RUTGERS UNIVERSITY
Office for Research

Rutgers Innovation Showcase 2026

Translating Rutgers Research Excellence into Real-world Impact

March 19, 2026 | 1:30 p.m. – 7 p.m.
Rutgers Academic Building, East Wing
15 Seminary Pl, New Brunswick, NJ 08901

GO.RUTGERS.EDU/RIS2026

Welcome to the Rutgers Innovation Showcase 2026

MICHAEL E. ZWICK, PhD
Senior Vice President for Research

The inaugural Rutgers Innovation Showcase convenes faculty, researchers, students, industry partners, and investors to accelerate discovery, forge new partnerships, and advance economic growth. This event highlights the breadth of innovation emerging across Rutgers—from breakthrough technologies and translational research to startup ventures and core facilities that power the region's innovation pipeline.

Each year, Rutgers invests nearly one billion dollars in research, serving as a major economic engine for New Jersey and beyond. Yet our greatest return is realized when discovery moves beyond the laboratory to improve lives, strengthen industries, and create opportunity. From advanced medical diagnostics and sustainable materials to artificial intelligence and emerging technologies, Rutgers research drives solutions with real-world impact.

Across science, brain health, agriculture, the humanities, and data-driven innovation, our researchers are translating knowledge into products, companies, and practices that fuel a competitive innovation economy. These efforts help attract investment, grow high-value jobs, and position New Jersey as a national leader in research-powered economic development.

The Rutgers Innovation Showcase features lightning talks, startup pitches, and a dynamic poster session designed to connect Rutgers innovators with industry leaders, investors, and venture partners. These interactions are central to moving ideas to market and transforming early-stage discoveries into scalable solutions.

Rutgers is deeply committed to ensuring that research and innovation address the pressing challenges facing New Jersey, the nation, and global industries. By supporting commercialization, entrepreneurship, and industry collaboration, we help turn discoveries into new ventures, technologies, and workforce opportunities that strengthen regional and statewide economies.

Our expanding innovation ecosystem is anchored by engagement with more than 240 industry partners who collaborate with Rutgers to advance technologies, de-risk innovation, and bring impactful solutions to market.

Thank you for joining us in celebrating the creativity, dedication, and economic impact of Rutgers research. Through collaboration and shared investment, we will continue advancing discoveries that drive growth, improve lives, and shape the future of New Jersey and the world.

– MICHAEL E. ZWICK, PhD

Rutgers Innovation Showcase 2026

AGENDA

REGISTRATION

1:30 p.m. – 2:00 p.m.

- **4th Floor,** Academic Building, East Wing

OPENING REMARKS

2:00 p.m. – Room 4225

- Michael E. Zwick, PhD, Senior Vice President for Research, Rutgers University

CONCURRENT SESSIONS

2:20 p.m. – 4:30 p.m.

- **Rutgers Startup Pitches ➲ Room 4400**
  Academic Building, East Wing, 4th Floor
- **Rutgers Translational Research Talks ➲ Room 4225**
  Academic Building, East Wing, 4th Floor

POSTER SESSION

4:30 p.m. – 7:00 p.m.

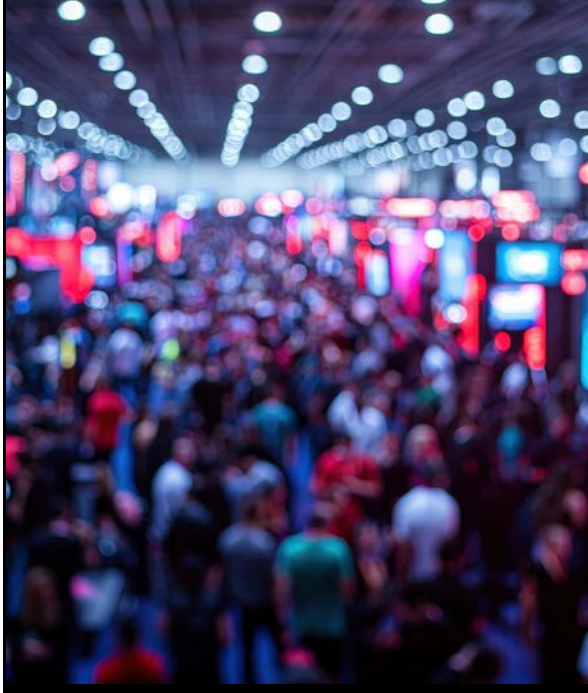
- Academic Building, East Wing, 4th Floor
- List of Posters ➲

NETWORKING RECEPTION

6 p.m. – 7:00 p.m.

- Academic Building, East Wing, 4th Floor
- **Rutgers Startups at the Showcase ➲**
- **Industry at the Showcase ➲**

Thank you for joining us today to explore new collaborations, spark strategic partnerships, and witness the future of innovation!



Rutgers Innovation Showcase is a dynamic opportunity to celebrate groundbreaking research and innovation led by Rutgers research faculty & staff, post-docs, and students. This exciting event is bringing together the university's brightest minds with industry leaders, venture capitalists, investors, and members of New Jersey's thriving innovation ecosystem.

Join us for research and innovation talks, interactive networking sessions, and a poster session that will spotlight bold ideas, transformative technologies, and inventive solutions emerging from Rutgers.

Rutgers Innovation Showcase 2026

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STARTUP PITCHES

TRANSLATIONAL RESEARCH TALKS

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The Rutgers Office for Research is a proud sponsor of the Rutgers Innovation Showcase

Rutgers research and innovation impacts our lives and the world around us. Every day, we accelerate solutions that safeguard our land and oceans, advance health and wellness, and modernize infrastructure and agriculture.

The Rutgers Office for Research supports the research, scholarship, and creative endeavors of ALL Rutgers faculty, staff, and students.

research.rutgers.edu

Rutgers Innovation Showcase 2026

STARTUP PITCHES

In this session, attendees will experience high-impact presentations from a select list of Rutgers venture teams, each showcasing their innovative solutions. The teams will focus on the problems they are addressing, their unique value proposition, the market opportunity, and traction.

2:20 p.m.–4:30 p.m.
Academic Building, East Wing
4th Floor, Rm 4400

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RESEARCH

Food

Notitia Biotechnologies

Jeffrey Zhao, co-founder and CEO

notitiabio.com

Notitia Biotechnologies is a clinical-stage, revenue-generating microbiome startup developing therapeutics and products for preventing and alleviating chronic diseases.

Founded on the Two Competing Guilds (TCG) Model and Foundation GuildTM Technologies originally developed by Dr. Liping Zhao at Rutgers University, Notitia develops Foundation Guild bacteria-targeted interventions that restore balance in the gut ecosystem. Our proprietary CoreGuildTM Therapy platforms—Foundation Guild Analysis (FGA), Foundation Guild Transplantation (FGT), and Foundation Guild Nutrition (FGN)—are designed to identify, enrich, and promote beneficial microbial guilds that combat gut dysbiosis and systemic inflammation.

We are advancing clinical-stage programs and precision nutrition products in multiple countries to address conditions including type 2 diabetes, diabetic kidney disease, and other chronic unmet medical needs.

Jeffrey Zhao
Co-founder and CEO

Notitia™ Biotechnologies

MedTech

PONS

Ilker Hacihaliloglu, PhD, co-founder and CTO of PONS (Newark, NJ), associate professor in Department of Radiology; Department of Medicine, University of British Columbia, Canada

ponstech.co

PONS is developing a scalable, AI-powered ultrasound platform designed to improve early disease detection, support decentralized care, and enable large-scale imaging research.

Our patented image enhancement technology increases sensitivity to subtle, early-stage pathophysiological changes that are often invisible in conventional ultrasound.

By expanding dataset size up to 50-fold, we generate diverse, high-quality training inputs that improve AI model robustness, generalizability across patient populations, and translational potential for multi-disease applications.

Ilker Hacihaliloglu, PhD
Co-founder, CTO

PONS

Pharma

Plexymer

Matthew Tamasi, PhD, chief executive officer, co-founder

plexymer.com

Plexymer is revolutionizing biologic therapeutics by developing autonomous laboratories for drug formulation. A Rutgers University spin-out company, Plexymer utilizes an AI-driven robotic platform to perform end to end scientific research & development and discover novel formulations for biologic therapeutics.

Focusing on enabling at-home treatment options for immunotherapies, they are applying their platform to autonomously re-formulate monoclonal antibody therapies to move from IV-infusion to at-home self-administration dosage forms.

Further, Plexymer seeks to dramatically reduce the typical development timeline of biologic formulation from over a year to months and use AI molecular profiles to de-risk therapies during clinical trials and manufacturing.

Matthew Tamasi, PhD
CEO and Co-Founder

PLEXYMER

Life Sciences

Lareda Therapeutics

Tunde Lawrence, MD, PhD, founder, CEO, CMO

laradartx.com

Larada Therapeutics is a clinical stage with lead asset LAR-101, that is fast-acting, long-lasting ophthalmic solution for critical unmet medical needs in ocular surface diseases (dry eye diseases – DED) that currently have poor or no standard of care (SoC), and those with difficult-to-treat or no approved therapies

Tunde Lawrence MD
Founder, CEO, CMO

Larada Therapeutics INC.

Medical

Thrive Genetics

Danielle Dick, PhD, co-founder/chief scientific officer; director, Rutgers Addiction Research Center

thrivegenetics.ai

Thrive Genetics offers the first evidence-based technology platform integrating genomic, behavioral, and environmental data to unlock personalized addiction risk profiles.

Our vision is to end the addiction epidemic by bringing the latest scientific advances to individuals, patients, and medical providers to enable personalized decision support healthcare strategies.

Danielle Dick, PhD, Co-Founder/Chief Scientific Officer

Thrive Genetics

Life Sciences

NanoNewron

Marco Taglietti, MD, chief executive officer

nanonewron.com

NanoNewron is a pioneering biotechnology company dedicated to developing innovative, humanized biologics that cross the blood-brain barrier (BBB) to treat central nervous system (CNS) diseases.

Founded by Luciano D'Adamio, MD, PhD, a professor at Rutgers University and holder of the Herbert C. and Jacqueline Krieger Klein Endowed Chair since 2017, NanoNewron leverages cutting-edge nanobody technologies to target neuroinflammatory and neurodegenerative conditions, including Alzheimer's disease and other CNS neurodegenerative pathologies.

The lead product NN-843 is a novel therapy to treat Alzheimer's Disease by targeting TNF-α induced neuroinflammation with a TNF-α inhibitor efficiently crossing the Blood-Brain Barrier (BBB) using our NewroBus technology.

Marco Taglietti, MD Chief Executive Officer

NanoNewron™

Food

Nutrasorb

Ilya Raskin, PhD, distinguished professor, School of Environmental and Biological Sciences

nutrasorb.com

Nutrasorb develops functionally enhanced complexes of dietary proteins and phytonutrients. Our proprietary, clean-label technology integrates edible proteins with beneficial phytonutrients derived from fruits and vegetables, markedly amplifying the nutritional and health benefits of both components.

This presentation highlights how Nutrasorb technologies improve protein bioavailability, enhance solubility, and significantly reduce allergenicity, while simultaneously delivering essential phytonutrients.

Our novel ingredients are designed for broad applications in sports nutrition, healthy aging, and child and infant nutrition.

Ilya Raskin, PhD
Chairman

nutrasorb® NATURE-POWERED PRODUCTS

Physical Sciences

SubUAS (The Naviator)

F. Javier Diez, PhD, MS, founder, professor, School of Engineering

thenaviator.com

SubUAS, based in Somerset, New Jersey, is a small business specializing in advanced unmanned systems capable of seamless operation across air, surface, and underwater environments. Its flagship platform, the Naviator, is multi-domain operation vehicle.

This dual-environment UAS/UUV that transitions from flying to swimming is serving critical commercial missions such us oil and gas, renewal energy, bridge inspection, port inspection, water quality monitoring but also defense missions in ISR, ASW, MCM, and maritime domain awareness.

SubUAS combines innovative design with experience in DoD contracting and TRL 9 platforms.

F. Javier Diez, PhD
Founder & Professor

SubUAS

Physical Sciences

RenewCO2

Dr. Anders B. Laursen, PhD, MS, co-founder and CEO

renewco2.com

RenewCO$_2$ develops electrocatalytic technology (eCUT) that transforms CO$_2$ into high-value fuels and chemicals using only water and electricity. Their proprietary catalyst enables the energy-efficient production of synthetic fuels and chemicals. eCUT is designed for flexible, distributed deployment, allowing industrial partners to localize production, stabilize supply chains, and reduce exposure to volatile markets. The system's modularity and compatibility with existing infrastructure make it ideal for on-site chemical and fuel manufacturing, offering a reliable and scalable alternative to traditional petrochemical routes.

Anders B. Laursen, PhD
Co-Founder and CEO

Physical Sciences

NanoCrystal Composites

Roger Spillmann, CEO; Daniel Allison, director medical JV, NanoCrystal Med-Tech Inc.; William Fixler, director

nanocrystalcomposites.com

NanoCrystal Composites (NCC) is commercializing a new category of revolutionary multi-crystal polymer nanocomposites called "NanoCrystalene" - co-developed with the AMIPP Advanced Polymer Center at Rutgers University. Produced via a patented method of in-situ exfoliation, where natural flake graphite - together with other crystalline materials (e.g., e-mica, boron nitride nanosheets) - is homogeneously dispersed within, and covalently bonded to, thermoplastic matrix materials, NanoCrystalene exhibits the following characteristics:

- Tensile modulus enhancements of 5x–10x over neat thermoplastics.
- Heat deflection temperatures exceeding 250°C.
- Impact resistance 2–3x higher than aerospace-grade thermosets.
- EMI/EMP shielding effectiveness ›99.99%.

By fusing 2D mono-atomic layered crystalline such as graphene directly with the substrate's polymer chains, NanoCrystalene delivers metal-like performance, including superior conductivity, thermal transfer, wear resistance, and more. NanoCrystalene can be seamlessly integrated into existing manufacturing, opening up a myriad of applications across a wide range of industries, including defense, transportation, construction, consumer, electronics and medical - the latter being pursued by NCC's JV partner, NanoCrystal Med-Tech Inc.

Roger Spillmann
CEO

Daniel Allison
Director Medical JV

Physical Sciences

Simsi

Joel Caplan, PhD, co-founder and COO; Sr. Vice Chancellor of Research and Collaborations at Rutgers University-Newark

simsi.com

Simsi is a technology company delivering software-as-a-service for precision policing and cross-agency partnerships.

Our platform is custom-built for public safety and bundles project management with analytics and AI for data-informed collaboration.

Joel Caplan, PhD
Co-founder and COO,
Vice Chancellor
of Research and
Collaborations at
Rutgers–Newark

Physical Sciences

Queens Carbon

Amrit Khalsa, PhD, VP of Finance and Business Operations

queenscarbon.com

Queens Carbon's mission is to accelerate the transition to sustainable cement and concrete.

We are doing that by pioneering breakthrough technology to produce carbon-neutral cementitious materials from industry-standard feedstocks, without a green premium.

Amrit Khalsa, PhD
VP of Finance and
Business Operations

Thank you to Don and Penny Pray
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vwr™
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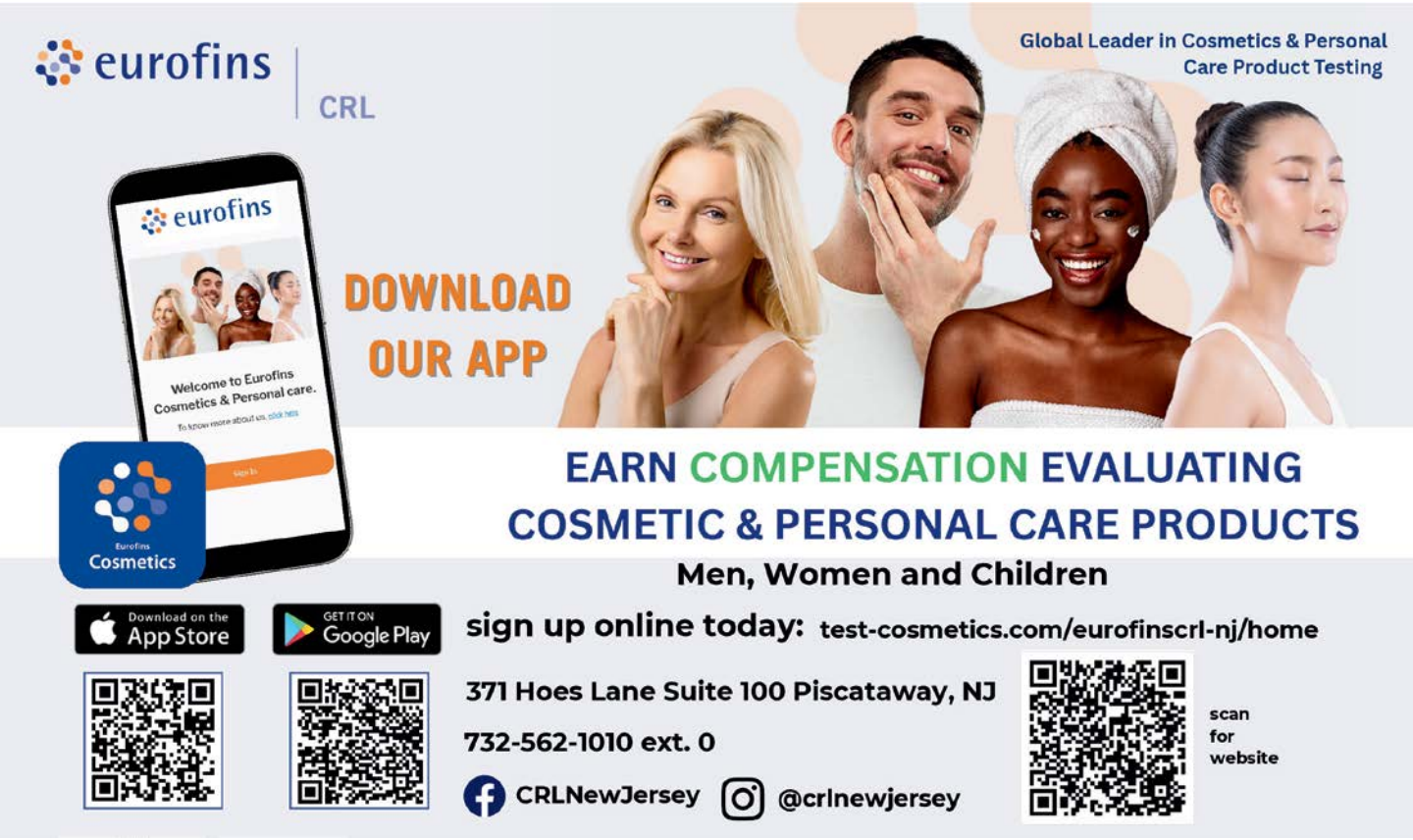

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ThermoFisher SCIENTIFIC

Rutgers Innovation Showcase 2026

TRANSLATIONAL RESEARCH TALKS

In this session, attendees will explore cutting-edge research emerging from across Rutgers University. Researchers and inventors from a variety of fields will highlight their innovative projects, share key findings, and discuss the positive impact of their work in the real world.

2:20 p.m.–4:30 p.m.
Academic Building, East Wing
4th Floor, Rm 4225

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RESEARCH

PHYSICAL SCIENCES & ENGINEERING

Self-Limiting Electrospray Deposition of Advanced Coatings

Jonathan Singer, PhD, associate professor of mechanical and aerospace engineering, associate director of the New Jersey Advanced Manufacturing Institute

Learn more about Hybrid Micro/Nanomanufacturing Lab

Self-limiting electrospray deposition is a conformal and efficient means of depositing micron-scale coatings. I will present my lab's work in understanding what makes a formulation compatible with this method and how we can use this understanding to reach any desired coating function.

Jonathan Singer, PhD

PHYSICAL SCIENCES & ENGINEERING

Microscale Thermal Sensing for Energy and Electronics

Amin Reihani, PhD, assistant professor, Mechanical and Aerospace Engineering, Graduate Faculty, Electrical and Computer Engineering

Learn more about Amin Reihani, PhD

Our lab develops advanced thermal sensors and microscopy tools for energy storage and microelectronics. We present two recent technologies:

(1) a thin-film anisotropic thermal conductivity sensor for real-time Li-ion battery diagnostics, which correlates 3D depth-resolved thermal transport properties with the battery cell's State of Health and State of Charge for applications in EVs, stationary energy storage, and defense; and

(2) a spatially aware thin-film sensor (developed in collaboration with Prof. Ramanathan's group) that employs quantum materials integrated onto cell electrodes to detect sub-millimeter hotspots in large-format batteries within seconds, providing a robust in-cell solution for early anomaly detection and thermal runaway prevention.

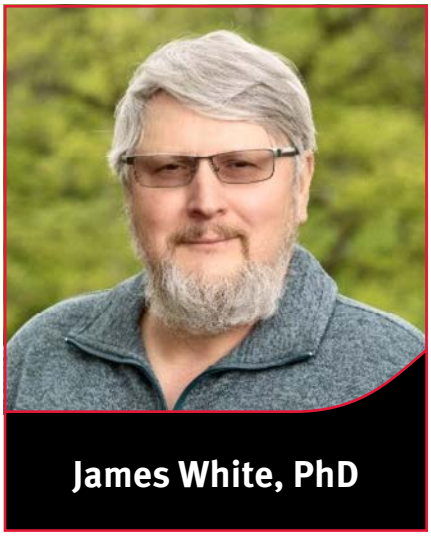
Amin Reihani, PhD

AGRICULTURE

Bioprospecting Weeds for Growth Promotional Microbes for Crop Plants

James White, PhD, professor, Department of Plant Biology

Learn more about Dr. White



James White, PhD

James White's lab seeks to identify endophytes (internal non-pathogenic microbes) in plants and other eukaryotic organisms (including mosses, liverworts and fungi) that play roles in facilitating ecological adaptation of hosts to their environments and enhance survival.

From a practical perspective, this research is to identify microbes that may be used in crops to reduce need for agrochemical applications, improve plant growth, improve tolerance of crops to biotic and abiotic stress, and improve tolerance to diseases.

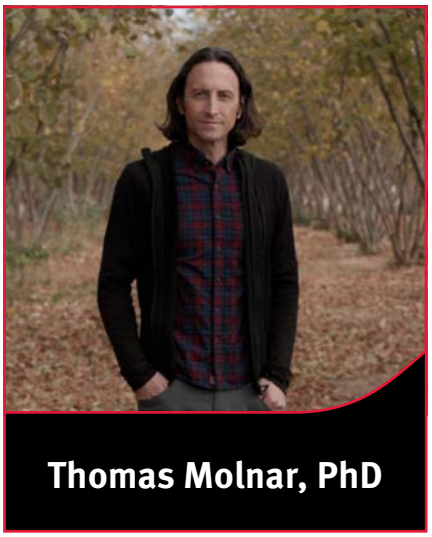
Further, we have identified a process (termed rhizophagy cycle) in roots whereby plants absorb microbes from soils, oxidize them and thereby extract nutrients from them. Efforts in the lab continue to focus on understanding how the rhizophagy process works.

AGRICULTURE

Long-term Investment in Plant Breeding Yields Substantial Breakthroughs in Hazelnuts and Dogwoods

Thomas Molnar, PhD, associate professor, Department of Plant Biology

Learn about Dr. Molnar's hazelnut advances and dogwood breeding.



Thomas Molnar, PhD

A fungal disease called eastern filbert blight occurs naturally in the eastern United States that kills European hazelnut trees. This disease has made it impossible to grow this valuable and sustainable crop in our region.

Our research at Rutgers on hazelnuts over the past 30 years allowed us to search the world for naturally occurring resistance to this disease and then through the art and science of plant breeding develop locally adapted, high-yielding hazelnuts for New Jersey's farmers.

While it took a couple decades of effort, we had tremendous success in this approach. Today, based on our new disease resistant cultivars,

for example 'Raritan' and 'Monmouth' hazelnuts released in 2020, an eastern U.S. hazelnut industry is emerging for the first time in history!

Building on the ambitious breeding approach used for hazelnuts, we set out to develop new dogwoods for the ornamental landscape industry with bloom colors never before seen in the species. We achieved this by making wide crosses among different breeding lines of dogwoods within the long-term Rutgers legacy program started by Dr. Elwin Orton in the 1960s.

By growing thousands of offspring from these wide crosses over about 10 years, we uncovered a highly coveted breakthrough: a vivid pink bloom in the Asian kousa dogwood species. This led to the release of the award-winning Scarlet Fire® dogwood and, more recently, Eternal Scarlet®, which features even darker pink blooms unlike any dogwood previously available.

These new cultivars are carving out their own niche in the flowering tree market, adding a splash of pink color to the landscape in late spring—after most flowering trees have already dropped their blooms

Physical Sciences & Engineering

Fluid Bed Impregnation - An effective method for formulating and manufacturing highly potent and/or poorly soluble pharmaceutical products

Fernando Muzzio, PhD, distinguished professor, Department of Chemical and Biochemical Engineering

Learn more about Professor Muzzio

Fernando Muzzio, PhD

Fluid Bed Impregnation is an emerging methodology for manufacturing oral solid dose pharmaceutical products. The technology is based on pre-dissolving the drug substance in a volatile liquid, impregnating the solution onto a pre-formed nanoporous carrier (typically by spraying it in a fluid bed processor) and then evaporating the solvent. The drug substance is therefore deposited throughout the carrier internal surface, creating a highly homogeneous stable amorphous distribution. The resulting particles can be converted into a finished product by compaction or capsule filling.

LIFE SCIENCES

An Antioxidant Gene Therapy to Prevent Hearing Loss

P. Ashley Wackym, MD, professor and chair, Department of Head and Neck Surgery and Communication Sciences, Rutgers Robert Wood Johnson Medical School

Learn more about Dr. Wackym

Todd M. Mowery, PhD, Assistant Professor, Department of Head and Neck Surgery & Communication Sciences, Rutgers Robert Wood Johnson Medical School

Learn more about Dr. Mowery

Noise-induced and drug-induced hearing loss affect millions of patients each year, yet no FDA-approved therapy exists to prevent the permanent damage they cause. Our team has developed a first-in-class AAV gene therapy platform that overexpresses the three endogenous superoxide dismutase antioxidant enzymes—SOD1, SOD2, and SOD3—to protect the inner ear from oxidative injury. In multiple preclinical models, including noise exposure, cisplatin chemotherapy, and aminoglycoside antibiotics, AAV-SOD therapy provides robust preservation of hair cells, synapses, and auditory/hearing function. This work establishes a generalizable oxidative-resilience platform with clear translational potential for protecting sensory systems in at-risk patients. The presentation will highlight the therapeutic mechanism, preclinical efficacy data, IP protection/coverage, and the roadmap toward IND-enabling studies and future clinical trials.

P. Ashley Wackym, MD

Todd M. Mowery, PhD

LIFE SCIENCES

Transforming How We Screen for Infectious Diseases through Rapid Antigen Testing

Bobby Brooke Herrera, PhD, assistant professor of global health

Learn more about BB Herrera Lab

We've built a next-generation pipeline that can generate monoclonal antibodies against new or re-emerging pathogens in weeks instead of months, turning discovery into deployable diagnostics almost in real time. Using an optofluidic single-cell platform, we isolate and clone antigen-specific plasma cells directly from immunized mice, producing high-affinity antibodies that outperform commercial standards. In our prototype for hepatitis C, this platform yielded antibody pairs capable of screening acutely infected patients with high sensitivity and specificity, rivaling PCR but requiring no instruments. The same approach can be rapidly adapted to new viruses, enabling on-demand creation of field-ready antigen tests during outbreaks.

Bobby Brooke Herrera PhD

Life Sciences

Next Generation Stem Cell-Based Platform Technology with Broad Biomedical Applications

Arash Hatefi, PharmD, PhD

Arash Hatefi, PharmD, PhD, professor of pharmaceutical sciences

Learn more about Dr. Haterfi's Lab

Technology: A next-generation, clinically translatable stem cell platform that is hypoimmunogenic, readily expandable, monoclonal, and built with intrinsic safety and real-time traceability.

Significance: This platform will serve as an allogeneic, donor-independent cell-based system that can be tailored to deliver a diverse range of biologics, including enzymes, proteins, and antibodies. Its versatility enables broad applicability across multiple biomedical fields, including cancer, autoimmune disorders, metabolic diseases, and tissue regeneration.

Impact: This platform can be seamlessly translated from preclinical into clinical settings

Digital Innovation

Continuous Multimodal Biomarker Fusion for Human-on-the-Loop Vital Sign Monitoring via Hybrid Analog-Digital Machine Learning

Dario Pompili, PhD

Dario Pompili, PhD, professor, Department of Electrical and Computer Engineering

Learn more about the Pompili CPS Lab

Current vital sign monitoring solutions face fundamental limitations: invasive methods provide accuracy but cannot operate continuously, while non-invasive approaches enable continuous monitoring but lack precision. The critical need for multimodal biomarker fusion arises from the spatial and temporal variability of different biomarkers at different body locations and time-frames.

Our technology addresses these challenges through a novel human-on-the-loop multimodal wearable sensing platform that combines the accuracy of invasive biomarker detection with the continuity of non-invasive monitoring via hybrid analog-digital Machine Learning (ML).

Specifically, our innovation consists in an all-analog supervised ML implementation using memristor crossbar arrays and Analog Joint Source-Channel Coding (AJSCC) with space-filling curve compression

that reduces power consumption by 2+ orders of magnitude compared to digital approaches while maintaining high accuracy, thus enabling continuous wearable operation with ‹20µW power consumption.

As an example, this technology can enable transformative applications in healthcare, workforce optimization, and mission-critical environments where individual and team stress monitoring is essential for safety and performance.

Our multimodal biomarker platform extends beyond stress assessment to enable mood detection, sleep quality assessment, alcohol/food disorder monitoring, glucose tracking for diabetics, and prosthetic malfunction detection, addressing the broader healthcare transition from reactive, hospital-centered to preventive, patient-centered care.

Digital Innovation

Novel computational algorithm for mechanism-centric biomarkers of treatment response in cancer

Antonina Mitrofanova, PhD, associate dean for research and associate professor, Rutgers School of Health Professions (SHP); deputy director, Rutgers Center for Biomedical Informatics and Health AI (BMIHAI)

Learn more about the Mitrofanova Lab

Antonina Mitrofanova, PhD

We have developed a novel computational algorithm TR-2-PATH that reconstructs first-of-its kind mechanism-centric regulatory network, which connects molecular pathways to their upstream transcriptional regulatory programs, and prioritizes them as markers of therapeutic resistance in cancer. Such network offers a novel way to identify biomarkers that are mechanisms-centric, rather than based on individual genes or alterations - a new way to identify functional interactions and valuable therapeutic targets. As a proof of concept, we have applied TR-2-PATH to metastatic castration-resistant prostate cancer (mCRPC). Network mining step addressed a knowledge gap of multi-collinearity among upstream transcriptional regulators (TRs) and identified TR groups that collaborate to regulate downstream pathways. Interrogating this network with signatures of resistance to Enzalutamide, a second-generation androgen-deprivation drug commonly administered to mCRPC, identified a collaboration between NME2 TR program and MYC molecular pathways as a biomarker of primary resistance to Enzalutamide.

DIGITAL INNOVATION

Signals of Change

Partho Sengupta MD, DM, FACC, FASE Henry Rutgers professor of cardiology; chief of cardiovascular disease and hypertension, Robert Wood Johnson Medical School; chief of cardiac services, Robert Wood Johnson University Hospital

Learn more about Dr. Sengupta

Naveena Yanamala, MS, PhD, FASE, associate professor of medicine; section chief, clinical research and AI innovation; director of data science and machine learning research, Rutgers Robert Wood Johnson Medical School; director, Center for Innovation at the Robert Wood Johnson University Hospital

Learn more about Dr. Yanamala

This presentation explores how emerging biosignal and imaging technologies—specifically ECG and wearable sensors, alongside pixel-level ultrasound imaging—are transforming early detection and prediction of cardiovascular disease. We bridge the gap between the electrical and structural intelligence of the heart, translating both signals and images into actionable, predictive insights to design care pathways.

Partho Sengupta MD, DM, FACC, FASE

Naveena Yanamala, MS, PhD, FASE

Thank you to Generous Bronze Sponsors

Bell Labs Venture Studio, Saul Ewing, Fox Rothchild, Millipore Sigma

Rutgers Innovation Showcase 2026

POSTER SESSION

The Rutgers Innovation Showcase Poster Session features groundbreaking research and entrepreneurial ideas by Rutgers students, postdocs, and research teams. In this interactive exhibit format, in-depth discussions and networking are encouraged!

Posters can be found throughout the event space, and a detailed map is available on the **event website**.

4:30 p.m. – 7:00 p.m.
Academic Building, East Wing
4th Floor – Floor Plan

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RESEARCH

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A01 — AgTech & Food

Deep-sea microorganisms as source of biotechnological innovation

Costantino Vetriani (lead poster presenter), School of Environmental and Biological Sciences

Microorganisms inhabiting deep-sea hydrothermal vents represent a unique reservoir of biological novelty driven by extreme conditions such as high pressure, temperature, and chemical toxicity. These extremophiles have evolved distinctive metabolic pathways, enzymes, and biomolecules with exceptional stability and efficiency. In biotechnology, vent-derived microorganisms provide thermostable enzymes for industrial processes, including biofuel production, waste treatment, and green chemistry. In medicine, their metabolites offer promising leads for novel antibiotics, anticancer agents, and anti-inflammatory compounds, addressing the growing challenge of drug resistance. Furthermore, insights into their adaptive mechanisms expand our understanding of life's limits and inform synthetic biology and protein engineering. Overall, deep-sea vent microorganisms constitute a critical and largely untapped resource for advancing biotechnological innovation and medical discovery.

A02 — AgTech & Food

Improved Oysters for Aquaculture

Ximing Guo (lead poster presenter), School of Environmental and Biological Sciences

Aquaculture, the farming of aquatic animals and plants, is the fastest-growing sector of food production, supplying most of the world's seafood and playing a crucial role in food security and sustainability. Oysters are among the most important aquaculture species in the US and around the world, with an annual production of over 7 million tons, valued at more than $10 billion. Oysters are mostly wild and lack the characteristics desired for aquaculture. Genetic improvement is crucial for the sustainable development of oyster aquaculture. Rutgers University has been breeding eastern oysters (Crassostrea virginica) since 1960 and has produced strains that have shown strong disease resistance. Tetraploid oysters (with four sets of chromosomes) were developed to produce a new type of triploid oyster (with three sets of chromosomes) by crossing diploid and tetraploid oysters. Due to their sterility, superior growth, and enhanced summer meat quality, new triploid oysters developed by Rutgers have become a significant component of the global oyster aquaculture industry, accounting for over 30% of total production. Capitalizing on recent advances in genomics, genomic selection has been developed and implemented to improve polygenic traits with low heritability, which has been challenging for traditional selective breeding. Genomic selection has led to significant improvements in resistance to dermo, a significant disease of the eastern oyster. Disease-resistant eastern oyster strains in both diploid and tetraploid forms are being distributed to hatcheries in the mid-Atlantic and northeastern regions for aquaculture production. They have become popular strains for eastern oyster aquaculture.

A03 — AgTech & Food

Natural Arthropod Repellents: Biting Back with a New, Higher Yielding Catnip Cultivar

Anna Snyder (lead poster presenter), School of Environmental and Biological Sciences

Diseases vectored by mosquitos and ticks are on the rise. Customer concerns about the safety of DEET and pesticides are creating a market for natural alternatives to synthetic arthropod repellents. Thus, in

our search for natural plant-based arthropod repellents we focus on both safety and efficacy. Here, we present some of our research conducted showing the efficacy of Nepeta cataria L. (catnip) bioactives as natural repellents for mosquitos, ticks, and bedbugs. This research will be presented in the form of a digital poster showing the video "Biting Back," produced as part of our science storytelling program. We also present the results of a field trial comparing a new catnip cultivar, CR5, against two of our previously released cultivars, CR9 and CR3, as well as against commercially available catnip from three seed companies. The oil yield of our newly developed CR5 catnip cultivar was consistently highest. This is significant as catnip in general produces such very low yields of essential oils it has been a serious bottleneck in commercialization. Recognizing this limitation, research at Rutgers over a decade led to the development through plant breeding of two higher yielding catnip varieties (CR9 and CR3) and now even higher yields may be procured with CR5. Using liquid chromatography with mass spectrometry, we also show that CR5 has higher levels of the compound dihydronepetalactone, a natural compound that more shelf-stable than nepetalactone, the most abundant compound in catnip oil, and has longer lasting repellency. Essential oils frequently have a shorter duration of repellency compared to DEET because of their volatility. Thus, along with slow-release formulations keeping the bioactives stable, the development of new catnips with less volatile bioactive compounds such as dihydronepetalactone may additionally provide further protection and support the longer periods of complete protection against arthropod bites consumers need and expect.

A04 — AgTech & Food

Integrating Traditional Breeding Techniques with Modern Genetic Tools to Develop New Disease-Resistant Basils

Jim Simon (lead poster presenter), School of Environmental and Biological Sciences

Basil is one of the most important herbs grown worldwide and is used both in culinary applications and in the perfume and fragrance industries. Ocimum basilicum, which includes sweet, Thai and lemon basils is the most important basil species in the US and Europe with over $300 million USD of annual revenue; however, its cultivation has been under threat from both biotic and abiotic sources. Basil downy mildew (BDM), caused by the pathogen Peronospora belbahrii, is the most significant biotic disease, resulting in complete crop loss when not growing resistant varieties. Recent research has discovered that the pathogen is rapidly evolving, with novel strains emerging that overcome resistant basil varieties almost as quickly as they are released. While BDM is the most significant biotic stressor, chilling damage during shipping is the most important abiotic stressor in basil, and it is especially important because cultural practices that can minimize this damage are expensive and unreliable. To address these concerns, our lab has developed high-throughput screens to identify promising individuals with increased disease and chilling tolerance within our germplasm collection, which comprises over 700 accessions of basil. Using traditional breeding, we've incorporated these genes into advanced breeding lines, which provide increased BDM resistance and chilling tolerance. Applying CRISPR/cas9 technologies, we've also begun to target susceptibility genes to both stressors. Combining our CRISPR-edited plants with the traditional breeding lines will stack these genes into elite cultivars, providing stronger resistance to BDM combined with increased chilling tolerance. Multiple resistance genes to BDM will provide more durable resistance that is not prone to breaking down to new strains of P. belbahrii.

A05 — AgTech & Food

Introducing two new Rutgers leafy green amaranth varieties meeting cultural preferences while optimizing leafy green yield and nutrient density

Tori Rosen (lead poster presenter), School of Environmental and Biological Sciences

Amaranth (Amaranthus spp.) is a crop of historical importance throughout the old and new world, used largely as a grain crop. Its resilience to high heat and drought stress and low-cost production has enabled its adaptability in Sub-Saharan Africa, Southeast Asia, Southern China, India and the Caribbean islands. Yet, the leaves of amaranth, which have been used locally in areas to which this plant has naturalized and grows wild are also high in provitamin A, vitamin C, iron, zinc, magnesium, calcium, and antioxidant pigments, known as betacyanin and betaxanthin, making it not only a culturally significant crop, but also one that significantly benefits human health and is preferred leafy green choice among those familiar. With a rapid increase in immigration into the US and sociodemographic population shifts, it is vital to adjust food production strategies to meet the dietary preferences and market demands of a changing population. The Rutgers University New Use Agriculture and Natural Plant Products (NUANPP) research team has developed two new novel leafy green amaranth cultivars with commercially important traits including high leafy green yield and short production time to be introduced to ethnic and mainstream consumer groups in the United States. RUAM24 and RUAM90 have been selected and bred for high yield, good field and greenhouse performance, nutrient density, and consumer interest as summer greens to meet the needs of home growers and commercial farmers alike. Amaranth leafy greens can grow during the hot summer periods when its too hot for spinach here. The process of how these new novel leafy green amaranths were developed and the participatory input by stakeholders including farmers and consumers were brought together in a science-in-action video story to inform the public of these soon to be available new nutrient rich leafy greens.

A06 — AgTech & Food

Science-in-Action Video Storytelling to Increase Public Trust in Science

Dena Seidel (lead poster presenter), School of Environmental and Biological Sciences

This science-in-action video storytelling model has produced more than a dozen high impact science film stories featuring Rutgers scientists on journeys of discovery that have reached millions of people on multiple science communication platforms. Grounded in research showing that science video storytelling engages viewers “visually, aurally, viscerally, and emotionally,” the model enables “character engagement”—a cognitive process where audiences have vicarious emotional experiences with on-screen scientists which increases information retention and perceptions of authenticity. The model’s collaborative approach combines observational documentary film methods with creative trusting partnerships between science storytellers and scientists to verify accuracy and create narratives that humanize scientists as complex, authentic people rather than stereotypes. The framework allows audiences to “vicariously experience scientists’ day-to-day choices and challenges,” which research shows can evoke audiences’ ability to relate to and trust in science. Additionally, these science-in-action films include members of the broader community who benefit from the featured science, such as farmers, fishers, teachers and business owners. Evidence of this model’s effectiveness includes viewers of the features science film Antarctic Edge: 70° South showing increased understanding of climate change (71% to 91%), and Fields of Devotion viewers (n=102) identifying scientists’ passion (71.6%),

desire to help others (70.6%), and commitment (69.6%) as key relatability factors—characteristics research links to trustworthiness—while only 12.7% cited physical appearance, suggesting behavioral authenticity drives connection. The model's integration of documentary ethics, cognitive film theory, and collaborative storytelling creates "connectivity" between scientists and audiences, ultimately providing opportunities for audiences to relate to and trust in science.

A07 — AgTech & Food

Investigation of hemp extract for cardiometabolic improvement in postmenopause

Hayley Palmer (lead poster presenter), School of Environmental and Biological Sciences

Decline in 17β-estradiol (E2) during postmenopause is associated with the onset of vasomotor symptoms, decline in mood and cognitive function, and elevated risk for cardiovascular disease and osteoporosis. Surveys reveal that women are using phytocannabinoid preparations to alleviate menopause related symptoms in the absence of clinical support. Cannabidiol (CBD) is the primary phytocannabinoid found in Cannabis sativa L. Our prior work was the first to demonstrate that ovariectomized (OVX) mice supplemented with CBD had improved metabolic and bone phenotypes. My present work has two objectives: 1) To determine how full spectrum hemp extract (containing CBD and minor cannabinoids) affects exercise capacity, behavior, and metabolic health endpoints in OVX and SS mice; and 2) To investigate putative interactions between CBD and proteins involved in estrogen signaling using an in silico approach. OVX and SS C57BL/6J mice were perorally administered full spectrum hemp extract containing 25 mg CBD/kg/day for 12 weeks. Compared to vehicle (peanut butter and coconut oil), OVX mice supplemented with hemp extract had reduced body weight. Hemp extract may worsen glucose tolerance and cognition/memory in SS mice. Hemp extract increased exercise power and locomotor activity in both groups. The predicted binding affinity obtained from performing molecular docking between CBD and estrogen receptors alpha and beta was -6 to -8 kcal/mol, suggesting CBD may weakly interact with these proteins.

A08 — AgTech & Food

Functional Foods and Metabolic Health

Diana Roopchand (lead poster presenter), School of Environmental and Biological Sciences

Dietary polyphenols are associated with protection from chronic metabolic disease despite their low bioavailability. In preclinical models we showed that grape polyphenol (GP) extracts rich in B-type proanthocyanidin (PAC) compounds can mediate their health benefits via the gut microbiota and microbial metabolites. Using proprietary methods, GPs are extracted from grape pomace (a by-product of grape juice production) and complexed to soy protein isolate (SPI) to create GP-SPI, a novel food ingredient delivering beneficial grape polyphenols in a low-sugar protein rich matrix. To investigate the links between PACs, the gut microbiota, and metabolic health, a human intervention study was performed (NCT04018066). Longitudinal metabolomic, metagenomic, and metaproteomic changes were measured in healthy participants (n= 27) before and after 5 days of soy protein isolate (SPI) supplementation alone followed by 10 days of supplementation with GPs complexed to SPI (GP-SPI). Serum, fecal, and urine samples were collected before and during the 17 day study and prepared for shotgun metagenomic sequencing, mass spectrometry-based metaproteomics, and targeted metabolomics (i.e., bile acids and polyphenols metabolites). Most multi-omic changes observed after 2 and/or 4 days of GP-SPI intake were temporary, returning to pre-supplementation profiles by day 10,

suggesting microbial adaptation to PAC-rich GPs. Notably, 10 days of GP-SPI supplementation decreased fasting blood glucose in association with increased serum hyocholic acid (HCA), a bile acid associated with improved glucose tolerance, and decreased abundance of a gut bacterial guild. While causal relationships remain to be investigated, this is the first study suggesting a link between PAC-rich GPs and serum HCA, a bile acid known for its inverse relationship with fasting blood glucose and increased metabolic resilience.

A09 — AgTech & Food

Characterization of fermented pulse-based dairy alternatives and evaluation of their potential to support metabolic health

Jeffrey Douyere (lead poster presenter), School of Environmental and Biological Sciences

Per capita consumption of dairy alternatives is projected to increase 3-fold world-wide, creating opportunities for novel pulse-based dairy alternatives (e.g., yogurt, kefir). Our laboratory has been characterizing the physicochemical properties of pulses (i.e., different varieties of dry beans, dry peas, chickpeas, and lentils) before and after fermentation. The goal of this work is to develop clean label, value-added, pulse-based dairy alternatives. Preliminary data indicate that fermented pulses develop pH ≤ 4.6 and titratable acidity values similar to dairy yogurts. Preliminary viable cell count data showed viable cells present in pulse extracts after fermentation but not before fermentation (after heat treatment). The color and texture after fermentation resembled dairy/non-dairy yogurts, formal measures remain to be completed. By delivering the health benefits of prebiotic fiber, probiotics, and postbiotics, we hypothesize that fermented pulse-based dairy alternatives can work synergistically to support host metabolic health. Preclinical and human intervention studies will be required to investigate metabolic health benefits while formulation work and sensory testing will be needed to evaluate consumer acceptance.

A10 — AgTech & Food

Agoraponic Farms

Raadha Garg (lead poster presenter), School of Engineering

Agoraponic Farms is a student-led social enterprise based in New Brunswick, New Jersey, dedicated to combating food insecurity and promoting sustainable agriculture through hydroponic farming systems. Our team designs, constructs, and maintains custom hydroponic installations for college campuses and local organizations. At Rutgers New Brunswick, 27.7% of undergraduate students and 29.9% of graduate students face food insecurity. The city of New Brunswick is also a food desert, meaning that residents have limited access to fresh produce. Many universities and community organizations struggle to offer fresh vegetables because of cost and shelf-life challenges, contributing to greater urban food insecurity. Currently, hydroponic farming system offerings typically target large-scale commercial producers or small-scale individual consumers. However, Agoraponic Farms focuses on providing mid-size systems to institutions that have both the space and the motivation to address food insecurity locally. By introducing on-site hydroponic systems, Agoraponic Farms directly addresses difficulties in sourcing produce year-round by creating a sustainable, hyper-local supply of nutritious produce while educating system caretakers about self-sufficient agriculture. Our team operates four systems at Rutgers located in Heylar House, Harvest IFNH, Basic Needs Center, and Floricultural Greenhouse. Each system continues to

contribute produce to the Rutgers Food Pantry throughout the duration of the fall and spring semesters, strengthening the university's food security capabilities. During the Fall 2025 semester, we produced 27,810 grams of fresh produce which is around 700 servings. The next phase of our development focuses on replicating our proven model at other universities and community organizations through the sale of our services. Agoraponic Farms is eager to scale its operations, empowering universities and communities to cultivate their own crops.

A11 — AgTech & Food

Considering Urea as a Functional Component of Human Milk and Infant Formula Design

Lisa Veerus (lead poster presenter), Center for Advanced Biotechnology and Medicine

Although infant formulas have largely been designed to replicate the macronutrient composition of human breast milk, most micronutrients with potential biological function have not been systematically considered in formula design. Here, we examine urea, a nitrogen-containing metabolite traditionally regarded as a waste product of mammalian metabolism, and identify it as a conserved, host-regulated component of mammalian milk with significant relevance to early-life microbial maturation and nutrition innovation. Through analyses spanning human milk samples and complementary mouse models, we show that milk urea levels follow a reproducible, developmentally patterned trajectory across lactation. In parallel, functional profiling of infant gut bacterial communities indicates that early-life microbes harbor the genetic capacity for urea uptake and degradation, supporting a model in which milk-derived urea can act as a selective nitrogen input during a critical window of microbiome establishment. We further show that urea levels in commercially available infant formulas diverge substantially from physiological patterns typical of human milk, reflecting formulation practices that do not account for lactation-stage biology. Together, these findings define a previously unrecognized design gap in current infant nutrition products and establish a competitive opportunity to incorporate biologically informed, milk-aligned nitrogen features into formula composition. Such alignment is particularly important given well-documented differences in early-life microbiome development and long-term metabolic and immune trajectories between breastfed and formula-fed infants. This work highlights an opportunity to improve nutritional design in ways that may help narrow early-life health gaps associated with feeding modality.

A12 — AgTech & Food

Assessing Agronomic and Economic Effects of Varying Nitrogen Split Application Timings in Corn

Ramandeep Kumar Sharma (lead poster presenter), School of Environmental and Biological Sciences

Improved corn yields and profitability are tied to efficient nitrogen (N) management. Currently, N is applied in one or two splits in New Jersey corn. However, growing interest in additional split applications raises questions about their economic viability as well as its impact on N utilization efficiency and grain yield. While increasing the number of N splits can enhance agronomic potential, it also raises production costs through added labor, fuel, and machinery use. This study evaluates the economic and agronomic balance of increasing N split frequency from two to four applications in corn. Field trials were established to compare three total N rates (150, 200, 250 lbs/acre) across three split arrangements: 2 (50% N at V2

+ 50% N at V6), 3 (33% N at V2 + 33% N at V6 + 33% N at VT), and 4 (25% N at V2 + 25% N at V6 + 25% N at VT + 25% N at R1)-way splits. Economic analysis incorporates fertilizer price and changes in operation costs to estimate the marginal cost of additional split and its effect on net returns per acre. The results will inform whether the marginal yield gains from higher split frequency offset the added operational costs, ultimately guiding growers toward the more profitable N management strategy.

A13 — AgTech & Food

Influence of Soil pH Gradient on Annual Bluegrass Putting Green

Emmanuel Nwachukwu (lead poster presenter), School of Environmental and Biological Sciences

Annual bluegrass (Poa annua L.) is either a problematic weed or a desired turfgrass species on golf course putting greens. Several greenhouse studies have reported increased aboveground growth of P. annua in high soil pH 6.5. A field experiment was conducted in 2025 on an over 10-year P. annua putting green at Rutgers Hort Farm No. 2, North Brunswick, NJ, on plots with an established mat layer pH gradient. The objective was to evaluate the effect of mat layer (rootzone) pH on turf quality of P. annua in a putting green. The pH gradient was set and maintained by five treatments of calcitic lime applied annually at increasing rates in prior years. To understand the influence of mat layer pH on P. annua, four additional treatments consisting of monthly supplements of phosphorus (5 kg P2O5 ha-1), nitrogen (5 kg N ha-1), gypsum (Calcium) were applied 5 times annually, and a combination of gypsum and nitrogen. Mat layer was sampled in June 2025 for mat layer pH and soil nutrient status. Mat layer pH ranged between 4.5 - 7.4. Turfgrass quality was evaluated monthly by visual ratings (1-9 NTEP), and NDVI and NDRE using a drone camera. Results revealed that treatments with near to neutral pH (≥6) had the best turf quality (>6) when visually rated across months. Supplements of gypsum + nitrogen, or gypsum alone, mostly ameliorated turf quality reductions caused by acidic (pH <5.5) mat layer in summer (July) and October, while phosphorus and nitrogen supplements had no effect. NDVI and NDRE results followed a similar trend with the visual turfgrass quality monthly ratings. There was a correlation between mat layer pH, nutrient status differences, and turfgrass quality of P. annua. Results assist golf course superintendents on their fertility management programs for annual bluegrass putting greens.

L01 — Life Sciences & Health

A myeloid Trisomy 21-associated gene variant is protective from Alzheimer's Disease

Peng Jiang (lead poster presenter), School of Arts and Sciences, RU–New Brunswick

Alzheimer's disease (AD) causes progressive cognitive decline, yet some individuals remain resilient despite developing hallmark pathology. A subset of people with Down syndrome (DS), the most common genetic cause of AD, demonstrates such resilience. Given the elevated risk of hematopoietic mutations in DS, we hypothesize that certain variants may confer microglial resilience. Here, using CRISPR-Cas9-mediated gene editing, we introduce a myeloid DS–linked CSF2RB A455D mutation into human pluripotent stem cell (hPSC)–derived microglia from both DS and healthy donors and study their function in 4 to 10-month-old chimeric mice. We find that this mutation suppresses type-I interferon signaling in response to tau pathology, reducing inflammation while enhancing phagocytosis, thereby ameliorating microglial senescence. CSF2RB A455D-expressing microglia form a unique protective subpopulation and preserve neuronal functions. Importantly, they replace diseased wild-type microglia after tau exposure.

These findings uncover a previously unrecognized protective mechanism in microglia and suggest two potential therapeutic strategies for AD and related neurodegenerative disorders: transplantation of microglia engineered to carry the protective variant, or gene therapy approaches that introduce the mutation into a patient's existing microglia, restoring their capacity to resist AD-associated damage. This work was recently published in Nature Neuroscience: Jin et al., Nat Neurosci. 2025 Nov 24. doi: 10.1038/s41593-025-02117-8; PMID: 41286452.

L02 — Life Sciences & Health

PD-1-mediated T cell dysfunction drives age-dependent susceptibility to La Crosse virus encephalitis in mice

Reem Alatrash (lead poster presenter), Rutgers Robert Wood Johnson Medical School

La Crosse virus (LACV) is the leading cause of pediatric arboviral encephalitis in the United States, with severe disease predominating in children and weanling mice. The immunological basis for this age-dependent susceptibility remains poorly defined. We previously established that adult mice mount robust LACV-specific CD4+ and CD8+ T cell responses that mediate viral clearance, whereas weanlings fail to generate protective effector responses. Here, we identify programmed cell death protein 1 (PD-1) signaling as a central driver of T cell dysfunction in weanlings. Flow cytometric profiling revealed marked upregulation of PD-1 on both CD4+ and CD8+ T cells following infection, accompanied by elevated PD-L1 expression in infected brain tissue, consistent with an inhibitory microenvironment. Functionally, PD-1^hi T cells in weanlings exhibited reduced CD44 upregulation, impaired IFN-γ production, and diminished cytolytic potential compared to adult counterparts. In vivo PD-1 blockade restored CD8+ T cell activation, enhanced granzyme B and IFN-γ expression, and increased the frequency of virus-specific effector cells as early as six days post-infection. These effects were accompanied by improved viral control in peripheral and central compartments. Together, these findings define PD-1-mediated T cell suppression as a mechanistic correlate of age-dependent susceptibility to LACV and suggest that early checkpoint blockade may restore antiviral immunity in immature hosts.

L03 — Life Sciences & Health

Gut Microbiota-Derived Phospholipids Regulate Intestinal Immunometabolism and Counteract Antibiotic Disruption

Xuesong Zhang (lead poster presenter), Rutgers Center for Advanced Biotechnology and Medicine

Early-life antibiotic exposure disrupts gut microbiome development and host lipid metabolism, increasing risk for immune disorders such as type 1 diabetes (T1D). How gut microbially produced lipids (GMPLs) involved remain poorly defined. We compared germ-free and conventional mice under different diets and identified 747 intestinal lipid compounds, defining a subset of GMPLs with distinctive chemical signatures. We assessed how antibiotics altered GMPL profiles in mice and humans and tested whether cecal microbiota transplantation could restore them. Four structurally characterized bacterial phospholipids, LPG(13:0), LPG(16:0), LPG(18:0), and PG(15:0_15:0), were evaluated for bioactivity, including effects on LPS-induced NF-κB activation, innate immune gene expression, and mitochondrial respiration. Finally, we administered LPG(16:0) or LPG(18:0) orally to antibiotic-treated NOD mice to examine impacts on microbial balance, intestinal transcriptomics, and immune parameters. Antibiotic

treatment disrupted GMPL signatures in both mice and humans, while microbiota transplantation partially restored them. The four GMPLs suppressed NF-κB activation, reprogrammed innate immune gene expression, and enhanced mitochondrial oxidative respiration. In antibiotic-treated NOD mice, oral LPG(16:0) or LPG(18:0) restored microbial and metabolic balance, normalized ileal transcriptomic and transport pathways, and corrected splenic T-cell alterations. These findings identify a chemically defined class of bacterial phospholipids that link microbial lipid metabolism with host immune and metabolic signaling and offer promising therapeutic candidates.

L04 — Life Sciences & Health

Design, synthesis and optimization of inhibitors targeting the P-stalk binding pocket of ricin

Lina El-Sharkawy (lead poster presenter), Ernest Mario School of Pharmacy

Ricin is a global biothreat classified as a category-B bioterrorism agent due to its high toxicity, environmental stability, and ease of extraction from castor beans. A single ricin molecule can kill a human cell. Despite decades of research, no small-molecule therapeutics have been approved to prevent or treat ricin intoxication. Previous efforts to develop inhibitors have met limited success, and the ribosomal P-stalk binding site remains underexplored. Our work shows ricin exerts its cytotoxic effect by binding the C-terminal domain of ribosomal P-stalk proteins, enabling depurination of the sarcin/ricin loop (SRL) on the large ribosomal subunit. To address this gap, we employed fragment-based lead discovery (FBLD) using surface plasmon resonance (SPR) to identify inhibitors targeting the P-stalk site of the ricin toxin A subunit (RTA). This yielded a lead compound, CC10501 (Ki=30 μM). Using structure-based design, we improved CC10501 to obtain RU-NT-192 (Ki=1 μM) and 323 (Ki=0.5 μM), which bind the P-stalk pocket with›50-fold greater affinity and inhibit RTA's catalytic activity with submicromolar potency. Structure-activity relationship (SAR) analyses guided second-generation compounds (RU-NT-274 through RU-NT-514), demonstrating micromolar to submicromolar binding and inhibition of ricin-induced cytotoxicity in mammalian cells. Novel X-ray structures of RU-NT-323 and RU-NT-422 (Ki=0.6 μM) and solution NMR studies revealed structural and dynamic changes upon inhibitor binding. Future work will focus on rational design of analogs to enhance interactions, maintain low molecular weight, and improve drug-like properties such as solubility. Importantly, our approach targets the toxin directly, offering a selective and potentially more effective therapeutic strategy without deleterious effects on the host.

L05 — Life Sciences & Health

Arylmyxopyronins: novel, first-in-class, oral treatments for drug-susceptible, drug resistant, and multi-drug-resistant bacterial infections

Richard Ebright (lead poster presenter), School of Arts and Sciences, RU–New Brunswick

We have discovered novel orally available arylmyxopyronins--APYs--that exhibit potent antibacterial activity against the full set of Gram-positive bacterial pathogens and fastidious Gram-negative bacterial pathogens relevant to lower-respiratory-tract infections and skin and soft-tissue infections--including drug-resistant and multi-drug-resistant strains. Our APY development candidate, APY409/461, exhibits in vitro coverage and potency superior to the current standard-of-care intravenous-only drugs vancomycin and daptomycin and superior to the current standard-of-care intravenous and oral drug linezolid.

APY409/461 exhibits potent in vivo efficacy in mouse MRSA lung infection and mouse MRSA thigh infection, exhibiting intravenous and oral in vivo efficacy comparable to the current intravenous and oral drug linezolid. APY409/461 has excellent intravenous and oral pharmacokinetics in mice. APY409/461 shows no toxicity in mice at doses at least 12 times the dose efficacious in mouse MRSA lung infection. Synthesis of APY409/461 has been optimized and validated on the 100 gram scale. Nine issued patents and four pending patents provide freedom to operate. We propose to develop APY409/461 as a novel first-in-class intravenous and oral treatment for lower respiratory-tract infections and skin and soft-tissue infections caused by drug-susceptible, drug resistant, and multi-drug-resistant Gram-positives and fastidious Gram-negatives. APY409/461 offers major competitive advantages as compared to current marketed drugs and projects in late-stage development. Advantages include class novelty, absence of cross-resistance with current antibacterial drugs, absence of pre existing resistance in current clinical isolates, severe fitness penalties for resistance mutants, high oral availability, high breadth of coverage, and high efficacy. In Q1-Q2 2026, we will complete candidate de-risking with APY409/461. In Q3-Q4 2026, we will start IND-enabling studies with APY409/491.

L06 — Life Sciences & Health

Design of a SARS-CoV-2 papain-like protease inhibitor with antiviral efficacy in a mouse model

Bin Tan (lead poster presenter), Ernest Mario School of Pharmacy

SARS-CoV-2 encodes two key proteases essential for its replication, making them prime targets for antiviral therapies. While drugs targeting the Mpro are currently in use, alternatives are needed to combat emerging SARS-CoV-2 variants and drug-resistant mutations. The PLpro of SARS-CoV-2 is a promising yet challenging target for drug discovery. In our recent study, we utilized a newly identified Val70Ub binding site in PLpro to design and synthesize a series of biarylphenyl PLpro inhibitors. The co-crystal structures of lead compounds revealed that they bind to both the Val70Ub site and the established BL2 groove near the S4 subsite, further validating our design strategy. These lead compounds inhibited PLpro with inhibitory constant (Ki) values ranging from 13.2 to 88.2 nM. Among these, the in vivo lead Jun12682 demonstrated exceptional antiviral activity against SARS-CoV-2, including nirmatrelvir-resistant strains, with EC50 values ranging from 0.44 to 2.02 μM. Jun12682 also exhibited favorable oral pharmacokinetics, with a bioavailability of 72.8%, and showed no toxicity. In the SARS-CoV-2 infection mouse model, oral administration of Jun12682 significantly improved survival, decreased lung viral titers, and prevented lung tissue damage. These findings highlight the potential of biarylphenyl PLpro inhibitors as promising oral antiviral agents against SARS-CoV-2. Moreover, these inhibitors offer hope for the development of effective treatments for other coronaviruses and emerging viral threats, providing a vital tool in the ongoing fight against viral pandemics.

L07 — Life Sciences & Health

Identifying antisense oligonucleotides for targeted inhibition of insulin receptor isoform A

Christopher Galifi (lead poster presenter), Rutgers New Jersey Medical School

The insulin receptor (IR) is alternatively spliced into two isoforms, IR-A and IR-B. IR-B is primarily associated with metabolic signaling, whereas IR-A is highly expressed during embryogenesis. IR-A

specifically has been associated with several aggressive cancers; however, selective targeting of IR-A has proven difficult due to its homology with IR-B. We generated several antisense oligonucleotides (ASOs) that target the exon 10-12 splice junction site present in IR-A, but not IR-B, mRNA. To test the efficacy of the ASOs, we performed lipofectamine transfections of MDA-MB-231 breast cancer, 22Rv1 prostate carcinoma, and Hs822.T Ewing sarcoma cell lines. We also incubated the MDA-MB-231 cell line with the ASOs in the absence of lipofectamine to determine if they are taken into cells unassisted. One ASO variant selectively reduced IR-A mRNA levels with minimal impact on IR-B mRNA and significantly reduced total IR protein. The IR-A ASO successfully induced selective IR-A knockdown in MDA-MB-231 breast cancer cells, which was maintained after a one-week incubation with the ASO. The ASO selectively reduced IR-A mRNA when administered to cells in high doses without the use of a vehicle (i.e. gymnotic delivery). The ASO was also effective at reducing IR-A mRNA in Hs822.T Ewing Sarcoma and 22Rv1 prostate carcinoma cells. We have developed an ASO that targets IR-A with minimal off-target knockdown of IR-B. We hypothesize that the IR-A ASO will be a useful research tool and may have therapeutic value by inhibiting the oncogenic functions of IR-A in cancer cells.

L08 — Life Sciences & Health

Rewiring Recovery: Human Cellularized Nerve Regeneration Grafts

Andrew Boreland (lead poster presenter), School of Arts and Sciences, RU–New Brunswick

Peripheral nerve injuries (PNIs) requiring surgery affect approximately 100,000 patients annually in the U.S., with even greater numbers globally. Current treatments often fail to fully restore motor and sensory functions, leaving patients with limited recovery. To address this unmet need, we developed a novel Cellularized Nerve Regeneration Graft (CNRG) designed to enhance nerve regeneration, accelerate functional recovery, and reduce the necessity for additional surgeries. Our graft consists of three integrated components: (1) an outer electrospun polymer conduit that is biodegradable, resorbable, provides nutrient exchange, and is gradually replaced by endogenous tissue; (2) an interior hydrogel matrix enhanced with growth factors and patterned microchannels to guide axonal regeneration; and (3) human induced Schwann cells, derived from the patient's own induced pluripotent stem cells, which support axonal growth through myelination and trophic factor secretion. The use of autologous Schwann cells not only promotes nerve regrowth but also reduces the risk of immune rejection, circumventing the need for additional tissue harvesting surgeries. The innovation of our approach lies in the combination of a biodegradable and resorbable scaffold, a functionalized 3D hydrogel matrix, and patient-specific cells. This approach offers significant potential to reduce lifetime medical costs and improve quality of life for patients with PNIs. Our graft represents a significant step forward in the field of peripheral nerve repair, with the potential to set a new standard of care in the clinic.

L09 — Life Sciences & Health

Development and validation of multi-domain PCR primer technology for ultra-sensitive detection and real-time monitoring of rare driver alterations in liquid biopsies

Diana Vargas-Gold (lead poster presenter), Rutgers New Jersey Medical School

We have developed a novel molecular diagnostic platform using multi-domain PCR primers for ultra-sensitive detection of rare cancer-associated driver alterations in liquid biopsy samples. This innovation

integrates SuperSelective primers for single-nucleotide variants with variant-signaling primers for detection of genetic rearrangements, including small indels, enabling comprehensive mutation profiling using standard real-time PCR and droplet digital PCR instruments. The technology addresses a major unmet need in oncology: rapid, affordable, and non-invasive detection of low-frequency tumor alterations that drive treatment response, resistance, and disease progression. Multi-domain primer assays achieve sensitivities of 0.05% in real-time PCR and 0.0125% in ddPCR while maintaining high specificity. In a multiplex EGFR assay, all NGS-predicted mutations were identified in blinded plasma samples from non-small cell lung cancer (NSCLC) patients. A key competitive advantage of this platform is its ability to detect multiple classes of genomic alterations, including point mutations and rearrangements, without the cost, infrastructure, or turnaround time of next-generation sequencing. The assays are modular, scalable, and deployable in clinical and reference laboratories, lowering barriers to adoption. The platform is being applied to real-time circulating tumor DNA monitoring in EGFR-mutant NSCLC to guide personalized therapy and early identification of resistance, as well as to a dual-panel plasma and cerebrospinal fluid liquid biopsy approach for early prediction of leptomeningeal disease. Additional applications include pediatric central nervous system malignancies. By enabling earlier detection, real-time treatment adaptation, and reduced reliance on invasive procedures and imaging, this innovation can improve patient outcomes, lower healthcare costs, and deliver significant socio-economic value, positioning it for broad clinical and commercial impact.

L10 — Life Sciences & Health

From Bench to Bedside: A Resistance Blocking Antifungal Peptide Platform

Robert Tancer (lead poster presenter), Rutgers New Jersey Medical School

Drug resistant fungal infections are a growing concern for global public health. In 2024, there were an estimated 6.5 million cases of fungal infections, with an average of 50% mortality rate. Clinical presentation of drug resistance to first-line therapeutic options like azoles and echinocandins rose by 50% and 300% respectively from 2004-2010. Our peptide inhibitor is inspired by drug resistance. The P4-ATPase (lipid flippase) complexes in fungal pathogens have been associated with drug resistance and virulence in multiple fungal pathogens, making it a great target for antifungal drug development. Our innovation, Cryptomycinamide (Myr-KKOO-NH2), was based on a hotspot region of the Cell Division Cycle 50 (Cdc50), the non-catalytic subunit of the eukaryotic lipid flippase complex. Our peptide enhances activity of existing therapeutic options by inhibiting drug-resistance and stress responses they induce. This effect is achieved by inhibiting proteins responsible for maintaining lipid distribution in the plasma membrane. The peptide exhibited broad activity spectrum against a variety of pathogenic molds and yeasts and a decent safety profile in cytotoxicity assays, which merits its ongoing development. Fungal infections exhibit high levels of morbidity and mortality according to infectious disease specialists at Rutgers University. Patients with comorbidities like AIDs, organ transplantation, old age, etc., are the most at-risk individuals in society. This means there is critical unmet need for new antifungal drugs in the clinic. The most impactful solutions possess new modes of action capable of circumventing the resistance mechanisms established from existing standards of care, exemplified by our peptide. This innovation has the potential to help millions of patients a year across the globe, and produce revenues in the hundreds of millions to billions of dollars per year.

L11 — Life Sciences & Health

Developing a New CRISPR Prime Editing Technology and Its Application for Cystic Fibrosis

Chi Su (lead poster presenter), Rutgers Robert Wood Johnson Medical School

Precise correction of pathogenic variants remains limited by double-strand break (DSB)–associated off-target effects with Cas9 nuclease/HDR approaches. Prime editing (PE) avoids DSBs, but pegRNAs can be structurally constrained and may generate unintended products such as gRNA scaffold insertion. We developed Match Editing (ME), a PE-derived system that splits targeting and templating into two RNAs to improve design flexibility and reduce byproducts. ME uses a Cas9 nickase–reverse transcriptase with a matching guide RNA (magRNA; spacer + matching tag) and a separate RT template RNA (PBS + edit template) recruited by PBS annealing and tag complementarity. ME and PE were compared in HEK293T cells at an EGFP reporter and an endogenous Site3 locus (flow cytometry, Sanger sequencing, high-throughput sequencing), and applied to CFTRΔF508 in 16HBE cells with Western blotting and CFTR-focused off-target assessment; HBB-E6V and SERPINA1-E342K were also tested in HEK293T cells. ME matched or exceeded PE across the EGFP reporter and endogenous Site3 locus. Under optimized designs/conditions, editing reached up to 80% (EGFP) and 60% (Site3). Notably, ME showed no detectable gRNA scaffold insertion relative to PE. In 16HBE cells, ME edited CFTRΔF508 up to 70% and increased mature, fully glycosylated CFTR (band C) by Western blot. ME also corrected HBB-E6V and SERPINA1-E342K with efficiencies comparable to or higher than PE. ME provides a modular two-RNA architecture that maintains PE's precise, DSB-free editing while reducing pegRNA constraints and minimizing scaffold-insertion byproducts. The robust increase in CFTR band C is consistent with improved protein processing/trafficking, suggesting robust functional rescue. This genome editor, with high correction efficiency and low off-target effect, is a promising candidate for therapeutic development for cystic fibrosis patients with CFTRΔF508, which accounts for 85% of patient population.

L12 — Life Sciences & Health

Development of a potent Cryptococcus vaccine against fungal infections

Yu Zhang (lead poster presenter), Rutgers New Jersey Medical School

The fungal pathogen Cryptococcus neoformans is the leading cause of deadly fungal meningitis in mostly immunocompromised population, and is account for ~15-20% HIV/AIDS related deaths. The treatment options for cryptococcal infection are limited to small number of antifungal drugs that often have adverse effects. Moreover, there is no fungal vaccine available for clinic use. Thus, there is a critical need to develop a vaccine targeting cryptococcosis. Our previous studies identified a vaccine candidate (HK-fbp1) that is based on heat-killed C. neoformans mutant cells lacking the F-box protein Fbp1. The HK-fbp1 vaccination achieved full protection against cryptococcosis on both naive and CD4+ T cell-deficient mice when administrated intranasally. The vaccine also showed cross protection against other fungal pathogens, e.g., C. gattii and Aspergillus fumigatus, indicating a potential broad-spectrum protection. Recently, we developed a novel combination vaccine by including a CpG adjuvant to HK-fbp1. Not only the combination vaccine provides a better protection in the intranasal vaccination model, it also allows us to successfully immunize animals through intramuscular and subcutaneous injection routes for the first time that are commonly used for vaccines in clinic. Excitingly, the intramuscular immunization of this combination vaccine can induce sterilizing protection in mice. To understand the

underline mechanism, we analyzed the host immunity following vaccination and found high recruitment of neutrophils, mo-DCs to the lung, systemic proliferation of CD4+ T cells, and robust IFN-γ and IL-17A production by CD4+ T cells. Overall, our data indicate a strong response of systemic activation CD4+ T cell and Th1/17 mediated protective immunity against pulmonary cryptococcal infection. Our long-term goal is to develop clinically relevant vaccines that induce potent and long-lasting antifungal immunity to combat cryptococcosis and other fungal infections.

L13 — Life Sciences & Health

A Next-Generation, Mechanism-Driven Therapeutic Platform for Idiopathic Pulmonary Fibrosis and Fibrotic Lung Disease

Debra Laskin (lead poster presenter), Ernest Mario School of Pharmacy

Recent evidence has established the farnesoid X receptor (FXR) as a clinically relevant regulator of pulmonary injury and fibrotic remodeling. FXR agonists have been shown to improve pulmonary function following chemical lung injury and in fibrotic disease models, highlighting FXR signaling as a validated but underexploited therapeutic axis in idiopathic pulmonary fibrosis (IPF) and related fibrotic lung diseases. Obeticholic acid (OCA) is a potent semi-synthetic FXR agonist derived from the endogenous bile acid chenodeoxycholic acid (CDCA). OCA has demonstrated efficacy in improving pulmonary function following lung injury. OCA is an FDA-approved drug (marketed as OCALIVA™) for primary biliary cholangitis, providing human clinical validation of FXR modulation, but its pharmacology and systemic activity limit its direct applicability in chronic pulmonary indications. Building on this foundation, our laboratories have designed and synthesized a novel class of OCA-derived inhibitors that specifically modulate FXR-driven pathways implicated in pulmonary fibrosis. These next-generation compounds are engineered to retain the beneficial anti-fibrotic signaling effects while overcoming the limitations of OCA, including non-optimal tissue selectivity and systemic bile acid–related liabilities.
This work establishes a mechanism-driven therapeutic platform with IPF as the lead indication and potential expansion into a broad range of fibrotic and inflammatory lung diseases, including restrictive lung disease, bronchiolitis obliterans, and other progressive pulmonary disorders.

L14 — Life Sciences & Health

Targeted Nanoparticles Disrupt the Pathological Convergence of Amyloidosis and Neuroinflammation in Alzheimer's

Hoda Gebril (lead poster presenter), School of Engineering

The brain's immune system plays a pivotal role in the onset and progression of Alzheimer's disease (AD). Fibrillar amyloid beta (fAβ) is recognized by scavenger receptors (SRs) on neurons and glial cells, driving neuroinflammation, which in turn exacerbates neurodegeneration. Currently, FDA-approved therapies such as the recently approved Leqembi either target a single pathological mechanism or focus solely on symptom management, calling for the need for a combination, multi-target therapy. Furthermore, the development of effective therapeutics is hindered by the restrictive nature of the blood–brain barrier (BBB), which limits drug delivery to the central nervous system (CNS) and reduces therapeutic efficacy. We have developed a novel class of nanoparticles (NPs) designed to target specific SRs in the brain, thereby disrupting the pathological convergence of amyloidosis and neuroinflammation. These therapeutic effects were validated across both in vitro (human and mouse) and in vivo models.

Furthermore, the NPs exhibited significant blood-brain barrier (BBB) permeability in a human in vitro model, underscoring their potential as a sophisticated delivery platform for CNS-targeted therapy.

L15 — Life Sciences & Health

Intraoral Electrotherapy Medical Device for Treating Peri-Implantitis

Li Xie (lead poster presenter), School of Dental Medicine

Peri-implantitis is a common and destructive inflammatory disease that affects dental implants and is a leading cause of implant failure. Nearly half of implant patients develop some level of this condition, and current treatments often fail because they do not restore the implant protective surface oxide layer. To address this unmet need, we developed a chairside mini-sized intraoral electrotherapy device designed to restore the implant's protective surface directly inside the mouth. With support from the Rutgers HealthAdvance Fund, we designed and built a functional prototype and conducted preliminary safety and performance validation. Standardized testing was used to assess implant surface stability, resistance to long-term degradation, and biological compatibility (ISO 10993)—key requirements for the translation of medical devices. The treatment operates at a very low voltage suitable for clinical use. The therapy restores and strengthens the implant's protective surface without altering its shape or texture. Treated implants demonstrated significantly improved resistance to corrosion and released far fewer titanium particles over time. Importantly, treated surfaces supported normal bone cell attachment and survival, confirming biological safety and the potential for successful integration with surrounding bone. More than 3 million people in the U.S. have dental implants, and approximately 10–20% experience implant failure due to peri-implantitis. This represents a major unmet clinical need and an estimated $1 billion annual market opportunity. Our technology introduces a new treatment paradigm: restoring implant stability rather than just detoxifying and cleaning implant surfaces, with no comparable technologies currently existing. By enabling in situ repair during routine dental visits, this approach has the potential to extend implant lifespan, reduce the need for repeat surgeries, and improve patient outcomes.

L16 — Life Sciences & Health

Development of novel mGluR5 agonists to facilitate remyelination

Hiroko Nobuta (lead poster presenter), Rutgers Robert Wood Johnson Medical School

Multiple sclerosis (MS) is a chronic inflammatory disease in the central nervous system that causes destruction of myelin, the protective sheath that surrounds the axons of neurons. Damage to myelin leads to motor and cognitive dysfunction, therefore, restoration of lost myelin is considered a key step toward functional recovery. Currently approved MS therapies primarily target immune modulation but do not promote remyelination. We previously demonstrated that activation of the metabotropic glutamate receptor 5 (mGluR5) with its selective agonist CHPG (2-chloro-5-hydroxyphenylglycine) enhances differentiation of human oligodendrocytes in vitro and increases myelin formation in a mouse model of MS. We extended this finding by analyzing postmortem MS brain tissue and found strong mGluR5 expression in oligodendrocyte precursor cells and astrocytes within lesions, supporting its relevance to human pathology. However, relatively high concentrations of CHPG (30μM) are required to achieve efficacy in vitro, indicating the need for improved analogs. Using in silico pharmacophore modeling and structural optimization, we designed five CHPG analogs (RUCD001 - RUCD005) predicted to retain functional activity with enhanced potency. Using cultured fetal oligodendrocytes, we found

that all analogs significantly promoted differentiation of human oligodendrocytes at 10μM or lower, outperforming CHPG. Two analogs, RUCD003 and RUCD004, showed favorable blood–brain-barrier permeability after peripheral administration in mouse. In a mouse model of MS, treatment with RUCD003 significantly increased myelin protein Plp1 compared to vehicle, reaching levels similar to those in CHPG-treated animals. These results identify RUCD003 as a potent, brain-permeable mGluR5 agonist that promotes oligodendrocyte differentiation and myelin repair. We plan to focus RUCD003 as a lead compound and proceed with further optimizations. A provisional patent application was filed on December 19, 2025.

L17 — Life Sciences & Health

A female reproductive system-on-chip to advance women's reproductive health

Shuo Xiao (lead poster presenter), Ernest Mario School of Pharmacy

Women's reproductive health depends on coordinated signaling among multiple reproductive organs, such as the ovary and uterus. However, current basic, translational, and safety-testing paradigms still rely heavily on whole-animal models that are slow, costly, and often poorly predictive of human outcomes. In response to recent FDA and NIH initiatives promoting New Approach Methodologies (NAMs), including organoids and microphysiological systems (MPS), we are developing a human-relevant Female Reproductive System-on-a-Chip (FemChip) as an animal-free platform to study female reproductive cycles, fertility, and early pregnancy. FemChip integrates engineered human ovarian and uterine organoids within a modular MPS platform that recreates key endocrine and tissue–tissue interactions. By enabling ovary-derived hormonal and paracrine signaling to directly regulate the endometrium, FemChip captures essential biological processes, such as endometrial growth and decidualization, that are absent from conventional 2D cultures and hormone-only in vitro models. Using this system, we demonstrate physiologically relevant activation of molecular programs associated with endometrial preparation for embryo implantation and placentation, including responses driven by ovarian factors beyond standard estrogen and progesterone treatment. Importantly, FemChip reveals ovarian control mechanisms that are missed by existing clinical and in vitro models, underscoring the value of multi-organ human platforms for reproductive research. This innovation directly addresses urgent unmet needs in women's health by providing a scalable, human-predictive, and regulator-aligned NAM for applications in drug development, reproductive toxicology, fertility research, and safety assessment.

L18 — Life Sciences & Health

Applications of Polyelectrolyte Complex (PEC) Films to Wound Healing

Francois Berthiaume (lead poster presenter), School of Engineering

Chronic skin wounds severely burden the healthcare system due to the large number of patients needing repeated medical visits and long treatment times. Risk factors that make individuals prone to chronic wounds include impaired circulation and impaired mobility, which are comorbidities often associated with older age. Given the increasing age of the population and looming obesity and diabetes epidemic, the incidence of chronic wounds is likely to increase dramatically. Current therapies are slow to show an effect and require multiple visits with the healthcare practitioners. Thus, the demand for new wound care modalities remains huge, and in the absence of reasonably priced truly effective bandages for chronic wounds, there remains interest in introducing new products to the market. We have developed a novel

polyelectrolyte (PEC) film made of natural and inexpensive ingredients known to be safe to humans, that by itself has pro-wound healing properties, and can simultaneously be used for controlled delivery of protein drugs to the wound. Thus, a novel approach is developed, whereby both the PEC film and released protein drug will promote healing through parallel mechanisms. This feature, along with the significantly lower cost, is a major advantage over competitors.
When PEC alone was applied to experimentally induced splinted mouse wounds (the splint is used to mitigate wound contraction and favor more human-like granulation tissue deposition), we found that wounds closed 15-20% faster than controls. Because our PEC platform is closely related to products already used in wounds (chitosan and pectin), we plan to pursue 501K or De Novo regulatory pathways for low-risk devices, facilitating transition to human clinical studies.

L19 — Life Sciences & Health

Medicinal Ice Popsicle for Pediatric Cancer Related Oral Mucositis

Robert Daly (lead poster presenter), Rutgers Robert Wood Johnson Medical School

Among the most common and distressing side effects from pediatric cancer treatment is oral mucositis; characterized by inflammation, ulceration, and irritation of the oral cavity. Current therapies are often ineffective, poorly designed for children, or limited in accessibility. To address this gap and improve care to pediatric cancer patients I propose my novel project: a medicinal ice popsicle.
Product development will follow a structured, patient-centered process. First, clinical and market needs are defined. The concept is generated and refined using existing research and clinical guidelines to guide formulation. A functional prototype is then created and iteratively improved. Finally, the product will undergo clinical evaluation to generate data supporting safety, efficacy, and patient experience.
Extensive market research confirmed the unmet clinical need and informed therapeutic and design decisions, culminating in a literature review accepted for presentation at the 2025 ASHP Midyear Conference. To further validate the gap, a survey study is being developed to assess challenges with oral mucositis, satisfaction with current therapies, and interest in novel treatment options among pediatric patients and caregivers. Initial popsicle prototypes were produced last month as proof of concept, with iterative testing planned to optimize flavor, consistency, and overall appeal.
There remains a clear need for improved treatment options for pediatric oral mucositis. This proposed product offers an affordable, accessible and effective solution by reimagining the benefit of cryotherapy in a child-friendly format while delivering therapeutic agents directly to the oral cavity. Although the ultimate goal is to generate rigorous safety, efficacy, and satisfaction data, the completed work and ongoing projects lay strong groundwork supporting the rationale behind the product.

L20 — Life Sciences & Health

The IGF/IGFBP5 Signaling Pathway Mediates 9-cis Retinoic Acid-Induced Lymphangiogenesis in Secondary Lymphedema

Justin Park (lead poster presenter), Rutgers New Jersey Medical School

Secondary lymphedema (SL) is a chronic and debilitating condition that can develop following tumor removal. While affecting many, there are no FDA-approved therapies available. We have demonstrated that 9-cis retinoic acid (RA) promotes lymphangiogenesis and reduces the incidence of SL in mice, but the pathways underlying this effect are not understood. In this study, we propose a mechanism

involving the IGFBP5-IGF signaling axis to explain the lymphangiogenic effects of RA. SL was induced in C57BL/6 mice using a murine tail model. Mice were treated with vehicle or RA and assessed by tail volume and histology. Spatial transcriptomics (ST) was conducted on each group of tail tissue to identify differentially expressed genes. LECs, human umbilical vein endothelial cells (HUVECs), and fibroblasts were also treated with varying concentrations of RA in-vitro. Characterization was performed using immunofluorescence (IF), western blotting, and immunohistochemistry (IHC). RA reduced tail swelling and preserved dermal histology compared with untreated controls. H&E confirmed reduced lymphatic dilation and dermal thickening in treated animals. ST of distal tail sections identified IGFBP5 as upregulated in LECs following RA treatment. RT-qPCR confirmed a 10x upregulation of IGFBP5 only in LECs treated with RA ($p=0.02$). Western blot demonstrated increased IGFBP5 protein with RA treatment. IGF2 expression was upregulated ($p=0.01$) in LECs after RA treatment, whereas IGF1 levels were unchanged. HUVECs demonstrated decreased IGF2 expression ($p=0.01$). IF and IHC confirmed the cell specificity of IGFBP5 expression to LECs. This study reveals that RA promotes lymphangiogenesis through an LEC specific mechanism through the IGFBP5/IGF signaling axis. ST and in vitro validation showed that RA upregulates IGFBP5 and IGF2 exclusively in LECs. This study provides the first mechanistic link between RA and IGFBP5, highlighting a promising therapy for SL.

L21 — Life Sciences & Health

Enhancer-AAVs for gene delivery to specific motor neuron subtypes

Yijia Chen (lead poster presenter), Rutgers Robert Wood Johnson Medical School

Adeno-associated viruses (AAVs) are emerging as powerful and clinically relevant tools for delivering therapeutic genes to the nervous system. However, most current AAV-based approaches lack cell-type specificity, limiting their precision and therapeutic potential. In this work, we identify and validate novel DNA regulatory elements, known as enhancers, that enable highly specific gene expression in distinct motor neuron (MN) subtypes in the mouse spinal cord when packaged into AAVs. By leveraging the intrinsic transcriptional programs of MNs, these enhancer-driven AAVs allow targeted genetic access to defined MN populations without off-target expression in neighboring cells. This specificity is particularly important for MN diseases such as Amyotrophic Lateral Sclerosis (ALS) and spinal cord injury, where different MN subtypes show distinct vulnerabilities and functional roles. Our approach provides a new platform for precise gene delivery, enabling cell-type-specific manipulation, disease modeling, and therapeutic intervention in motor neuron disorders. These enhancer-AAV tools represent a significant step toward safer and more effective gene therapies for neurodegenerative disease and neural repair.

L22 — Life Sciences & Health

Novel imaging assay for detecting early dopaminergic decline in Parkinson's disease

Pingyue Pan (lead poster presenter), Rutgers Robert Wood Johnson Medical School

Parkinson's disease (PD) is characterized by the degeneration of dopaminergic neurons and the progressive spread of protein aggregates enriched in alpha-synuclein. Substantial loss of brain dopamine is the primary cause of PD motor symptoms. Unfortunately, PD is typically diagnosed at advanced stages, when the majority of dopamine neurons has already degenerated. Early identification and intervention would greatly improve clinical outcomes, yet reliable biomarkers for early PD remain

limited. Although skin biopsies detecting pathological alpha-synuclein have recently entered clinical practice, biomarkers capable of detecting early dopaminergic decline are still lacking. Dopamine storage in the brain critically depends on the dopamine transporter (DAT), which is expressed in all dopaminergic neurons and mediates dopamine reuptake into the cytosol. As a membrane protein, DAT undergoes regulated trafficking at the cell surface, a process that directly influences neuronal dopamine storage capacity. Recent work from our laboratory suggests that impaired DAT surface trafficking may represent an early feature of PD that precedes overt neurodegeneration. To directly measure DAT trafficking and surface availability, we developed a novel genetically encoded optical sensor, DAT-pHluorin, by fusing the pH-sensitive fluorophore pHluorin to an extracellular domain of human DAT. We performed extensive validation of this sensor. Using DAT-pHluorin, we showed that healthy axons display ~75% of DAT at the cell surface, whereas dystrophic axons exhibit only ~20%, with the majority retained in acidic intracellular vesicles. We further established proof-of-principle methodologies for quantifying DAT surface fraction and trafficking in cells expressing PD-associated mutations. We propose that DAT-pHluorin represents a powerful toolkit for developing future biomarkers of early dopaminergic dysfunction and could complement alpha-synuclein skin biopsies to enable earlier diagnosis of PD.

L23 — Life Sciences & Health

MetaFrame: An Autonomous Scaffold Platform for Stabilizing Cellular Microenvironments in Vitro

Hadis Gharacheh (lead poster presenter), Rutgers Robert Wood Johnson Medical School

Cellular behavior is governed by the metabolic and chemical microenvironment. In vivo, nutrient availability, waste removal, pH balance, and oxygen tension are continuously regulated through vascularization and feedback mechanisms that maintain viability and phenotype. In contrast, most in vitro culture platforms rely on static media and periodic bulk exchange, leading to nutrient depletion, waste accumulation, pH drift, oxygen fluctuations, and abrupt environmental perturbations. These effects reduce reproducibility and physiological relevance, particularly for metabolically sensitive primary and stem cell–derived systems, and limit long-term live-cell imaging. To address this unmet need, we developed MetaFrame, an adaptive biomaterial scaffold that autonomously regulates the local metabolic and chemical microenvironment in vitro without external hardware or frequent media exchange. MetaFrame combines additively manufactured, optically compatible polylactic acid (PLA) framing elements with spatially integrated functional hydrogel domains. PLA provides mechanical stability, imaging compatibility, and controlled degradation, while hydrogels incorporate buffering, enzymatic, and controlled-release functionalities to locally regulate nutrient availability, waste clearance, and pH. Scaffold performance is assessed through material characterization, metabolite analysis, and biological evaluation using metabolically sensitive cell types, supported by imaging-compatible microsensors. MetaFrame-supported cultures exhibit reduced microenvironmental drift, improved stability of pH and metabolite levels, and extended uninterrupted live-cell imaging with improved experimental reproducibility compared with conventional culture systems. Cells maintain viability, morphology, and functional markers over prolonged culture periods, demonstrating that embedding regulatory functions directly within the scaffold stabilizes local conditions.

L24 — Life Sciences & Health

Retinal Regulation of Locus Coeruleus: A Chemogenetic Approach to Treat Neurodegenerative Disorders

Sarah Delcourte (lead poster presenter), Rutgers Robert Wood Johnson Medical School

Alzheimer's disease (AD) affects over 6 million Americans with annual healthcare costs exceeding $345 billion. The disease involves early tau pathology in the locus coeruleus (LC), a brainstem nucleus critical for cognition. While direct LC stimulation improves cognitive deficits in preclinical models, the LC's deep anatomical location renders it clinically inaccessible, requiring invasive neurosurgical approaches incompatible with widespread use. We developed an innovative approach leveraging the eye as a gateway to the brain by targeting the Photic Regulation of Arousal and Mood (PRAM) pathway-a retina-to-LC circuit projecting through the suprachiasmatic nucleus and dorsomedial hypothalamus. Unlike deep brain stimulation, intravitreal delivery is a routine outpatient procedure in ophthalmology, offering unprecedented accessibility for neuromodulation. We delivered excitatory DREADDs (hM3Dq) to retinal ganglion cells via intravitreal AAV injection in 9-month-old Tg-F344-AD rats. Animals received CNO (2mg/kg i.p.) 30 minutes before Morris Water Maze testing, enabling precise temporal control of PRAM pathway activation during spatial learning, memory retention, and reversal learning. PRAM stimulation completely rescued spatial learning deficits in female AD rats, normalizing acquisition to wild-type levels. Memory retention significantly improved in PRAM-activated AD animals during probe trials. Notably, PRAM activation during initial learning influenced subsequent reversal learning, demonstrating persistent cognitive benefits beyond immediate stimulation. This work establishes proof-of-concept for retina-to-brain therapeutics with critical advantages: clinical accessibility via established intravitreal techniques, precision targeting with temporal control unavailable in systemic drugs, and broad therapeutic potential across neurodegenerative conditions. These findings open new avenues for treating cognitive decline through minimally invasive, scalable interventions.

L25 — Life Sciences & Health

Clearance of Huntingtin Aggregates by Induced Proximity Screening

Rahul Saxena (lead poster presenter), School of Graduate Studies

Protein aggregation is a prominent feature of many neurodegenerative diseases including Huntington's disease (HD). HD is characterized by aggregation of mutant huntingtin (HTT), which drives progressive neuronal dysfunction and death. Despite major advances in approaches that reduce HTT levels, we lack tools that can directly break down pre-existing HTT aggregates. Induced proximity is a powerful strategy in which endogenous proteins ("effectors") are recruited to act on pathogenic targets, often to drive targeted protein degradation. However, few effectors have been harnessed for degradation, and none for protein disaggregation. To address this gap, we developed SPOTLITES, a pooled screening platform that tags hundreds of proteins at their native genomic sites (one tag per cell) and recruits each protein to HTT aggregates to assess clearance activity. Aggregate breakdown is measured by high-content imaging, and in situ barcode sequencing links each phenotype to the recruited protein. We engineered and validated cell models that reproducibly form fluorescent mutant HTT aggregates and established quantitative microscopy and flow-cytometry readouts of aggregation dynamics. Using a generic chemically inducible proximity system, we achieved efficient recruitment of a model effector to aggregates, demonstrating robust control of target engagement and supporting the feasibility of pooled functional screening. These

results establish a high-throughput framework for discovering endogenous protein effectors that reduce or eliminate HTT aggregates. These effectors will form a foundation for the development of proximity-based therapies for HD and other protein-aggregation disorders.

L26 — Life Sciences & Health

Re-activation of Mutant p53 by Induced Protein Proximity Screening

Dominick Spera (lead poster presenter), School of Graduate Studies

TP53 is the most frequently mutated gene in human cancer, occurring in about half of all tumors. Wild type (WT) p53 is a tumor suppressor protein that plays a critical role regulating DNA repair, cell cycle arrest, and apoptosis. Mutations in p53 can cause loss of tumor-suppressive function and can also lead to gain-of-function properties that convert p53 into an oncogenic driver. Due to the high frequency of TP53 mutations and its crucial role in tumor suppression, p53 is a widely accepted cancer target. Yet, there is still no FDA approved p53-based treatment after decades of research, largely due to off-target toxicity. Induced protein proximity is a strategy in which a target protein is modulated through recruitment to an endogenous protein "effector" using a proximity-inducing molecule. This rapidly growing approach holds promise for treating many diseases, yet the repertoire of available effector proteins remains limited, with the majority currently limited to targeted degradation. To discover new effector proteins with functions beyond degradation, we use a pooled tagging and recruitment platform called SPOTLITES (Scalable POoled Targeting with a LIgandable Tag at Endogenous Sites). We will deploy this system on a mutant p53 model to identify effector proteins with p53 re-activation activity. Here, we describe our model system consisting of an inducible mutant p53 protein fused to a ligandable domain and a fluorescent protein. WT p53 transcriptional activity is measured with a fluorescent reporter. This model maintains expected differences in p53 localization and transcriptional activity between WT and mutant forms. Vitally, the system enables targeted recruitment of proteins to mutant p53. Future work will employ pooled recruitment screens to reveal novel induced proximity effector proteins. Effectors identified in these screens will be candidates for the development of cancer therapeutics that selectively activate mutant p53 with minimal off-target toxicity.

L27 — Life Sciences & Health

A Scalable Immune Cell Platform to Advance Cancer Therapy Research

Mukta Asnani (lead poster presenter), School of Arts and Sciences, RU–New Brunswick

Effective cancer immunotherapies rely on precise activation of the immune system, yet progress has been limited by the lack of scalable, human-relevant models to study key immune cell populations. One such population, conventional dendritic cell type 1 (cDC1), plays a critical role in initiating anti-tumor immune responses but is extremely rare in patient samples, making it difficult to study, manipulate, or leverage for therapeutic development. We have developed a robust ex vivo platform that reliably generates large numbers of functional cDC1-like immune cells from mouse and human stem cell sources. Using a streamlined, two-stage differentiation process, this system produces cells that closely mimic their natural counterparts, demonstrating expected immune signaling behavior, activation responses, and surface markers relevant to cancer and immunotherapy research. Importantly, the platform is compatible with scalable genetic manipulation, enabling systematic testing of gene function using CRISPR-based tools. By providing a translationally relevant, genetically tractable model of human and murine cDC1 biology, this innovation offers a versatile foundation for industry partnerships, translational

research programs, and commercialization efforts focused on next-generation cancer immunotherapies that enhance dendritic cell–driven antitumor immunity.

L28 — Life Sciences & Health

Single-Cell Multiomic Dissection of Fibroblast Heterogeneity and Its Association with Immunotherapy Resistance in Metastatic Melanoma

Mikaela Lijo (lead poster presenter), School of Arts and Sciences, RU–New Brunswick

Immune checkpoint inhibitors (ICIs) can produce durable benefit in metastatic melanoma, yet many patients do not respond. A major barrier to personalized care is the lack of robust predictors that identify who will benefit from ICI therapy. Cancer-associated fibroblasts (CAFs) are key components of the tumor microenvironment (TME), but their genomic and regulatory programs under ICI therapy remain incompletely characterized. We analyzed single-cell RNA sequencing (scRNA-seq) from clinically annotated ICI-treated metastatic melanoma tumors to resolve CAF heterogeneity at cell-state resolution. CAFs were subset, integrated, and annotated using marker-driven and program-based approaches. CAF state proportions were quantified per patient and tested for association with response and clinical outcomes, including progression-free and overall survival. We analyzed single-cell ATAC sequencing (scATAC-seq) and integrated RNA and chromatin profiles. Differential accessibility, motif enrichment, and RNA–ATAC integration were used to infer regulatory programs and candidate drivers linked to resistance. We identified 15 transcriptionally distinct CAF states with reproducible biological programs. A CD74-positive CAF state expressed MHC class II and chemokine programs consistent with immune modulation. An RGS5-positive, contractile pericyte-like CAF state was significantly enriched in non-responding tumors ($p = 0.035$). Integrated RNA and chromatin analyses revealed distinct regulatory architectures across CAF states and nominated candidate regulators associated with resistance phenotypes. This work provides a single-cell and regulatory map of CAF programs linked to ICI resistance in metastatic melanoma. Integrating transcriptomic and chromatin data enables mechanistic interpretation beyond bulk biomarkers and supports stromal-informed biomarkers and targeting strategies to improve ICI efficacy.

L29 — Life Sciences & Health

Catalytic Molecular Sensor for Detecting Viral Nucleic Acids

Nishat Jahan (lead poster presenter), School of Graduate Studies, RU–Camden

Hemin/DNA aptamers can catalyze the hydrogen peroxide (H_2O_2)-mediated oxidation of various chemical compounds. For instance, hemin/G-quadruplex (G_4) complexes convert Amplex Red into fluorescent product resorufin, enabling fluorescence-based detection. Due to their high catalytic efficiency, hemin-binding DNA aptamers have been extensively explored for biosensing applications, particularly in the detection of various targets. Among these, a unique non-G-quadruplex hemin-binding aptamer (Hem1) was reported in the literature to enhance the peroxidase-like activity of hemin. However, unlike G-quadruplex structures, which non-specifically bind to various porphyrins and other planar molecules, these non-G_4 aptamers enable selective discrimination among different porphyrins, resulting in more robust hemin/aptamer complexes that provide biosensor versatility and specificity. For this study, we selected the hemin-binding aptamer mutant, Hem1-2T (K_d = 43 nM for hemin), to investigate the catalytic reaction with H_2O_2 using Amplex Red as the dye substrate for biosensor development. By splitting the aptamer Hem1-2T into two fragments and optimizing their sequences,

we aimed to develop split aptamer pairs that reassemble and bind to hemin in the presence of target DNA (COVID-19 DNA), exhibiting enhanced catalytic activity towards H2O2. Different split aptamers were designed and evaluated under various conditions (pH, temperature, and magnesium ion concentrations) to enhance sensitivity and specificity, thereby optimizing their performance. Hybridization predictions were conducted using NUPACK analysis, and fluorescence spectroscopy was used for experimental characterization. Our findings demonstrate the feasibility of using split aptamers for sensitive and selective detection of target DNA, highlighting their potential for biosensing platforms with promising applications in diagnostics and molecular detection.

L30 — Life Sciences & Health

Switchable Nucleic Acids Nanoparticles for Enhancing Cell Uptake and Drug Delivery

Qiaochu Zhang (lead poster presenter), School of Arts and Sciences

Over the past few decades, the self-assembly of DNA and RNA has enabled the design and fabrication of sophisticated one-dimensional (1D), two-dimensional (2D), and three-dimensional (3D) nanostructures. DNA nanostructures have been widely used to organize biomolecule networks, engineer biomimetic structures, and develop smart nanodevices and vesicles for applications in chemical synthesis, smart materials, biosensing, and biomedicine. We have developed nucleic acid particles (NANPs) for carrying small molecule ligands and large payloads. In one example, NANPs are loaded with minocycline and doxorubicin via metal ion-assisted self-assembly, allowing for controlled drug release in anti-inflammatory treatments. NANPs can also be incorporated into lipid nanoparticles (LNPs) to improve the encapsulation and delivery of therapeutic nucleic acids and small-molecule drug ligands. In addition to small molecules, NANPS can carry large proteins and modulate biological activities, such as enzymes, IgG, and Cas protein. NANPs can be used to position the spatial pattern between catalytic components to mimic substrate channeling, regulate enzyme-substrate cooperative binding, and probe distance-dependent activation of the complement cascade for triggering an immune response. In another application, we demonstrated the use of NANPs for efficiently delivering the CRISPR/Cas9 system into cells to guide genome editing. A recent study focused on the development of pH-switchable NANPs to respond to the cellular environment upon uptake, especially promoting endosomal escape. We also explore the peptide-modified NANPs to enhance the cellular uptake and cytosolic delivery of payloads. Developing a NANP-based delivery system not only has a significant biomedical impact but could also contribute to the broader applications of nanohybrid materials.

L31 — Life Sciences & Health

Systems and methods for improved identification of microbiomes through genomic sequencing

Subhajyoti De (lead poster presenter), Rutgers Cancer Institute

The human microbiome serves as a critical regulator of physiological homeostasis, where its diverse microbial communities not only maintain systemic health and immune function but also significantly influence the development, progression, and therapeutic response of various diseases, including several types of cancer. Microbiome Recent controversy around the cancer microbiome highlights the need for improved microbial analysis methods for human genomics data. We developed two

computational genomic resources - SAHMI and more recently PRISM, computational approaches for precise microorganism identification and decontamination from low-biomass sequencing data. PRISM removes spurious signals and achieves excellent performance when benchmarked on a curated dataset of 62,006 known true- and false-positive taxa. We then use PRISM to detect microbes in 8 cancer types from the CPTAC and TCGA datasets. We identify rich microbiomes in gastrointestinal tract tumors in CPTAC and identify bacteria in a subset of pancreatic tumors that are associated with altered glycoproteomes, more extensive smoking histories, and higher tumor recurrence risk. We find relatively sparse microbes in other cancer types and in TCGA, which we demonstrate may reflect differing sequencing parameters. Overall, PRISM does not replace gold-standard controls, but it enables higher-confidence analyses and reveals tumor-associated microorganisms with potential molecular and clinical significance. Publications: Ghaddar, et al. Cancer Cell, 2022; Ghaddar, Blaser, De. Nature Comp Sci, 2023; Ghaddar, Blaser, De. Cancer Cell, 2026. Patents: U.S. Patent Application No. 63/177,808; 63/177,696; 63/705,994

L32 — Life Sciences & Health

Non-invasive, ultra-sensitive detection of cancer biomarkers in cell-free RNA using ROCBD

Subhajyoti De (lead poster presenter), Rutgers Cancer Institute

Cost-effective, sensitive, and timely detection of oncogenic signals allows early cancer diagnosis and leads to better survival rates in cancer patients. Liquid biopsies are becoming integral parts of clinical management due to their non-invasive nature and ability to provide real-time monitoring of tumor progression, but most applications are based on cell-free DNA. Cell-free RNA is abundantly present in circulation and can indicate real-time gene expressions of cancer biomarkers, offering multiple unique advantages for cancer diagnosis. We developed ROCBD (Rapid Oncogenic cfRNA Biomarker Detection), a CRISPR-Cas12a-based novel, ultra-sensitive, rapid, and flexible cancer biomarker detection method. As proof-of-concept, we show its potentials to detect multiple targets including a common cancer biomarker CEA from blood and urine of bladder cancer patients. The method is compatible with both PCR based amplifications and isothermal amplification methods, and subsequent CRISPR-based detection could achieve detection limits relevant for clinical settings. The entire process can be completed in 50 minutes. ROCBD detected cancer associated CEA expression in blood and urine of bladder patients, who were initially tested negative for recurrence but later developed recurrence. ROCBD can facilitate development of cost-effective, sensitive, rapid applications for early cancer detection and clinical management. Publications: Sattar, Quezada, De. Cancer Detection and Diagnosis, 2025; Sattar et al. in revision. Provisional Patents: Sattar, De. U.S. Provisional Patent Application: 63/868,682

L33 — Life Sciences & Health

Development of a Streamlined RT-RPA and CRISPR-CAS12A Workflow for Non-invasive Early Cancer Detection Using CFRNA Biomarkers

Pratyush Venkatesh (lead poster presenter), Rutgers Cancer Institute

Early and accurate detection of cancer is essential for improving patient outcomes, yet current diagnostic methods like imaging and tissue biopsies are invasive, expensive, and incapable of real-time monitoring. Liquid biopsies, especially those analyzing circulating free RNA (cfRNA), offer a promising

alternative due to their ability to capture dynamic transcriptional activity. Unlike cfDNA, cfRNA reflects real-time gene expression and enables detection of even a single oncogenic transcript. In this study, we developed and validated an integrated, cost-effective workflow for cfRNA-based cancer diagnostics. Using blood, urine, and tumor specimens collected under IRB-approved protocols, we optimized RNA isolation procedures to preserve integrity and minimize genomic contamination, as confirmed by Bioanalyzer profiles and RIN scores. We successfully isolated high-quality cfRNA across all sample types, with yields ranging from 2–414 ng/ml, enabling transcript-level analysis of cancer-associated genes like CEA and internal controls like GAPDH. To amplify cfRNA targets under physiological conditions, we implemented reverse transcriptase recombinase polymerase amplification (RT-RPA), which produced consistent and robust CEA amplification, especially at an optimized 39°C incubation temperature. Amplified products were then subjected to CRISPR-Cas12a detection, which produced high fluorescence signals for target samples while maintaining no background activity in negative controls. The system successfully identified oncogenic cfRNA in both blood and urine, demonstrating high specificity, sensitivity, and reproducibility. This streamlined workflow enables real-time, non-invasive cancer detection with minimal resource requirements and offers potential for clinical translation, particularly in low-resource settings.

P01 — Physical Sciences & Engineering

Dual-Mode Optical Navigation for Continuous Ureter Tracking: Pre-Clinical Phantom Validation Under Simulated OR Conditions

Hussam Shwaib (lead poster presenter), Rutgers Robert Wood Johnson Medical School

Ureteral injury remains one of the most costly and avoidable complications in abdominal and pelvic surgery, occurring in 0.3–2% of cases. Current fluorescence systems require conscious activation and provide only momentary visualization. Our platform creates a dual-layer autonomous navigation system capable of continuous ureter identification without user activation. The first layer is a smart ureteral stent, and the second is a real-time computer vision pipeline that tracks the stent. The goal was to establish proof of function and preclinical validation under simulated surgical conditions. Bench experiments were conducted using a dual-arm robotic phantom replicating laparoscopic geometry and illumination. A custom pipeline was developed for contour extraction and distance tracking. The “smart” stent marker was optimized for continuous visibility. Testing was performed under simulated operating room conditions. System performance was evaluated across key metrics: frame rate ≥ 25 frames per second (fps), latency ≤ 75 milliseconds (ms), tracking error ≤ 1.5 millimeters (mm), and continuity ≥ 98%. The system sustained stent detection in 10 of 12 trials (89%). Per-frame color-marker detection averaged 97 ± 2%, and mean tracking continuity was 1,785 ± 65 seconds per 1,800 seconds (≈99%). Real-time performance was maintained at 30 ± 2 fps with a latency of 47 ± 8 ms, and distance estimation error remained ≤ 1.5 mm. The marker was consistently detected at ~20 mm. This platform demonstrates an activation-free, continuously visible ureteral stent with autonomous tracking capability. The dual-layer optical navigation approach enables sustained detection under surgical lighting and motion, addressing a major unmet need in intraoperative safety. These findings establish a technical foundation for future navigation systems designed to prevent ureteral injury.

P02 — Physical Sciences & Engineering

Agrivoltaics Innovation at Rutgers

Shawn Sorrels (lead poster presenter), School of Environmental and Biological Sciences, RU–New Brunswick

Agrivoltaics refers to the practice of combining solar energy generation and agricultural production on the same land. This co-location can allow for greater land-use efficiency by generating renewable energy and a predictable source of income for a farmer, while maintaining the agricultural productivity of the land. Depending on the type of agricultural production planned, the installed solar panels may be raised and the spacing between the solar panel rows widened to accommodate farm equipment and facilitate farm management practices. Ideally, a solar installation design considers the changing needs of a farmer. Market fluctuations and other external factors may alter the type of agricultural production required for a farm to remain financially viable over the long term. Innovations now being studied combine stationary ground-mounted environmental sensor technology (that can provide a continuous stream of data constrained to small areas) with aerial drone technology (that can provide periodic high-resolution data over large areas). The use of ground-mounted sensors alongside aerial drones can provide more timely and less labor-intensive methods of data collection compared to individual sampling techniques. Early detection of issues often means lower costs and fewer negative impacts to the environment through precise intervention strategies. Precision agriculture enables data-driven decision making, which is especially important when optimizing farm management practices for emerging technologies like agrivoltaics. Another Rutgers innovation covers a new solar array design that combines the benefits of single axis tracking arrays and vertical bifacial arrays with the goal of enhancing the energy production of agrivoltaic solar arrays while maintaining ample room for crop growth. This array design is referred to as Tilting Nearly-Vertical Bifacial (TNVBF) and involves small-angle tilting of a vertical bifacial panel to improve sun incidence angles in the morning and afternoon to increase efficiency while the sun is at its height. This technology is subject to invention disclosure P2024-021-02 and a USPTO filing is pending. The new technology has been modeled thoroughly in the Master's thesis work of Megan T. Page who graduated in May of 2025 and a journal publication of the energy yield predictions is in preparation. Megan also served as the Entrepreneurial Lead in the Fall 2024 Regional I-Corps training where we delved into the overall agrivoltaics value proposition and a deeper understanding of the way that solar+ag projects are being developed now. Working as a large team known as the "Rutgers Agrivoltaic Program" (RAP) we continue to develop these and other innovations that can be beneficial for farmers of the future. More information about RAP can be found at agrivoltaics.rutgers.edu.

P03 — Physical Sciences & Engineering

Electrocautery Pen For Pediatric Surgery

Joseph Barone (lead poster presenter), Rutgers Robert Wood Johnson Medical School

Electrosurgical pens are used in most surgical cases for cutting and coagulating tissue. Current electrosurgical pens are designed for adults. Using these large pens during pediatric surgeries presents significant challenges related to pen control and precision. We developed the first fully functional electrosurgical pen for pediatric surgery. Current electrosurgical pens are designed for the surgeon to grip the pen in the middle rather than near the end, like you might hold a regular pencil. Holding the pen

in the middle leads to instability, akin to writing with a pencil while holding it in the middle. Pediatric surgeons need pens with better control since they operate in smaller, more delicate areas, where control of the cutting current is paramount. We developed a fully functional electrosurgical pen for pediatric surgery. The unique design of our electrosurgical pen is tailored for pediatric use. The pen features a unique design that lowers its center of gravity; enabling surgeons to hold it like a regular pencil for enhanced control. It allows cutting precision that is not possible with an adult pen. This innovative device addresses a specific unmet need in pediatric surgery. There is nothing like it on the market and it is the first improvement to electrosurgical pens in decades.

P04 — Physical Sciences & Engineering

MeniscoFix, a Novel Meniscal Replacement Device

Michael Dunn (lead poster presenter), Rutgers Robert Wood Johnson Medical School

There are approximately 1 million meniscus tears per year in the US alone. The standard of care is partial or total meniscectomy (removal of damaged meniscus), which alleviates acute symptoms but leaves the knee without its primary shock absorber. There is no off-the-shelf meniscus replacement that is used clinically for post-meniscectomy syndrome. This represents a significant unmet medical need for regenerative solutions that can restore meniscal function. MeniscoFix is a bioresorbable implant designed to mimic the architecture and biomechanical properties of the native meniscus, serve as a load sharing device following implantation, then gradually resorb, supporting development of neo-meniscus tissue. Its development has been a joint effort between RWJMS Orthopaedics and NovoPedics, Inc., a start-up company which has exclusive licenses to the intellectual property developed at RWJMS. In large animal (ovine) total meniscus replacement studies, MeniscoFix was efficacious, with development of functional chondroprotective neo-meniscus tissue through 2 years post-implantation. Based on its novelty and addressing an unmet clinical need, in September 2020 MeniscoFix™ was granted Breakthrough Device Designation from the FDA. Biomechanical testing demonstrated that MeniscoFix has initial tensile properties similar to that of the native meniscus. The high-strength fiber network within MeniscoFix gradually loses strength over time and is replaced by functional, chondroprotective neo-meniscus tissue. Pre-clinical testing is nearing completion; an Investigational Device Exemption application to the FDA for a first-in-human clinical trial will be submitted in 2026. Ongoing studies include shelf-life, sterilization and packaging validations and short-term biocompatibility studies (cytotoxicity, pyrogenicity, sensitization). These studies are presently supported by an NIH Phase II SBIR grant.

P05 — Physical Sciences & Engineering

Novel Passive Sampler to Assess Personal Exposures to Airborne Biological Agents

Gediminas Mainelis (lead poster presenter), School of Environmental and Biological Sciences

Airborne microorganisms (bioaerosols) pose persistent and often underestimated health risks in indoor environments. Although the COVID-19 pandemic and annual flu seasons have highlighted their role in disease transmission, accurate assessment of personal bioaerosol exposure remains challenging. Most studies rely on area sampling or active personal samplers that require pumps, power, and tubing, which restrict mobility, limit sampling duration, and may compromise microbial viability. To overcome these limitations, we developed and tested the Personal Rutgers Electrostatic Passive Sampler (P-REPS), a fully passive, pump-free, lightweight wearable device designed for unobtrusive, extended monitoring

of personal bioaerosol exposure. P-REPS leverages permanently polarized ferroelectric materials, (i.e., PVDF film) and a novel spiral geometry. Oppositely polarized film surfaces, separated by 2.25 mm, create a permanent electrostatic field that pulls airborne microorganisms into the sampler and deposits them on the film without airflow or external power, while preserving microbial viability. P-REPS was evaluated and optimized in a 250 ft^3 walk-in chamber using Staphylococcus epidermidis and Escherichia coli bacteria, Penicillium chrysogenum fungal spores, and bacteriophage Phi6. P-REPS was mounted in the breathing zone of a rotating mannequin and compared with a classical filter-based personal sampler (2 L/min). Performance was assessed using physical collection efficiency, ATP-based viability, and culturability (CFU/PFU), and expressed as collection ratios and equivalent sampling flow rates.
The 47 mm P-REPS captured ~4–8x more organisms compared to settle filters and exhibited an equivalent flow rate of up to ~0.3 L/min – a remarkable achievement for a passive sampler. Thus, P-REPS embodies a novel, lightweight, low-burden, low-cost tool for extended personal bioaerosol monitoring. It is currently used in exposure studies in Canada and Mozambique.

P06 — Physical Sciences & Engineering

Generating Treasure from Trash: Enzymatic Deconstruction of Invasive Algae for Downstream Bioproduct and Biostimulant Applications

Rebecca Garcia (lead poster presenter), School of Engineering

Sargassum, an invasive brown algae, has increasingly accumulated annually in regions throughout the world, such as the Caribbean, and Mexico, washing up on beaches. Tonnes and tonnes of this material ends up on coasts, undergoing degradation, due to the lack of space in landfills, negatively impacting both local economies and environments. Despite being a physical nuisance, this biomass is abundant in complex sugars and materials which can be broken down and extracted for applications ranging from biofuel, to biostimulants. To further elucidate these benefits, my research has focused on three main objectives; determining composition of the algal biomass and how to process it, identifying and characterizing enzymes for sugar deconstruction, and developing minimal cocktails with bioprocessing systems for biomass deconstruction. To better understand composition and biomass structure, I have done linkage analysis, developed methods for hydrolysis, and worked to develop pretreatment methods to improve accessibility. Enzymes that have and will be characterized were identified from literature, bioprospecting, and from methods of protein engineering. Through this process of characterization, I want to be able to determine activity on real world substrates under marine-like conditions. Lastly, based on the individual enzyme characterization, and optimal assay conditions, I want to develop minimal cocktails to deconstruct the major polysaccharides within the biomass, simplifying the substrate in a concerted manner for downstream applications such as fermentation or biostimulant synthesis.

P07 — Physical Sciences & Engineering

Superhydrophobic collection devices facilitate metaviromic analyses of mosquito excreta and identification of new and emerging viruses

Dana Price (lead poster presenter), School of Environmental and Biological Sciences

Recent outbreaks of mosquito-vectored arboviruses – including Dengue, Chikungunya, and Zika viruses – have garnered significant attention and raised concerns regarding what will emerge next, and where. Effective surveillance of both vectors and pathogens is critical to monitoring current outbreaks and

assessing the potential for future outbreaks before they occur. Although surveillance and detection of infected mosquitoes can serve as an early predictor of impending human infection, virus testing does not commonly occur until the insects have been identified and pooled. Large quantities of mosquitoes require extended pre-processing steps, the bulk of which need to occur on a cold chain to prevent RNA degradation. This standard protocol in the vector surveillance toolkit may not provide information quickly enough for threat detection and effective response in emergent epi- and panzootic outbreaks. As in the human populace, mosquito arboviral infection is often reflected in excreted waste product; how does one effectively construct a "mosquito toilet"? Here we develop and test superhydrophobic excreta collection devices for field and lab use. Populations of field-caught mosquitoes were sampled to efficiently aggregate and collect all excreta into attached microfuge tubes. Shotgun metagenome sequencing of this template uncovered a rich and diverse RNA virome, with analyses to confirm the mosquito species from which the samples were collected and the trypanosomatid parasites they harbored. We envision methods and devices such as these becoming widely used in future surveillance practices, particularly in remote areas where repeated collections are difficult. We emphasize how this novel monitoring can help detect emerging and/or unknown pathogens of One Health significance, expand our understanding of mosquito virome biogeography, and identify as-yet undescribed viruses.

P08 — Physical Sciences & Engineering

Plasma-Assisted Surface Nitridation of Proton Intercalatable WO3 for Efficient Electrocatalytic Ammonia Synthesis

Zhiyuan Zhang (lead poster presenter), School of Arts and Sciences, RU–Newark

Ammonia (NH_3) is a cornerstone of global agriculture and an emerging carbon-free energy carrier. However, current industrial production (Haber-Bosch process) is highly energy-intensive and carbon-heavy. Our team at Rutgers has developed a breakthrough solution: a hybrid WOxNy/WO_3 catalyst with a unique Heterogeneous Interfacial Complexion (HIC) structure for Electrocatalytic Nitrogen Reduction (eNRR). Unlike conventional catalysts that suffer from low efficiency due to the competing hydrogen evolution reaction (HER), our HIC design enables the precise in situ generation and delivery of active hydrogen atoms, significantly enhancing ammonia yield. Utilizing a scalable, two-step fabrication process—microwave hydrothermal growth followed by plasma-assisted nitridation—our electrode achieves an NH_3 yield of 3.2 × 10−10 mol·cm−2·s−1 and a Faradaic Efficiency (FE) of 40.1%, outperforming most existing transition-metal-based catalysts. This technology offers a sustainable, decentralized, and high-performance pathway for green ammonia synthesis, presenting significant opportunities for collaboration in the green energy and chemical manufacturing sectors.

P09 — Physical Sciences & Engineering

Electrocatalytic Reduction of Dioxygen by a Cobalt-Redox-Active Ligand Complex

Sewwandi Kuruppu (lead poster presenter), School of Arts and Sciences, RU–New Brunswick

The oxygen reduction reaction (ORR) is integral to emerging renewable energy technologies, serving as the reduction half-reaction for fuel cells. As such, developing non-noble metal systems for ORR and understanding how catalyst structure governs the ORR selectivity for water versus hydrogen peroxide are important research areas. Most studies into molecular transition metal complexes based on earth-abundant metals have utilized macrocyclic ligands, while studies to explore the possible

roles of redox-active ligands for this reaction are scarce. In particular, redox-active ligands with protic sites may engage in proton-coupled electron transfer with oxygen to favor water formation, opening new avenues for selective catalyst design. We have prepared a dicationic cobalt complex supported by the o-phenylenediamine ligand and have shown that this complex reacts with O2 or air via ligand-centered two-hydrogen atom transfer. Spectrochemical studies using stopped-flow techniques with decamethylferrocene as a homogeneous chemical reductant confirm catalytic O2 reduction activity, yielding water as the 4e−/4H+ reaction product with high selectivity in the presence of trifluoroacetic acid. The reaction under these conditions is first order in both cobalt catalyst and Brønsted acid. Electrochemical studies reveal electrocatalytic current enhancement for ORR at mild potential, which shows a strong dependence on the trifluoroacetic acid concentration and catalyst loading. Experimental and computational investigations into the thermodynamic properties of the cobalt complex enabled determination of the two-electron, two-proton, two-hydrogen atom transfer square scheme, setting the energetic requirements for these fundamental processes.

P10 — Physical Sciences & Engineering

Comparative direct fluorescence CRP assay performance in various matrices

Pegah Jamali (lead poster presenter), School of Engineering

C-reactive protein (CRP) is considered an acute phase protein, and an indicator of infection and inflammatory response. CRP test is commonly ordered for patients suspected of infections and/ or sepsis in emergency and critical care settings of the hospitals. The current gold-standard method for C-reactive protein (CRP) testing is the enzyme-linked immunosorbent assay (ELISA). However, ELISA typically requires lengthy processing times and trained personnel, which can delay clinical decision-making. Accordingly, there is a need for rapid, accurate, and user-friendly CRP testing. In this study, we developed a simple assay for detecting CRP, a key biomarker of inflammation and infection. CRP polyclonal antibody is conjugated to 5.9 µm magnetic beads using standard EDC/NHS activation. FITC-labeled CRP is incubated with antibody-conjugated bead samples of various concentration in PBS buffer, human serum and human urine. Images of the samples were taken using VWR Inverted Phase Contrast Microscope and were analyzed using a custom computational pipeline developed in ImageJ. Strong correlation coefficients were found in quantifying CRP in all biological sample matrices tested. The linear equations for calibration curves were obtained as follows: for PBS buffer $y = 54.10 + 1.12x$ ($R^2 = 0.98$); for human serum, $y = 58.95 + 1.35x$ ($R^2 = 0.98$); and for human urine, $y = 13.0 + 0.32x$ ($R^2 = 0.95$). There is a linear proportionality to the CRP concentration ranges from 0.5-100 µg/mL, with a LOD value is 0.5 µg/mL across all sample matrices. With the future integration of sample processing on a microfluidic chip, this method has the potential to enable a rapid, point-of-care CRP detection test.

P11 — Physical Sciences & Engineering

Structural origins of high MoO3 solubility in peraluminous borosilicate glasses

Nedgine Joseph (lead poster presenter), School of Engineering

Molybdenum imposes strict solubility limits in conventional borosilicate nuclear waste glasses due to the tendency of tetrahedral molybdate (MoO42-) species to phase separate and crystallize as alkali molybdates. Here, we demonstrate an unprecedented 13.96 wt.% (7.51 mol%) MoO_3 solubility in peraluminous sodium aluminoborosilicate glasses—a ~15× increase over their peralkaline counterparts. Using Raman spectroscopy, multi-nuclear and dipolar-correlation MAS NMR, EPR, and STEM-EDS,

we reveal that Na-deficient, low-optical-basicity conditions stabilize octahedral MoO6 units, which polymerize into molybdite-like Mo–O clusters dispersed within the glass matrix. These Mo-rich clusters suppress the formation of depolymerized [MoO4]2- environments typically responsible for Na2MoO4 precipitation and instead promote the formation of Na2Mo2O7 as the saturation phase. Concurrently, Mo incorporation drives the conversion of AlO4- to higher-coordination AlO5 species, liberating Na+ that is subsequently sequestered into molybdate-rich domains. The combined evolution of Mo coordination, modifier redistribution, and network depolymerization provides a mechanistic basis for the markedly enhanced Mo solubility in peraluminous compositions. These findings establish new structural guidelines for designing aluminoborosilicate waste forms with substantially greater capacity to incorporate Mo-rich nuclear waste streams.

P12 — Physical Sciences & Engineering

Rethinking Glass Durability: The Hidden Role of Higher-Coordinated Aluminum in the dissolution kinetics and mechanism of borosilicate glasses

Ann Mary Jose (lead poster presenter), School of Engineering

Aluminum is known to exist in four, five, and six coordination in the structure of glasses, where their fraction is governed by the non-framework cation-to-alumina ratio and the ionic field strength of the cation. The role of higher-coordinated alumina in the structure of glasses and its impact on their thermo-physical properties has been a longstanding point of discussion in the glass community. In this work, we aim to elucidate the effect of aluminum coordination on the dissolution kinetics of magnesium aluminoborosilicate glasses. The melt-quenched glasses have been investigated for their short-to-intermediate range structure via 1D and 2D MAS NMR, and Raman spectroscopy. The dissolution behavior of glasses has been studied at pH = 1 in HCl solution over a period of 3 days followed by the characterization of post-dissolution glasses and liquid aliquots using XRD, MAS NMR spectroscopy, XPS and ICP-OES. The normalized elemental release data reveal systematic changes in the dissolution mechanism and rate with increasing Al2O3 content, contrary to conventional expectations. Molecular dynamics simulations further indicate that the presence of hydrolysis-resistant Al–O–Al and Al–O–Si linkages plays a key role in governing the dissolution behavior of peraluminous glasses (MgO/Al2O3 ‹ 1). In contrast, the higher fraction of strong Si–O–Si bonds in peralkaline (MgO/Al2O3 › 1) and metaluminous (MgO/Al2O3 = 1) glasses leads to incongruent silicon release relative to other constituent elements.

P13 — Physical Sciences & Engineering

Designing cermet waste forms for immobilizing advanced reactor waste streams

Rajan Saini (lead poster presenter), School of Engineering

The high-level waste (HLW) expected from advanced reactor (AR) fuel cycles is anticipated to contain substantial amounts of stainless steel, undissolved solids (UDS), graphite, metal oxides, and halide-based salts. Such a complex waste composition poses significant challenges for immobilization in borosilicate glass, including limited waste loading, complicated processing, reduced chemical durability of the waste form, higher costs, and longer processing times. To address these challenges and enhance vitrification, the present work focuses on developing high-density, chemically durable cermet waste forms (WFs) capable of immobilizing multiple AR waste streams. These cermets, comprising metals

(stainless steel, Hastelloy), sodalite, halides, and phosphates, will be fabricated using spark plasma sintering and hot uniaxial pressing. Their phase assemblage and microstructure will be characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), energy-dispersive spectroscopy (EDS), mercury porosimetry, and helium pycnometry. The density and chemical durability of the cermets will be optimized by varying metal-to-ceramic ratios and processing parameters (temperature, pressure, time). The findings from these investigations will be presented.

P14 — Physical Sciences & Engineering

Scale-Up of a Hard and Crack-Resistant Glass

Brian Wang (lead poster presenter), School of Graduate Studies

Transparent structural materials are essential for applications such as transparent armor, safety glass, and electronic packaging, yet current solutions face major tradeoffs. Crystalline materials, such as aluminum oxynitride (ALON) and sapphire, offer exceptional strength but are prohibitively expensive and difficult to manufacture at scale, while conventional oxide glasses are affordable and scalable but struggle to achieve high hardness and crack resistance simultaneously. Even recently reported high-performance oxide glasses often require extreme processing temperatures and suffer from devitrification, limiting industrial-scale production. Here, we develop a new family of high-performance oxide glasses that overcome these limitations. Using a composition-structure-property-driven design strategy, we engineered glasses within the peraluminous MgO-Al2O3-B2O3-SiO2 system by modifying oxide ratios and introducing targeted components to suppress crystallization during cooling from the melt. The baseline system exhibits Vickers hardness values of 7-8 GPa and indentation crack resistance up to 26.5 N, while remaining transparent and processable below 1650 degrees Celsius, but shows devitrification at large batch sizes. A newly engineered composition fully suppresses crystallization, even under slow cooling and large-batch conditions, and retains a hardness of 7 GPa and crack resistance of 15 N, exceeding benchmark requirements and conventional commercial glasses. The reduced processing temperature enables compatibility with standard manufacturing methods such as tank melting and float processing, lowering energy consumption and cost. Compared to existing glasses and crystalline alternatives, this material system provides a scalable, sustainable, and economically accessible platform for next-generation transparent protective applications, with ongoing work extending performance through chemical strengthening and thermal tempering.

P15 — Physical Sciences & Engineering

Understanding Composition – Structure – Property Relationships in multicomponent silicate glasses

Anjan Bagchi (lead poster presenter), School of Engineering

Multicomponent silicate glasses underpin both commodity and specialty glass industries, yet their compositions have traditionally been developed through costly and time-intensive trial-and-error approaches. Advances in computational materials science now enable the integration of experimental measurements with molecular dynamics simulations and artificial intelligence to establish predictive quantitative structure–property relationship (QSPR) models. Such models rely on high-quality experimental datasets that directly link molecular-level structural descriptors, such as silicate and borate speciation, to measurable physical properties. In this work, we measure key physical properties,

including density, coefficient of thermal expansion, refractive index, and elastic moduli, for more than 50 multicomponent silicate glasses and correlate them with structural information obtained from MAS NMR spectroscopy. These data provide a foundation for integrating experiments with molecular dynamics and machine-learning approaches toward the rational design of glass compositions.

P16 — Physical Sciences & Engineering

Inducing plasticity in cementitious materials

Oleksiy Golub (lead poster presenter), School of Engineering

Plastic forming, such as pottery, has been correlated with the very concept of ceramics throughout their history and technical development. Creating a workable formulation is a key step to mass manufacturing products using impactful materials such as wollastonite, which can be used for carbon capture, development of wood-like materials, and high-performance cementitious supplements. This project has successfully induced plasticity in several main-body wollastonite formulations (90% wt). The formulation was used to hand-form and throw multiple varied shapes, which after low-temperature carbonation demonstrated improved performance in compressive strength, impact strength, and low shrinkage. This innovation is a crucial step for mass producing the material industrially, using extrusion, to manufacture carbon negative ceramics, low-fire pottery, and wood-like materials.

P17 — Physical Sciences & Engineering

Wood-like Carbon Sequestering Polymer-Ceramic Composites

Noemie Denis (lead poster presenter), School of Graduate Studies

The construction sector remains heavily dependent on concrete and steel, which together contribute 12% of global anthropogenic CO_2 emissions annually. While both materials provide exceptional structural reliability, neither was developed with carbon neutrality or climate resilience as a core objective. Wood, the third most widely used building material, offers up to a fourfold reduction in CO_2 emissions compared to non-wood alternatives, while being lightweight, strong in both tension and compression, and cost-competitive with concrete. However, it is hygroscopic, susceptible to rot, UV degradation, and fire, presenting major liabilities as commercial and residential buildings are expected to withstand stronger winds, heavier rainfall, and rising temperatures. These limitations underscore the urgent need for a next generation of building materials that are lightweight, mechanically robust, damage-tolerant, derived from abundant feedstocks, and intentionally designed to function as net carbon sinks. No single class of man-made materials offers this combination of properties at a low cost. The polymer–ceramic composite presented here addresses this gap by combining the strength, stiffness, and low cost of traditional ceramics with the toughness and lightweight property of polymers. Reactive hydrothermal liquid-phase densification (rHLPD), a low-temperature process (<100 °C), enables a novel pathway for co-processing ceramic and polymer phases. CO_2 gas is used as the reactive phase, allowing the permanent sequestration of CO_2 in the composite. This work focuses on establishing the processing–microstructure relationships governing the composite's strength properties by systematically varying key processing parameters to elucidate how porosity, connectivity, and phase distribution influence microstructural evolution and mechanical performance.

P18 — Physical Sciences & Engineering

Neodymium Iron Boride-Carbonate-Bonded Ceramic Composite Magnets

Paul Antonick (lead poster presenter), School of Graduate Studies

Permanent magnets play key roles in advanced technology applications, such as motors, actuators, transformers, and much more, making them essential for the transportation and energy generation industries. Neodymium iron boride (NdFeB) is the most common solid-state chemistry used for high-performance magnets. Many polymer binders currently used in bonded NdFeB magnets display some (but not all) of the ideal binder properties. In this work, a new method for fabricating bonded permanent magnets with a ceramic binder was developed. Commercial melt-spun NdFeB magnetic particles were mixed with wollastonite ($CaSiO_3$) ceramic and pressed into pellets. These pellets were carbonated, thereby bonding them together using the gas-reactive hydrothermal liquid phase densification (g-rHLPD) technique. Hierarchical powder packing enabled the creation of samples with an NdFeB packing fraction of 0.64, which resulted in magnets with a maximum energy product of 6.6 MGOe (Mega-Gauss-Oersted). The highest average compressive strength was 97.3 MPa. These results are well within the property range of polymer-bonded magnets currently available on the market, suggesting that this method is promising and warrants further development.

P19 — Physical Sciences & Engineering

A Novel Mechanical Process for Sustainable Concrete Recycling

Ranuri Dissanayaka Mudiyanselage (lead poster presenter), School of Engineering

The extensive global use of concrete poses major environmental challenges, including high greenhouse gas emissions, depletion of natural resources, and the generation of large volumes of construction and demolition waste. Achieving circularity in concrete production requires innovative recycling strategies that allow its constituent materials to be recovered and reused at the end of their life cycle. However, current separation technologies are often energy-intensive, costly, and environmentally unfriendly. This work explores a novel mechanical separation technique that enables selective recovery of cement hydrates and aggregates from concrete waste. The process relies on controlled particle-particle collisions to promote fracture along material interfaces, exploiting differences in mechanical properties among different components of concrete. Experimental results indicate that effective separation can be achieved in under ten minutes, producing clean aggregates in coarse fractions and cement hydrates concentrated in fine fractions. While early-stage trials revealed some aggregate contamination in the cement hydrate fraction, the findings suggest that targeted process optimization could enhance separation efficiency. Overall, this method demonstrates strong potential as a low-energy, cost-effective and scalable solution to support circular concrete recycling.

S01 — Software & Data/AI

Ocean Observing Leadership: RUCOOL's Contributions to Oceanographic Sampling Utilizing Unmanned Vehicles

David Aragon (lead poster presenter), School of Environmental and Biological Sciences

Autonomous underwater vehicles (AUVs) have been utilized for over 2 decades to assist with the normally associated high costs and low data density of oceanographic sampling. The primary workhorse

has been the drifting autonomous profilers known as Argo Floats. The evolution of the float concept progressed to oceanographic gliders to give them velocity and thus controlled via lift or propellers. These navigable gliders have brought about previously impossible levels of spatial and temporal sampling resolutions. Rutgers Center for Ocean Observing Leadership (RUCOOL) has been central to the design, development, and implementation of oceanographic gliders since 1998 with an industry partnership with Teledyne Webb Research. RUCOOL hosts a fleet of these sensor-customizable devices amongst several other forms of AUVs. To date RUCOOL gliders have over 500 deployments, 400,000 km flown, and over 20,000 days at sea. Collected data has been used from AI analysis for estimating marine mammal locations to improving ocean models for environmental events such as hurricanes. Operational expertise and data from these platforms are integrated into several educational efforts such as the Master's of Operational Oceanographic (MOO), and several undergraduate courses. Innovation continues with the development of the Sentinel glider, a long range sensor platform, which mitigates concerns of payload space and endurance.

S02 — Software & Data/AI

Accelerating engineering design with finite-element-based physics informed neural network surrogate models

Ryan Sills (lead poster presenter), School of Engineering

Finite element (FE) simulations are ubiquitiously employed for engineering design and analysis. These simulations are computationally expensive and time intensive. In contrast, neural networks are notorious for their flexibility to learn and their rapid evaluation times. Our finite-element-based physics-informed neural network (FE-PINN) technology serves as a bridge between the FE method and neural networks, enabling one to easily train an efficient surrogate model for any engineering problem. We demonstrate performance of the FE-PINN method in linear and nonlinear solid mechanics problems with variable geometry and boundary conditions. Our technology enables a future where all engineering design is accomplished using rapid FE-PINN surrogate models which usurp traditional sluggish FE simulations.

S03 — Software & Data/AI

IntelliGenes

Zeeshan Ahmed (lead poster presenter), Rutgers Robert Wood Johnson Medical School

The cutting-edge artificial intelligence (AI) and machine learning (ML) techniques have proven effective at uncovering elucidative knowledge on disease-causing biomarkers and the biological underpinnings of a plethora of human diseases. We present IntelliGenes, a next generation, reproducible, replicable, transparent, cross-platform, interactive, multidimensional and user-friendly AI/ML application for multimodal data exploration to discover novel biomarkers and predict complex diseases [PMIDs: 38096588, 38884000, 40781583]. The overall computational methodology of IntelliGenes is based on a unique nexus of statistical techniques and cutting-edge AI/ML algorithms [PMID: 38096588]. Furthermore, IntelliGenes produces intuitive, interactive and multidimensional visualization, which offers deeper insights, most importantly by capturing greater variability in the patient data by understanding both linear and non-linear structures, evaluating AI/ML model performance, and delineating the joint impact of biomarkers on the corresponding disease states [PMIDs: 40781583].

The performance of IntelliGenes has been successfully tested at variable in-house and peer reviewed studies. Most recently, we employed IntelliGenes methodology to discover significant biomarkers, and predict cardiovascular and other diseases e.g., cancer, diabetes, and oral infectious [PMID: 38167627]. The high-dimensional nature of multimodal data presents numerous challenges in its effective analysis, annotation, interpretation, and presentation. AI/ML applications like IntelliGenes have the potential to impact researchers and physicians in clinical settings by aiding in the identification of novel and predictive biomarkers to enable earlier diagnosis and personalized treatment options for complex diseases.

S04 — Software & Data/AI

ResBase: Residential Building Analytics and Simulation for Energy Transition

Kiran Ghosh (lead poster presenter), Edward J Bloustein School of Planning and Public Policy

This project introduces a statewide database for assessing residential energy use and electrification potential in New Jersey. It is the first publicly accessible dataset integrating household-level energy demand, building characteristics, and socio-economic indicators at the census tract level. This analysis is innovative, as unlike other unified datasets in New Jersey, ResBase integrates census data and household energy consumption characteristics at the most granular scale.
We combine publicly available datasets (American Community Survey PUMs data, and EIA's Residential Energy Consumption Survey (RECS) 2020) to generate synthetic households at the census tract level. These are used to estimate household energy consumption characteristics, HVAC equipment and fuel type by income group, and to evaluate local energy-saving and electrification scenarios. The ResBase dashboard allows policymakers, utilities, and local governments to visualize residential demand patterns, compare municipal baselines, and explore scenario outcomes. This effort addresses a core challenge. Municipalities and program administrators lack tools to determine where residential demand is concentrated, how energy burdens vary, and which communities would benefit most from targeted clean energy programs. The residential energy use baseline is showcased through an innovative web-based interactive data dashboard. Results indicate that many census tracts across New Jersey show strong potential for efficiency and electrification upgrades when considering demographic factors and building characteristics. Building on these findings, the ResBase framework supports equitable clean energy planning, reduces program design uncertainty, identifies municipalities ready for evaluation, and translates data analytics into actionable deployment pathways aligned with New Jersey's decarbonization goals.

S05 — Software & Data/AI

NJ Geothermal Assessment Tool

Muhammad Yousaf Shahid (lead poster presenter), Edward J Bloustein School of Planning and Public Policy

This project presents a novel statewide spatial framework for assessing the potential of large-scale geothermal HVAC systems, or Thermal Energy Networks (TEN), in NJ. It is the first publicly accessible dataset to integrate physical geothermal capacity with building-level heating and cooling demand across the entire state, addressing a major gap in NJ's clean energy and decarbonization landscape. It integrates public building energy data with parcel-level inventories to estimate annual and peak thermal loads, evaluate heating–cooling balance, and identify locations within 30 percent load

balance, a key condition for efficient TEN deployment. Geothermal potential is evaluated using local geologic conditions and feasible borehole density informed by parcel geometry. These inputs are combined into a single analytical framework that enables thermal demand and physical geothermal potential to be assessed together, allowing rapid screening of feasibility across parcels, census tracts, and statewide. This framework addresses a critical gap faced by utilities, municipalities, and HVAC contractors, who currently lack integrated tools that reconcile geothermal potential with concentrated demand and affordability considerations. The project's competitive advantage lies in integrating engineering constraints, geospatial analysis, and policy-relevant metrics, including energy burden, low- and moderate-income status, fuel-switching potential, emissions impacts, and proximity to anchor buildings, into a unified decision-support dataset. Results indicate that many census tracts across NJ exhibit balanced heating and cooling demand and sufficient physical geothermal capacity to meet projected electrified peak loads for existing buildings. The resulting statewide maps and prioritization framework support affordable clean energy planning, identify market-ready districts, and translate technical feasibility into actionable deployment pathways aligned with NJ's decarbonization goals.

S06 — Software & Data/AI

Anisotropic Diffusion-based Analog Neural Network Architecture

Khizar Anjum (lead poster presenter), School of Engineering

Our Anisotropic Diffusion-based Analog Neural Network Architecture operates by implementing convolution operations through controlled diffusion processes in passive element lattices. The fundamental principle leverages the mathematical relationship between anisotropic diffusion and convolution operations.The core mechanism begins with input physiological signals (such as EEG or ECG data) being applied to a square lattice of passive elements. Each element in the lattice has controllable conductances to its neighbors, and these conductance values are set according to the desired convolution kernel. When a signal is applied to this lattice, the resulting voltage distribution across the lattice represents the convolved output, performing the same computation as a digital neural network. The key innovation lies in our modified lattice architecture where adjacent pixels are not directly connected. Instead, we use analog adders implemented in CMOS technology to create summation-based connections. For the (i,j)-th pixel with voltage v_{i,j}, the analog adder computes the weighted sum of neighboring voltages according to the desired kernel coefficients. This modification provides the degrees of freedom necessary to implement arbitrary convolution kernels while maintaining ultra-low power operation.Data flow through the system begins with sensor input, proceeds through multiple analog convolution stages for feature extraction, undergoes local analog decision-making for basic screening, and concludes with transmission of processed results to digital systems for comprehensive analysis. This architecture enables real-time processing of physiological signals with latency measured in microseconds rather than the milliseconds typical of digital systems.
The system's effectiveness has been demonstrated through theoretical analysis showing equivalence to digital convolution operations and practical implementations showing successful pattern recognition in physiological signals.

S07 — Software & Data/AI

Finder, Evaluator, Explainer, Generator (FEEG): A Bloom's Taxonomy-Based Query Classification Framework for LLMs and Generative AI

Siritha Chidipothu (lead poster presenter), School of Arts and Sciences, RU–New Brunswick

Generative artificial intelligence (AI) and natural language processing (NLP) systems powered by large language models (LLMs) have demonstrated strong capabilities, yet their reliability remains inconsistent in domain-specific and high-complexity settings. While Retrieval-Augmented Generation (RAG) improves factual grounding, the role of user query intent and structure in influencing response accuracy remains underexplored. This work introduces a taxonomy-driven approach to improving LLM reliability through systematic query classification. Building on Bloom's Taxonomy, we evaluate RAG-LLM performance using 480 expert-validated question–answer pairs from technical geoscience reports. Results show substantial accuracy variation across cognitive levels, with generative tasks outperforming analytical and evaluative ones. These findings motivate the development of a Taxonomical Query Classifier (TQC) comprising four intent-based categories: Finder, Evaluator, Explainer, and Generator (FEEG). The proposed FEEG-TQC framework classifies queries by dominant functional intent rather than hierarchical cognitive complexity. Empirical evaluation reveals statistically significant performance differences across FEEG categories, with Generator queries achieving the highest accuracy and Explainer queries performing worst, even with retrieval support. By enabling predictive estimation of response reliability prior to generation, FEEG-TQC offers a domain-agnostic framework for improving transparency, managing query quality, and enhancing trust in LLM-based systems. In addition to the above published work, we have established the generalizability of FEEG-TQC with a second paper which automated the process and applied to healthcare successfully, and is currently under review at IEEE Transactions on AI journal. Ongoing research aims to extend FEEG-TQC to education, business and governance domains.

S08 — Software & Data/AI

Measuring Ocean Currents for New Jersey

Hugh Roarty (lead poster presenter), School of Environmental and Biological Sciences

Oceanographic High Frequency radars (HFR) have been mapping currents in the U.S. Mid-Atlantic Bight since 1998 when two stations were installed in New Jersey at Brant Beach and Brigantine as part of the Rutgers University Long Term Ecosystem Observatory (LEO-15). Twenty-five years later, that seminal duo has grown into the 41-site Mid Atlantic HFR network providing continuous current maps along more than 1,000 km of coastline from Cape Cod to Cape Hatteras. The expansive gridded current velocities serve a variety of stakeholders including federal agencies like the U.S. Coast Guard for search and rescue, NOAA for oil spill response, Homeland Security for vessel detection and ocean scientists developing both short-term forecasting applications as well as longer term, multi-decadal changes in coastal circulation. Long-term archives are now available with calculated decadal mean, annual and seasonally averaged surface currents. This paper provides a history of the network to date and a glimpse towards the future.

Poster Session

C01 — Core Facility

Comprehensive Medicinal Chemistry and Synthetic Support: Bridging Academic Research and Drug Discovery

Jacques Y. Roberge (lead poster presenter)

C02 — Core Facility

The Rutgers Health Clinical Trials Office

Nancy Reilly (lead poster presenter)

C03 — Core Facility

In Vivo Research Services

Derek Adler (lead poster presenter)

C04 — Core Facility

Advanced Preclinical Imaging Laboratory (APIL): Ultra-High-Resolution Multimodal Preclinical Imaging and Radiopharmaceutical Development Core

Sushil Tripathi (lead poster presenter)

C05 — Core Facility

Advanced Fluorescence Microscopy Techniques

Nanci Kane (lead poster presenter)

C06 — Core Facility

Validation Studies of an Automated Instrument, Qiagen EZ2 Connect, for Nucleic Acid Extraction

Adita Sivakumar (lead poster presenter)

C07 — Core Facility

Biospecimen Repository and Histopathology Service to Enhance Translational Research

Xin Yu (lead poster presenter)

C08 — Core Facility

Research Services, Activities and Advances at SoE Nanofabrication CORE Facility

Huazhong (Henry) Wang (lead poster presenter)

Rutgers Innovation Showcase 2026

NETWORKING SESSION

Join us for a networking reception designed to foster meaningful connections and collaborations.

4:30 p.m.
Academic Building, East Wing
4th Floor, Rm 4450

RUTGERS STARTUPS AT THE SHOWCASE

SubUAS
QUEENS CARBON
Larada Therapeutics
NANOCRYSTAL COMPOSITES INC.
RENEW CO_2
Notitia Biotechnologies
nutrasorb
ZENA THERAPEUTICS
SIMSI
Thrive Genetics
PLEXYMER
PONS
NanoNeWron
SAMPLED

Agenda
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**The following companies are registered to attend as of March 16, 2026*

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Adhvan Health Care and Life Sciences, LLC
Advanced Manufacturing Innovation, AIChE
Agoraponic Farms
APY Therapeutics, LLC
ARC Capital Management, LLC
Ark Foods
Aventurine
Adirna Therapeutics
Affinity Asset Advisors
Agilent Technologies
Axria

Big Idea Ventures
BioNJ
Bio-Rad
Bios Logos
Blue Ocean Life Sciences
BTIG

C10 Labs
CannaCoverage Insurance Services
CarbonDots, LLC
Casabona Ventures
CHANEL
Colgate Palmolive
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Commission on Science Innovation and Technology
Cooper University Health Care
Creative Ventures
CUNY Advanced Science Research Center
Center for Ocean Observing Leadership
CMH power and energy consulting
Cohance Lifesciences Limited

Dale Carnegie Training
DayStar Energy Solutions Corp
Deep Lake Insights
Delphine Diagnostics, Inc.
Driven Tech
Decisive Point
DEVCOM AC - Picatinny Arsenal (US Army)
Digital Transformation Solutions
DRI Healthcare

Eduscape
EndoSound
Evotec (US), Inc.
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IG Venture Partners
Innovation+
Institute for Life Science Entrepreneurship
Institute for Women's Leadership
Insight Global

Jiekun Yang Lab of Computational & Systems Biology
JBC Consulting
Johnson & Johnson

Kaida BioPharma
Kill The Headlights
KolateAI PharmaTech, Inc.
Kean University
Kader IP Advisory

Larada Therapeutics, Inc.
LeagueMed
Legend Biotech
Lionheart Biosciences
Lymphagen

McCooe & Associates
Middlesex County Office of Business Engagement
MilliporeSigma
MARMER Capital
mTap Corporation
Materium Technologies
Meagher Emanuel Laks Goldberg & Liao, LLP
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MG Digital

Nanocrystal Composites, Inc.
NanoNewron
NanoTemper Technologies
NeuroTechnology Innovation Center
New Jersey Bioscience Center

New Jersey Institute of

Industry at Rutgers Innovation Showcase*

**The following companies are registered to attend as of March 16, 2026*

Technology (NJIT)
New Use Agricultural and Natural Plant Products
NJ Commission on Science, Innovation and Technology (CSIT)
NJ Edge
NJ Health Foundation
NJIT Highlanders Angel Network
Notitia Biotechnologies
Nokia Bell Labs Venture Studio
Novogradac Rivers Foundation
NJ Economic Development Authority
NeuroTechR3, Inc.
New England Ocean Cluster
New Jersey Film Academy
NJ Bioscience Center
NJ Edge
NJ Maternal and Infant Health Innovation Authority
NERVANA Therapeutics Inc.
NJSBDC State Office

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Ott Management Solutions
Outlier
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PONS, Inc.
Portal Innovations
P&F Solutions
Percival Scientific, Inc.
Plexymer, Inc.
Princeton Plasma Physics Lab
PTC Therapeutics

QuantumToMarket
Queens Carbon

RenewCO2
Rutger's Food Innovation Center
Research & Development Council of New Jersey
Regkey.AI
Ricovr Healthcare
RUCOOL

Sampled
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Rutgers Innovation Showcase 2026

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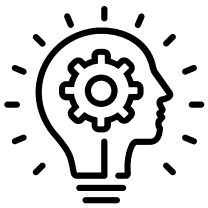
CAMPR offers technical expertise in high-sensitivity protein and metabolite analysis. It provides high-throughput protein profiling and targeted protein quantification with high sensitivity through its Bruker timsTOF AIP mass spectrometer and proteoElute UHPLC system. CAMPR's expanded capabilities also include Mass Spectrometry Imaging, enabling label-free spatial mapping of drugs, metabolites, and lipids directly within tissue sections.

RUTGERS INNOVATION

By the Numbers FY25



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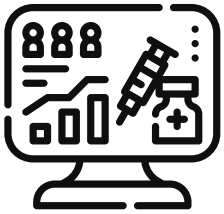

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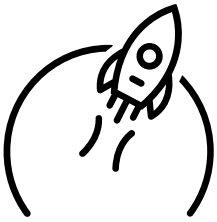

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Inventions, Startups, & Commercialization at Rutgers

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