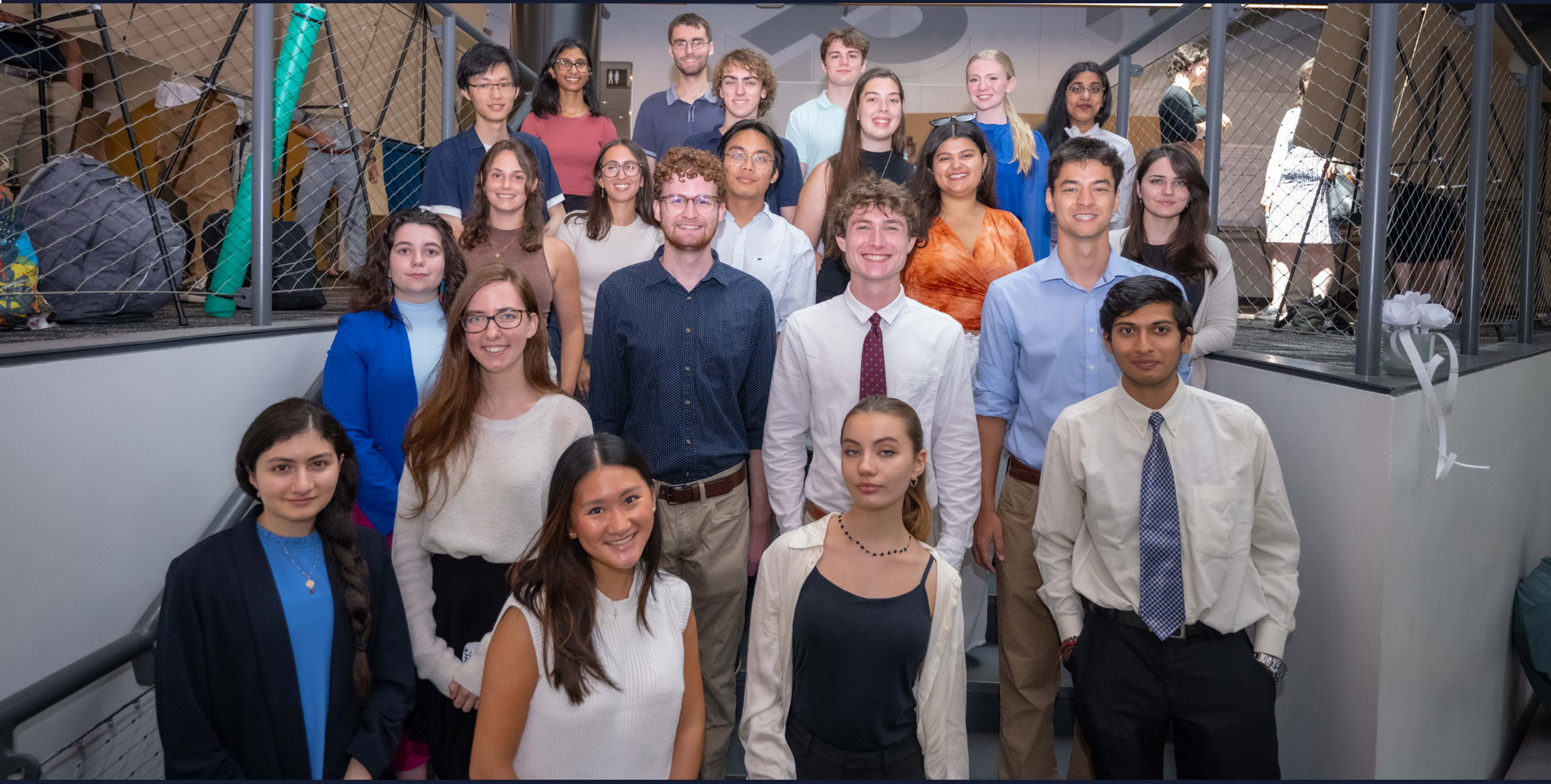
Arts & Sciences Week

Undergraduate Student Research Showcase

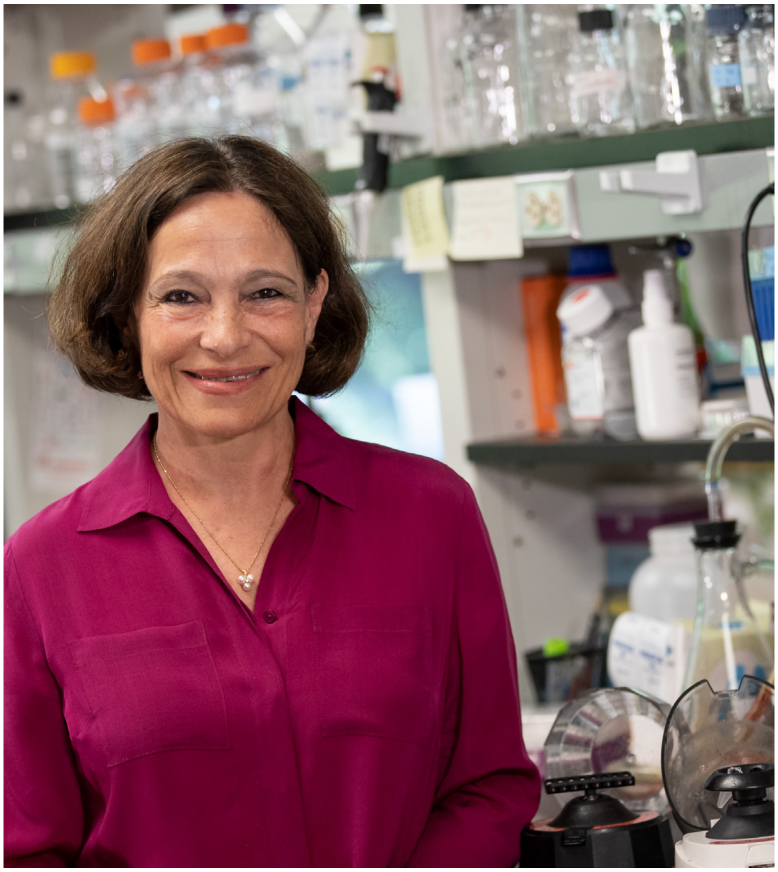
Wednesday, September 25, 2024
12:00 PM - 1:30 PM
Odeum



Here Comes the Sun...We Discover to Transform

Keynote Speaker: Silvia Corvera

The Puzzle of Diabetes



Silvia Corvera is Professor of Molecular Medicine, and holds the Endowed Chair in Diabetes Research at UMass Chan Medical School.

She received her M.D. and MSc in Molecular Biology at the Universidad Nacional Autonoma de Mexico, and was awarded an NIH Fogarty International Fellowship to conduct postdoctoral research studies in the USA. She was on the Faculty at the Department of Pathology and Laboratory Medicine at the University of Pennsylvania before moving to the University of Massachusetts Medical School to the newly formed Program in Molecular Medicine.

The goal of her lab is to understand the relationship between obesity, insulin resistance and Type 2 diabetes. Her studies center on understanding mechanisms of human adipose tissue development and function. Current efforts are focused on elucidating the mechanisms by which mesenchymal progenitor cells develop into different types of adipocytes, including white, and beige, with the goal of identifying potential therapeutic strategies in Type 2 diabetes and gestational diabetes.

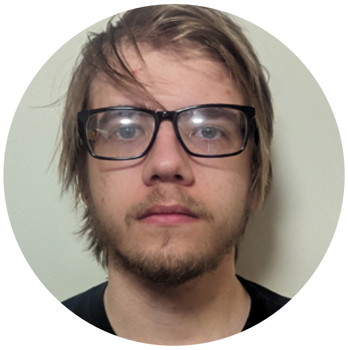
She has served on numerous national advisory committees, including the NIH BMDM study section, Chair of the Mentor Advisory Group for the new “Pathway to Stop Diabetes” of the American Diabetes Association, and was a member of the NIH Diabetes Research Strategic Plan Working Group for the Diabetes Mellitus Interagency Coordinating Committee (DMICC) of NIDDK (2010). She has served as organizatizer for national meetings including for the Keystone Symposia, and the Federation of American Societies for Experimental Biology (FASEB), and has been a member of the Scientific Sessions Meeting Planning Committee of the American Diabetes Association. She has served on the editorial boards of FASEB J., Diabetes and the Journal of Biological Chemistry. She is also committed to developing the next generation of biomedical scientists, having served as the director of the MD/PhD program at UMass Chan from 2019 to 2021.

STAR Fellowship

1

Name: Zachary Adams
Class of 2025
Majors: Mathematical Sciences, Physics
Advisor: Burt Tilley - Professor, Mathematical Sciences
Title: ***Optimal Defect Layer Position in Layered Electromagnetic Energy Absorbers***

Abstract: Beamed energy applications require the use of heat exchangers to collect the thermal energy produced from the absorption of electromagnetic radiation. To explore the effects of wave-geometry interactions on heat transfer in resonant systems, we consider a 7-layer susceptor composed of alternating high and low-permittivity lossless dielectric layers, and one layer with a temperature-dependent loss factor. It is irradiated from one side by a plane electromagnetic wave normal to the susceptor, and grounded on the other. We consider the system at a thin-domain limit, such that constant temperature is maintained across its width.We show that with an asymmetrically placed defect layer, resonant states produce higher temperatures at lower incident powers, and exhibit greater efficiency of energy transfer to the defect layer. We additionally demonstrate transient behavior of the system to show that low-reflection states are attainable in finite time. We additionally show that these states possess high efficiency. Finally, we show that these behaviors can be replicated in a asymmetric 7-layer system composed of titanium dioxide, air and silicon dioxide.



2

Name: Peter Cancilla
Class of 2026
Major: Computer Science
Advisor: Harmony Zhan - Assistant Professor, Computer Science
Title: ***State Transfer in Continuous Quantum Walks***

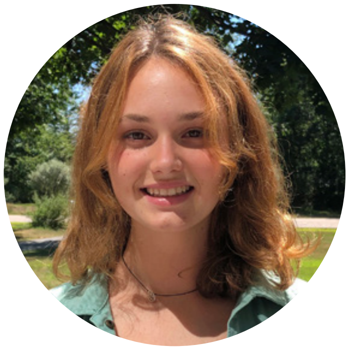
Abstract: Quantum walks are fundamental tools in quantum computation. One desired phenomenon of quantum walks is the ability to transmit information from one site to another with high fidelity. In this project, we study perfect state transfer (PST), where such transfer occurs with certainly, and pretty good state transfer (PGST), where the transfer probability gets arbitrarily close to 1.

For continuous quantum walks, it is shown by Godsil that perfect state transfer is rare; on the other hand, there is a polynomial time algorithm, due to Coutinho and Godsil, that decides if a graph admits perfect state transfer. We implemented this algorithm in a python-based programming language known as SageMath and built a database for graphs up to 8 vertices and trees up to 14 vertices that admit PST, as well as those with periodic vertices/cospectral vertices/parallel vertices, which are necessary prerequisites for PST to occur.

Within discrete quantum walks, PST and PGST are much less understood. So far, the study is focused on regular graphs, and very few examples have been found. We extend the theory of PST and PGST to irregular graphs, utilizing a connection between these properties and the spectrum of the normalized adjacency matrix. In particular, we write code in SageMath that determines if a general graph admits PST and

construct new infinite families of irregular graphs with this phenomenon.

A goal for our research going forward is to construct a database of graphs that admit discrete PST. Ideally, we will also construct a database for graphs admitting PGST, however doing this will prove to be more of a challenge as the characterization of PGST involves more complicated number theoretic constraints.



3

Name: Olivia Dube
Class of 2025
Major: Chemistry
Advisor: Ronald Grimm - Associate Professor, Chemistry & Biochemistry
Title: *Air-Free, Molten-Salt Etching of Ti3AlC2 "Yields" Cl-Terminated Ti3C2Clx MXene*

Abstract: MXenes are a new class of 2-dimensional conductive layered nanomaterials, about five atoms thick, that hold promising applications in clean energy storage, water purification, electromagnetic shielding, and more. Traditionally, MXene synthesis uses hydrofluoric acid to etch atomic layers out of MAX phase precursor, resulting in mixed –F, –O, and –OH surface terminations. Novel synthetic methods utilize molten-salts in a Lewis-acid reaction yield MXenes with alternative, desirable surface terminations such as chlorine, which creates highly conductive, reactive, and hydrophobic MXenes. To limit oxidative destruction and preserve chlorine terminations, an air-free molten-salt reaction was conducted by sealing copper(II) chloride and MAX powder in a vacuum-sealed tube and cooking at high temperatures with vapor transport. Terahertz spectroscopy was used to confirm the preservation of the delaminated MXene structure. X-ray photoelectron spectroscopy was used to characterize the atoms at the surface of the material. This displayed proof of synthesis and preservation of Cl-terminations through observation of the Ti, C, and Cl regions. The immediate implications of this research are development of air-free delamination procedures of hydrophobic and oxidatively unstable Cl-terminated MXenes the enable preservation of the nanomaterial.

4

Name: Pegah Emdad
Class of 2026
Majors: Data Science, Bioinformatics & Computational Biology
Advisor: Fabricio Murai - Associate Professor, Data Science
Title: *Diagnosing Bias: Predictive AI Models for Identifying Biased Health Information in Medical Curriculum*

Abstract: There have been growing concerns around high-stake applications that rely on models trained with biased data, which consequently produce biased predictions, often harming the most vulnerable. In particular, biased medical data could cause health-related applications and recommender systems to create outputs that jeopardize patient care and widen disparities in health outcomes. A recent framework titled Fairness via AI posits that, instead of attempting to correct model biases, researchers must focus on their root causes by using AI to debias data. Inspired by this framework, we tackle bias detection in medical curricula using NLP models, including LLMs, and evaluate them on a gold standard dataset containing 4,105 excerpts annotated by medical experts for bias from a large corpus. We build on previous work by coauthors which augments the set of negative samples with non-annotated text containing social identifier terms. However, some of these terms, especially those related to race and ethnicity, can carry different meanings (e.g., "white matter of spinal cord"). To address this issue, we propose the use of Word Sense Disambiguation models to refine dataset quality by removing irrelevant sentences.

We then evaluate fine-tuned variations of BERT models as well as GPT models with zero- and few-shot prompting. We found LLMs, considered SOTA on many NLP tasks, unsuitable for bias detection, while fine-tuned BERT models generally perform well across all evaluated metrics.

5

Name: Esther Mao
Class of 2026
Majors: Society, Technology, and Policy, Data Science
Advisor: Robert Krueger - Professor, Social Science & Policy Studies
Title: ***The Importance of Process When Acquiring Data for Machine Learning: An Examination of Public Perceptions of Governance in Ecuador***

Abstract: Researchers in international development, especially those using AI tools, are often agnostic about where their data comes from. This project is a step toward demonstrating the value of data collected through processes found in social science.

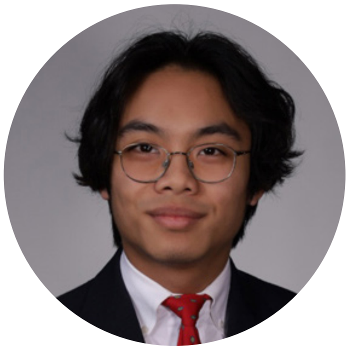
The Poverty Stoplight (PSL) method, first developed by Fundación Paraguaya, utilizes an individualized, inductive methodology to create targeted anti-poverty solutions. The survey consists of various indicators, which represent different dimensions of poverty, and are based on input from respondents in each community. Participants rank each indicator as red, yellow, or green, based on whether they feel "very poor", "poor", or "not poor" in each category. The dataset includes indicators related to poverty and democracy and trust in institutions.

This research project sought to understand what can be gained from an individualized approach in studying dimensions of democracy using AI tools. By utilizing various machine learning methods on the PSL data from Ecuador, we built a model by isolating indicators tied to democratic norms and perceptions. We then compared our model's results with other Latin American democracy studies which did not utilize an individualized survey methodology. Our findings showed that when trained on PSL data the ML model demonstrated improved accuracy.

6

Name: Corbin Narita
Class of 2025
Majors: Mechanical Engineering, Physics
Advisor: William McCarthy - Assistant Professor, Physics
Title: ***Streamlining the Framework for SPECT Image Reconstruction***

Abstract: This research project focused on developing and translating UMass Chan Medical School's OSEM SPECT reconstruction algorithm from the C language to the python language. This project aimed to create a more accessible, efficient, and well documented reconstruction algorithm. Throughout the 2024 STAR fellowship, I created detailed documentation for existing C code, enhancing my understanding and ability to optimize the code. I began writing new python code to closely replicate the input and output of the C code. Concluding the fellowship, I have written over 1,000 lines of python code, replicating the functionality of over 3,000 lines of C code. My research is the beginning of a larger project to fully develop the algorithm in python and deploy it for research purposes at UMass Chan Medical School.



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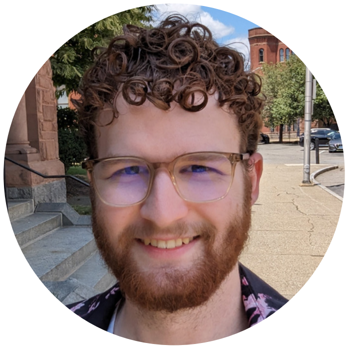
Name: Ryan Nguyen
Class of 2025
Major: Computer Science
Advisor: Neil Heffernan - Professor, Computer Science
Title: ***Creating a Conversational AI Tutor (CAIT)***

Abstract: CAIT (Conversational Artificial Intelligence Tutor), is an intelligent tutoring system aiming to leverage generative AI to give a tailored learning experience to struggling students. Our research investigates three primary questions: (1) The usefulness of AI-generated supports (hints, explanations, scaffolding, etc.) for students, (2) The effectiveness of AI tutors compared to human tutors, and (3) What teachers think of using AI tutors in current form. Initial findings suggest that while not replacing teachers, AI tutors can provide effective support when teachers cannot, becoming a useful assistive tool.



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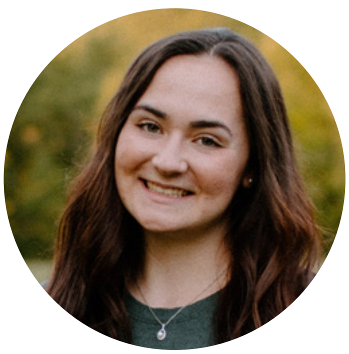
Name: Alec Norton
Class of 2026
Majors: Robotics Engineering, Computer Science
Advisor: Erin Solovey - Associate Professor, Computer Science
Title: ***Validating Neural Circuit Policies for fNIRS Brain Signal Classification***

Abstract: As brain-computer interfaces (BCI) advance and become widespread, the demand for low-energy accurate algorithms increases. Presently, high-energy deep learning (DL) is successfully applied to brain signal classification but faces difficulty with noisy data or when generalizing to different users. Is there a low-energy model that can achieve competitive accuracy, noise robustness, and generalization? An interesting candidate is Neural Circuit Policies (NCP): a novel low-cost DL model inspired by the architecture of the C. elegans nematode's nervous system. NCP consumes less energy and is far smaller than standard DL models but has been shown to be remarkably capable at time-series applications. To validate this for BCI, we constructed a NCP and Convolutional Neural Network (CNN) model for comparison. Using brain signal data collected by fNIRS from Tufts University, we performed a 10-fold cross validation to determine each model's accuracy on the shuffled dataset and then perturbed the data with noise and recorded the declining accuracy of both models. Finally, to determine generalization, each model was trained on a subsection of the entire dataset and then tested on the entire whole to determine the accuracy for unseen subjects. NCP achieved a 96% accuracy rate and showed competitive noise robustness and generalization with the CNN model. Therefore, NCP seems to be a low-cost competitive alternative to standard DL models, reducing the energy requirement for BCI.

9

Name: Conner Olsen
Class of 2026
Majors: Computer Science, Math
Advisor: Daniel Reichman - Assistant Professor, Computer Science
Title: ***Building a Dataset of NP-Hardness Reduction Proofs for Generative AI Applications***

Abstract: The study of using techniques such as Generative AI and automated theorem provers in constructing reductions has great potential to benefit both the theoretical understanding of reductions and the development of automated tools in formalizing mathematics. There exist short yet unintuitive proofs of NP-hardness reductions, suggesting that automated discovery of such proofs may be feasible. Many of these proofs, while conceptually complex, can be expressed concisely in formal language or code. This conciseness, combined with the structured nature of reduction proofs, indicates that with appropriate heuristics and search strategies, AI systems could potentially generate these proofs within reasonable computational bounds. By constructing a dataset of solved NP-Hardness reductions, we have provided the means for the application of Generative AI into the field. Such datasets are hard to come by in other domains of mathematics and differ from datasets that are currently used to evaluate the mathematical capabilities of large language models (LLMs). Reductions have significant applicability in STEM undergraduate education. A core tenet of problem-solving is the ability to recognize and establish connections between equivalent approaches or problems. Finally, this work could allow for the existence of AI models that can construct relations, which could automate the discovery of new algorithms.



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Name: Brenna Pfisterer
Class of 2025
Major: Psychological Science
Advisor: Erin Ottmar - Associate Professor, Social Science & Policy Studies
Title: ***Revealing Variations in Math Strategies and Perceptual Structures***

Abstract: Creativity and strategic thinking are foundational for effective problem-solving, particularly in mathematics, where the ability to navigate between divergent and convergent thinking can influence solution and learning outcomes. In mathematics, creativity extends beyond finding correct answers; it encompasses exploring multiple pathways, uncovering novel approaches, and identifying connections that may otherwise be overlooked. This STAR research outlines a study design that investigates the variations in mathematical problem-solving strategies and perceptual structures among undergraduate students using Graspable Math. GM is a digital tool designed to help students learn and interact with mathematical concepts in a hands-on way. On this platform, the steps and behaviors of participants can be tracked as they solve problems. The proposed study designed over the course of the summer aims to classify and visualize diverse solving strategies, with a focus on understanding how problem types, structured similarly but with different goals and instructions, influence the use of divergent versus convergent problem-solving approaches. The mathematical problems were created with distinct instructions and three variations of solution states. I propose that approximately 100 undergraduate students recruited through the WPI SONA pool participate in this 45 minute online study. This study will use a 2 x 3 factorial design and multilevel modeling. Additionally, the use of multi-level modeling will allow for examination of variance due to problem variations vs variance due to the individual students. The proposed research is to be continued as an MQP for the 2024-2025 academic year.

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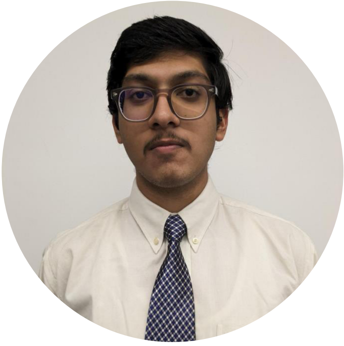
Name: Srisaranya Pujari
Class of 2026
Majors: Physics, Data Science
Advisor: Raisa Trubko - Assistant Professor, Physics
Title: *Pulsed Quantum Diamond Magnetometry*

Abstract: With the emergence of quantum sensors such as the Quantum Diamond Microscope (QDM), we can now image magnetic fields. The QDM uses Nitrogen-Vacancy centers within a diamond to study geological samples, biological samples, and novel materials. Of the different schemes for the QDM, a pulsed measurement protocol offers many advantages. Pulsing the laser leads to faster data acquisition times and higher contrast in our measurements. We also find reduced heating of our samples, which helps us prevent sample burning. In this project, we built a pulsed QDM. We demonstrate this with Rabi Oscillations and a pulsed Optically Detected Magnetic Resonance (ODMR) spectrum for five different Nitrogen-Vacancy Diamonds.



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Name: Ronak Wani
Class of 2026
Major: Computer Science
Advisor: Matthew Ahrens - Assistant Teaching Professor, Computer Science
Title: *Grounded Theory-Driven Software Solutions for Advising*

Abstract: This research explores challenges in academic advising. These issues contribute to student stress. To address these challenges, we propose AI-integrated solutions for detailed academic planning. These innovations aim to improve advising quality, support, and enhance student success in higher education.

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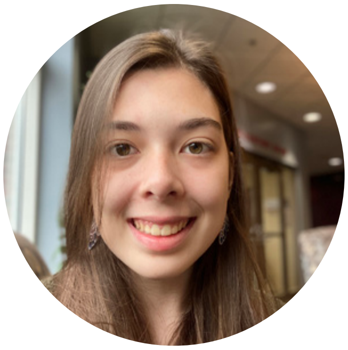
Name: Tianxing Weng
Class of 2026
Major: Physics
Advisor: Kun-Ta Wu - Associate Professor, Physics
Title: *Active cavity flow with a Hybrid Lattice Boltzmann Method*

Abstract: The lid-driven cavity flow system as a benchmark problem in fluid mechanics, is well-known to develop turbulence at high Reynolds number in response to the external stimuli, yet active fluid being internally driven, exhibits turbulence even at very small Reynolds number. In our study, we numerically investigate the competition between external and internal driving and the so-induced transition from disordered states to ordered states via a hybrid lattice Boltzmann method in collaboration with experiments. A transition in flow patterns and the velocity-velocity correlation length is observed in numerical simulations in consistency with experimental observations.

LaPre Fellowship



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Name: Grace Baumgartner
Class of 2025
Majors: Chemistry, Mathematics
Advisor: Ronald Grimm - Associate Professor, Chemistry & Biochemistry
Title: ***Cationic Pollutants Adsorb Reversibly to 1DL Surfaces***

Abstract: To effectively remove industrial pollutants from waterways, new materials are needed. Titania-based onedimensional lepidocrocite (1DL) is a promising candidate for this application due to its inexpensive synthesis and its photocatalytic ability. Furthermore, due to its anionic terminations, 1DL readily adsorbs cations from solution, changing its interlayer spacing. Crystal violet and methylene blue, two visible-light dyes and proxies for cationic organic pollutants, are adsorbed by as-synthesized 1DL, forming a complex with emergent electronic behavior. Now, it is shown that this adsorption can be reversed by the addition of LiCl salt, freeing the dye from solution and rinsing the material for future reprocessing. This demonstrates how 1DL's varying affinities for different cations can be leveraged to optimize its performance as an adsorbent. Special thanks to David LaPré for funding this summer.

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Name: Trevor Bush
Class of 2025
Majors: Biotechnology, Biochemistry
Advisor: Pamela Weathers - Professor, Biology & Biotechnology
Title: ***Validating Methodology for MMP3 and Collagen Detection and Quantification in Dermal Fibroblasts***

Abstract: Fibrosis is pathological healing process through non-regenerative mechanisms and leads to scar formation. Approximately 30% of deaths are attributed to fibrosis. Here methods for detecting and quantifying pro and anti-fibrotic markers in vitro, such as collagen and MMP3 proteins respectively, were tested for their validity in determining the efficacy of the therapeutics dihydroartemisinin, previously shown to upregulate MMP3 and downregulate a-SMA. Human dermal fibroblasts (HDF) were pre-treated with two doses of ±TGF-b (10 ng/mL), seeded into 24 well plates and treated with DMSO control (0.1% v:v) or dihydroartemisinin (DHA, 50 µM). Media was collected and cells were fixed after 4 days and 10 days with either a one or two dose DHA treatment. An ELISA was used to quantify MMP3 in the media. Sirius Red/Fast Green FCF dyes were used to determine collagen and total protein concentrations in media and fixed cells. Immunocytochemistry (ICC) was used to observe a-SMA and collagen I protein expression and cell nuclei were localized with Hoechst. By the 10th day of 1 dose of DHA, a-SMA decreased, and collagen fibrils were undetectable in cells compared to DMSO controls. MMP3 significantly increased in the media of both 1 and 2 dose DHA treated cells after days. Although collagen in cells decreased with 2 doses of DHA after 10 d, relative to total protein there was no change. Unfortunately, the Sirius Red/Fast Green FCF gave false positive results indicating it was unreliable. Together results showed that most methods were valid, but that collagen assay of the media requires improvement.

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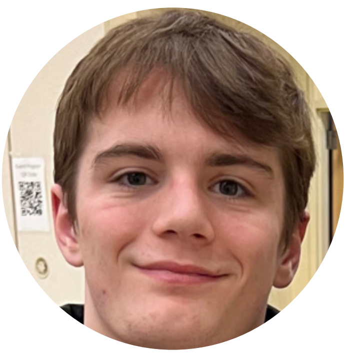
Name: Jillian Crandall
Class of 2025
Majors: Biotechnology, Biochemistry
Advisor: Ronald Grimm - Associate Professor, Chemistry & Biochemistry
Title: ***Solving the Kek1/EGFR Binding Pocket Puzzle***

Abstract: The Epidermal growth factor receptor (EGFR) is a receptor tyrosine kinase, whose activation controls cell proliferation, survival, migration, and cell fate determination[1]. As such, activating mutations to EGFR is associated with many cancers, including breast, brain, lung[1]. Therapeutic approaches typically involve molecules designed to inhibit the receptor[2]. Kekkon1 is an inhibitor of Drosophila EGFR (dEGFR) and one of a family (Kek) of six transmembrane molecules in Drosophila[13]. Interestingly, within the family only Kek1 inhibits the Drosophila receptor and the extracellular and transmembrane regions have been identified as the domains required for inhibition[4]. The extracellular region consists of N-insert, seven LRRs, flanked by cysteine rich domains and an Ig domain[1]. While the importance of the LRRs to Kek1's ability to bind the receptor have been established, key questions remain. Are the cysteine rich flanking regions involved in binding, what LRR residues within the predicted binding pocket drive specificity of the interaction, and is the N-insert required for inhibition in vivo?



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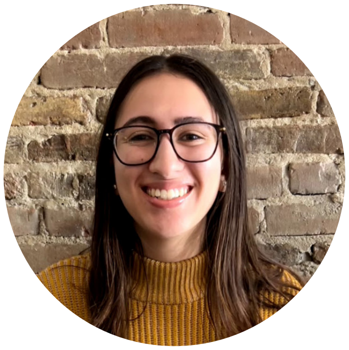
Name: Connor Doran
Class of 2026
Major: Chemistry
Advisor: Shawn Burdette - Professor, Chemistry & Biochemistry
Title: ***Synthesis and Characterization of a Quinoline Based Zinc Photocage Designed for Red-Shifted Absorption***

Abstract: Zinc is an important metal that is utilized throughout the body for a variety of tasks. In the brain, zinc is an important neurotransmitter where an imbalance correlates to neurological disorders such as Parkinson's and Alzheimer's. However, due to having a full valence orbital, it is difficult to monitor zinc pathways using optical spectroscopy. Cell permeable photocages that selectively chelate to zinc ions are useful tools for the controlled release of zinc in cell assays. Optimally, these cages should be activated by low-energy light to reduce cell damage. 8-aminoquinoline (8AQ) was utilized to red-shift the activation wavelength of a novel zinc photocage. The synthesis of 8AQdeCage was optimized and partially characterized, displaying a bathochromic shift of the λmax to 346 nm when compared to previous cages.

Manning/Leser Fellowship



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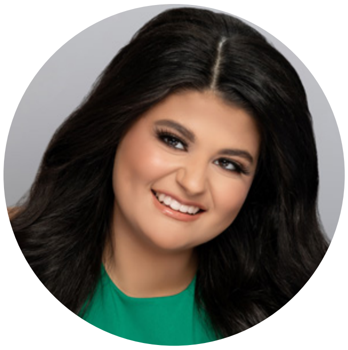
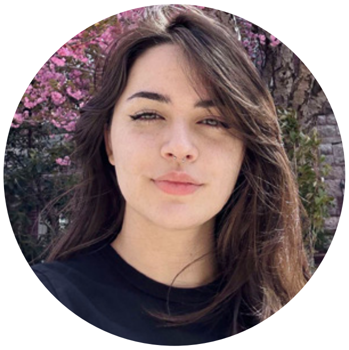
Name: Leah Maciel
Class of 2025
Majors: Bioinformatics & Computational Biology
Advisor: Luis Vidali - Professor, Biology & Biotechnology
Title: ***Bioinformatics driven analysis of Arl8 structure and myosin interactions in Physcomitrium patens***

Abstract: This project focused on two proteins in the moss model organism P. patens: Arl8, a small GTPase involved in vesicle trafficking, and myosin XI, a motor protein that facilitates intracellular transport. Despite the importance of Arl8 in cellular processes, the 3D structure of P. patens Arl8 and its interactions with the cargo binding domain of MyoXI have not yet been experimentally determined. Understanding these structures and interactions in P. patens could provide insight into fundamental processes such as vesicle transport and plant growth. By predicting the 3D structure of Arl8 based on its amino acid sequence, this project aims to elucidate its structure and potential interaction sites between Arl8 and MyoXI to identify key amino acids in the interaction. A multiple sequence alignment and phylogenetic tree of Arl8 sequences across organisms were generated using Geneious to determine that Arl8 is a conserved protein; hence structural information about other Arl8s can be used to inform the P. patens structure. The predictive software tools SWISS-MODEL, Alphafold3, and Cluspro were then used to predict the structure of Arl8 and generate models of Arl8 with MyoXI. These tools were first tested using amino acid sequences of MyoXI with Rab-E14, a known interaction in P. patens. The models were then visualized using UCSF Chimera, and residues involved in the interaction were identified. A potential model of MyoXI, Arl8 and Rab-E14 was also generated using the same methods. These results yielded predictive models of Arl8 and its interactions with MyoXI and Rab-E14. Future steps include experimentally confirming these structures and the key residues in the interactions.

Neuroscience Fellowship



Name: Vishali Baker
Class of 2025
Majors: Biomedical Engineering, Professional Writing
Advisor: Benjamin Nephew - Associate Research Professor, Biology & Biotechnology
Title: *Multimodal (fNIRS and fMRI) Neuroimaging On Resting State Functional Connectivity*



Name: Amanda Shea
Class of 2025
Major: Biomedical Engineering
Advisor: Benjamin Nephew - Associate Research Professor, Biology & Biotechnology
Title: *Multimodal (fNIRS and fMRI) Neuroimaging On Resting State Functional Connectivity*

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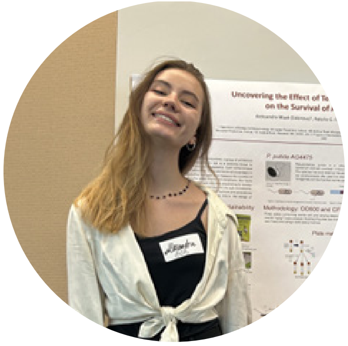
Abstract: Resting-state functional connectivity (RSFC) is a measure of temporal correlation in the absence of an event or stimuli. The most common technique to analyze these networks is through functional magnetic resonance imaging (fMRI). While this method provides reliable, insightful data, it has inherent limitations. In recent studies, however, data suggests that an alternative modality known as functional near-infrared spectroscopy (fNIRS) may offer a unique opportunity to investigate brain functionality and whole brain connectivity by proxy. This study analyzes multimodal (fNIRS & fMRI) neural hemodynamics data during resting-state for future data collation and applications in whole brain RSFC research. For analysis, a sample set of seven participating healthy individuals over age 18 underwent multimodal neuroimaging utilizing both fMRI and fNIRS imaging techniques simultaneously. Both the fNIRS and fMRI data were successfully processed and analyzed to derive functional connectivity metrics during resting state to observe neural activity in the absence of an event or stimuli. The resulting metrics indicated spontaneous increase in hemoglobin in the four valid samples identified, which aligned with existing literature and expectations of resting state neural activity. The data points garnered from the functional connectivity maps will be used to compare the brain activity between fNIRS and fMRI. These results will be used to determine if the cortical data from fNIRS are indicative of deep brain fMRI data connectivity networks.

NSF/CAREER Student (Farny Lab)



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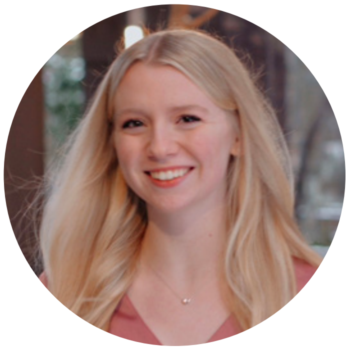
Name: Aleksandra Maak
Class of 2027
Majors: Computer Science & Bioinformatics
Advisor: Natalie Farny - Assistant Professor, Bioinformatics & Computational Biology
Title: ***Uncovering the Effect of Tetracycline Contamination on the Survival of P. putida in Soil***

Abstract: Worldwide, agricultural activity is boosted with tetracyclines, a group of antibiotics used as growth promoters. Their accumulation in soil is a potential threat to microbial communities and, thus, to whole soil ecosystems. Such compromised soil poses global environmental and health risks. There are bacterial biosensors in place to measure the levels of tetracycline. Our goal is to measure the survival of cells that have biosensors for tetracycline under sterile soil conditions. Our basic method is to use Colony Forming Unit assays and 16S DNA sequencing to monitor bacterial populations and the effects of the contaminant on the soil microbiome. We expect to better understand the pattern of survival and persistence of contaminated soil microbiomes. This work will help inform the design of biosensing bacteria for soil applications.

Not in Attendance



Name: Olivia Cava
Class of 2026
Major: Data Science
Advisor: Randy Paffenroth - Associate Professor, Mathematical Sciences
Title: ***Dynamical Systems Approach for Neural Imaging Data***

Abstract: This research is centered around the neural responses of Caenorhabditis elegans to various stimuli. ASH neurons were injected with a protein derived from jellyfish that caused them to illuminate upon activation. The normalized intensity of this luminescence was captured as neural imaging data. The primary objective of this research was to employ and evaluate denoising autoencoders for their effectiveness in classification, noise reduction, and feature importance from this complex and unique dataset. Preliminary findings show the successful classification of stimuli and uncovering of important features all through the use of denoising autoencoders with a dynamical systems approach.

Notes

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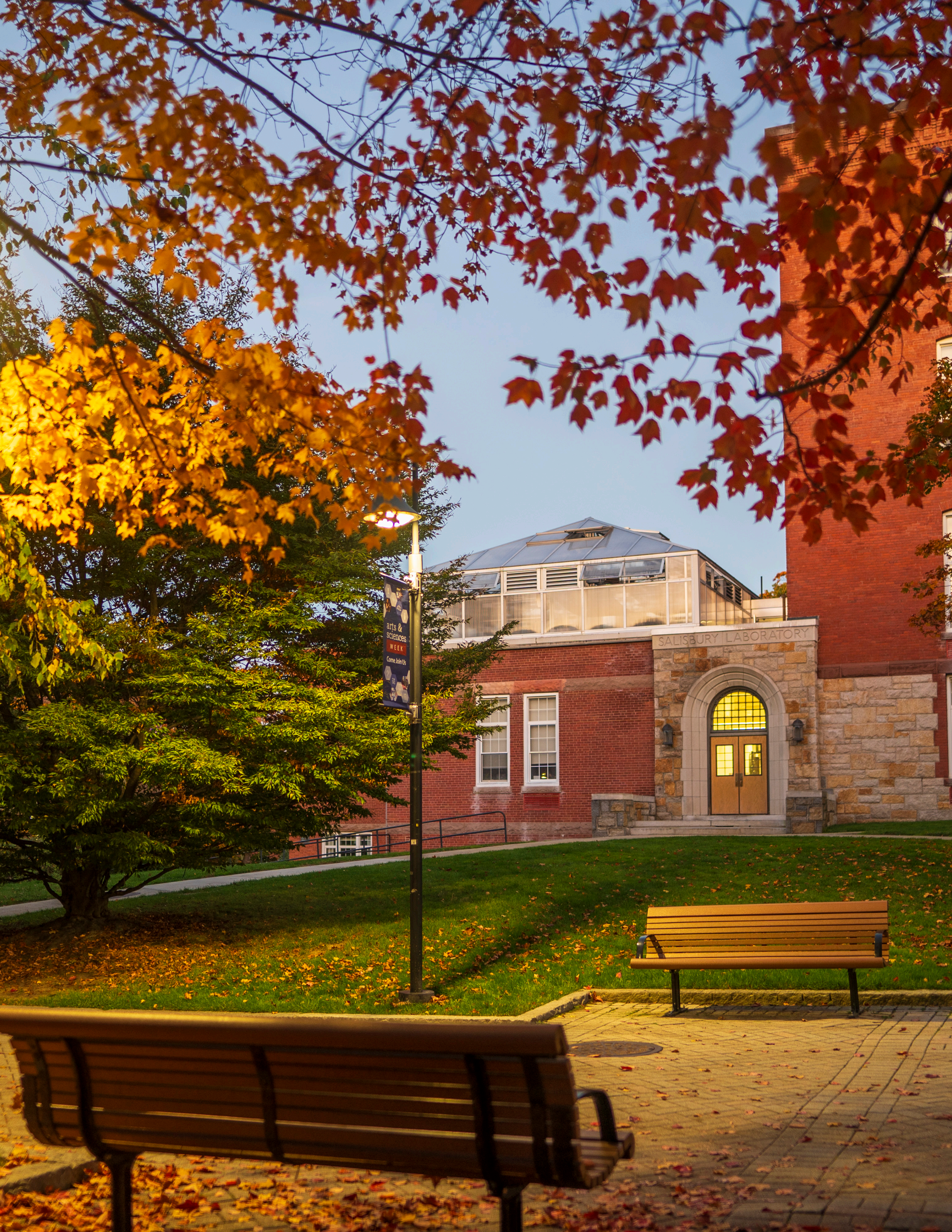
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