

2.1A University of Arizona Space Institute

The overall objective of the University of Arizona Space Institute (UASI) is to maintain the University's status as the leading university for space sciences in the world. UASI's activity focuses on enabling researchers to submit high-quality proposals for spacecraft missions and space instrumentation. For FY21, UASI has given financial or personnel support to, or committed to support, 17 projects.

The first success is NASA's selection of the PIONEER mission Aspera (Carlos Vargas, Principal Investigator), a \$20M Astrophysics mission. One other proposal has been declined, five are pending, and the rest are for proposals that are currently in preparation, in some cases for expected due dates more than a year in the future, or discussions about projects with the private sector. The projects reflect a diversity in personnel and approaches that will be necessary for UArizona to succeed in the future. In FY21, UASI has supported 14 different PIs (including four females and two Hispanics) from three different departments, proposing to three different divisions of NASA, as well as three non-NASA projects.

UASI remains on target to reach its objectives.

2.1D Defending Our Planet

The activities in initiative 2.1D, Defending Our Planet, have focused on two efforts. One is to build and operate a space-based infrared telescope to find dangerous asteroids. The other is to defend Earth's ecosystem from climate change by providing high-resolution monitoring of the emission of greenhouse gases such as methane.

Development of the telescope, NEO (Near-Earth Object) Surveyor, continues to progress, with formal approval of the mission possible as early as May 2021. The primary challenges in FY21 have been in defining the management structure of a mission that is different in intent from either NASA's normal competed scientific mission or NASA's normal directed missions, and in securing funding.

The work on greenhouse emission monitoring has involved proof of concept studies, airborne work in conjunction with several institutes and state governments, and the development of a public-private partnership for a space-based system, a partnership that has raised nearly \$100M in philanthropic donations this year.

2.2A Arizona Institutes for Resilience (AIR)

The Arizona Institutes for Resilience (AIR) integrates research, education, and solutions applications at the University of Arizona with a focus on building resilience to address climate and environmental crises and change, particularly in arid regions. AIR is a convener across campus and community; a promoter of cross-disciplinary activities, partnerships, innovation, and education; a source of new financial opportunities; an inspiration for greater student enrollment; and a mechanism for addressing the environmental threats faced by communities everywhere.

Still in the early stages of its first funding year by the Office of Strategic Initiatives, new programs have been launched to strengthen student engagement opportunities and university partnerships with local to international communities. Some examples include:

- Bridging Biodiversity and Conservation Science (BBCS) is researching biodiversity science as it intersects ecology, public health and environmental security, food security, and national security to help inform policy makers on the impacts of conservation and biodiversity actions on societal well-being.
- The Applied Regional Hydroclimate Modeling Center will use observations and modeling to provide hydroclimate information at regional and local scales to inform decision making.
- The RESTRUCT Built Environment Research program is developing a university-wide ecosystem to support research, teaching, and service aimed at the future of the built environment.
- The Earth Grants paid internship program will pair students with mentors at community and campus organizations to gain real-world experience while testing out potential careers and contributing meaningful work to the organizations.
- The Environmental Education program aims to connect education, training, and undergraduate research experiences for learning across disciplines to elevate the university's excellence in Earth and environmental science and in applied resilience solutions, provide unique and valuable learning experiences for students, and contribute to the quality of life for all Arizonans.

Through innovative programs and community partnerships, AIR aims to elevate Arizona to be the top choice for students and faculty who are committed to managing climate and environmental risks and building equitable and effective solutions in collaboration with those most affected by these risks.

2.5A1 Data Sciences Academy (DSA)

The Data Sciences Academy (DSA) was created in 2020 as an umbrella organization to coordinate and facilitate activities across campus and in the community. Given the ubiquity in the data driven endeavors at the University of Arizona, the DSA has the opportunity to extend the reach of existing projects and, by creating new communities, to foster new educational, research, and service opportunities. As this understanding of the centrality of the data sciences expands to reach our schools and the children in these schools, then the Academy should serve a critical role in attracting students, providing them new opportunities and helping them navigate the complex environment of University life in their choices for data science education and career ambitions.

With a budget reduced by the economic consequences of the pandemic, the Academy focused attention on design projects that establish the infrastructure to accommodate a much larger Academy footprint in future years.

For its focus on graduate student research, the Academy provided support to extend the activities of TRIPODS, Transdisciplinary Research in the Principles of Data Sciences, to keep in place the hard-earned gains in new collaborations begun under TRIPODS and to position the University to compete for funding as new opportunities arise in the foundations of data science. The major thrust in graduate student education was the design of a professional master's degree program. The program will satisfy the workforce needs of those now longer in school and those who need additional training while on campus to their own research and career ambitions.

The major undertaking in undergraduate education was to create a website with a roadmap so that current and potential students can weigh their options in the data sciences and make effective plans. Undergraduate research was devoted to a joint activity with the Undergraduate Biology Research Project to create a DSA/UBRP fellows' program with the aim to extend beyond the life sciences in future years.

Finally, the Academy has begun a K-14 initiative to bring to teachers and to their students tools, and the confidence to use those tools, so that data inspired activities becomes a routine part of a child's education.

UAHS 2.3 Comprehensive Pain and Addiction Center

Our vision is to create a center that embraces and thrives in preclinical and clinical research that addresses chronic pain and addiction while educating all health care providers and students across the state of Arizona. Goals include designing new legislation that helps prevent future addiction crisis while developing innovative technology that will predict those at risk of substance misuse and prevent opioid induced deaths. The Center includes a clinical component that provides state-of-the-art and affordable care to all Arizonans suffering from chronic pain and addiction, as well as trains and prepares future physicians to adequately manage both chronic pain and addiction.

Our mission is to help those who suffer from chronic pain and substance use disorder through clinical care, research, education and legislation. We strive to train the next generation of subspecialty health care providers and researchers as well as to reach out to the community with the latest outcomes of research and education.

Progress in FY21 includes: 1) Establishing a new Center, 2) Four new NIH R01 grants to study preclinical targets for pain and opioid use disorder, 3) An NIH grant for a clinical trial in metastatic cancer patients, and 4) Two new federal grants from HRSA – one that trains a paraprofessional workforce to help families with substance use disorder in Pima and Santa Cruz County and a second one that starts an Addiction Fellowship at UArizona/Banner. We received an additional third sub award from HRSA to help with Rural Communities Opioid Response-Implementation with programs like Medication Assisted Training (MAT).

Accomplishments also include 17 peer-reviewed publications from team members, submission of one pre-patent, acceptance of an Investigational New Drug use for the clinical trial mentioned above, implementation of a AzDHS required curriculum certificate for the medical school on pain and addiction, and acceptance of the UArizona/Banner neonatal abstinence program for use in Banner –UMC Phoenix with hopes to extend to all Banner hospitals.

UAHS 3.1 Precision Aging Network Pilot Study

Cognitive healthspan does not currently match human lifespan. The strategic vision of the Precision Aging Network (PAN) is to develop the essential scientific knowledge to explain the contrast between cognitive healthspan and human lifespan. Specifically, we must understand the neural mechanisms that 1) account for optimal brain performance in old age resulting in healthy cognitive function, and 2) those that underlie decline in brain function leading to cognitive impairment, Alzheimer's disease, or Alzheimer's disease-related dementias. The ultimate goal of the PAN is to develop not only a strong scientific foundation for the essential knowledge needed to match cognitive healthspan with human lifespan, but also leverage big data approaches to apply precision medicine concepts to prolong optimal brain function. The PAN directly addresses the goal to position the University of Arizona as the global leader in Precision Aging.

The overall goal of Strategic Initiative UAHS 3.1 is to obtain key preliminary data required for the successful resubmission to the NIA PAR-19-374: Complex Integrated Multi-Component Projects in Aging Research (U19 Clinical Trial Optional), entitled Precision Aging Network: Closing the Gap Between Cognitive Healthspan and Human Lifespan. The investment in building the infrastructure necessary to conduct proof of concept pilot experiments has allowed us to be in a strong position to be competitive for the \$60M grant that, if funded, will support the full PAN effort for five years.

The infrastructure necessary for the Precision Aging Network includes the ability to recruit, collect, analyze, and synthesize data from the world's largest, nationally representative cross-sectional cohort of individuals age 18 years and above, and to study a subset of these individuals (50 years and older) in some depth in order to create unique profiles of each person that can eventually lead to specific predictions for customizable therapeutic interventions.

This project will 1) expand the size and diversity of the existing MindCrowd cohort by recruiting new individuals to take the MindCrowd web-based survey, 2) will leverage UA's CyVerse platform and Data Science Institute for data harmonization and analysis, 3) will develop a new set of grass roots recruiting efforts, 4) will develop methods and metrics for evaluating recruitment approaches, and 5) will recruit individuals for in-depth follow-up in Tucson, Arizona.

Despite specific milestone delays due to COVID-19 restrictions in early FY 2021, project planning activities moved forward, and we were successful in resubmitting the grant proposal in September 2020.

UAHS 4.1 Personalized Defense

The Personalized Defense initiative will elucidate how the immune system and microbes interact in infection, inflammation, health and disease. This will enable new diagnostics, prevention and therapeutics to combat major health challenges of today. Specifically, it will define how microbiome, environment, nutrition, persistent infection, inflammation and immunity impact each other, and how they influence chronic diseases (cancer, heart, brain, metabolic) and health disparities.

COVID-19 brought about fiscal woes with drastic budget cuts, as well as a difficult hiring situation with reduced social and personal mobility. Nonetheless, we have achieved quite a lot. One of the biggest achievements was the massive pivot of much of the initiative towards SARS-CoV-2 research on many fronts, including establishment of outstanding detection, testing and research platforms. The initiative plans to leverage and harness much of that creative energy to create machine learning and text reading/ natural language understanding and in silico hypothesis validation and discovery pipelines that can subsequently be used for all host: microbe-related research.

This initiative will work to establish collaboration channels between different university departments, institutes and centers by creating an Immune-Microbe Interface in Health & Disease (IMIHD) Interest Group with the support of a focused hire of a senior faculty member. The initiative will also incentivize existing faculty by providing resources to hire postdocs that will expediently jump-start collaborations. Paired with bioinformatics and infrastructure support for high-resolution immunome and microbiome mapping, this initiative will position UArizona as a revolutionary real-time point of care leader for inflammatory and chronic diseases.

UAHS 5.1 Advanced Technologies in Healthcare

We aim to connect researchers across disciplines within health sciences and beyond, to develop an array of technologies and digital solutions to improve health and wellbeing.

Supported by UAHS funding, the Faculty Commons + Advisory is an innovative gathering place for faculty across the university to meet, collaborate and get advice. During the pandemic, it has transformed into a virtual collaboration incubator and digital resource to continue its mission during the worldwide COVID-19 pandemic. We advance FC+A programming to provide faculty and researchers with easy access to research experts, lectures, and workshops, as well as campus-wide resources designed to serve them, including: HIPAA Privacy Program, Data Science Fellows Program, Research Laboratory and Safety Services, Conflict of Interest Program, Center for Biomedical Informatics and Biostatistics, Arizona FORGE, and many more. The resource is operating without walls now, but when campus reopens, the FC+A will continue to draw upon its physical design to achieve collaboration and inspiration.

Also supported by UAHS funding, the Health Sciences Design (HSD) Program was envisaged to develop facilities and curricula that engage undergraduate, graduate, and professional students in all majors in the design of solutions for health care challenges. Although SIF funding was suspended before HSD could be fully equipped, three distinct courses were nevertheless launched during COVID, with core HSD faculty engaging 36 students from four colleges. Each course has successfully helped develop critical skills and competencies in health sciences design thinking content, and related activities have established both community partners and a campus makerspace network. Despite COVID, exclusively online courses, and an incomplete makerspace, the past year has delivered a successful proof of concept. Program sustainability now depends on future investment, with clear resource requirements in equipment, supplies, and broader course adoption across UA degree programs.

The Sensors Lab, funded by the Strategic Plan, allows students, faculty, industry and community members to come together to use and develop novel hardware and software to detect, monitor, analyze and provide feedback to human physiology and behavior. The goal is to develop an engaging and productive environment including equipment and a knowledgeable staff member to encourage creativity and innovation. While the physical space is one year delayed, a laboratory coordinator has been hired and commenced purchasing equipment, engaging with internal and external constituents, and the Lab has already been written into proposals. There is tremendous enthusiasm around this capability and an eagerness to both check out sensors when they arrive, and reserve the space when renovations are completed.