



Institute for Integrative & Innovative Research

Some First Year Highlights 2022



From our Executive Director, Ranu Jung

Dear Friends,

The Institute for Integrative and Innovative Research was born of extraordinary philanthropy and a bold vision to transform Northwest Arkansas and, ultimately, the world. This past year we laid the groundwork to make this vision a reality.

I³R is moving forward on all fronts. Purpose driven to address grand challenges and ensure societal impact, we are strategically hiring faculty and staff, engaging with industry and the entrepreneurial ecosystem, and securing nationally competitive grants. Construction of the I³R building is well underway, and we are outfitting the building with equipment and resources that will facilitate world-class research and economic development.

This report is a testament to those who envisioned and support the Institute and the many people who are driving our progress. I am so proud of what we have accomplished and excited about what is to come. All of us, together, are bringing the future to now.

Ranu Jung, Ph.D.

Founding Executive Director and Endowed Chair, I³R
Associate Vice Chancellor and Distinguished Professor of
Biomedical Engineering

Integrative Health

Bringing the Future to the Now



National and global trends indicate rising populations, dwindling resources of food, energy and clean water, increasing challenges with mobility of people and goods, a growing need for advanced digital literacy in the workforce, and increasing challenges to health, especially of aging and underserved populations. Many of these trends are directly or indirectly impacting metabolic health in a manner that has increased rates and severity of obesity, heart disease, diabetes, and depression.

Reversing the decline in metabolic health is a complex problem that can only be solved by multi-pronged, aggressive, innovative, and integrated actions that address the social determinants of health.

I³R has been created to solve such wicked problems and is committed to take on the grand challenge of metabolic health by an Integrative Health approach – an approach that recognizes the multiple physiological, social, and environmental factors at play and an approach that utilizes a wholistic and integrative strategy to produce impactful solutions that are deployable at-scale.

I³R has a vision of a world that provides all with opportunity to enjoy a high-quality of life. This vision will be achieved through better access to healthy food, innovative treatments of metabolic disease and its consequences, improved mobility of goods and people, and enhanced digital literacy of the workforce and the broader population. The factors that will drive these improvements in metabolic health – environments that support healthy lifestyles, FoodTech that provides access to nourishing meals, HealthTech that promotes physical activity and treats diseases, technologies that improve access to education and information, and systems that enable secure and equitable

access to resources – will also create new economic opportunities and drive other improvements in quality of life in our region, our country, and the world.

Integrative Health programs at I³R will create and integrate advances in FoodTech and HealthTech to bring the future to the now. CRISPR-enabled advances in cellular agriculture will create food that is nutritious, sustainable, safe, and personalized for targeted health benefits. Whole-person physical and mental health will be enabled by diagnostic and therapeutic technologies that are client-centered wearable, ingestible, embeddable and deployable at the point-of-care, at home, or in the community. Innovations in data science, computational modeling, AI/ML, and cybersecurity will underpin the future of food and digital health. To implement solutions for societal impact, I³R's Integrative Health programs will create solutions for deployment at-scale by considering the supply chain, regulatory, policy, and economic challenges to effective utilization of novel technologies.

Collaboratories for Research and Education

Collaboratories of People

Advanced Technology

Operations

Industry Engagement and Communications



The people of I³R address the challenges facing our world and have a mindset that is driven by purpose and ready to adapt. They intertwine into mission-based, cross-functional teams ready to pursue complex problems and to converge ideas and expertise.

Collaboratories of Physical & Digital Spaces

The physical and digital spaces of I³R allow us to gather to deliberate, to disseminate knowledge and to put discovery into action to spur economic development.



Groundbreaking

Philanthropic, academic, industry and government leaders broke ground on the I³R Building on Friday, April 1.

Through its collaborative spaces and leading-edge technological equipment, the ~144,000 square foot building will bring change-makers and thought-leaders together to partner with industry, philanthropic, non-profit and governmental organizations.



Excellence in Research

Launching Impactful R&D

I³R has hit the ground running, establishing an organizational structure conducive to convergent partnerships and performance of cutting-edge research with potential for societal impact.

WGC Grant

Researchers at I³R were awarded a grant by the Women's Giving Circle to study the use of neurohaptic feedback in virtual reality for sensorimotor rehabilitation. Assistant research professor Andres Pena and doctoral fellow Aliyah Shell are collaborating on the project “Making ‘Sense’ of Sensorimotor

Rehabilitation in Virtual Reality.” They identified a need for sensorimotor rehabilitation therapy that is accessible and meets the demand for training frequency, especially in the wake of the COVID-19 pandemic.

Virtual reality, with its relatively low cost and portability, appears to hold great promise for telerehabilitation, enabling patients to train and rehabilitate at home. Pena and Shell will utilize technologies developed by the Adaptive Neural Systems Group and will collaborate with the AgeingOn Research Group at the University of the Basque Country in Spain and Dr. Ana Rodriguez Larrad to investigate the role sensory feedback plays in the use of interventions such as exoskeletons and restoring motor function.



NSF's Convergence Accelerator Program

Led by I³R and Principal Investigator Meredith Adkins, faculty across four academic institutions and two startups will engage in a year-long innovation accelerator meant to translate basic research into societal impact, particularly addressing food insecurity, a key determinate of inadequate metabolic health, I³R's initial Grand Challenge.

The team's innovation is a data insights platform that will incorporate novel technologies around AI and computer vision to develop pricing models and forecast market demand for small farmers' specialty crops and food animals, enabling access to institutional buyers.

The project will engage small farmers across Northwest Arkansas, the Arkansas Delta, and the Cherokee Nation through collaboration with the Indigenous Food and Agriculture Initiative.



NSF's Convergence Accelerator



Excellence in Research

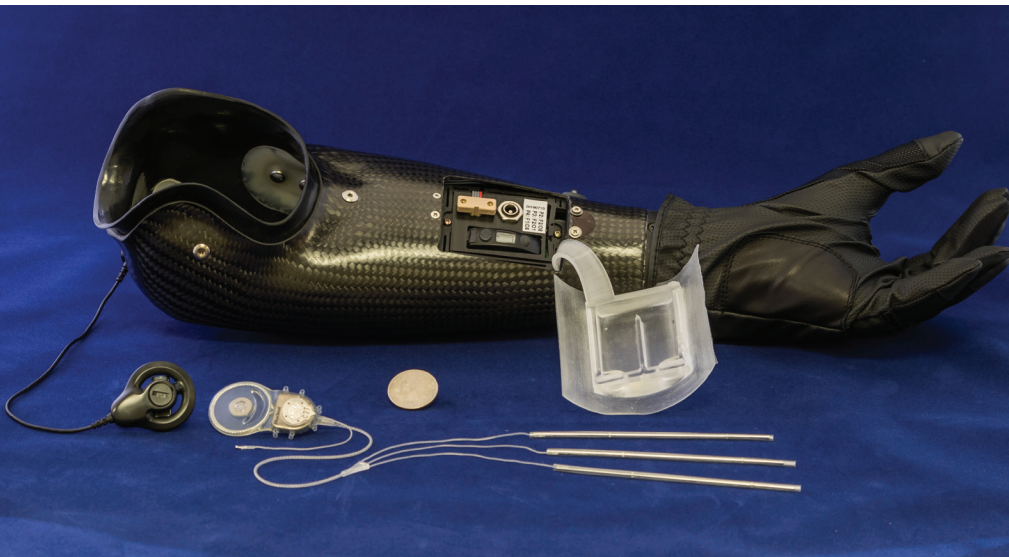
NIH and US Army

The Adaptive Neural Systems (ANS) Group at I³R seeks to restore the nervous system's integrative capabilities that enable us to stay healthy and thrive after experiencing injury or disease. Precise and personalized delivery of neural stimulation can enable someone to feel with a prosthetic hand or activate internal organs to promote integrative health.

The ANS Group transferred and launched a First-in-Human Clinical Trial of a new investigational prosthetic system with support from the NIH and the US Army. The neural-enabled prosthetic hand (ANS-NEPH) system was designed and developed by ANS members and others, including commercial partners. It uses

information from sensors in the prosthetic hand and a fully implantable neurostimulation system to activate neurons that elicit sensations that feel as if they were coming from the hand. People with upper limb amputation can use sensations from the hand as they perform everyday tasks. ANS is preparing for broader deployment in partnership with UAMS, Snell Prosthetics and Orthotics, and Walter Reed National Military Medical Center.

The ANS Group is also re-entering the innovation-deployment cycle with their neurostimulation technology - this time seeking to promote integrative health. Bioelectronic medicine uses electrical stimulation to influence the functioning of internal organs and the brain. With support from the NIH BRAIN Initiative, ANS is partnering with collaborators in France to develop new neurostimulation systems and strategies to focus and direct neural stimulation that will enable integrative approaches to sustain and promote health.



NIH The BRAIN Initiative®

NIH National Institute of
Biomedical Imaging
and Bioengineering

Engineering the
Future of HealthSM

Faculty Spotlight



James Abbas

Dr. Abbas is a Senior Member of the National Academy of Inventors and of the Institute of Electrical and Electronics Engineers. Currently, he serves on the Editorial Boards of the Journal of Neuroengineering and Rehabilitation and Frontiers in Neuroengineering, is an Associate Editor for the IEEE EMBS and Neural Engineering Conferences and is a member of the Steering Committee for the Data Resource Center of the NIH SPARC Initiative.

Dr. Abbas received his B.S. in bioelectrical engineering from Brown University. He received M.S. and Ph.D. degrees in biomedical engineering from Case Western Reserve University and completed a post-doctoral fellowship at the Shriners Hospital in Philadelphia. Dr. Abbas' research program develops and applies neural engineering techniques in the areas of medical rehabilitation and exercise. His research includes the design and development of neurotechnology, the development and use of computational models, and experimental evaluation of neurotechnology and rehabilitation systems in human subjects.



Andres Pena

Dr. Pena focuses on the research, development, and translation of neurotechnology to offset the effects of injury or disease. He is the principal investigator on our recent Women's Giving Circle grant.

He received bachelor's degrees in electrical and biomedical engineering, and a Ph.D. in biomedical engineering from Florida International University. He has training and expertise in neural engineering and neuromodulation approaches for understanding neural function and providing rehabilitation after trauma. He also has experience with human subject psychophysical testing and computational modelling. He is currently spearheading efforts to develop a business framework that will facilitate translation and commercialization of novel neurotechnology.

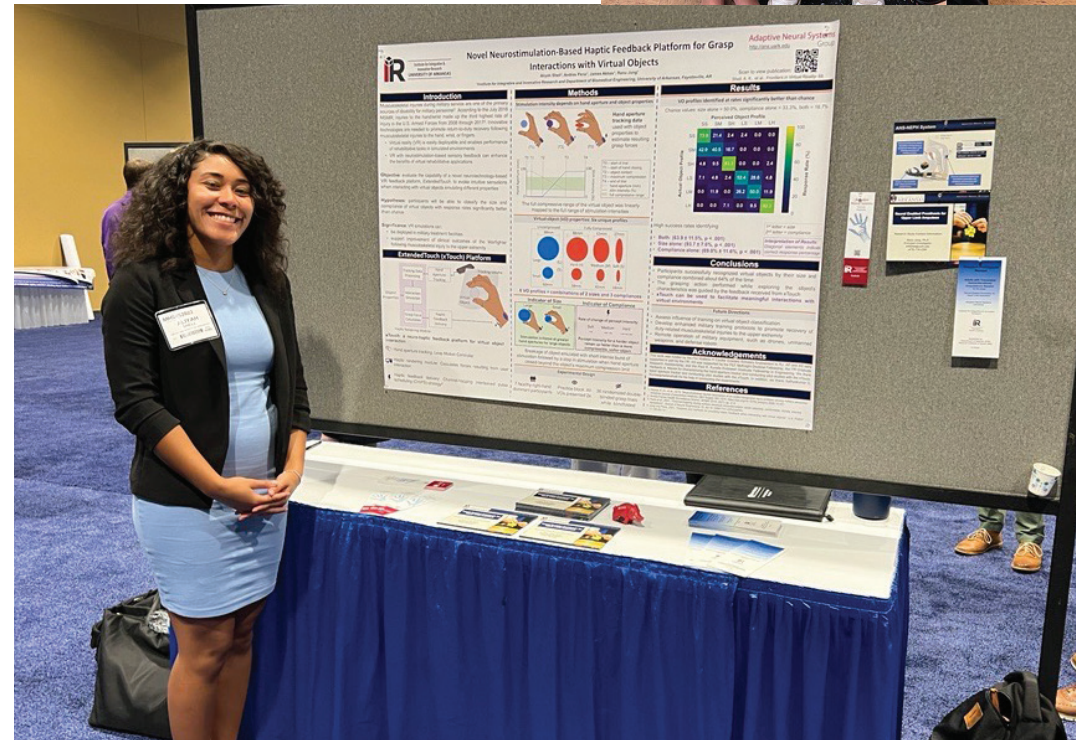
Educating Tomorrow's Generation

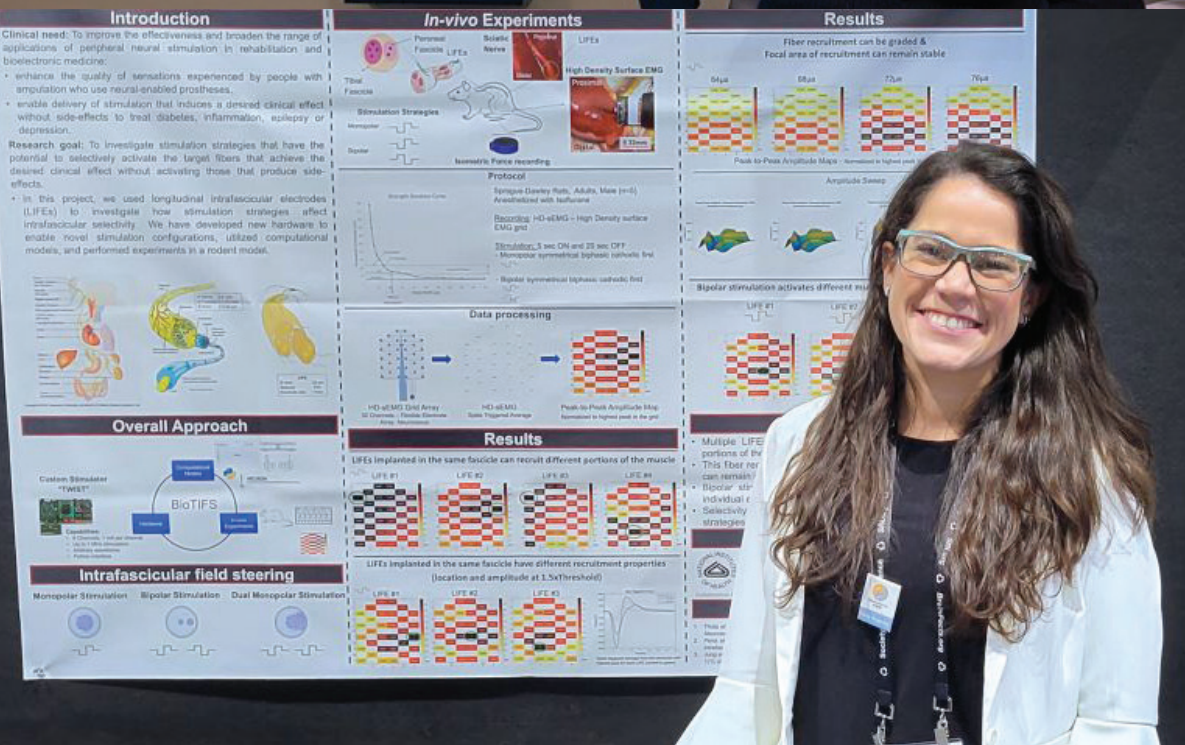
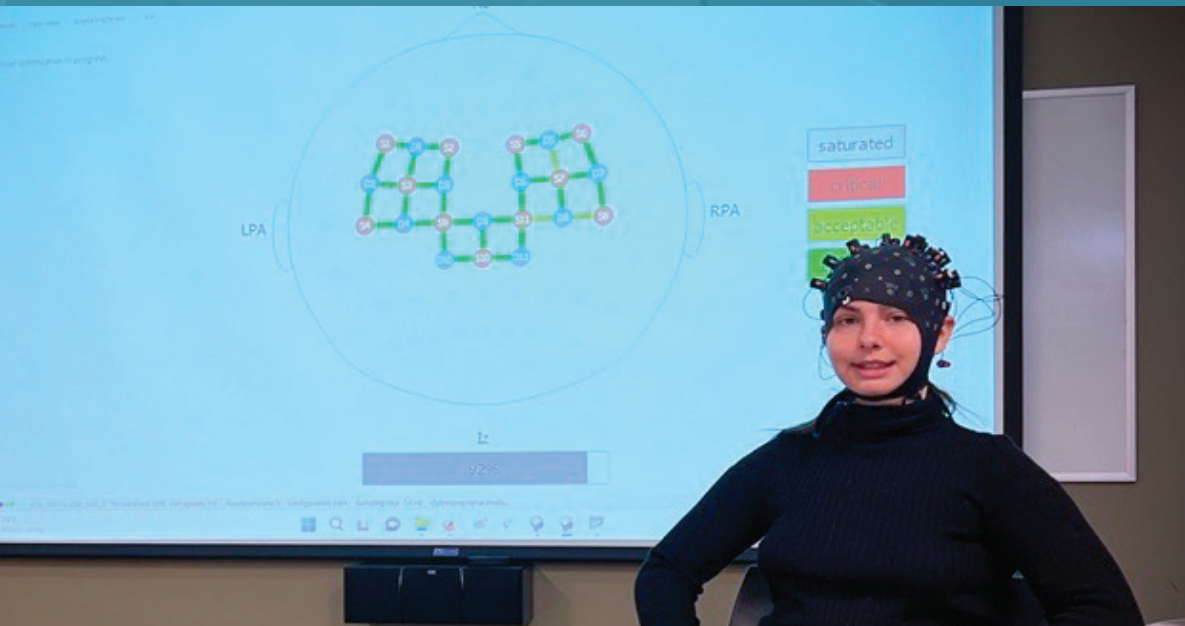
Making an Impact

To maximize its positive impact, I³R is following the model set forth by the Carnegie Foundation for the Advancement of Education Elective Classification for Community Engagement.

The purpose of community engagement is the partnership of college and university knowledge and resources with the public and private sectors to enrich scholarship, research, and creative activity; enhance curriculum, teaching, and learning; prepare educated, engaged citizens; strengthen democratic values and civic responsibility; address critical societal issues; and contribute to the public good.

Our doctoral fellows, students, and staff exemplify this spirit of educating and empowering through a series of support talks in partnership with the Balance Amputee Wellness Communities. In addition, they have worked on a National Institutes of Health Collaborative Research in Computational Neuroscience project along with groups from Arizona State University, Washington University, Université de Bordeaux, and Université de Cergy-Pontoise in France.





Leveraging Location for a Growing Wheel of Impact

Building a Sense of Belonging

Understanding needs of our community, and thoughtfully growing a wheel of impact that expands from the local to the global direct our actions.

Rockin' Baker

I³R Advanced Technology team members met with Rockin' Baker, an artisanal bakery that serves the neuro-diverse community and provides bread to local food banks, schools, and communities throughout NWA.

Based on a needs assessment, I³R determined that Rockin' Baker would benefit from a software solution to aid with order management. A prototype software solution was developed and is now undergoing field testing at the bakery.



BRAVO VICTOR

I³R hosted an executive team from BRAVO VICTOR, an international research organization working to fight blindness in military veterans

I³R's Adaptive Neural Systems Group and faculty of the U of A departments of Psychological Science; Rehabilitation, Human Resources and Communication Disorders; and Computer Science and Computer Engineering had several discussions.

Wide-ranging collaborative projects in neuroscience; mental health including stress and anxiety, sleep, arts engagement and well-being; artificial intelligence and virtual reality research show promise for the future.



Arkansas Children's Research Institute

I³R Advanced Technology team members have worked closely with HealthTech Arkansas to identify clinicians from Arkansas hospitals and health systems who could benefit from the engineering resources available at the Institute.

Two health care device projects from the Arkansas Children's Research Institute were identified for potential support by I³R staff. Work on one of the projects has commenced.





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