



RIIFFC

RII FACULTY FORESIGHT COUNCIL
2022 ANNUAL REPORT
RESEARCH, INNOVATION & IMPACT
THE UNIVERSITY OF ARIZONA



38



CONTENTS

- 01 What is RIIFFC?
- 02 Senior Advisors
- 03 Members
- 05 Cores & Facilities
- 07 Global Research Engagements
- 08 Centers, Institutes & Grand Challenges
- 11 Growing Research
- 12 Accomplishments & Action Items
- 15 The D.C. Conference
- 20 SWOT
- 22 What's Next?



WHAT IS RIIFFC?

A MESSAGE FROM DR. CANTWELL

As one of the nation's top-tier research institutions, our ability to enthusiastically embrace new ways of thinking is critical to our continued success. That is why, in my role as senior vice president of research and innovation at the University of Arizona, I believe strongly in the practice of futurecasting: that is, strategically planning our future based on impacts we foresee—from a rapidly changing funding landscape to increasingly stringent federal regulations.

Prior to the onset of the pandemic three years ago, research expenditures at UArizona were on an upswing fueled by investments made three to five years earlier. Since then, however, universities across the country have seen a leveling off of investments and a dearth of support mechanisms for infrastructure such as core facilities.



Perhaps more than anyone, our faculty understand the complex interplay of issues we face as we work to maintain a robust research enterprise at the cutting-edge of innovation. So, as we map out our future direction, defined largely by President Robbins' Strategic Plan, faculty insights and engagement are key. To augment the role of faculty in our futurecasting, we established the RII Faculty Foresight Council (RIIFFC) in late 2021.

Through thoughtful counsel, RIIFFC members are helping UArizona build capacity, ensuring that our research programs are sound well into the future. During its inaugural year, the council has advised me on four separate matters pertaining to the future of UArizona research. This report will allow stakeholders to see the results of those discussions, making evident the importance of the RIIFFC at the University of Arizona.

Elyse R. Cantwell

SENIOR ADVISORS

**Joaquin Ruiz, Vice President of Global Environmental Futures
Research, Innovation & Impact**

Dr. Joaquin Ruiz serves as dean emeritus of the College of Science, director of the Biosphere 2, executive director of the Alfie Norville Gem & Mineral Museum, and professor for the BIO5 Institute and in the College of Science's Department of Geosciences. As a scientist with equal abilities in chemistry and geology, Dr. Joaquin Ruiz's research addresses problems ranging from the origins of life to present-day climate change.

**James Buizer, Professor
School of Natural Resources and the Environment, College of Agriculture and Life Sciences**

Dr. James Buizer founded and serves as interim director of the Arizona Institute for Resilient Environments and Societies at the University of Arizona. He is a professor of climate adaptation and international development in the School of Natural Resources and the Environment, a research scientist in the Arid Lands, Water, and People Program, and a faculty affiliate to the Graduate Interdisciplinary Program in Global Change. Dr. Buizer's research focuses on connecting decision-makers to scientific findings on climate variability and change.

**Marvin Slepian, Regents Professor
Department of Biomedical Engineering, College of Engineering**

Dr. Marvin Slepian is a regents professor of medicine and biomedical engineering at the University of Arizona. Dr. Slepian is the founder and director of the Arizona Center for Accelerated Biomedical Innovation (ACABI), a research hub focused on novel solution development for unmet medical needs. In parallel with his clinical career, Dr. Slepian's research has focused on the development and use of novel biomaterials for tissue engineering, drug delivery, and medical device development.

**Cherry Murray, Professor
Department of Physics, College of Science**

Dr. Cherry Murray is a professor of physics in the College of Science at the University of Arizona. She also serves as deputy director for research at the Biosphere 2. Her research interests have varied from experimental condensed matter and surface physics to nanotechnology, telecommunications networks, and national security.

MEMBERS

Gayatri Vedantam

Professor

Department of Immunobiology
College of Medicine – Tucson

Michael Crimmins

Professor and Extension Specialist
Department of Environmental Science
College of Agriculture and Life Sciences

Roberto Furfaro

Professor

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College of Engineering

Jil Tardiff

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College of Engineering

Karen Hastings

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College of Medicine – Phoenix

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College of Law

Marlys H. Witte

Professor

Department of Surgery
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CORES & FACILITIES

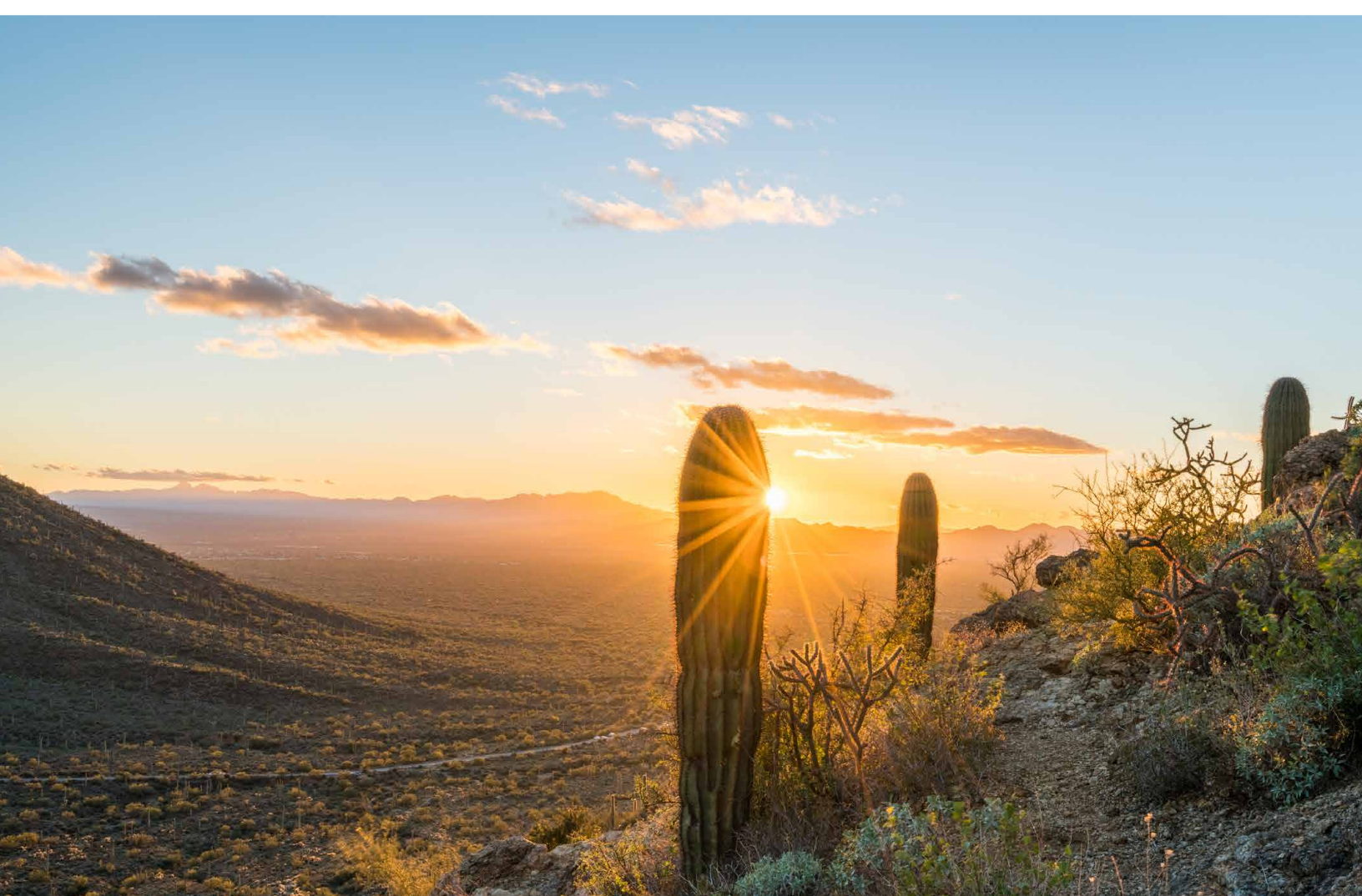
Building and maintaining preeminent research programs requires significant investment in infrastructure, equipment, and people. To decide how best to allocate funds to achieve our research goals, the RIIFFC's first meeting was dedicated to a discussion of the cores, facilities, and equipment needed to grow existing capacity, establish new research areas, and attract the faculty required to guide such programs to prominence.

One important take-away from the discussion was that growing capacity in one area—cores, facilities, equipment, or people—requires simultaneously growing capacity in each of the other areas. UArizona cannot attract top-tier faculty without state-of-the-art equipment housed in world-class facilities supported by robust infrastructure. Therefore, it was determined that a faculty survey, equipment audit, and needs assessment should be conducted.

KEY DISCUSSION POINTS

- Salaries must be more competitive because success depends on people
- Technicians are critical, but cores should be led by savvy scientists who can envision, design, and build new processes and instrumentation that can be translated into IP and leveraged into teaching opportunities
- Communication about and coordination of available services is essential to reducing siloed knowledge and access
- Processes should be in place to evaluate and sunset cores that are no longer needed
- Focus investment on growing fields and grand challenges
- Students should be provided more experiential learning opportunities to enhance the educational environment and workforce development

Cutting-edge
research relies on
access to state-of-
the-art facilities and
equipment—all led by
expert-level scientists
and technicians.





GLOBAL RESEARCH ENGAGEMENTS

As an R-1 institution, University of Arizona is one of the top 20 in research expenditures among U.S. public universities with research relationships that reach across the country and around the world. We are No. 1 in astronomy and astrophysics, No. 2 in water resources, and No. 5 in NASA-funded activity. In other words, we are a research powerhouse. We know this, but the question is, how do we brand UArizona so that the rest of the world knows it too?

To frame the issue, RIIFFC members considered the attributes that make UArizona unique. One thing of note is that Arizona shares a 373-mile border with Mexico and has long-standing ties to governments, universities, and institutions in Central and South America. Another unique attribute is that Tucson is home to both a large Air Force base and a major defense contractor, Raytheon. And because we are situated in the one-of-a-kind Sonoran Desert, we have, by necessity, become experts in issues surrounding arid lands, water use, climate change, and sustainability.

KEY DISCUSSION POINTS

- Identify the right international partners based on context, i.e., which countries/institutions excel in a desired area
- Make more concerted efforts to reach out and create global partnerships in focused areas of interest
- Value and emphasize intercultural awareness regarding methodology and approaches to research
- Leverage assets to become the place to go for research-based solutions
- Use Tech Launch, Tech Parks, and other innovation organizations to position the University and Southern Arizona as the next Silicon Valley
- Emphasize the generation of new IP and incentivize scaling up existing technologies and start-ups for global collaboration and impact
- Offer more collaborative grants and nurture research partnerships with the goal of pursuing large awards
- Build network of local partners for sustainability of global engagement
- Increase focus on student research programs that encourage global connections

CENTERS, INSTITUTES & GRAND CHALLENGES

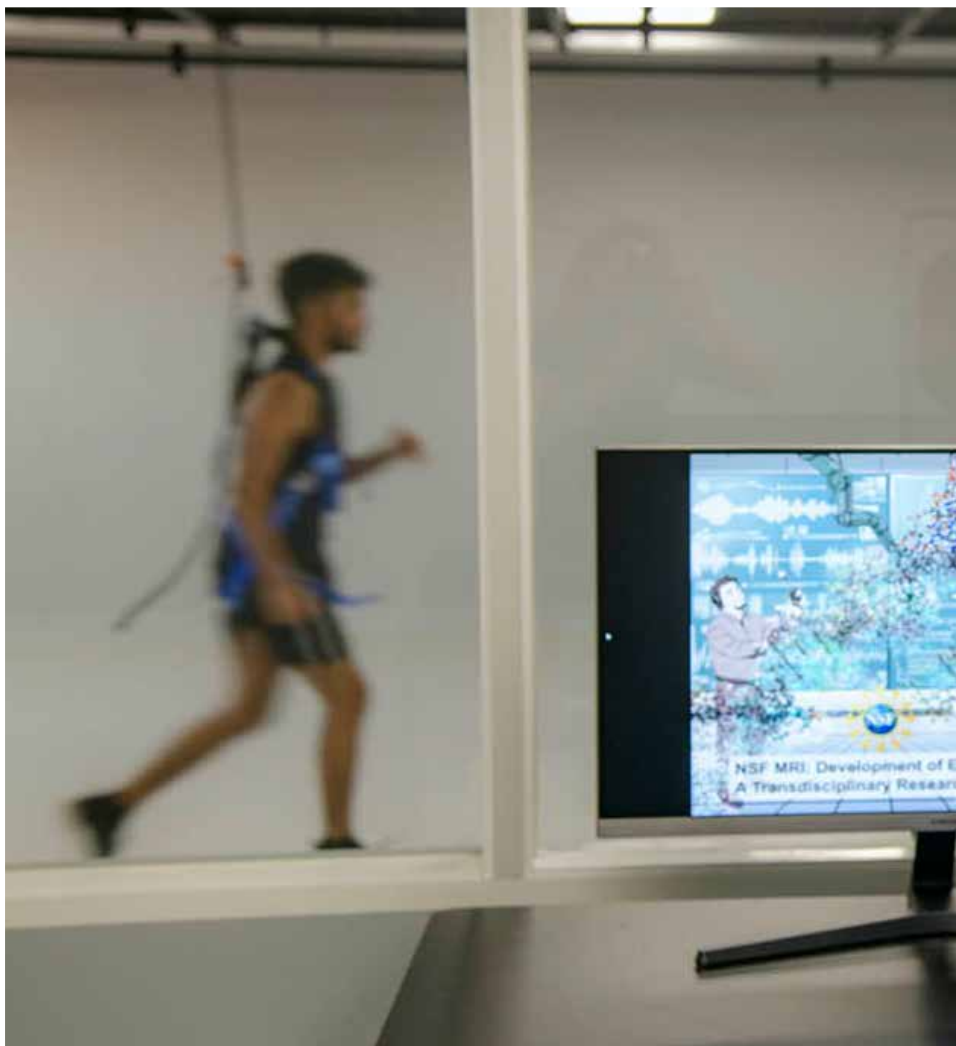
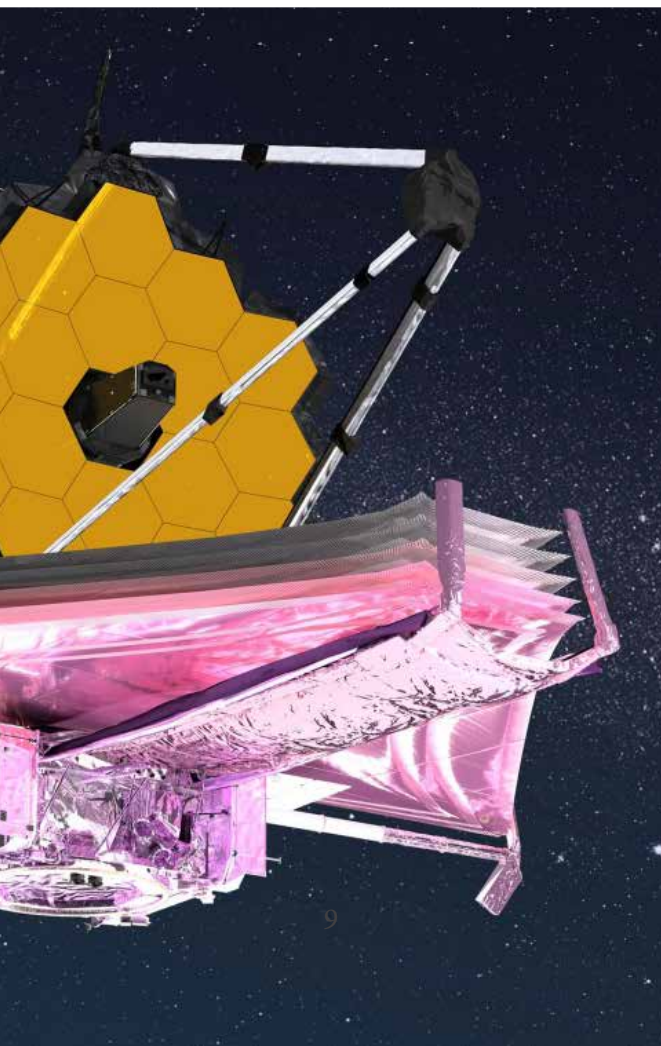
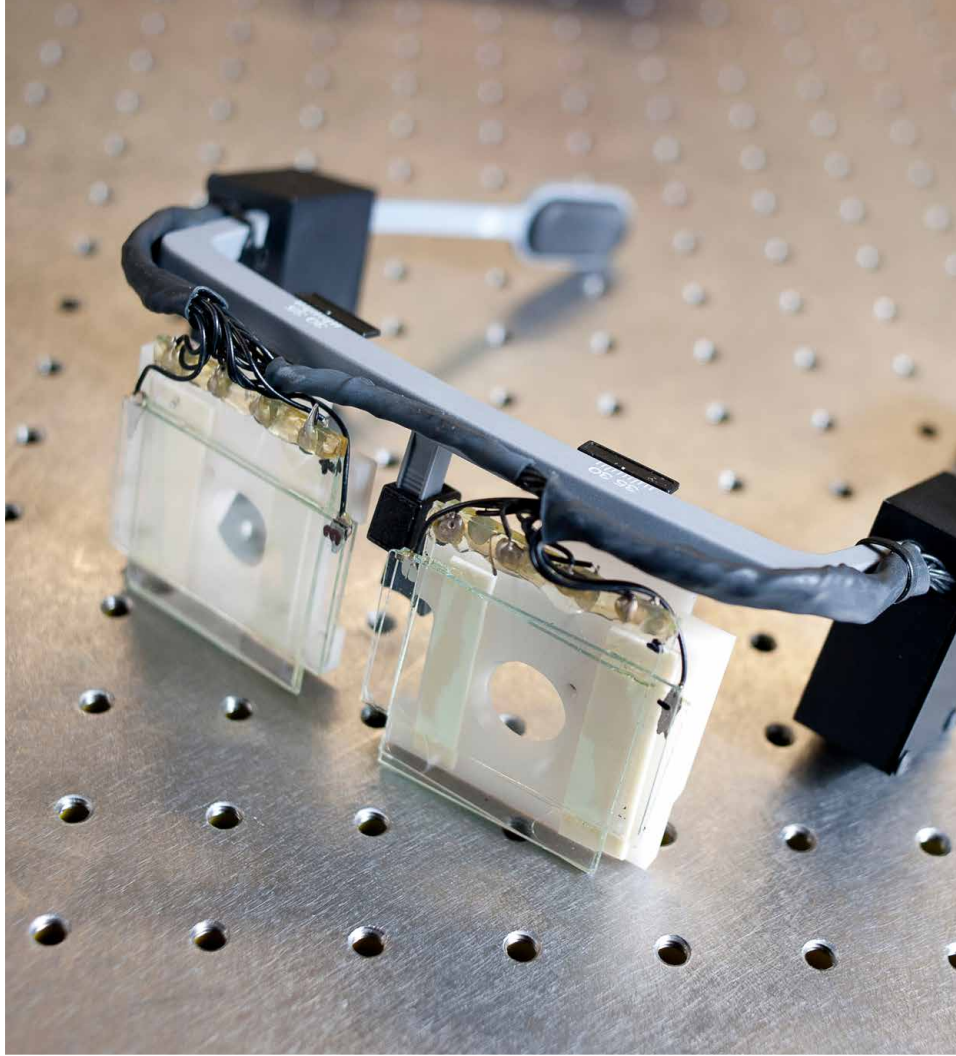
Grand challenges: Tackling critical problems at the edges of human endeavor. This is Pillar 2 of the University's Strategic Plan which reads: "Consistent with our dual mandate to expand educational opportunities and address important societal challenges, we are well positioned to fully leverage the 4IR advancements in our existing strengths in research. The strategic plan tackles pressing grand challenges in the areas of space, human and intelligent systems, natural and built environments, health care technology, and disease prevention and treatment in ways that will fundamentally shape the future."

Beyond our academic programs, to successfully address these grand challenges, the University must have in place the necessary centers, institutes, and partnerships as well as the mechanisms for creating and funding new entities. RIIFFC members considered the University's internal processes for ensuring the necessary institutional units are identified and that the steps required to bring them to fruition are in place.

KEY DISCUSSION POINTS

- Defining the goals, objectives, and metrics of a successful center or institute is essential
- To better meet stated goals, objectives, and metrics, a center or institute should not seek to become a college
- Adaptability and flexibility are essential attributes of effective centers and institutes—attributes often out of reach of colleges
- Faculty potentially affected by the establishment (or sunseting) of centers and institutes should always be consulted and included in decision-making
- Better promote the multidisciplinary activity, innovation, translational strategies, ideas, and collaborations centers and institutes are able to generate
- Encourage junior faculty to get involved as potential gateways for enhancing their research, collaborating with senior faculty, and as a tool for retention
- Emphasize centers and institutes as collaborative "safe spaces"
- Recognize that funding is tightly correlated with centers and institutes and that fiduciary responsibility is linked to that funding







ACID

FLAMMABLE
KEEP FIRE AWAY



GROWING RESEARCH

In 2021, we spent \$791 million on research, making UArizona the 19th-biggest spender among public institutions, according to the National Science Foundation's Higher Education Research and Development Survey. Despite our success, we continue to dream big and strive for more. Because big dreams require big support, the University has set a goal of \$1 billion in research and development spending by 2028.

Planning to meet the institutional ramifications of scaling up to such large expenditures, RIIFFC members were asked to consider the support needs of such a large and robust research enterprise. Questions such as what additional oversight programs or new research development services will be needed and how facilities planning and faculty hiring should be approached were considered.

KEY DISCUSSION POINTS

- Proper infrastructure needs to be in place, i.e., researchers, administration, facilities, equipment
- Enable more research match-making, especially in terms of multidisciplinary collaborations and international partnerships
- Provide more oversight for partnerships, especially internationally
- Increase institutional support for graduate students and their research
- Recognize that post-award support can make us more competitive, lead to more partnerships, and enhance the effectiveness of faculty recruitment efforts
- Enhance funding for cluster hires
- Hire more program managers to reduce the administrative load of PIs and researchers
- Invest in better marketing and communications techniques, including updated faculty profiles, program descriptions, websites, and elevator pitches for potential sponsors
- Develop better networking strategies and opportunities for researchers at all levels

ACCOMPLISHMENTS & ACTION ITEMS

Based on the University's Grand Challenges as outlined in its Strategic Pillars as well as observations and feedback provided by council members, we have taken or are taking the following actions.



CORES & FACILITIES

- Augmenting oversight and planning positions such that the needs of cores are a part of every strategic facilities conversation on campus
- Established the Institute for the Future of Data and Computing, in part, to begin the planning process for research data facilities and cores
- Considering the core facility needs for the Phoenix Biomedical Campus
- Developing new revenue streams for funding cores, to include philanthropy and other non-federal sources



GLOBAL RESEARCH ENGAGEMENTS

- Established the Office of Resilience and International Development to create opportunities for faculty to be in direct conversation with policymakers and practitioners in the field as well as develop strategic collaborative partnerships in the development space
- Developed relationships to work with foreign research institutions such as the Moroccan Foundation for Advanced Science, Innovation & Research and the French Centre National de la Recherche Scientifique



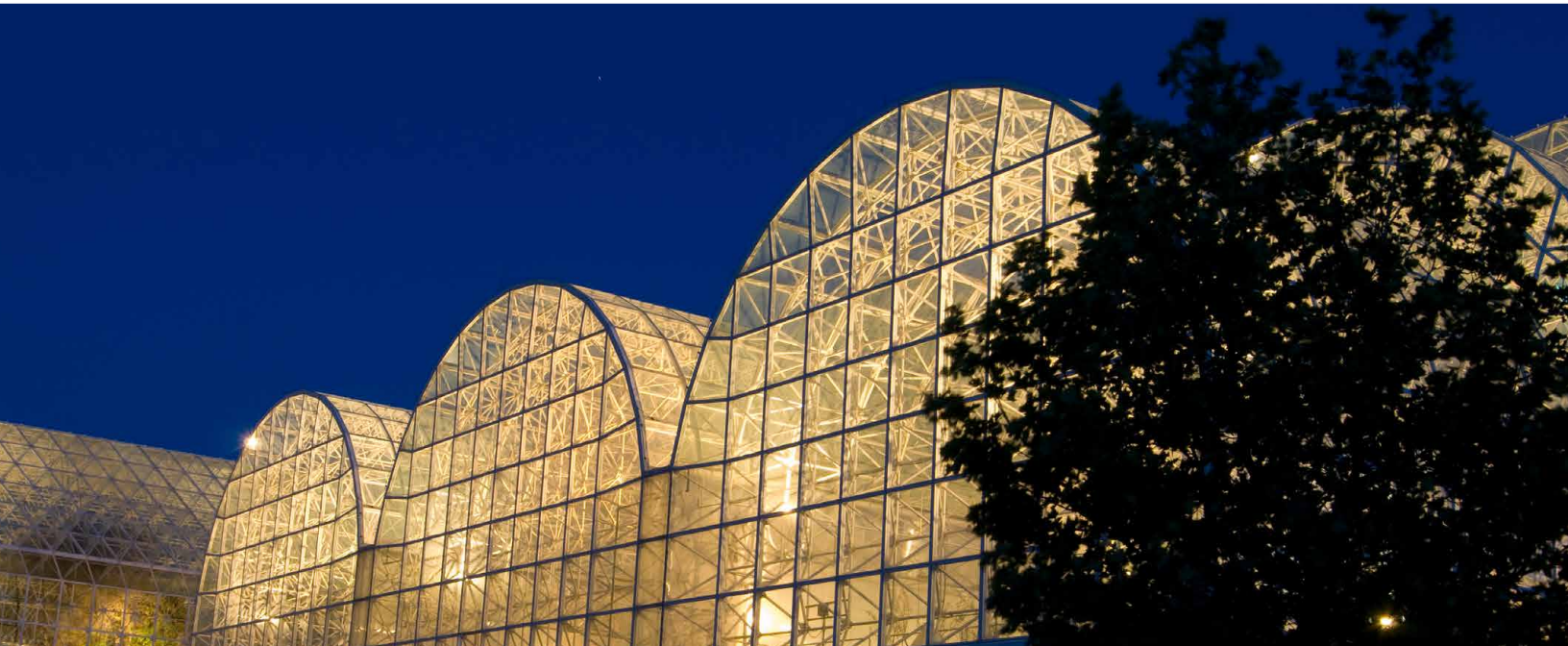
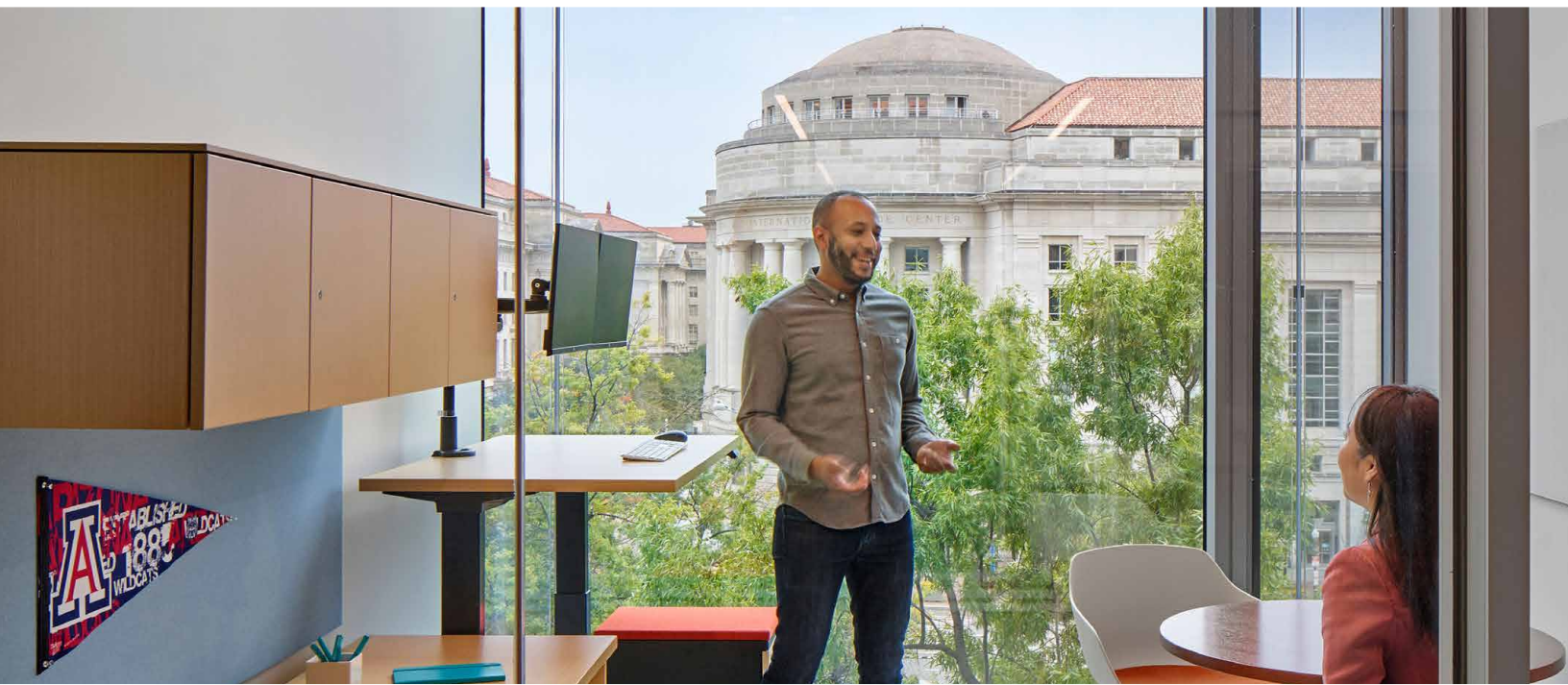
CENTERS, INSTITUTES & GRAND CHALLENGES

- Sending proposals for new centers to associate deans for research to solicit feedback, promote awareness, and encourage potential collaborations
- Streamlining center reviews and performance metrics



GROWING RESEARCH

- Expanding Sponsored Projects' proposal support team
- Related the Research Development Fund to returned Facilities and Administrative charges to leverage funds for research growth





THE D.C. CONFERENCE

The RII Faculty Foresight Council's inaugural year culminated in a two-day conference at the University's D.C. Center for Outreach & Collaboration, where members heard from a range of experts in university research and strategized for the coming year. This section includes summaries of the presentations given and a S.W.O.T. analysis performed by the council.

PRESENTATIONS

FY22 Federal Funding from the Association of Public and Land-Grant Universities (APLU) **Debbie Alternberg | Associate Vice President for Research Policy and Government Affairs**

During the annual federal budgetary process, the APLU advocates on behalf of public research universities. Once the president's budget is sent to Congress for appropriations, the APLU analyzes its key priorities and policy changes. Below are selected takeaways from the APLU's FY22 budget analysis.

- Biden's FY22 budget for the Department of Health and Human Services represented a \$25 billion (23.5 percent) increase from FY2021 and a \$1.7 billion (20 percent) increase for NSF
- Priorities include climate change and climate resilience, expanding the diversity of the STEM workforce and addressing inequality, use-inspired applied research, minority health and health disparities across populations, Alzheimer's disease, opioid misuse, and artificial intelligence

Lewis-Burke Associates: Federal Government Overview **Reed Skaggs, Emily Durham, Miriam Quintal, and Libby O'Hare | Associates**

Lewis-Burke Associates advocates for policy and funding interests of universities, research, and other educational organizations. They have been instrumental in successful funding efforts around our programs in data science, quantum, and hypersonics, among others. Potential funding areas articulated under Biden's proposed FY2023 budget include:

- Broadening participation with a focus on a more just, inclusive, and sustainable society
- Closing the learning gap and rebuilding arts communities impacted by COVID-19
- Entrepreneurial Science, a new DARPA-like funding mechanism
- Modeling impacts of climate change as it relates to potential military conflict
- Cleaning up toxic DoD sites
- Renewable energy generation and energy storage
- Lunar and planetary sciences, including climate studies, probes, and new technologies for exploration

Lewis-Burke Associates: Agriculture and the Future of Research
Bridget Krieger | Associate

President Biden's 2023 budget request of \$1.859 billion for the USDA marks an 11.4 percent increase over 2022. As Arizona's land grant university, agriculture is critical to our overall mission. Because dollars allocated for agriculture-related science are largely flat, increasing funding depends on leveraging our approach to multi- and interdisciplinary research. Such research areas include:

- Farm of the Future and AgARDA (Agriculture Advanced Research and Development Authority)
- Food as Medicine
- Climate impacts, sustainable agriculture, education, and workforce development
- Next generation technologies, AI, machine learning, predictive science
- Genomics and CRISPR
- Zoonotic disease research
- Food supply chain impacts from COVID-19 and military conflicts such as the Russia/Ukraine war

Research Security from the National Science Foundation (NSF)
Rebecca Keiser | Chief of Research Security Strategy and Policy

Since late 2018, federal agencies have made multiple policy shifts intended to reduce undue foreign influence in research, including the following from the NSF:

- Research security is defined as “safeguarding the research enterprise against behaviors aimed at misappropriating research and development to the detriment of national or economic security, related violations of research integrity, and foreign government interference”
- Research integrity is defined as “adherence to professional values and principles—including objectivity, honesty, transparency, fairness, accountability, and stewardship—in proposing, performing, evaluating, and reporting research and development activities”
- The Office of Inspector General is now involved with addressing risks
- Disclosure helps with risk evaluation, conflict avoidance, and qualifications assessment

NIST: Innovation & Industry**Mojdeh Bahar | Associate Director for Innovation and Industry Services**

Elucidating the National Institute of Standards and Technology (NIST) ecosystem was the focus of Mojdeh Bahar's presentation. NIST's comprehensive portfolio of programs span the research continuum, including policy development. Some of the ways in which the University can work with NIST include:

- Enhance STEM workforce development programs
- Collaborate with NIST scientists
- Problem-solve through use of equipment and facilities that would otherwise be cost prohibitive
- Access aid for startups to improve systems and processes, mitigate cyber and natural disaster threats through business continuity planning and developing growth strategies
- Target NIST's future focus areas: Engineering Biology, Internet of Things, Quantum Science, and Artificial Intelligence

Regional Innovation from the U.S. Economic Development Administration (EDA)**Eric Smith | Office of Innovation and Entrepreneurship Director**

Established by the America COMPETES Reauthorization Act of 2010 and housed within the EDA, the Office of Innovation and Entrepreneurship (OIE) aims to empower communities so that entrepreneurs can launch companies, scale technologies, and create the jobs of tomorrow. Key opportunities to engage with the OIE include:

- Establish and operate an OIE University Center program to enable programs that leverage university assets to foster regional economic development
- Target regional programs that support technology entrepreneurs, increase the availability of capital, and build STEM talent pipelines
- Focus on equity, recovery and resilience, workforce development, manufacturing, technology-based economic development, environmentally sustainable development, and exports and foreign direct investment

The Association of American Universities (AAU) Public Opinion Polling: Research, Science, & Higher Education

Ken Goldstein | Vice President for Survey Research and Institutional Policy

Founded in 1900, the Association of American Universities (AAU) is composed of America's leading research universities (ALRUs). In a presentation on public perceptions of university research, key data points included:

- 65 percent of Americans believe that leading research universities are headed in the right direction
- Only 1 in 5 Americans believe a degree from an ALRU is valuable and worth the cost, while 51 percent believe such a degree is valuable but not worth the cost
- While greater than 70 percent of Americans believe that ALRUs are “powerful,” “innovative,” and “make important scientific discoveries,” 77 percent also believe they are “too expensive,” and just 36 percent believe ALRUs are “careful with taxpayer money”

AAU: The Future of Research

Toby Smith | Vice President for Science Policy & Global Affairs

As vice president for science policy and global affairs at the Association of American Universities (AAU), Toby Smith oversees matters related to science and innovation policy and broader impacts, including at the international level. Key points of his presentation, which focused in large part on the new Technology, Innovation and Partnerships (TIP) initiative within NSF, included:

- TIP's focus is on technological breakthroughs and emerging technologies, job growth and the development of new education pathways, and global competitiveness
- NSF's existing innovation and translation portfolio is being moved into the TIP Directorate
- Research focus areas include artificial intelligence systems, biotechnology, cybersecurity, next-generation wireless networks, microelectronics and semiconductors, and quantum computing platforms



THE UNIVERSITY
OF ARIZONA
Global Campus



SWOT ANALYSIS

To conclude our conference in the state's capital, members of the RIIFFC gathered to perform a comprehensive analysis of UArizona's research strengths, weaknesses, opportunities, and threats. Below are the results of that exercise.



STRENGTHS

- Location in the arid Southwest
- Designation as Arizona's land-grant university
- Political desirability
- Proximity to local defense contractors including Raytheon
- Robust athletics programming
- Research strength in health, astronomy, climate, water security, and optical sciences
- College of Public Health's unique, cutting-edge One Health program, bridging faculty from ten colleges and almost two dozen departments
- College of Humanities' Center for Digital Humanities, a research and innovation incubator for the computational study of the human condition
- Tech Parks Arizona to attract and retain technology companies and talent
- Leadership of CyVerse, an NSF-funded platform enabling data-driven discovery by providing scientists with supercomputing capabilities



WEAKNESSES

- Branding for UArizona research, including a clear direction for our future
- Siloed research programming hindering us from thinking "big"
- Challenges in scaling projects
- Impact of the budget progression
- A dearth of support for early career faculty
- Too few investments in career support for staff
- Lack of integrated research infrastructure and planning



OPPORTUNITIES

- Expanding our expertise in resilience-related research, including but not limited to climate, health, economy, ecology, Indigenous resilience, and democracy
- Expansion of the One Health program to include a translational research arm
- Solutions for a low- or no-carbon future
- D.C. Center for Outreach & Collaboration
- Broader approaches to research on aging
- Growing research in robotics and industrial automation, quantum networks, climate, cybersecurity and mining
- Create stronger messaging consistent with the university brand identity



THREATS

- Dearth of government funding
- Competition with Arizona State University
- An inability to be agile and responsive
- Public perception of universities' value, as described by presenter Ken Goldstein of the AAU
- TRIF uncertainties
- Research security challenges
- Future presidential transition
- The future of the workforce
- Constraints on our physical capacity for expanding our research portfolio



WHAT'S NEXT?

We are continuing to leverage the RII Faculty Foresight Council to address new and emerging challenges in a constantly changing higher education landscape. Some topics to be addressed in the coming year include:



Preparing for **varied political futures**



Communicating our research narrative to external audiences



Preparing for impacts of **increasingly stringent compliance policies**



Forecasting **emerging research** areas



Understanding effects of the **hybrid work environment** on research



Exploring **research revenue** opportunities

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