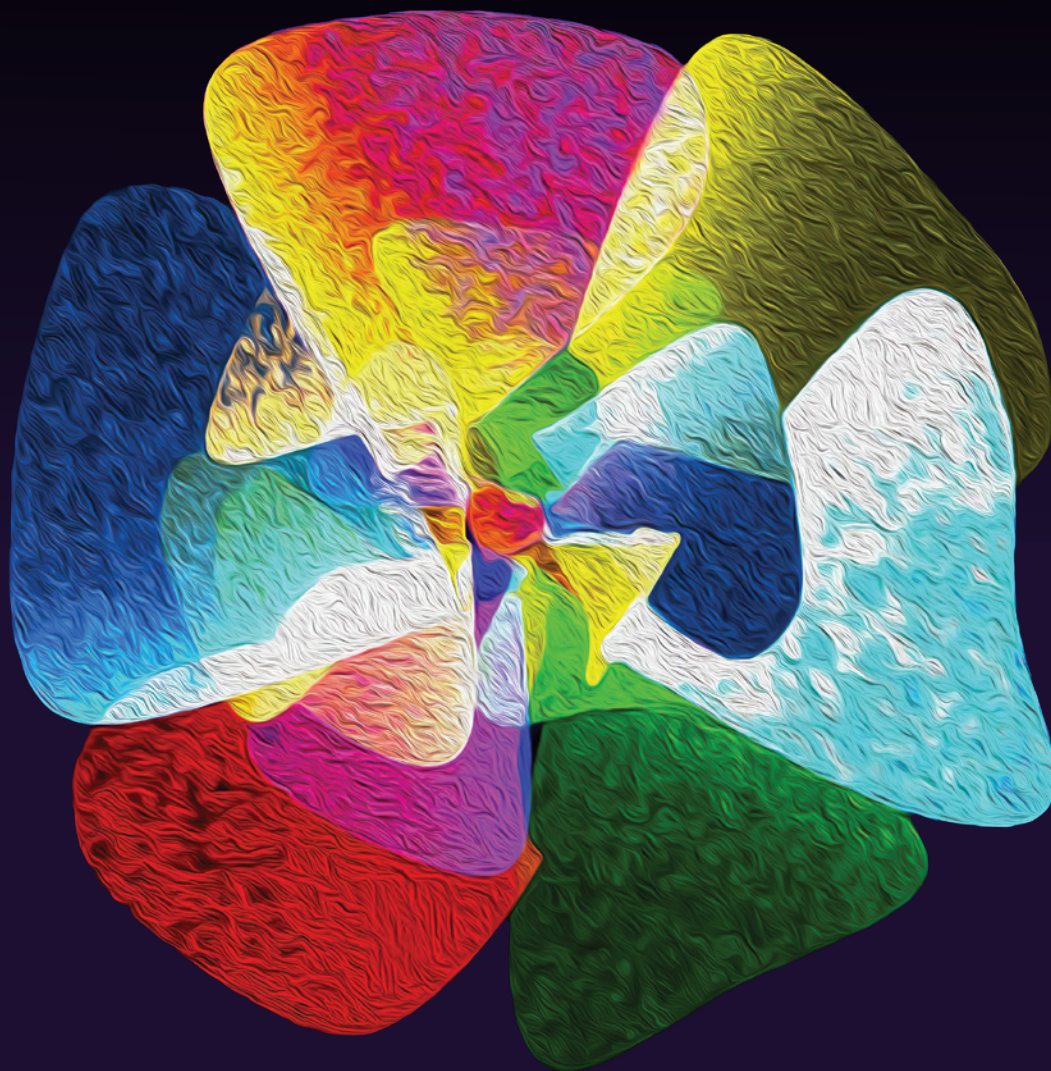


NextGen Precision Health

BIANNUAL REPORT 2025



STATE OF THE ART

Featured in BioNexus KC's Science2Art program, this rendering by University of Missouri Translational Biosciences PhD student Arooj Shahid depicts heart muscle recovery data following exposure to a high dose of caffeine. The multi-colored loops represent data from an experiment tracking calcium-contraction relationships in heart muscle cells.



FROM THE EXECUTIVE DIRECTOR

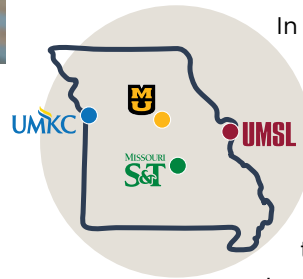


W. DAVID ARNOLD, MD
EXECUTIVE DIRECTOR,
NextGen Precision Health Initiative
CO-DIRECTOR,
Tom and Anne Smith MD-PhD Program
PROFESSOR,
Physical Medicine and Rehabilitation
University of Missouri

In these pages, you'll get a glimpse of the new collaborations we're forging, the community interest we're building, and the new class of talented young scientists we're fostering to ensure this initiative endures.

Getting recruited to NextGen Precision Health in 2022 was bigger than the dream job I could have imagined. The project was still in its earliest stages, but I saw great things for its future.

NextGen is an audacious idea. It's a conscious step toward unlocking Missouri's potential as a powerhouse leader in health science. The effort also represents the greatest investment in biomedical research in the history of the University of Missouri System.



In our campus communities across the state, we've all witnessed colleagues who are driving significant innovations in their fields. Now is the time for us to bring that expertise together – along with our industry and community partners – to deliver game-changing solutions that improve health. We have the muscle to do this right here in the Midwest, and our global peers are already taking notice.

On average, it takes 14 years for a basic lab discovery to make it all the way through the pipeline to clinical availability. But many patients can't wait that long. We all know someone affected by Alzheimer's disease, cancer, heart disease or diabetes. Our teams are motivated by the stakes, and we're committed to fast-tracking the development of promising new ideas.

I'm very pleased to share with you how far our vision has come. In these pages, you'll get a glimpse of the new collaborations we're forging, the community interest we're building, and the new class of talented young scientists we're fostering to ensure this initiative endures.

Achieving our ambitious goals will require building trust and bringing in a range of perspectives. If you take away one thing, I hope it's this: No matter who you are, there's a part you can play within the NextGen network to advance health for Missourians and beyond.

Dave Arnold

OUR MISSION



Innovation

At the center of NextGen is innovation, the work of our researchers and strategic partners using world-class facilities and resources.

Learn more on pages 4, 6, 7, 8, 9 and 14



Engagement

NextGen is dedicated to bringing the patient perspective into research conversations and connecting with our communities to move discoveries forward.

Learn more on pages 5, 9, 12 and 15



Talent

We strive to cultivate a workforce fluent in collaboration and driven by innovation. This means implementing training programs and networking opportunities to guide the next generation of precision health leaders for Missouri and beyond.

Learn more on pages 8, 10, 11 and 14



Anchoring World-Class Research

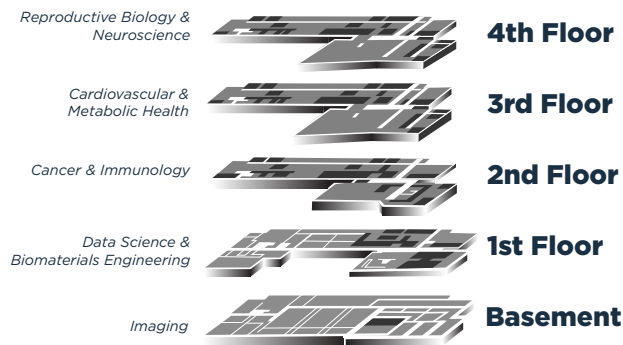
On October 19th, 2021, the University of Missouri celebrated the grand opening of the Roy Blunt NextGen Precision Health building. Serving as the epicenter of the NextGen initiative, it's brought together a truly exceptional set of resources, leading industry partners, and internationally-recruited research faculty to drastically shorten the time it takes for innovations to go from the lab to clinical implementation.



"Starting right here, this is going to be a place where discoveries happen. This is going to be a place that focuses on health, but also on hope. Hope that you are going to give to people who don't even know we're having this ceremony, who may, a year or two or a decade from now, have their lives saved by the work that goes on in this building."

Francis Collins, MD, PhD

Director, National Institutes for Health (2009-2021)
Project Head, Human Genome Project (1993-2008)



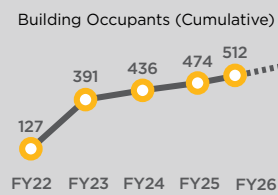
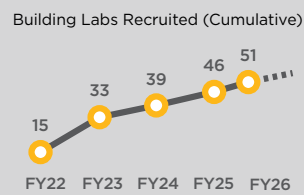
Top row: Tom Spencer, Latha Ramchand, Mun Choi, Mike Kehoe, Richard Barohn, Talissa Altes, Rebecca Shyu, Michael Williams
Bottom row: Jeffrey Layman, Keith Holloway, Robin Wenneker, Darryl Chatman, Roy Blunt, Francis Collins, Todd Graves, Maurice Graham

The University of Missouri in Columbia was already one of only a handful of institutions in the country with medicine, veterinary medicine and law on the same campus, but it also boasts strong programs in health sciences, nursing, engineering, food and natural resources, and the nation's most powerful university research reactor producing radiopharmaceuticals.

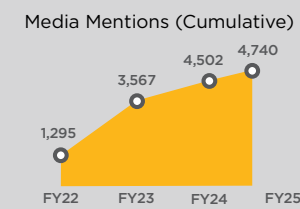
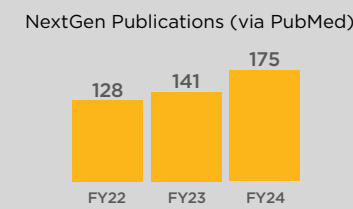


"We are not just state of the art. We are making the art."

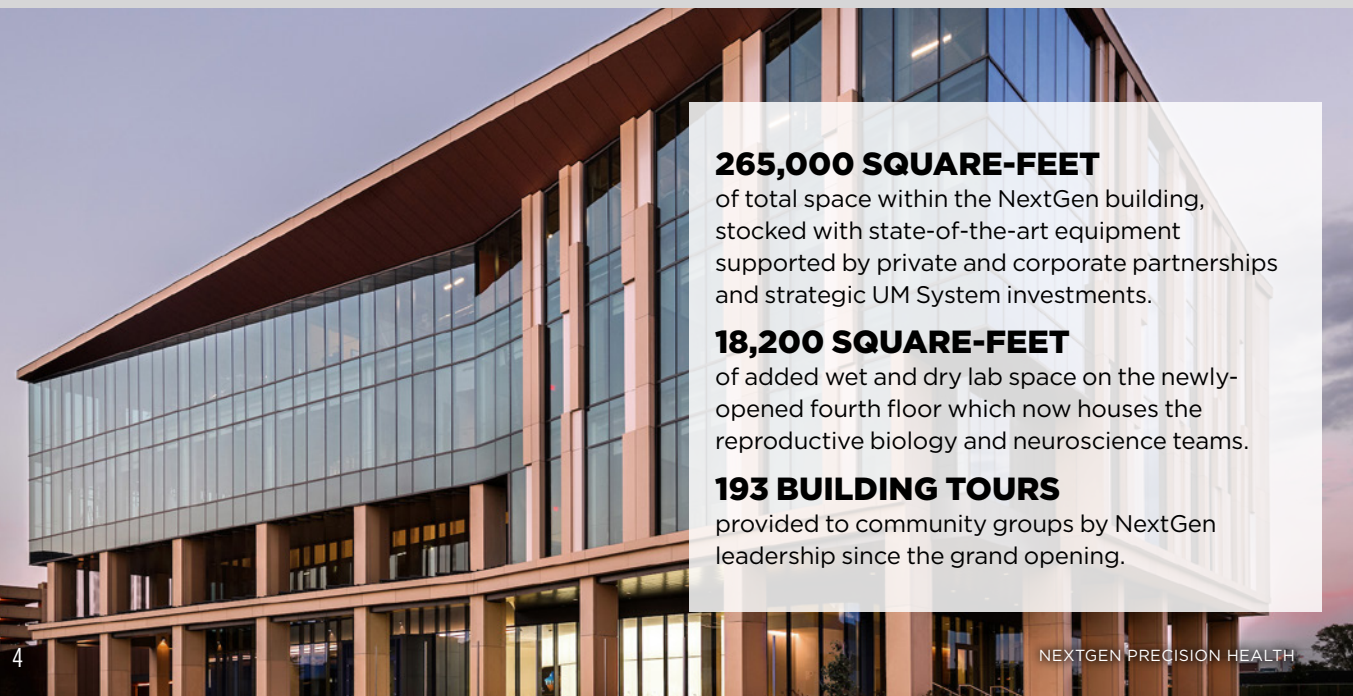
Richard J. Barohn, MD | Inaugural Executive Director, NextGen Precision Health Initiative | Executive Vice Chancellor for Health Affairs | Hugh E. and Sarah D. Stephenson Dean, MU School of Medicine



\$222.6 million in grants awarded
\$832.4 million in total grant proposals submitted (1,056)
Data from Oct. 2021 - Nov. 2024.
Does not include awarded amounts for future budget years.



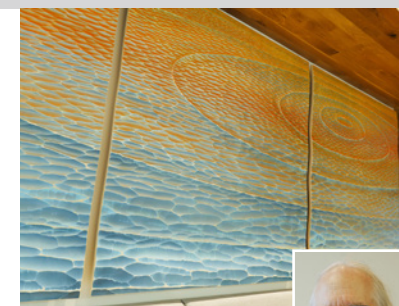
201 Seminars hosted
11,705 Seminar attendance
Data from Feb. 2021 - Dec. 2024



265,000 SQUARE-FEET of total space within the NextGen building, stocked with state-of-the-art equipment supported by private and corporate partnerships and strategic UM System investments.

18,200 SQUARE-FEET of added wet and dry lab space on the newly-opened fourth floor which now houses the reproductive biology and neuroscience teams.

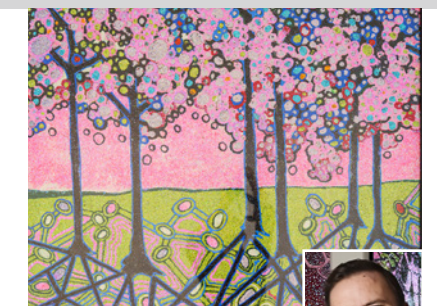
193 BUILDING TOURS provided to community groups by NextGen leadership since the grand opening.



Michael Bauermeister | Based in Augusta, Missouri, Michael is an internationally-celebrated sculptor. For NextGen, he explored the interplay between nature's transient beauty and the search for human knowledge. His carved wood panel reflects a moment frozen in time, the impact of a pebble's ripple as it spreads its influence, echoing the expansion of our collective research and understanding.



Katina Bitsicas | Bitsicas lost her father to mantle cell lymphoma in 2020. "A month after he died, the FDA approved the treatment that would have saved him," Bitsicas said. "Facilities like NextGen only speed up those types of life-saving discoveries." The colorful patterns are fashioned from two sources: the swirl of a liquid light show and magnified cross-sections of mantle cell lymphoma.



Dylan Mortimer | This Kansas City native graduated with an MFA from the School of Visual Arts in New York. Unburnable Bushes, which now resides in the Roy Blunt NextGen Precision Health building, portrays the artist's lived experience with chronic illness and organ transplant. The trees, surrounded by illuminating fire, represent lungs, and the root systems littered with pills evoke bronchi.

Building Research Highlights



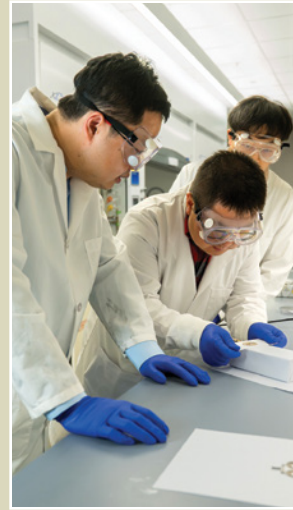
Developing a universal cancer prevention platform

HAVAL SHIRWAN, PhD
ESMA YOLCU, PhD



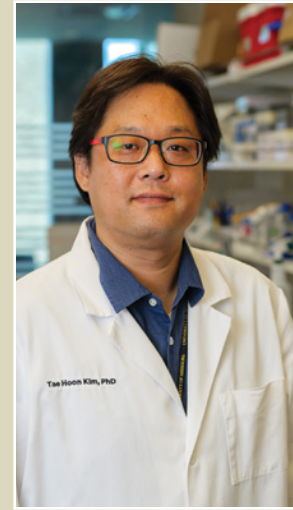
The “Weakest Link” theory of neuronal networks

SMITA SAXENA, PhD



Soft, wireless-charging, battery-free material for self-health monitoring

ZHENG YAN, PhD



Targeted cancer cell therapy may slow endometrial cancer

JAE-WOOK JEONG, PhD
TAE HOON KIM, PhD



Cracking the code on rare disorders like Charcot-Marie-Tooth disease

KATHRYN MOSS, PhD



Founding the International Journal of Artificial Intelligence and Robotics Research

DONG XU, PhD



Pioneering a new diagnostic tool for respiratory diseases: xenon gas MRIs

ROBERT THOMEN, PhD
TALISSA ALTES, MD



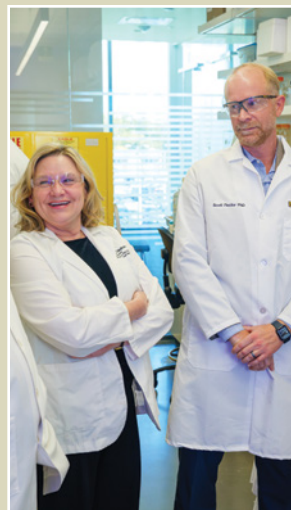
10-year MERIT grant supports reproductive biology research

TOM SPENCER, PhD



A fully-automated method for generating accurate protein models from Cryo-EM data

JIANLIN “JACK” CHENG, PhD



New study shows diet and exercise reverses liver damage

R. SCOTT RECTOR, PhD
ELIZABETH PARKS, PhD
JAMAL IBDAH, MD



A Technology, Entrepreneurship and Commercialization Hub spanning all disciplines

SHEILA GRANT, PhD



Too much of a good thing: Overconsuming protein can be bad for your health

BETTINA MITTENDORFER, PhD



Electron Microscopy Core re-opens, offering world-class resources to UM System and industry researchers

MIN SU, PhD



A treatment for arterial stiffness, a leading cause of heart disease

CAMILA MANRIQUE-ACEVEDO, MD
LUIS MARTINEZ-LEMUS, DVM, PhD
JAUME PADILLA, PhD



Studying how gut health affects progression of Alzheimer’s disease using 7T MRI

AI-LING LIN, PhD

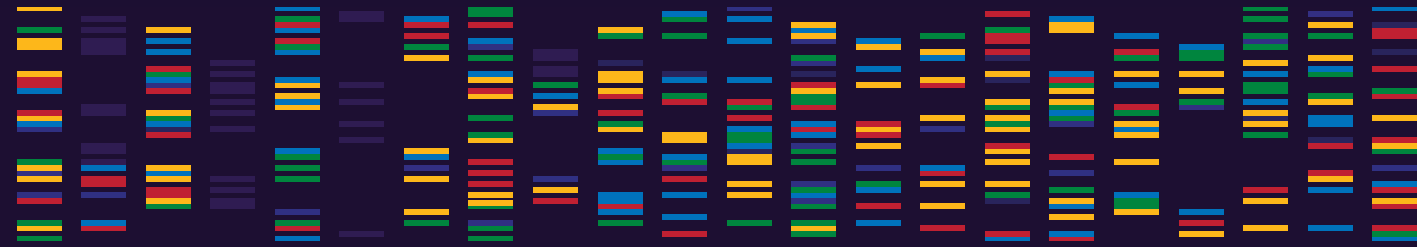


Discovering potential treatments for a common complication following bone marrow transplant

SENTHILNATHAN PALANIYANDI, PhD
GERHARD HILDEBRANDT, MD

PATHWAYS 2024

NextGen Precision Health's inaugural Pathways Symposium drew on pathbreaking work from across the University of Missouri System to celebrate research collaborations with the potential to impact global health. Its dual mission — accelerating discoveries and fostering discoverers — provided networking opportunities for experts across our four universities and gave young researchers a pragmatic approach for connecting to other fields.



Neuroscience researcher Smita Saxena, PhD from MU addresses the crowd at the State Historical Society of Missouri in Columbia.



Keynote Speaker, Thomas Pedersen, PhD is the co-founder and CEO of NMD Pharma — headquartered in Aarhus, Denmark.

Early career researchers like Amen Teshome from UMKC receive feedback from faculty across the state during the poster session.



200 ATTENDEES
98 RESEARCH POSTERS
5 RESOURCE POSTERS
4 UNIVERSITIES
10 FACULTY TALKS
4 SPONSORS

DISCOVERY SERIES

5,381 ATTENDEES
47 EVENTS
4 CAMPUSES

The Discovery Series is NextGen's flagship community science event series. It's designed to bring the frontiers of health research into focus for patients, caregivers, clinicians, policy makers and those who are just irrepressibly curious. Whether it's cardiometabolic health, gene therapy, artificial intelligence tools, healthy aging, or the toughest cancers, every month there's a world-class expert on hand to discuss the latest breakthroughs and to answer your questions. Research cannot be successful without input from the communities it will impact. The Discovery Series is an acknowledgement that scientists have as much to gain from an open dialogue as non-scientists do.

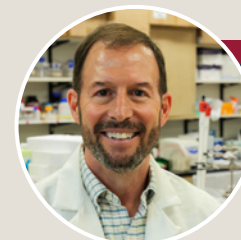


HOSTED AT MU

Tracy Shors, PhD | Rutgers University
Center for Collaborative Neuroscience

Everyday Trauma: Learning to Forget

Exploring how trauma impacts the brain, especially for women — and how we can learn to heal ourselves. When we are reminded of our trauma, reliving it copies another memory in our brain, making it that much more difficult to forget.



HOSTED AT UMSL

Michael Nichols, PhD | University of Missouri-St. Louis
Department of Chemistry & Biochemistry

Decoding the Chemistry Behind Alzheimer's Disease Therapies

The number of Missourians living with Alzheimer's will exceed 130,000 by 2025. The Nichols lab targets the amyloid beta (Aβ) protein, which initiates the disease by depositing in the brain and stimulating inflammation.



HOSTED AT S&T

Mark Towler, PhD | Missouri University of Science & Technology
Department of Chemical & Biochemical Engineering

Using Bioactive Glass to Rapidly Stop Bleeding for Injuries in the Field

Death from blood loss results in more than 60,000 deaths in the U.S. and 1.9 million worldwide each year. Dr. Towler shared his journey as an inventor developing patented technology to stop severe bleeding in the field.



HOSTED AT UMKC

Simon Friedman, PhD | University of Missouri-Kansas City
School of Pharmacy

Using Light to Control Biology and the Delivery of Therapeutics

The Friedman lab develops chemical tools that allow for control of the spacing, timing and degree of gene expression and therapeutic delivery, such as the release of insulin into the bloodstream of a patient with diabetes.



HOSTED AT MU

David Fleming, MD | University of Missouri-Columbia
Department of Chemistry & Biochemistry

Enhancing Care with Precision Medicine When Cure Is Not Possible

A former President of the American College of Physicians discusses the potential impact scientific discovery can have on enhancing trust in the healing relationship and improving communication in complex decision-making at the bedside, particularly at the end of life.

Beyond The Bench



Beyond the Bench is a half-day event exposing graduate and postdoctoral trainees to a more comprehensive view of the career pathways in translational research while also educating researchers about entrepreneurship within academia.

On September 10, 2024, participants heard from Dr. Anthony Japour, who has over 30 years of experience as a physician, researcher and biotechnology and pharmaceutical executive. Afterward, there was a workshop on personal branding and a panel discussion about non-traditional career pathways. Attendees were encouraged to bring their resumes to the networking reception that concluded the event, so industry guests and panel speakers could provide feedback aimed at increasing marketability in biotech and entrepreneurial spaces.



"I really liked hearing a lot more about diverse fields that I don't necessarily hear about in academia. And those industry opportunities were way more broad than I initially anticipated."

Claudia Chambers | CHEMISTRY PhD STUDENT
STUDYING RADIOPHARMACEUTICALS



"Seeing from a recruiter perspective... It felt like there was a spotlight on me and what I wanted. It was tailored towards me."

Anjugam Paramanatham, PhD | POSTDOCTORAL
RESEARCHER, MU SCHOOL OF MEDICINE

NextGen Postdoctoral Fellows Program

This program is for graduate students and postdocs who intend to begin or continue postdoctoral work within the UM system in basic and/or translational research relevant to human health. Fellows will receive competitive stipends, health and retirement benefits, and yearly travel support. Through this program, fellowships are awarded to recent graduates who will be based at UM System universities for two-year terms. The fellows will highlight work that bridges disciplines or translational areas, and special emphasis is placed on demonstrating effective communication of scientific concepts to a variety of audiences. As new cohorts of fellows bring their perspectives into our statewide community, we aim to establish dynamic new collaborative relationships.



127 CERTIFICATES
AWARDED

7 EVENTS

FALL 2021 - FALL 2024

Clinical Trial Investigator Training

This is an educational program — offered in-person with additional online modules — designed for investigators who currently lead or would like to lead clinical trials. The series includes lectures and panel discussions from leaders across the University of Missouri System and Washington University to define the regulatory, operational and ethical components of clinical trials. The goal is to develop a skilled workforce that provides the highest level of patient safety, teamwork and data quality. The program also covers institution-specific resources for investigators, and participants can opt in for continuing education credit.



Clinical Research Study Coordinator Bootcamp

This is a two-day, in-person training designed to provide basic knowledge that is beneficial for research coordinators and staff. The program includes lectures, interactive activities, and breakout group exercises covering the responsibilities of research coordinators, principles of good clinical practice, best practices for study start up, conduct, and closeout, and resources available at the institutional level.

169 CERTIFICATES
AWARDED

9 EVENTS

FALL 2022 - FALL 2024



Team Science

Collaboration is the lifeblood of the NextGen initiative. Trailblazing health technology can't happen without new conversations and connections. Team science activities are a regular occurrence amongst NextGen researchers. At these events, scientists work with facilitators to generate new ideas, build networks, and dream up long-term research strategies.



Motor Neuron Symposium | October 10-11, 2024

Organized by faculty, staff and community volunteers, the inaugural Motor Neuron Symposium was held in October 2024 to advance our understanding of motor neuron disorders, specifically amyotrophic lateral sclerosis (ALS, or Lou Gehrig's Disease). Speakers and guests came from institutions in Germany, Canada, Japan, Ohio, Florida and of course, Missouri.



In keeping with NextGen's commitment to include those who stand to benefit from discoveries, families and patients affected by ALS played a central role in the event. Funding for the symposium was raised by the Brundige family, including Dr. Tyler Brundige, a Kansas City ophthalmologist and MU School of Medicine graduate. Dr. Brundige lost his brother Chase to ALS a year before and offered words of encouragement for those in attendance. We were also joined by Mary Ellen Sobule (and her husband James), who lost her sister Kathleen to ALS; and Renee White (joined by her husband Michael), who is living with an ALS diagnosis. All had the chance to share their stories, which were incredibly powerful for the assembled researchers and clinicians to hear.



Mary Ellen Sobule



Dr. Tyler Brundige



Renee White

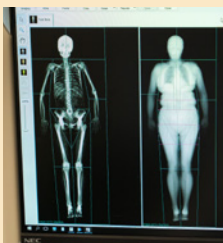
Muscle Health Study Reception

NOVEMBER 11, 2024

Joining a research study shouldn't be a one-off encounter. At NextGen, we're building an ongoing relationship with our statewide community by inviting them into a transparent and explanatory process, sharing data whenever possible to inform them about their health, and providing fellowship with other participants.



In November 2024, the Roy Blunt NextGen Precision Health building hosted a complementary reception to express gratitude to past participants in a Muscle Health Study for older adults. Attendees enjoyed food and drinks, guided tours of the facility, and a presentation from the Alzheimer's Association about extending brain health. Celebrations like this are aimed at providing value that keeps the community engaged in research endeavors; not only because participants are necessary to create new scientific knowledge, but also because they bring new perspectives that improve the questions we ask.



This particular study ran from August 2023 to September 2024 and involved 100 participants, ranging in age from 65 to 91, each of whom generously provided four to five hours of their time. Their muscle strength was tested with technology called EIM (electrical impedance myography), along with more standard muscle and physical function testing, and they received MRI and DEXA imaging. It's part of an effort to better understand how we can efficiently assess sarcopenia, which is the age-related loss of skeletal muscle mass and function.

Clinical study capacity available to UM System researchers

The Clinical Translational Science Unit (CTSU)

is a special research unit to investigate and discover how human research participants vary in their responses to disease and novel treatments. The unit features two wings in Columbia - at the Roy Blunt NextGen Precision Health building and at University Hospital - providing the spaces, staff and equipment to conduct innovative clinical trials in publicly accessible locations. In addition to coordinating clinical research projects and trials, the team there collaborates with clinical research investigators and staff throughout the UM System to support our clinical research endeavors.



Services and Capabilities

- Full study coordination services
- Conducting and carrying out study enrollments and visits
- Laboratory specimen collection and processing
- Assistance with clinical research procedures
- Data collection and reporting
- Expertise and guidance for successful conduction of clinical trials research

These human research spaces are adjacent to basic and preclinical research to promote greater coordination and collaboration. They're equipped to measure muscle strength, blood pressure, memory, food intake and cardiovascular fitness and boast leading edge tools like a Lunar iDEXA scanner and high-resolution CT bone scanner.

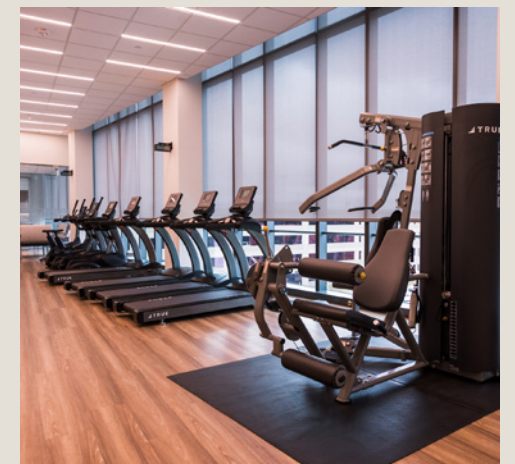
15,000 square-feet of dedicated space

250 study visits serviced each month;

about 3,000 study visits per year

Topics we're investigating:

- A first-in-human pharmacological treatment for Charcot-Marie-Tooth disease
- A natural history and mechanistic study of Baker Gordon Syndrome, a rare genetic disease
- Identifying molecular markers of immune responses to influenza virus infection
- Measuring outcomes of a low-impact group exercise program for people with ankle, knee, and/or hip pain or who are at risk for bone density issues
- Dissecting the impact of dietary protein on macrophage mTOR signaling and atherosclerosis
- Prevention of cardiovascular and diabetic kidney disease in type 2 diabetes
- The NIH's All of Us study, a large research program aimed at helping researchers understand more about why people get sick or stay healthy



Meet Jill Delston

Dr. Jill Delston brings crucial guidance to the initiative through her work as a bioethicist, placing the welfare of patients and research subjects at the center of decision making and identifying unintended outcomes before they happen. An assistant professor of Philosophy at the University of Missouri-St. Louis, Dr. Delston has published prolifically on inequities in the health care field.

Her work illuminates the value judgments that are made, often subconsciously, when dealing with a complex web of priorities on a patient's or research participant's behalf. Precision health means targeting our approach on an individual level to promote longevity and better quality of life for individuals and groups.

"One of the things I love about the NextGen Precision Health initiative is that we are interested in ensuring that the research is broadly inclusive and accessible," she said. "The more we do that, the more helpful our results will be for everybody across a diverse set of backgrounds."



COMMUNITY ENGAGEMENT

Health research impacts entire communities in the long run, so it's best conducted with those partners on board from the beginning. That means being visible to Missourians and indulging curious minds face to face.



Celebrating good food and Missouri growers at the Columbia Center for Urban Agriculture's Harvest Hootenanny in 2023.



At the Missouri State Fair, Eliana Eubanks and Mackenzie Lynch invite all ages to partake in a grip strength test.



David Arnold on KFRU's Sunday Morning Roundtable.



Darren Hellwege interviews NextGen researcher Adebowale Adebisi about kidney disease in the KBIA studio.



UMKC's Healthcare Delivery and Innovation Building will be the new home for dSAIC.

NextGen Data Science and Analytics Innovation Center

The University of Missouri-Kansas City (UMKC) plays a critical role in powering the success of the UM System precision health enterprise through its **NextGen Data Science and Analytics Innovation Center**, known as **dSAIC**. By harnessing immense datasets to extract insights, patterns, and knowledge to drive technological advancements, dSAIC will provide the mission-critical foundation for leading edge research. That will involve using high performance computing services to solve critical problems, as well as producing a skilled workforce to meet growing industry demand.

2023 Collaborative Biomedical Research Symposium

Missouri S&T hosted the 2023 Collaborative Biomedical Research Symposium with NextGen Precision Health and the Ozark Biomedical Initiative on April 28, 2023. The event focused on translational medicine and biomedical informatics in the biomedical field and functioned as a chance for faculty across multiple campuses to find collaborative research partners. Session topics include biosensor development, drug delivery, tissue regeneration engineering, artificial intelligence, machine learning, biomedical data analysis and TBI studies.



Mo S&T Cognitive Psychology student Kendra Mehl shares her poster with Dr. Yue-Wern Huang, the Director of the S&T Center for Biomedical Research and the symposium's organizer.



Dr. Henry Wan's long-term goal is to customize the annual influenza vaccine into personalized medicine.

NextGen Center for Influenza and Emerging Infectious Disease

The mission of the NextGen Center for Influenza and Emerging Infectious Diseases at MU is to develop and apply systems biology-based translational approaches to counteract influenza and emerging/re-emerging infectious diseases. The center includes a facility to study influenza, infectious disease transmission and vaccinology using various animal models, especially swine. This facility is equipped to test vaccine efficacy under a wide range of humidity and temperature parameters, mimicking important transmission conditions.



Two participants in the Air Race Classic – covering 2,300 nautical miles – meet the NextGen team at the Moberly checkpoint.



Researcher Dongsheng Duan meets Dennis Ridenour, CEO of BioNexus KC, at a Collaborate-2Cure event.



Meeting families at the MU College of Veterinary Medicine's pet-friendly Open House in 2023.



NextGen building director R. Scott Rector leads a tour for members of the Columbia Chamber of Commerce.



The NextGen team fields questions from the Fayette Rotary Club and Central Methodist University nursing students.



Executive Director David Arnold speaks at an Osher class for lifelong learners.



Charlene Emerson and Alyssa McLeod meet mid-Missouri students at the Young Scientists Expo.



High school biomedical students learn about gene therapy as part of a partnership with the Columbia Area Career Center.



U.S. Senator Roy Blunt visits the Roy Blunt NextGen Precision Health building for a tour from building director R. Scott Rector.



ALS Research Program Manager Jaime Basnett and neuromuscular physician Erik Ensrud at the ALS Nexus Ice Bucket Challenge in Dallas.



Connecting with international researchers at the Society for Neuroscience's 2023 conference in Washington, D.C.

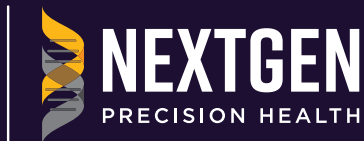


ALS Research Program Manager Jaime Basnett interviewed on KBIA by health reporter Anna Spidel.

Contact the team at nextgen@umsystem.edu.

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Mackenzie Lynch, MPH | Program Coordinator
Alyssa McLeod, MPH, CAP | Senior Executive Assistant
Ben Stewart | Director of Communications

Special thanks to Lydia Phillips and Eliana Eubanks
for art direction and data preparation.



NextGen Precision Health Initiative

umsystem.edu/nextgen

Roy Blunt NextGen Precision Health Building

precisionhealth.missouri.edu