I am thankful."



Atharva Chopde

M.S. Computational Linguistics University of Washington

PNNL Mentor:

Jonathan Forman

pnnl.gov/msipp-nnsa PNNL-SA-165650.

Jonathan Mills



Experience

- Ph.D. Intern
- Minority-Serving Institution Partnership
 Program

Accomplishments

- Experienced in applied physics and engineering with a background in computational and digital systems, data science, optics, spectroscopy, signal processing, sensors, and information technology.
- Worked in national security with Departments of Defense and Energy to present science and technology deliverables.
- Conducting doctoral research using artificial intelligence with Raman spectroscopy.

- Data Scientist, Ph.D. Summer Intern, PNNL
- Research Assistant, Alabama A&M
- R&D Engineer, Founder, Warpflux Corporation
- Optical Engineer, Intellectual Properties Inc.
- Research Scientist, Optical Processing Technological Systems Inc.
- Student Research Assistant, UAH Laser
 Propulsion Group
- Performed image fusion development using artificial intelligence techniques in R and Julia.
- Researched, coded, and recommended solutions related to artificial intelligence risk models and resource deployment.
- Awarded the 2017-2018 National Science Foundation Established Program to Stimulate Competitive Research Graduate Fellowship Award.



Jonathan Mills

Ph.D. Applied Physics, Optics Alabama A&M University

Research in Artificial Intelligence and Machine Learning to Enhance National Security



Overview

PNNL supports many projects for national security with a focus on artificial intelligence (AI) and machine learning.

This year I continued exploring AI concepts for the Airport Risk Assessment Model (ARAM).

Additionally, I provided support for the Machine Assisted GEOINT Exploitation project (MAGE) as part of the overhead few-shot team for object detection and classification.

Outcomes

I explored ways to enhance my previous work in ARAM with real-time / near real-time data. This concept would provide situational awareness to account for new and evolving threats. ARAM is currently deployed at the Seattle-Tacoma International Airport.

Under the MAGE program, I trained few-shot overhead image models based on "superclasses." I also experimented with meta-datasets for enhancing object detection and classification. This research supports the U.S. Air Force and is ongoing.



PNNL article on ARAM, real-time situational awareness concept graphic, and Outstanding Performance Award

Summary of 2021 Accomplishments:

- Completed ARAM risk formulation publication.
- Updated game-theoretic and real-time data approaches in ARAM / final project report on AI.
- Assisted with ARAM symposium.
- MAGE Overhead Few-Shot meta-dataset training experiments.
- Received Outstanding Performance Award for work involving MAGE and stakeholder briefing.

"The science, people, and impact of research at PNNL revealed an exciting path forward that fuses together my personal interests with academic and professional skillset."



Jonathan Mills

Ph.D. Applied Physics, Optics Alabama A&M University



PNNL Mentor: Dr. Robert Brigantic



Geremy Paige



Experience

- Intern
- Minority-Serving Institution Partnership Program
- National Nuclear Security Administration

Accomplishments

- Managed security and activities for the NFL House sponsored by Verizon.
 Collaborated with diverse network of professional athletes, Executive
 Directors, NFL employees, board members, and VIP guests, to ensure the success of the NFL's premier event.
- Oversaw a \$59 million multi-purpose arena and a staff of four colleagues, prepared annual program budgets, analyzed and evaluated programs to cut budget cost.

- Intelligence Analyst, Gannon University
- Research Analyst, Rooney Consulting
- NFL Event Manager, HXECUTE
- Convocation Center Graduate Assistant, California
- Contracted to a competitive intelligence firm that specializes in analysis systems.
- Utilized cutting-edge data-mining technology to dissemination of information products.
- Created and compiled large data sets and research studies from various databases; interpreted pertinent data from online and database survey tools to established reports.



Geremy Paige

M.S. Information Assurance and Cybersecurity Gannon University

The Future of Artificial Intelligence and Cybersecurity



Overview

Artificial Intelligence (AI) has become engraved in our society and continues to innovate other aspects of life. PNNL has been tasked with conducting research of the current applications and future innovations of AI. I worked on research that focused on AI applications such as but not limited to machine learning, honeypots, fuzzing, and generative adversarial networks.

Outcomes

During my research I contributed to a research report on the future threats of AI. The goal was to identify the threats that cyber threat actors could use against the U.S. This included analyzing the strategic steps the U.S should consider to win the AI era. I also undertook Python learning modules to better comprehend the AI applications I was researching.

Architecture of Artificial Neural Network



Example of an artificial neural network, "Artificial Neural Network applications, algorithms and examples - TechVidvan," TechVidvan.com, 14-May-2020. [Online]. Available: https://techvidvan.com/tutorials/artificial-neural-network/. [Accessed: 16-Aug-2021].

These efforts helped me drastically improve my understanding of AI and its future within cybersecurity. I have been able to recognize the dire need for more AI professionals and apply this knowledge to my professional journey. "This internship has truly been life changing. I had just gotten into STEM in August of 2020 and to work within one of the highest research laboratories in the U.S. has been amazing. I look forward to leveraging this knowledge in my professional journey."



Geremy Paige M.S. Information Assurance and Cybersecurity Gannon University

PNNL Mentor:



 "NSCAI Final Report - Table of Contents," Nscai.gov. [Online]. Available: https://reports.nscai.gov/final-report/table-of-contents/. [Accessed: 14-Aug-2021].

[2] "Machine learning and cybersecurity," Georgetown.edu, 16-Jun-2021. [Online]. Available: https://cset.georgetown.edu/publication/machine-learning-and-cybersecurity/. [Accessed: 14-Aug-2021].

Omari Paul



Experience

- Intern
- Minority-Serving Institution Partnership Program
- Energy Sciences: Experimental and Modeling Consortium

Accomplishments

- Conducted research in material science to synthesize nanocomposite materials and fabricated sensors with optimal properties.
- Conducted solar cell research in the Nano-Materials and Sensors Group to optimize the light absorption range through nano-particle doping.
- Worked with a Pulsed Laser Deposition System at Vanderbilt University's Free Electron Laser Center using the matrix assisted pulsed laser evaporation technique.

- Graduate Student Researcher, Tennessee
 State University
- Certified Tutor, C2 Education
- College Tutor, Nashville State Community College
- Physical Science Teacher, Bellevue Middle International Baccalaureate
- Graduate Student Researcher, Fisk University
- Fabricated a piezoelectric substrate using the polymer polyvinylidene fluoride for microsensor device application.
- Researched and developed solutions for implementing appropriate functionality of all the features (buttons, menus, forms, etc.) of the user interface for DollarMetro using React, CSS, JavaScript, and HTML.
- Mentored a senior undergraduate computer science student in developing an augmented reality application for his senior project.



Omari Paul

Ph.D. Engineering and Computational Science Tennessee State University

Using a Deep Convolutional Neural Network Architecture for Segmentation and Classification of SEM Micrographs with **Statistical Analysis on the Predictions**

Pacific Northwest

Overview

PNNL's Disruptive Technology Group conducts research on various projects. A major objective is to conduct research within the scope of tritium-producing materials for tritium-producing burnable absorber rods to be used in pressurized water reactors. I worked on a project that leverages machine learning to analyze in-reactor behavior of specific materials that are pertinent to the nuclear reaction process.

Outcomes

I assisted in investigating the training and inference steps of a Deep Convolutional Neural Network. The goal was to identify statistical methods of determining pixel-level predication uncertainty. I also assisted in implementing unit tests, documentation, code linting, and other software engineering tasks.



Karl Pazdernik, Nicole L. LaHaye, Conor M. Artman, Yuanyuan Zhu, Microstructural classification of unirradiated LiAIO, pellets by deep learning methods, Computational Materials Science, Volume 181, 2020, 109728, ISSN 09270256, https://doi.org/10.1016/j.commatsci.2020.109728.

These efforts help to improve the efficiency of tritium production by data that details in-reaction behavior of tritium-producing material. This allows for synthesizing materials that are optimized for most efficient tritium production.



"This internship made me aware of the high level in which machine learning is being conducted. Working at a national laboratory gave me exposure to how experts leverage machine learning within the research field."



Omari Paul Ph.D. Engineering and **Computational Science Tennessee State University**

PNNL Mentors:





Alex Hagen

Neil Henson



Guddi Suman



Experience

- Intern
- Minority-Serving Institution Partnership Program
- Energy Sciences: Experimental and Modeling Consortium

Accomplishments

- Presented research in Workshop 2019 at Oak Ridge National Laboratory and won Best Poster Award, Second Place.
- Synthesized and characterized carbon nanotube/poly (methyl methacrylate) nanocomposite thin-film devices.
- Characterized semiconductor solar cell as X-rays radiation sensor and designed and simulated power circuits including buck, boost, buck-boost circuits using various simulation software.

- Ph.D. Student Researcher, Prairie View A&M University
- Material Science and Electrical Engineering Student Researcher, Prairie View A&M University
- Graduate Teaching Assistant, Prairie View A&M University
- Assisted undergraduate and graduate students to use laboratory equipment for electrical characterization of semiconductor devices, software tools, and simulation and interpret statistical data.
- Familiar with MATLAB, NI Multisim, S-Math, Xilinx, P-Spice, LTspice, FPGA Tools, Verilog System Design, Interactive Characterization Software, Arduino Coding, and Python.
- Member of Institute of Electrical and Electronics Engineers.



Guddi Suman

Electrical Engineering Prairie View A&M University, Texas

Toward Real-time Environmental Monitoring of an Experimental Test-Bed



Overview

- Challenge: Polymer material and electrical system performance are heavily influenced by ambient environmental conditions.
- Objective: Develop a system to monitor environmental parameters in real-time.
- Method: Design using Arduino Nano based system connected to five DHT 22 temperature and humidity sensors and monitor data in real-time.



Temperature and humidity data collected using an Arduino Nano board and DHT 22 (wired) sensors



Arduino Nano board and five DHT 22 sensor interfaced with (1) Arduino IDE Software and (2) MATLAB including DHT 22 ADD-ON

- Improved the monitoring of environmental parameters using Arduino system.
- Different sensors allowed monitoring different locations at the same time.
- Arduino system and DHT 22 sensors were coupled with MATLAB to monitor temperature and humidity in real-time.
- Online monitoring technologies are expected to revolutionize aging management programs.

"This internship gave me an opportunity to explore polymer aging and applications of DHT sensor connected to Arduino microcontroller board to monitor environmental parameters."



Guddi Suman Electrical Engineering Prairie View A&M University, Texas

Mentors

Leo Fifield







Neil J Henson

Mychal P Spencer

La'Darius Thomas



Experience

- Intern
- Minority-Serving Institution Partnership Program
- National Nuclear Security Administration

Accomplishments

- Designed protection relay to detect faults based on abnormal conditions across ends of transmission lines. Developed computer program for performing a dynamic state estimation, chi-square test, and issuing a trip command for fault detection.
- Developed models of communication infrastructures to serve as test cases. Implemented distributed optimization algorithms such as Dual-Decomposition to analyze and solve Optimal Power Flow problems.

- Software Engineer, Northrop
 Grumman
- D&I Graduate Representative, Georgia Institute of Technology

- Designed a simulation tool to comprehensively capture the characteristics of improving resilience in microgrids.
- Facilitated the modernization of network monitoring capabilities of software systems for an autonomous aircraft.
- Conducted software regression tests on integrated software station for aircraft.



La'Darius Thomas

Electrical and Computer Engineering Ph.D. Student Georgia Institute of Technology

A Mitigation Strategy for Electrical Vulnerabilities in Distributed Energy Resources with the use of Wireless Communication



Overview

As the electric power grid continually evolves, technological advancements such as distributed energy resources (DERs), renewable energy resources, and grid expansion introduce complex designs. One pivotal enhancement is the use of 5G wireless communication to produce intelligent systems and equip the conventional, legacy electrical network with Smart Grid Technology.



An Electrical Energy System from Generation to Distribution [1]

Wireless Service Networks are technologies that have shown efficient results in quickly identifying threats and minimizing the disturbances to create a resilient environment for electrical energy systems. However, the lack of awareness of varying current and voltage levels in DERs highlight the need for an examination of wireless technology to monitor these states of an electrical energy system. "PNNL has provided me with ample opportunities to build relationships, create career goals, and hone my technical skillset. This internship has propelled me into a new atmosphere of innovation as I strive to be a trailblazer in my field."



La'Darius Thomas

Electrical and Computer Engineering Ph.D. Student Georgia Institute of Technology

PNNL Mentors:

Ethan Farquhar David Sheen

pnnl.gov/msipp-nnsa PNNL-SA-166026

Outcomes

With modern technology, the need for more secure and protected power utilities becomes apparent due to vulnerabilities such as GPS spoofing, jamming, interference, and denial-of-service attacks. This project provides an investigation and identification of the vulnerabilities in the power grid as a result of DERs being supplementary and how wireless communication technology can detect and mitigate the malicious and accidental disturbances.

[1] Meliopoulos, A. P. Cyber-Physical Security in Electrical Energy Systems