



The BIO5 Institute at the University of Arizona brings together hundreds of scientists from across five disciplines - agriculture, engineering, medicine, pharmacy, and basic science - to find creative solutions to humanity's most pressing health and environmental challenges. This interdisciplinary approach is an international model of how to conduct collaborative research, and has resulted in disease prevention strategies, promising new therapies, innovative diagnostics and devices, and improved food sustainability.

BIO5 was launched in 2001 with financial support generated by the Technology and Research Initiative Fund (TRIF), a special investment to expand statewide efforts in bioscience, biomedicine, and biotechnology made possible by Arizona voters with the passage of Proposition 301. Twenty years later, BIO5 continues to catalyze results-driven bioscience research and innovation with projects that are carefully chosen to improve the health and resiliency of Arizonans and those around the world. Additionally, BIO5 supplements classroom learning and advances workforce-readiness by offering interactive STEM training opportunities, internship programs, and student employment.

Crushing Cancer



Cancer directly affects almost every person in the U.S., so BIO5 researchers are advancing better prevention, diagnostic, and treatment approaches. **Clara Curiel-Lewandrowski** and **Dongkyun Kang's novel imaging device** better enables doctors to quickly and safely diagnose many skin cancers and monitor responses to treatment without a biopsy. **Rachna Shroff** uses genomic profiling of tumors to **tackle hard-to-treat gastrointestinal cancers**. **Donato Romagnolo, Ornella Selmin, Cynthia Thomson, and Janet Funk** are identifying how different foods and supplements may **prevent breast cancer or lessen disease aggressiveness**.

Enhancing Overall Health As We Age



Understanding the biological mechanisms behind normal versus disease-laden aging is essential to achieving a lifetime of good health. **Janko Nikolich-Žugich** studies how to **rejuvenate the immune system** to defend against infection and inflammation, promoting long-lasting immunity from disease. **Carol Barnes, Roberta Diaz Brinton, Meredith Hay, and Lee Ryan** lead the **Precision Aging Network**, collaborating to develop more effective and individualized treatments and individually-targeted interventions to transform the way we think about the aging brain. **George Sutphin** is **testing drug combinations** that will extend healthy lifespan.

The Future of Farming



BIO5 researchers are developing novel solutions that enable the production of more food with less use of resources. Using the framework of sustainable agriculture, **Joel Cuello** is looking up for answers in the form of **vertical farming**. **Rebecca Mosher, Judith Brown, and Nirav Merchant** are **creating digital tools to capture data that show how plants interact with their environments** and will inform new techniques for breeding crops to meet the challenges of a changing global climate.

Giving COVID-19 A Run For Its Money



Over the past 20 years, \$135M has been invested in building specialized UArizona facilities and critical expertise that researchers were able to leverage in a **robust response** to the complex fight against COVID-19. Additionally, in April 2020, thirteen interdisciplinary BIO5 teams were awarded a collective \$500K in **rapid seed grants** to quick-start projects studying transmission, treatment, and prevention strategies.

Innovations To Improve Health



BIO5 members embrace an entrepreneurial culture where scientific discovery leads to innovation. This translates into technology and companies focused on impacting human health and well-being. **Steve Goldman**, co-founder of **Avery Therapeutics, Inc.**, is addressing heart failure with the invention of the **MyCardia™ engineered beating heart technology**. **Klearchos Papas**, co-founder of **Procyon Technologies**, is developing oxygen enabled encapsulated cell therapy technology with a focus on providing a **functional cure for people with type 1 diabetes** without the need for drugs that suppress the immune system.

Advancing Technology- Enabled Health



Phillip Gutruf is engineering **personalized 3D-print wireless wearables that never need a charge** which could mean massive improvements in the monitoring and treatment of diseases, the testing of new drugs, and the ability to track personal health. **Janet Roveda** is developing devices that will allow clinicians to **gather patient data remotely** and provide “care in place” so patients don’t need to leave their homes. **Judith Su’s** technology **detects ultra-low levels of disease particles**, performance-enhancing drugs, contaminants, and “anything worth sensing.”

Helping The Helpers



Firefighters and those in the military dedicate their lives to protecting and serving our community, state, and nation, and BIO5 researchers are working to help those who help us. Since cancer is a leading cause of death among firefighters because of daily exposure to carcinogens, **Jeff Burgess, Shane Snyder, and Julia Fisher** are working to **reduce cancer exposure rates** among **first responders**. **John Szivek** is studying how to use a combination of 3D printing and adult stem cells to **heal devastating bone injuries** that affect military personnel.



Next-Gen STEM Engagement



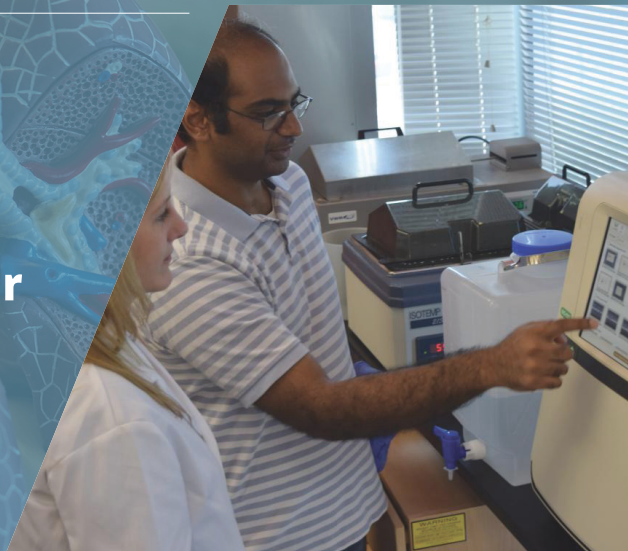
BIO5 leads annual training and outreach programs to promote experiential learning and STEM proficiency, contributing to Arizona's economy through workforce development. We impact students through programs like the **KEYS Research Internship**, **BIO5 Ambassadors**, and the **Postdoctoral Fellowship**, and engage the community in public offerings like **Science City** – Arizona's largest STEM event, **Precision Wellness**, **Ignites Science**, and **Women in STEM** series, and our **Science Talks podcast**/video series.

Strengthening Women's Reproductive Health



BIO5 researchers are passionate about addressing unique challenges that affect women. **Jennifer Barton** has invented a novel **falloscope imaging device** that will enable earlier detection of ovarian cancer. **Melissa Herbst-Kralovetz** studies the **delicate balance between "good" and "bad" bacteria** in the female reproductive tract, with the goal to develop better diagnostics, preventatives, and treatments for sexually transmitted infections, gynecological cancer, and more. **Leslie Farland** aims to identify patterns of **association between endometriosis and other conditions** like type 2 diabetes and stroke in order to learn more about the causes and risk factors.

Helping Us Breathe Easier




Nearly 37 million Americans suffer from a chronic lung disease. Looking at a combination of genetic and environmental factors, **Fernando Martinez, Donata Vercelli, Julie Ledford** and other BIO5 researchers are studying new ways to **prevent, detect,** and **treat** chronic lung diseases, as well as learning more about how **exposure to protective bacteria in early life** may provide solutions. To inform **more personalized treatments,** **Francesca Polverino** is differentiating unique immune system responses associated with COPD versus emphysema.

Combating Infectious Diseases



Infectious diseases are the leading cause of death in developing countries and ignite pandemics. BIO5 researchers aim to develop better prevention, diagnostic, and treatment strategies to decrease the global burden of these diseases. **Deepta Bhattacharya** merges stem cell biology and immunology to understand the development of white blood cells and devise novel strategies to fight illnesses such as **COVID-19,** influenza, and **Dengue virus.** **Michael Johnson** aims to understand **how bacteria sense and interact with metals like copper** during the process of infection, with the goal to develop better therapeutics that guard against antibiotic resistance.



Strengthening Psychological Resilience



BIO5 researchers know that positive mental and emotional health play a key role in preventing illness, improving mood and productivity, and increasing lifespan. Sleep expert **Michael Grandner** studies how sleep is essential to enhanced cognitive function, **mental health**, and **athletic performance**. **John Allen** found that **yogic breathing improves stress responses in students**. **Esther Sternberg** created a guide for architects to **design workspaces that help improve emotional well-being**.



Treating Chronic Pain Without Opioids



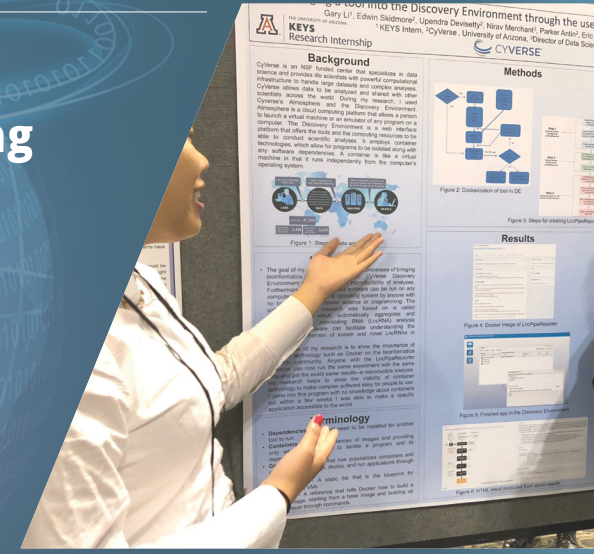
Pain is a normal response to injury – but chronic pain is different, and it's often poorly managed with habit-forming opioids. **Todd Vanderah** is leading the UArizona Health Sciences Comprehensive Pain and Addiction Center to **address the opioid epidemic** by tackling the related issues of substance misuse, chronic pain, and addiction. BIO5 researchers **Rajesh Khanna**, **Vijay Gokhale**, and **May Khanna** are closer to **developing a safe and effective non-opioid pain reliever** after their discovery of a new compound that regulates a biological channel linked to pain.

Regenerative Medicine Provides Renewed Hope



Pak Kin Wong and **Donna Zhang** manipulate cell form and function to create new tissue and organs, and to **repair**, restore, or replace those damaged by injury or disease. To address treatment limitations for Parkinson's and other age-related neurodegenerative diseases, **Lalitha Madhavan** is using **innovative patient-derived induced pluripotent stem cell (iPSC) technologies** to develop novel therapeutics for individual patients. **Marvin Slepian**, an innovator of **artificial heart valves** and ventricular assist devices, has developed and brought to the clinic several **tissue-engineered technologies** including “smart stents” to improve blood flow.

Supercomputing Tools Enable Data-Driven Discovery



Foreseeing the need to create a cyberinfrastructure that would democratize access to research data, the National Science Foundation (NSF) **established the iPlant Collaborative (now CyVerse)** at the BIO5 Institute in 2008 with a \$50M grant - the largest grant ever awarded by the NSF in the biological sciences, and three times larger than any NSF grant received by the state of Arizona at that time. With a five-year renewal grant in 2013, the federal government clearly endorsed their unprecedented \$100M total investment. By enabling data-driven research by providing powerful tools and technologies to handle huge datasets and complex analyses, CyVerse has changed the way we do and teach science.

Reducing Health Disparities



BIO5 researchers are focused on breaking down barriers that limit access to quality health care. Because traditions are deeply interwoven with the environment for Indigenous peoples, **Paloma Beamer** uses a **culturally anchored approach** to assessing health risks and devising interventions for environmental exposures. **Sairam Parthasarathy** is **co-leading an NIH COVID-19 initiative to build trust**, increase awareness and education, and promote clinical trial inclusion among underserved populations.

Precision Therapies For Alzheimer's Disease



Neurodegenerative diseases like Alzheimer's lead to a devastating loss of cognitive function and independent living. **Roberta Diaz Brinton's** team has **developed the first regenerative therapeutic for Alzheimer's disease** designed to restore cognitive function in early-stage patients. **Ying-hui Chou** is **integrating the power of traditional MRI technology with transcranial magnetic stimulation** to improve memory function and develop personalized, noninvasive treatments for mild cognitive impairment. **Matthew Grilli** is using a **new cognitive test** to link how well people remember past events in their lives to early predictions about who is at risk for developing Alzheimer's.

Harnessing Technology To Improve Health Outcomes



Eller MIS

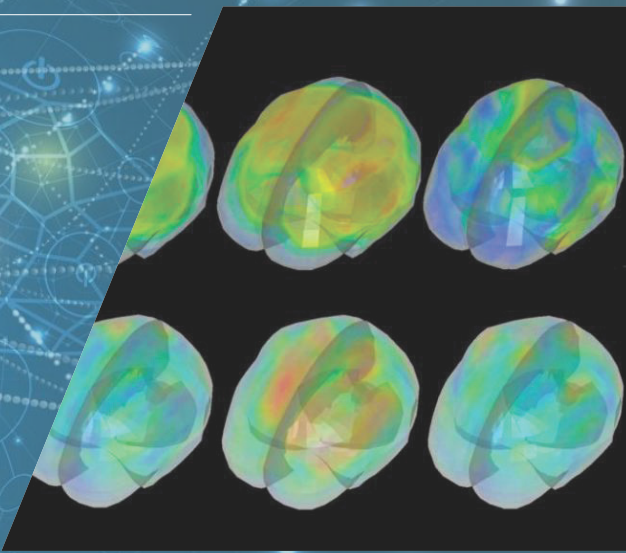
BIO5 scientists are leveraging big data, predictive models, and nanotechnology to further understand the complex processes involved in disease and design patient-specific prevention and treatment strategies to improve health. **Jianqin Lu created a nanotherapeutic platform** that delivers chemotherapy in a way that makes it more effective against aggressive tumors. **Sudha Ram** designed a model that used Twitter to predict with 75 percent accuracy how asthma-related tweets, analyzed alongside air quality data, can help **predict asthma-related emergency room visits.**

Feeding A Hungry Planet



BIO5 researcher **Rod Wing** and his team in the **Arizona Genomics Institute** have played a significant role in over 75 plant and animal genome projects, including **sequencing the rice** and **corn** genomes. In an attempt to answer how to feed 10-billion people on the planet by 2050, AGI is developing new varieties of crops that are higher yielding and more nutritious, while at the same time have less of an environmental footprint. Their approach involves identifying, understanding, and harnessing the majority of natural variation that is already present in cultivated rice and its wild ancestors, and using that information to create the **next generation of green super crops.**

Tackling Traumatic Brain Injury



Traumatic brain injury (TBI) is the leading cause of death and disability for individuals under age 44 with an estimated 1.7 million cases occurring in the U.S. every year. TBI dismantles circuits in the brain, leading to short and long-term cognitive dysfunction. **Kaveh Laksari** utilizes biomechanics to study the underlying processes of TBI and **model the injury** to aid in prevention and accurate diagnosis. **Vignesh Subbian** analyzes data gathered from advanced monitoring of brain injury patients to **develop methods to better classify TBI patients** and predict what might happen next. These efforts will allow clinicians to provide the right care to the right TBI patient at the right time.

\$1B

new funding into our economy
GENERATED

68

new spin-out companies
LAUNCHED



15,000

UArizona students
TRAINED

576

KEYS high school research internships
COMPLETED



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