The Utica University Student Conference for Research, Professional Activities, and Creative Arts

Wednesday, April 22, 2026

Donahue Auditorium/Gordon Science Center

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SCHEDULE OF EVENTS

1:45 pm	**Poster Set-up: Presenters bring your posters to Gordon Science Center, first floor** **Oral setup: Presenters go to classrooms to set up presentations with faculty moderators**
2:00 pm	**Opening Remarks – Provost Ann Damiano** • Donahue Auditorium (Gordon Science Center)
2:10 - 3:10 pm	**Poster Presentations & Refreshments** • Gordon Science Center, first floor
3:15 – 5:00 pm	**Concurrent Oral Presentations** • Session A: Gordon 261 • Session B: Gordon 271

POSTER SESSION: 2:10-3:10 PM – Gordon Science, First Floor

1. **Awe and Appreciation: Amplifying Altruism**
   Howara Almayahi Ajla Babic (John Schwoebel, Faculty Advisor)

2. **Records System - Cache Simulator**
   Connor Cooper (Rutal Mahajan, Faculty Advisor)

3. **Concentrations of Heavy Metal Pollutants in Water and Sediment Along the Length of the Mohawk River, New York State: Preliminary Examination of Possible Controls**
   Madelyn Cozzens (Sharon Kanfoush, Faculty Advisor)

4. **Green Synthesis of Silver Nanoparticles Using Glucose and Acacia Extract as Reducing Agents**
   Kayla Dunn (Alyssa Thomas, Faculty Advisor)

5. **NextShift: A Hockey Skill Progression Tracking System**
   Alex Gomez (Angel Rivera, Faculty Advisor)

6. **Playing Chat and Mouse: Impacts of Nonlinear Squeak Playback on Male Mouse Nonvocal Behavior**
   Marshall Hildreth, Fausto F. Martinez, and Caedyn R. Rowlands (Sarah Keesom, Faculty Advisor)

7. **Phosphomimetic Mutations in the *Caenorhabditis elegans* Cellular Fusogen EFF-1**
   Aubrey Hughes and Izabella Osilovskiy (Jessica H. Shinn-Thomas, Faculty Advisor)

8. **CX-SHAP: A Scalable Cross-Domain Explainable AI Framework for Clinical Decision Support**
   Aryan K C (Rutal Mahajan, Faculty Advisor)

9. **Synthesis and Characterization of [NiFe]-hydrogenase with Flexible Biomimetic Sulfur-based Ligands**
   Katherine Mattes (Elaine Liu, Faculty Advisor)

10. **Was It Murder? TLC and GC-MS in the Organic Laboratory**
    Brayden McCaw (Michelle Boucher and Curtis Pulliam, Faculty Advisors)

11. **Synthesis and Spin-coating Studies of Organosilicate Systems**
    Xavier Moore (Michelle Boucher, Faculty Advisor)

12. **Technical but Tongue-Tied?**
    Revati Nishant Nasikkar (Unnati Shah, Faculty Advisor)

13. **Bioactivity-guided Isolation of Antibiotic Metabolites From the Mycoparasitic Fungus, *Niveomyces coronatus* (Cordycipitaceae, Hypocreales)**
    Nathan Sand (Richard Tehan, Faculty Advisor)

14. **Synthesis and characterization of Ni(II) and Ni(II)-M heterobimetallic complexes as [NiFe]-hydrogenase mimics**
    Nevaeh Scott-Dominguez (Elaine E. Liu, Faculty Advisor)

15. **Utica University and Student Support Offices**
    Emma Sheldon and Trinity Bailey (Laurah Klepinger and Helen Blouet, Faculty Advisors)

16. **Study of Siloxane Polymer Plastic Systems**
    Gabriella Sponburgh (Michelle Boucher, Faculty Advisor)

17. **Green Synthesis of Gold Nanoparticles Using Amino Acids as Reducing Agents**
    Yamilet Taveras (Alyssa C. Thomas, Faculty Advisor)

SESSION A: Gordon 261*

Moderator: **Laurah Klepinger, Associate Professor of Anthropology**

3:15 - 3:30: **Anti-feminism in South Korea**
Morgan Bush (Jun T. Kwon, Faculty Advisor)

3:30 – 3:45: **Role of the Chief of Protocol in Peacetime, Crisis, and Wartime Diplomacy**
Isabella Boehm (Jun Kwon, Faculty Advisor)

3:45 - 4:00: **Why Rising U.S. Oil Production Has Not Guaranteed Lower Gasoline Prices: Evidence from 2000–2025**
David LaTour (Luke Perry, Faculty Advisor)

4:00 - 4:15: **Immigration and Support for Right-Wing Populist Parties in Europe**
Demetre Prittipaul (Jun Kwon, Faculty Advisor)

4:15 - 4:30: **What Is Your Favorite Season? A Mathematical Ranking Approach to Identify Mental Disorders in Advance**
Trinity Fendsack (Shandeepa Wickramasinghe, Faculty Advisor)

4:30 - 4:45: **Community Policing in the Digital World**
Kelsey Elliott (Helen Blouet, Faculty Advisor)

* This session is available via Zoom for those who cannot attend in person. Please use this link: https://utica-edu.zoom.us/j/96788585355

SESSION B: Gordon 271

Moderator: **Unnati Shah, Associate Professor of Computer Science**

3:15 - 3:30: **VulneraX: Drift-Aware Time-Series Forecasting for Software Vulnerability Risks**
Patrick Penna and Vonnie Magnussen (Unnati Shah, Faculty Advisor)

3:30 - 3:45: **ConnectPlus: A Demonstration of a Full-Stack Collaboration Toolfor Academic and Team Projects**
Makayla Coleman (Unnati Shah, Faculty Advisor)

3:45 - 4:00: **What Is the Derivative of a Number?**
Gavin MaGill (Xiao Xiao, Faculty Advisor)

4:00 - 4:15: **AlgeBridge: Advanced Algebraic Modeling, Solver, & Analytical System**
Ju Mi La (Unnati Shah, Faculty Advisor)

4:15 - 4:30: **Real-Time Bias-Aware AI for ACL Rehabilitation: Beyond Clearance to Sustained Performance**
Ashim Pandey (Unnati Shah and Angel Rivera, Faculty Advisors)

4:30 - 4:45: **Educational Sudoku Game**
Colin Zouck (Unnati Shah, Faculty Advisor)

4:45 - 5:00: **MG Gesture Project**
Ethan Smith, Alexander Gomez, and Kyle Hartness (Rutal Mahajan, Faculty Advisor)

ABSTRACTS

Abstracts are listed alphabetically by first author on the following pages.

Awe and Appreciation: Amplifying Altruism

Howara Almayahi and Ajla Babic
John Schwoebel, Faculty Advisor
Poster Presentation

Prosocial behavior—voluntary action that benefits others—improves health and well-being for both the beneficiary, benefactor, and wider community (Kubzansky et al., 2023). Consistent with self-perception theory (Bem, 1972), research demonstrates that reflecting on one's previous prosocial behavior (i.e., being a benefactor) leads to increases in prosocial behavior (Grant & Dutton, 2012). Further, boosting the self-transcendent emotions of gratitude and awe also increases prosocial behavior (van Kleef & Lelieveld, 2022; Jiang et al., 2024). We aimed to test the relative effectiveness of these interventions. Seventy-six Utica University undergraduate participants were randomly assigned to reflect, and write for 10 minutes, about an experience of: (1) their own prosocial behavior (2) gratitude (3) awe, or (4) a recent everyday experience. After these reflections, participants completed surveys measuring benefactor self-efficacy, gratitude, awe, and self-transcendence. Participants were all given 10 raffle tickets for a $200 prize as an incentive to participate. At the end of the study, participants were given the option to donate raffle tickets to the Tangerine Grove, which was our measure of prosocial behavior. Our main finding was that participants in the gratitude condition donated significantly more raffle tickets than those in the other conditions, $F(3,72) = 9.053$, $p < 001$, $\eta 2 = .27$. Our findings suggest that reflecting on gratitude toward others may foster self-transcendence—focusing attention on others and greater feelings of connectedness with others—which may lead to increases in prosocial behavior benefiting strangers. The theoretical and practical implications of these findings and the limitations of these findings will be discussed.

Role of the Chief of Protocol in Peacetime, Crisis, and Wartime Diplomacy

Isabella Boehm
Jun Kwon, Faculty Advisor
Oral Presentation

Diplomacy is often portrayed as a carefully choreographed process governed by rules of protocol. Ceremonial practices such as seating arrangements, handshake etiquette, the order of introductions, and the placement of national flags structure interactions between political leaders and communicate respect between states. These practices are not merely decorative traditions. Rather, they serve as an important political function by providing a framework through which states recognize each other's authority and legitimacy. Diplomatic protocol helps prevent symbolic misunderstandings that could escalate tensions between political leaders and their respective governments. Within the United States government, the Office of the Chief of Protocol is responsible for coordinating these ceremonial and diplomatic interactions, including state visits, diplomatic ceremonies, and official engagements between world leaders. Responsibilities include arranging seating orders, determining forms of address, coordinating ceremonial greetings, and ensuring that engagements follow established protocols. While these practices may appear symbolic, they structure diplomatic interactions in ways that reduce uncertainty and prevent diplomatic incidents. This research design examines how the role and authority of the Chief of Protocol vary across three diplomatic contexts: peacetime diplomacy, crisis diplomacy, and wartime diplomacy. Using a comparative case study approach, this project analyzes diplomatic interactions across three presidential administrations representing each context. Drawing official records, state visit documentation, and crisis-era diplomatic exchanges, the study evaluates how closely protocol norms are followed and when they are strategically bypassed.

Anti-feminism in South Korea

Morgan Bush
Jun T. Kwon, Faculty Advisor
Oral Presentation

This presentation explores why anti-feminism has grown in South Korea despite the movement to improve gender equity and economic growth. A quantitative research approach is used to examine the question, 'What caused the rise in anti-feminism in South Korea? Drawing from existing research, key factors include changing gender roles, political influences, economic struggles, traditional cultural values, and the impact of social media. The study hypothesizes that worsening economic conditions contributed to the anti-feminist movement, particularly among young men. Using a theoretical framework suggesting that economic stress and social expectations lead to frustration, which is directed toward gender equity efforts. Political messages and social media further contribute to the tensions. Analysis relies on secondary data, such as GDP, employment rates, and political participation. These findings suggest that the combined social and political dynamics and economic strain have led to the increased gender conflict and the emergence of “quiet feminism” among South Korean women.

ConnectPlus: A Demonstration of a Full-Stack Collaboration Tool for Academic and Team Projects

Makayla Coleman
Unnati Shah, Faculty Advisor
Oral Presentation

This paper presents ConnectPlus, a full-stack project management application designed to unify multiple collaboration features within a single platform, including a dashboard, project workspace, messaging, task tracking, alerts, and user settings. The application addresses a common challenge in group work: communication often becomes scattered across multiple tools, leading to missed updates and fragmented information. The proposed application, ConnectPlus provides a centralized environment where students, instructors, and coworkers can manage tasks, share updates, and maintain all project information in one dependable location. The proposed application is implemented using MERN stack, MongoDB, Express.js, React.js, and Node.js, with supporting middleware such as CORS, JSON parsing, and environment configuration to ensure reliable server behavior. A key feature is the integrated alerts system, which enables users to send immediate notifications about needs, locations, or urgent updates, helping prevent important information from being lost. The proposed application serves both as a practical collaboration application and as a demonstration of full-stack development, backend design, and scalable communication features.

Hospital Records System - Cache Simulator

Connor Cooper
Rutal Mahajan, Faculty Advisor
Poster Presentation

In the contemporary world, information processing technologies are widely used in various spheres of human activity. One of the key fields where these technologies play an important role is healthcare. Accessing patient records such as their medical history, laboratory results, and medications prescribed by a physician may be helpful for making decisions and providing quality healthcare services. However, frequent accessing centralized databases creates latency that negatively affects performance. Thus, the proposed cache simulator will illustrate how cache memory can speed up patient records retrieving processes.

Cache Simulator Implementation

The project includes implementing cache simulator design based on two types of caches: direct-mapped and set-associative caches. In addition, two replacement policies, FIFO and LRU, will be used for managing limited cache size. As a result, the program will receive a list of patient record requests and determine whether the specified record is available in cache memory. Moreover, it will compute the hit and miss rate of data retrieving process.

Key Features of Cache Simulator

One of the distinctive features of the developed cache simulator is the simulation of data transfer from a network-based database to cache memory. If the program does not find a required record in cache, it will get the data from a virtual database and store it in the cache. Therefore, the next request for the same record will be a hit.

Conclusion

The obtained results will be presented in graphs, which will help to compare different cache configurations and performance under diverse conditions.

Concentrations of Heavy Metal Pollutants in Water and Sediment Along the Length of the Mohawk River, New York State: Preliminary Examination of Possible Controls

Madelyn Cozzens
Sharon Kanfoush, Faculty Advisor
Poster Presentation

The Hudson River has been heavily polluted by industries surrounding areas, with effects still being felt today despite massive cleanup efforts (EPA, 2026). Similarly, the Buffalo River had experienced industrial contamination, with pollutants ranging from polychlorinated biphenyls (PCBs) and other organics to heavy metals like lead and mercury (DEC, 2026). With these known, and the fact numerous industries were and are situated on the banks of the Mohawk River, this raises a similar concern about contamination in it and tributaries.

Publicly available surface water and sediment sample data were obtained from USGS National Water Information System. Fourteen sites were selected for this pilot study, including sites on the Mohawk River and several tributaries. Nine metals (arsenic, cadmium, chromium, copper, iron, mercury, nickel, lead, and zinc) were examined due to their harmful effects on human health and aquatic life and ecosystem health. Samples had been collected once or periodically from 1952-2025. The data we utilized were analyzed using QGIS to discern spatial or temporal patterns in the concentrations.

Research showed no obvious spatial patterns and most concentrations were below levels defined by the WHO and EPA to be safe for human consumption, with iron exhibiting the highest levels but still below 300 μg/L in most samples. A small number of extremely high concentrations suggest episodic pollution events. Recent data shows substantial and sustained decreases in iron concentration compared to the first 40 years. Future efforts should focus on obtaining higher-resolution data to better identify pollution sources and sinks and explore mitigation strategies.

Green Synthesis of Silver Nanoparticles Using Glucose and Acacia Extract as Reducing Agents

Kayla Dunn
Alyssa Thomas, Faculty Advisor
Poster Presentation

Nanoparticles have gained significant attention due to their versatility in applications such as medicine and technology. Silver nanoparticles (Ag NPs) specifically have unique chemical and physical properties which makes them useful in biomedicine and nano-technological applications. From previous studies, Ag NPs were found to bind strongly to substances possessing hydroxyl groups of carbohydrate molecules, including glucose. The focus of this research is to use glucose and acacia extract as reducing agents for the green synthesis of Ag NPs. The formation of the Ag NPs will be confirmed and characterized using UV-Vis spectroscopy. The synthesis will be optimized according to green chemistry principles for further studies with potential biological applications.

Community Policing in the Digital World

Kelsey Elliott
Helen Blouet, Faculty Advisor
Virtual Oral Presentation

Community policing is an evolving subject in modern times. It seeks to explore the relationship between police agencies and the communities they serve beyond the traditional roles to establish long-standing relationships that are mutually beneficial. This presentation explores the evolution of community policing into the digital age of technology. Specifically, it analyzes digital group forums on Facebook and Ring camera footage community boards to present a new platform for community policing to engage in. Findings of this research reveal that there is limited active engagement of agencies and municipalities on public community forums, offering opportunities to bring aspects of community policing into the digital community. Further, the engagement of the community on these digital platforms is sporadic, referencing lost mail, stolen property, and warnings of suspicious activities. Despite this, I believe that these digital platforms are not useless in policing. They provide an opportunity to exercise involvement in a quick fashion that mirrors the way in which the community utilizes them.

What Is Your Favorite Season? A Mathematical Ranking Approach to Identify Mental Disorders in Advance

Trinity Fendsack
Shandeepa Wickramasinghe, Faculty Advisor
Oral Presentation

Anthropogenic changes have significantly affected nature for a long time, and now there is a counterreaction to humans due to the irreversible damage. Climate change and mental health are current hot topics, and many research studies are ongoing around the world on the connection between weather events and mental health disorders and outcomes. Recent findings suggest that geographical location may impact health disorders such as Seasonal Affective Disorder (SAD) and Bipolar Disorder, and early identification may help in seeking guidance and support for self-management. In this research project, we were focused on determining if Winter is the best time to be alert about you and your loved ones' mental health, as SAD is highly prevalent in Winter. A survey was conducted and gathered data through social media on people's favorite season and used a variety of ranking methods, such as Plurality, Borda Count, Plurality with Elimination, and Pairwise Comparison, to identify the best choice. Our results indicate that many people do not prefer Winter in general because it is associated with lower overall happiness due to environmental factors.

NextShift: A Hockey Skill Progression Tracking System

Alex Gomez
Angel Rivera, Faculty Advisor
Poster Presentation

NextShift is a system designed to address the lack of structured skill development tracking in hockey training. Current platforms primarily focus on video sharing and feedback but do not provide a clear progression model for player development. This project introduces a level-based skill progression system where players complete defined skill checks to advance through structured levels.

Players select skills, upload video attempts, and submit them for evaluation. Coaches review each attempt, provide feedback, and approve or deny progress. The system tracks all attempts, maintains progress over time, and unlocks new levels once all required skills are completed. This creates a standardized and measurable approach to skill development.

The system is supported by a relational database that manages users, teams, skills, levels, and attempts. It ensures efficient storage, retrieval, and updating of player progress and feedback. Additionally, the design allows for scalability beyond hockey, enabling adaptation to other sports or skill-based activities through customizable skills and levels.

NextShift provides a structured, data-driven solution that improves communication between players and coaches while creating a clear pathway for development.

Playing Chat and Mouse: Impacts of Nonlinear Squeak Playback on Male Mouse Nonvocal Behavior

Marshall Hildreth, Fausto F. Martinez, and Caedyn R. Rowlands
Sarah Keesom, Faculty Advisor
Poster Presentation

House mice (*Mus musculus*) utilize multiple vocalization types, including squeaks and ultrasonic vocalizations. Prior research has prioritized ultrasonic vocalizations, however, recent studies have highlighted how squeaks possess variation in acoustic structure which may convey information. Moreover, these studies have demonstrated that female squeaks possess longer-duration nonlinear segments, a type of acoustic variation, during estrus, when female mice are sexually receptive. However, the extent to which vocal nonlinearities affect male nonvocal behavior is unknown. Thus, we conducted this study to test the hypothesis that nonlinearities within female mouse squeaks convey sexual receptivity and influence male nonvocal behavior. This was tested by pairing male mice with novel females in an arena divided by a perforated barrier under one of three treatments: background noise, linear squeaks, or nonlinear squeaks. We quantified male behavior toward the female as a percent change in investigation of the perforated barrier ("barrier investigation") during a five-minute playback period relative to the preceding five-minute baseline period. Based on our hypothesis, we predicted an increase in male barrier investigation following nonlinear squeak playback compared to linear squeak playback. We found that the percent change in male barrier investigation during nonlinear squeak playback was significantly greater than during linear squeak playback, supporting our hypothesis that nonlinearities convey female receptivity. These findings hold numerous implications, especially due to squeaks sharing similar productional qualities to human speech. Thus, understanding squeaks and utilizing them as a model may help in furthering the study of communication disorders.

Phosphomimetic Mutations in the *Caenorhabditis elegans* Cellular Fusogen EFF-1

Aubrey Hughes and Izabella Osilovskiy
Jessica H. Shinn-Thomas, Faculty Advisor
Poster Presentation

Cell-cell fusion is a process in which cells fuse to form a multinucleated cell known as a syncytium. Cell-cell fusion occurs during sperm-egg fusion and to form tissues and organs such as skeletal muscle, placenta, osteoclasts, and the vertebrate eye lens. It is also implicated in cancer biology. However, this vast topic is still not fully understood. Our research focuses on the cell-cell fusion process in *Caenorhabditis elegans*. *C. elegans* is an ideal model organism for viewing and studying cell-cell fusions because of its transparency and approximately one-third of its cells fuse. In this research, we study the type-1 transmembrane protein EFF-1, which is a cellular fusogen necessary and sufficient for cell fusion in *C. elegans*. More specifically, we focus on the pair of serines at positions 632 and 634 (S632, 634), as well as position 654 (S654) in EFF-1's cytoplasmic domain. Previous studies showed that the cytoplasmic domain and potential phosphorylation of S632,634 and S654 are important for cell fusions. In this research, we made phosphomimetic mutations at S632,634 and S654 where we mutated the serines to aspartic acid (S632,634D and S654D in separate plasmids). These mutations mimic constitutively phosphorylated amino acids allowing us to further analyze the impact of phosphorylation on EFF-1. In future research, we will observe how cell fusions are affected in *C. elegans* with these phosphomimetic mutations.

CX-SHAP: A Scalable Cross-Domain Explainable AI Framework for Clinical Decision Support

Aryan K C
Rutal Mahajan, Faculty Advisor
Poster Presentation

Clinical AI models that predict risk without explanation are not trusted by clinicians. This work presents CX-SHAP, a domain-agnostic explainability framework that decomposes feature attributions into shared versus outcome-specific components, quantifies cross-method agreement via concordance scoring, and validates explanations against clinical guidelines; all in a single unified pipeline.

CX-SHAP is demonstrated on MaternaAI, a multi-task neural network that simultaneously predicts three maternal-neonatal outcomes: Postpartum Hemorrhage (AUC 0.897), Neonatal Sepsis (AUC 0.816), and Hypoxic-Ischemic Encephalopathy (AUC 0.626). A three-phase training procedure called O-DIL resolves the F1=0.00 failure mode caused by extreme class imbalance (1.2% HIE prevalence), achieving F1 scores of 0.653, 0.528, and 0.258, respectively.

To evaluate deployability, CX-SHAP is benchmarked across a heterogeneous computing environment, spanning laptop CPU, cloud GPU, HPC cluster, and ARM edge hardware, on four domains (Healthcare, Finance, Manufacturing, Environment) at scales from 500 to one million samples. A central finding emerges: GPU accelerates batch training up to 19× over CPU, but is 8× slower for single-patient inference. This GPU paradox motivates a split deployment strategy, cloud GPU for training, CPU or edge hardware for real-time clinical inference.

CX-SHAP operates across all four domains with zero code changes, demonstrating generalizability as a responsible AI framework for high-stakes decision support.

AlgeBridge: Advanced Algebraic Modeling, Solver, & Analytical System

Ju Mi La
Unnati Shah, Faculty Advisor
Oral Presentation

Algebra learning tools often emphasize answer generation over conceptual understanding, limiting students' ability to connect symbolic manipulation to graphical and analytical representations. Many existing graphing calculators and algebra platforms, such as Desmos, GeoGebra, and Mathway, provide either basic computational outputs or advanced features behind paywalls, thereby restricting accessibility and reducing their pedagogical value in classroom settings. To address this gap, the Advanced Algebraic Modeling, Solver, & Analytical System (AlgeBridge) is proposed as a Python-based educational tool that integrates symbolic computation, visualization, and guided analysis in a single platform. The system enables users to explore algebraic expressions across multiple representations, including symbolic, factored, and graphical forms, while highlighting structural and behavioral properties of equations. AlgeBridge incorporates a multi-method equation solver (factoring, quadratic formula, and systems of equations), an expression analysis module, and interactive graphing capabilities. The system is implemented with a Tkinter-based graphical user interface (GUI), supporting user interaction, profile-based tracking, and feedback-driven learning support. By combining computation with visual and interpretive feedback, AlgeBridge aims to enhance conceptual understanding and improve students' engagement with algebraic problem-solving.

Why Rising U.S. Oil Production Has Not Guaranteed Lower Gasoline Prices: Evidence from 2000–2025

David LaTour
Luke Perry, Faculty Advisor
Oral Presentation

This paper will explore the relationship between the United States' domestic oil production and gasoline prices in order to answer the question: why do gasoline prices in the United States remain so volatile and high despite a significant increase in domestic oil production? This research is focused on the period from 2000 to 2025 and will analyze national data on U.S. crude oil production, petroleum consumption, the global price of crude oil, and an average gasoline price at the pump. The analysis derived from the data compares trends across these variables to determine the extent to which domestic oil production influences gas prices.

The data shows that while the United States has increased its oil production significantly during the shale revolution during the 2010s, gas prices did not see a significant decline in response. Instead of following domestic demand for oil, gas prices seem to track global crude oil prices more closely. This relationship mirrors the overall structure of the global oil market, where crude oil is internationally traded and priced, which hinders the ability for any one country to determine global fuel costs. That is not to say that domestic factors do influence domestic gas prices; additional factors such as, consumption patterns, refining capabilities, distribution, and taxes, can further influence the price of gas at the pump.

The findings imply that although increased domestic oil production bolsters energy security and reduces the reliance on foreign oil, it does not provide a path to direct control over gasoline prices. To account for this, policy has been aimed at managing the global market and the structure of domestic energy production. This research seeks to provide clarity to a contentious and very pertinent issue in modern America by understanding the limits of domestic energy production in shaping consumer gas prices. The analysis begins with a historical overview of the United States' relationship with oil, then reviews the economics around gasoline pricing, followed by an empirical analysis of gasoline trends from 2000 - 2025, and concluding with policy implications throughout various administrations.

What is the Derivative of a Number?

Gavin MaGill
Xiao Xiao, Faculty Advisor
Oral Presentation

The arithmetic derivative of a number is the map that sends every prime number to 1 and satisfies the Leibnitz rule (aka product rule). In this talk we will discuss the basic definition and properties of the arithmetic derivative and their connections with the Goldbach's conjecture. The main focus of the talk is a conjecture by Ufnarovski and Åhlander regarding the long term behavior of the sequence of higher derivatives. We will present a partial answer to the conjecture by Emmons and Xiao, and a result of ours that potentially gives a more general solution to the conjecture.

Synthesis and Characterization of [NiFe]-hydrogenase with Flexible Biomimetic Sulfur-based Ligands

Katherine Mattes
Elaine Liu, Faculty Advisor
Poster Presentation

As societies worldwide accelerate further into an irreversible energy crisis, there is a stark need for renewable energy resource options that don't negatively impact our environment. One of the most promising options is H2 as an environmentally innocuous energy resource. Hydrogenases, metalloenzymes that catalyze the reversible oxidation of H2, are ubiquitous throughout nature. However, synthetic efforts to replicate hydrogenases have struggled with low efficiency, short life spans, and the need for high catalyst loading. This arises partly because of the limited understanding of the [NiFe]-hydrogenase mechanism which has been the focus of significant research efforts since the crystallographic determination of the active site in 1995. However, the understanding of metal center, in particular the role of the iron, remains poorly understood. It has been determined that the redox chemistry happens solely at the Ni-center while the Fe-center has been found to contribute to stabilization. Significant efforts have been made to identify the intermediates in the catalytic pathway of the [NiFe]-hydrogenase. In previous synthetic systems, the Ni(II) precursor has shown limited catalytic activity compared to the Ni(II)-Fe(II) complex. Given the separate yet equally vital roles of the Ni and Fe centers, we aimed to explore the effects of a series of tetradentate sulfur ligands on the structure and function of nickel (II) complexes and the effects on their corresponding NiFe complexes as precursors for [NiFe]-hydrogenase mimics. This presentation will discuss structure and characterization of the full series of Ni(II) complexes and heterobimetallic complexes.

Was It Murder? TLC and GC-MS in the Organic Laboratory

Brayden McCaw
Michelle Boucher and Curtis Pulliam, Faculty Advisors
Poster Presentation

In this work, a two-week TLC laboratory was designed to provide not only experience with TLC but also with method development leading to use and understanding of multiple analysis techniques. The story provided the students is a manufactured one, where students are asked to determine the identities of components of an unknown substance found at the scene of a suspected murder. The usual analgesics are among the potential compounds, as are some potential toxins (such as naphthalene). In the first week, students are tasked in quartets to determine a chemical library of TLCs. Each quartet is in charge of assigning different tests to each member, and each student runs their own TLCs and adds them to the group data set. By the end of the first week of laboratory, each group has a protocol and TLC library that they believe will work to separate an unknown mixture. In the second week they are provided the unknown "found" at the "crime scene", and are tasked with using their developed method to determine the identities of the unknown substance. Some groups will discover they need to adjust their protocol to get good separation, leading to good conversations about polarity and this technique. Once students believe they have positively identified the substances, they are able to move as a quartet to the GC-MS. During this last phase of the laboratory, the instrument is introduced, building on the work they did with method development for TLC, and then their unknown sample is run.

Synthesis and Spin-coating Studies of Organosilicate Systems

Xavier Moore
Michelle Boucher, Faculty Advisor
Poster Presentation

Silicates are a useful backbone for creating organizing reinforced materials because sheets within the silicate are flexible and extremely organized. Apophyllite, which is the silicate modified in this study, is a single layer sheet silicate that has the ability to be chemically modified to have new organic groups attached on both sides of the silicate sheet; these single sheets can be modified into organosilicate systems. The resulting oragnosilicate system, with covalently bound siloxy groups on the surface of the silicate, has properties from both the parent silicate and the attached pendent groups. The new materials have functionalized groups which allow for additional reactions and further modifications to occur.

In this experiment, a series of systems with various pendent R groups were produced and characterized. These new materials were synthesized to study how the various R groups would react when attached to the backbone of the starting material. The library of different compounds were investigated further in order to find their ability to form uniform suspensions in a variety of solvents and be spin coated.

Technical but Tongue-Tied?

Revati Nishant Nasikkar
Unnati Shah, Faculty Advisor
Poster Presentation

Strong analytical ability is essential for data professionals, yet many struggle to present their findings clearly in public settings. This gap between technical skill and communication effectiveness is often underestimated in data education. While students in data science and analytics frequently demonstrate competence in analysis and visualization, many experience presentation anxiety, leading to unclear thinking, reduced confidence, and limited audience engagement.

This issue matters because the value of analytical work depends not only on accuracy but also on how effectively results are communicated to diverse audiences. In academic environments, lack of confidence can limit participation and access to opportunities. In professional settings, poor communication can diminish the impact of otherwise sound analyses and restrict career growth. Given its role in equitable advancement, this challenge deserves greater attention.

Prior research highlights that study-related anxiety is widespread. A large-scale survey by Vitasari et al., involving 770 university students, identified multiple forms of anxiety, including presentation, mathematics, language, and social anxiety. These findings confirm that presentation anxiety is both common and persistent in higher education.

The evidence suggests that this anxiety stems less from weak technical knowledge and more from limited communication strategies. Many students struggle to structure narratives, highlight key insights, and clearly explain visualizations.

To address this, we applied a structured storytelling framework based on established principles (Teaching Data Science through Storytelling: Improving Undergraduate Data Literacy [1]). This approach emphasized clear guiding questions, single insights per slide, and annotated visuals. With practice and peer feedback, students showed improved clarity, confidence, and audience engagement.

Real-Time Bias-Aware AI for ACL Rehabilitation: Beyond Clearance to Sustained Performance

Ashim Pandey
Unnati Shah and Angel Rivera, Faculty Advisors
Oral Presentation

The process of making decisions about an athlete's readiness for returning to play following an ACL reconstruction is frequently viewed as in binary form "0 and 1". On the contrary, the rehabilitation of athletes suffering from ACL reconstruction requires two critical steps in clinical decision-making processes, which are the Return to Sport (RTS) and Return to Performance (RTP). An athlete might have been deemed clinically fit to return to play; however, this individual might not be capable of performing at the same pre-injury level of performance or even worse than the expected rate of deterioration after returning. Hence, RTS and RTP must be regarded as distinct but correlated events.

The current technical report introduces a bias-conscious machine learning pipeline for forecasting RTS and RTP individually and simultaneously evaluating the pipeline's fairness at runtime. This pipeline accepts uploaded and synthetic datasets, auto-generates labels for RTS and RTP when labels are absent and utilizes supervised learning techniques like Gradient Boosting and Random Forests. It also conducts batch-based and streaming fairness assessments among different protected groups based on factors like race, gender, and age group.

However, the primary emphasis of our system is the detection layer within the pipeline. The system measures fairness metrics such as demographic parity and equalized odds, triggers the alerts based on the defined threshold, detects which protected variable is being violated, and indicates which fairness metric was violated. This involves plotting the monitoring traces for detecting the drift in fairness over time despite having high accuracy, precision, and recall rates.

It is important to note that the objective here is not just accurate predictions but also responsible decision-making.

VulneraX: Drift-Aware Time-Series Forecasting for Software Vulnerability Risks

Patrick Penna and Vonnie Magnussen
Unnati Shah, Faculty Advisor
Oral Presentation

Cybersecurity encompasses many necessities for companies to invest in to ensure their information and services are compliant with confidentiality, integrity, and availability. Notably, all organizations must understand the relevant risks to their interests and assess them based on their impact. Cybersecurity efforts must be willing not only to perform these risk assessments on valuable infrastructure but also make decisions based on the volatility in a certain vulnerability's prominence over time. This study presents a framework for how risk forecasting can strengthen risk assessment efforts. The solution, VulneraX, is a time-series forecasting model that predicts trends in high-severity vulnerabilities (CVSS ≥ 7.0) and formulates realistic predictions of those vulnerabilities based on inbound scanner outputs and the National Vulnerability Database (NVD). The solution was developed with Prophet and, through extensive research into forecasting methodologies and the inclusion of relevant key metrics, it serves to preprocess data, mitigate outliers, generate forecasts, detect drift, visualize trends and metrics, and issue alerts when predictive reliability is compromised. Moreover, this study builds on existing implementations and ideologies by introducing the concept of a “preliminary evaluation” during its preprocessing phase. Given a dataset, CVSS scores in two-day windows are juxtaposed with one another to calculate the standard deviation between the two; should that deviation exceed a predetermined threshold (<=50), the abnormal outlier will be ignored for the model’s training and placed into a CSV file containing relevant fields (date, vulnerability, vulnerability count, percentage from deviation, and the rate of change in between) for anomalies to be assessed separately. The goal of this solution is to build on existing, standardized drift-detection safeguards by reinforcing data preprocessing to enhance cybersecurity efforts and enable the model to produce a generalized, accurate, and stable forecast. Through this, VulneraX enables organizations to turn from reactive vulnerability remediation to proactive, data-driven risk management.

Immigration and Support for Right-Wing Populist Parties in Europe

Demetre Prittipaul
Jun Kwon, Faculty Advisor
Oral Presentation

Why do some European democracies experience higher levels of support for right-wing populist parties than others, despite facing similar immigration pressures? Existing research has emphasized economic insecurity, political distrust, and the scale of immigration as key drivers of populist support. However, these explanations do not fully account for cross-national variation in electoral outcomes. This study argues that perceived cultural threat, rather than objective immigration levels, is a primary factor shaping support for right-wing populist parties.

Using a comparative research design, this study examines variation between Sweden and Hungary. While both countries are embedded in the European political context, they differ significantly in public attitudes toward immigration and levels of populist party support. Employing a Most Similar Systems Design, the analysis isolates the effect of perceived cultural threat while controlling for economic conditions and institutional similarities.

The study combines survey data, including Eurobarometer and World Values Survey indicators, with electoral data on populist party performance. It is expected that higher levels of perceived cultural threat will be associated with increased support for right-wing populist parties, even in contexts with relatively low immigration levels.

By focusing on perception rather than material conditions, this research contributes to comparative politics by highlighting the importance of identity and subjective attitudes in shaping political behavior. It also offers insight into the broader dynamics driving the rise of populism in contemporary democracies.

Bioactivity-guided Isolation of Antibiotic Metabolites from the Mycoparasitic Fungus, *Niveomyces coronatus* (Cordycipitaceae, Hypocreales)

Nathan Sand
Richard Tehan, Faculty Advisor
Poster Presentation

The continued rise of antimicrobial resistance, projected to cause up to 10 million deaths annually by 2050, highlights the urgent need for new antibiotic agents from diverse and underexplored biological sources. Natural products (= specialized metabolites), including many derived from fungi, remain a major source of clinically used therapeutics including antibiotics and anticancer agents, yet fungal biodiversity is still significantly under investigated. *Niveomyces coronatus* (Cordycipitaceae, Hypocreales) is a fungal hyperparasite of the ant pathogen, *Ophiocordyceps camponoti-floridani*, part of the "zombie ant fungus" species complex4. This unusual ecological niche suggests the potential for specialized metabolite production driven by complex biological interactions. To investigate this, a new strain of *N. coronatus* was isolated from an infected ant cadaver collected in Collier County, Florida, USA and cultured under multiple conditions. Crude extracts exhibited antimicrobial activity against *Bacillus cereus*, prompting scaled-up fermentation (9 L) and bioassay-guided isolation using reversed-phase high-performance liquid chromatography (RP–HPLC) to purify active compounds. Structure elucidation by 1D and 2D nuclear magnetic resonance (NMR) spectroscopy identified active compounds as beauvericins, a family of N-methylated, six-residue cyclodepsipeptides. This work represents the first chemical investigation of the genus *Niveomyces* and the first report of beauvericins from this taxon, highlighting fungal hyperparasites as promising sources of biologically active natural products.

Synthesis and Characterization of Ni(II) and Ni(II)-M Heterobimetallic Complexes as [NiFe]-hydrogenase Mimics

Nevaeh Scott-Dominguez
Elaine E. Liu, Faculty Advisor
Poster Presentation

As the imminent danger of depleting energy resources becomes significant, there is an increasing need for clean sources of energy. Hydrogen evolution has gained attention due to its clean and stable water vapor byproduct. One synthetic approach to developing systems for hydrogen evolution is through mimicking naturally occurring [NiFe]-hydrogenase which efficiently catalyzes reversible redox reactions resulting in H2 production. To date, several [NiFe]-hydrogenase mimics have been reported, but few demonstrated any catalytic activity; those that did were limited by high catalyst loading, short catalyst lifespans, and low turnover numbers. Previous research demonstrates that the H2 evolution by the [NiFe]-hydrogenase is the result of the redox chemistry occurring at the Ni(II) center. To better understand how the ligand environment affects the redox chemistry of the Ni(II), this research sought to modify a previously reported ligand structure and probe effects on the structure and function of the Ni(II) and NiFe complex. This poster will discuss the synthesis and characterization of the Ni(II) complexes, the subsequent incorporation of a second metal to the Ni(II) complex, and the structure and reactivity of this heterobimetallic complex.

Utica University and Student Support Offices

Emma Sheldon and Trinity Bailey
Laurah Klepinger and Helen Blouet, Faculty Advisors
Poster Presentation

We are two sociology & anthropology majors who have applied anthropology and sociology theories and methods to our interactions with secondary education and the Utica University community. Throughout this research project, the purposes, functions and perceived significance of Utica Offices are analyzed. The main departments we focus on include the Young Scholars program, the TRIO office and the Student Success office. The main question we investigate in this project is: How do different departments of Utica University interact with students, and what impact does this have on the students? This poster will share our process, initial findings and significance of the research.

EMG Gesture Project

Ethan Smith, Alexander Gomez, and Kyle Hartness
Rutal Mahajan, Faculty Advisor
Oral Presentation

This project presents a complete system for real-time EMG gesture classification, combining Smachine learning with low-level system optimization. Raw electromyography (EMG) signals are segmented into fixed-size windows and processed through filtering and feature extraction stages, where key features including mean absolute value (MAV), root mean square (RMS), and zero crossings (ZC) are computed.

A Logistic Regression model is trained in Python using the extracted features, and the learned weights are integrated into a C-based implementation for efficient inference. The system is designed using a pipelined producer-consumer architecture with multithreading, enabling concurrent execution of signal processing and classification stages. A shared buffer with synchronization primitives ensures safe and efficient data transfer between threads.

Performance is evaluated across multiple configurations, including sequential and pipelined execution on CPU, as well as optimized implementations using techniques such as SIMD and quantization. Additionally, GPU-based inference is explored using ONNX to compare performance across different hardware environments.

The results demonstrate that combining machine learning with architectural optimizations significantly improves throughput and efficiency, highlighting the impact of parallelism and hardware-aware design in real-time signal processing systems.

Study of Siloxane Polymer Plastic Systems

Gabriella Sponburgh
Michelle Boucher, Faculty Advisor
Poster Presentation

Siloxane polymer systems are used in many different lubricant roles in daily use materials. These systems can, with crosslinking, form plastic sheets with great versatility for tuning of properties. Plastics made in this fashion can be flexible or tough, opaque or translucent, and other tunable properties depending on the choice of groups on the siloxane matrix. Reinforcement agents, materials mixed into the plastic, can also be used to create systems that are tougher and more durable than the unfilled plastic.

In this work a set of plastic blocks was made to test conditions for a thermosetting siloxane polymer system. The system ratio of siloxane to crosslinker was studied as well as concentration of the catalyst and thermosetting conditions. Once these conditions were refined, tests were done using fumed silica as a reinforcement agent, and plastic bricks were cast successfully. The eventual goal of this work is to introduce organosilicate systems that can crosslink to the siloxane polymer system as reinforcement agents to this matrix, and to test the relative properties of the three systems (unfilled, silica filled, organosilicate filled).

Green Synthesis of Gold Nanoparticles Using Amino Acids as Reducing Agents

Yamilet Taveras
Alyssa C. Thomas, Faculty Advisor
Poster Presentation

Nanoparticles have gained significant attention due to their versatility in applications such as medicine and technology. Gold nanoparticles (Au NPs) specifically have unique chemical and physical properties which makes them useful in biomedicine and nano-technological applications. From previous studies, Au NPs were found to bind strongly to substances possessing thiol groups such as cysteine and its dimer, cystine. The focus of this research is to use amino acid tyrosine as a reducing agent for the green synthesis of Au NPs. The formation of the Au NPs will be confirmed and characterized using UV-Vis spectroscopy. The synthesis will be optimized according to green chemistry principles for further studies with potential biological applications, as well as adjusting the pH. Study showed that the synthesis and aggregation of Au NPs was highly dependent on pH.

Educational Sudoku Game

Colin Zouck
Dr. Unnati Shah, Faculty Advisor
Oral Presentation

I've always been interested in how websites function, but I had little to no idea what makes a website tick. After using a computer my whole life, the inner workings of web pages were still vague to me. I've been studying cybersecurity and computer science for the past three years and decided it was time to take a deeper dive into web development. I also enjoy playing web games like sudoku or solitaire, so I decided creating a web game would be my goal, in the greater purpose of learning more about web development. This would become an obtainable goal that provides an entertaining final product, and new knowledge (to myself) of computer science concepts.

Included in this report is multiple programming languages (HTML, CSS, Javascript) working together to create a working project. It's important that people learn about web development as the internet is the biggest marketplace worldwide and will seemingly continue to be. There are countless sources to learn about creating a website, making now the easiest time to create one in history.

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