ASU Insight
ARIZONA STATE UNIVERSITY
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# Biodesign Institute brings world-class labs to ASU

## Institute improves quality of life through discovery

***By Skip Derra***

When the Biodesign Institute opens the doors of its first new building Dec. 14, it will mark a significant milestone for Arizona State University. By adding some of the most advanced research laboratories in the nation, it will mark a major step toward fulfilling President Michael Crow's vision for ASU becoming a New American University.

George Poste

The 170,000-square-foot building, the first of four that will make up the Biodesign Institute, will be home to 285 researchers and eight of the institute's initial 10 centers. The building itself is sleek-looking, and the labs incorporate the latest innovations in design and functionality to promote scientific inquiry and collaboration.

"This building and the Biodesign Institute are visible signs of where we want to take ASU to make it one of the great American universities of the 21st century," Crow says. "Researchers at the Biodesign Institute will advance scientific knowledge, but do so to advance society and help improve the quality of life for all people.

"Because the research that will be done in the institute is advanced, the researchers need an advanced facility to perform their work. The first building of the Biodesign Institute is one of the best in lab design and functionality," Crow says.

Collaboration is one of the themes for the building. Inside, every design element tries to foster collaboration and the exchange of ideas, from the visually open spaces in the interior, to meeting nooks located throughout the building, to the large number of whiteboards scattered throughout the building. But it took the support of many ASU departments, Arizona legislators, Valley industry and research entities to make this foray into the lucrative, yet highly competitive, field of biomedical sciences a reality.

Because Arizona lags behind other bioscience "corridors" (Boston, the Silicon Valley and San Diego), and because Arizona was starting from scratch, it was determined that if the state was serious about the biosciences, it needed to make significant investments. ASU's own investment funded construction of the first of the four interconnected buildings that will comprise the institute. The Arizona Legislature passed a research infrastructure bill that funded construction of the second phase, which will be completed next fall.

"The Biodesign Institute is the flagship entity intended to launch ASU into the ranks of a pre-eminent research university," says Biodesign Institute Director George Poste. "It had its origins in the imperatives Michael Crow outlined in his vision for a New American University, such as an entrepreneurial focus and intellectual fusion."

Poste's own job is to build the institute in what he says is the next conceptual shift in the evolution of the life sciences: the convergence of biology, computing and engineering.

The mission of the institute is to advance innovations for improving human health and quality of life through use-inspired biosystems research and effective, multidisciplinary partnerships. Researchers at the institute will tackle some of the thorniest issues facing humans today, ranging from the development of vaccines to treat a myriad of emerging viruses, to the integration of devices that can restore movement to those who are paraplegic or quadriplegic; from new laboratory instruments that work on the scale of nanometers (a thousandth the width of a human hair) to understanding how genes evolve and change over time; from design of sensor technology that could assure the safety of the foods we eat, to new miniature biology-based devices that could be the basis of generations of compact and highly powerful computers.

"I think one of the great advances of the coming decade will be the ability to combine the cognitive capacity of biological molecules, to recognize any other class of biological molecules and to link those into miniature devices," says Poste, who recently was named *R&D Magazine's* Scientist of the Year.

Behind much of the basic philosophy of the Biodesign Institute is the goal of replicating what is found in nature. Employing the "design principles" of nature, which have evolved over millions of years, could lead to a range of extraordinarily elegant solutions to what look like intractable problems.

For example, understanding how plants generate sugars could lead to new pathways, whereby plants can be used to generate human-like proteins and possibly lead to an effective means of producing proteins that are medically important and inexpensive to produce. Or developing the technology to utilize plant-based vaccines that can be freeze-dried and distributed to areas of the world where normal vaccines, with their need for syringe-delivery and refrigeration, cannot be effective.

Both are research projects at the institute.

By taking cues from nature, it is expected that researchers of the Biodesign Institute will find the innovative solutions to the complex problems of today. But in their quest, the scientists need the infrastructure, the high-tech lab space, to succeed.

In other words, these advances would not be possible without a world-class facility to conduct the research – a facility like the first building of the Biodesign Institute.

*Derra, with Marketing & Strategic Communications, can be reached at (480) 965-4823 or (skip.derra@asu.edu).*

Tim Trumble photo

**The new Biodesign Institute facility features world-class laboratories and will serve as the home to eight of the institute's 10 research centers.**

## *Dynamic research facility comes to life*

***By Gary Campbell***

At first glance, the new Biodesign Institute facility may appear to be just another new building on ASU's Tempe campus. But in reality it is the physical embodiment of the institute it will house: dynamic, flexible and focused on the process of scientific discovery.

Construction began on the 170,000-square-foot facility in late 2002 and has rapidly advanced through a fast-track process in construction – an approach in which construction begins while some aspects of design still are being finalized. This method was selected to address the shortage of research infrastructure in Arizona, as more space is critical if Arizona is to compete in the biotech arena. This approach allowed the facility to be completed in a year's less time than it would have taken using traditional methods.

The $69 million building includes a large, open atrium designed to provide natural lighting throughout. Researchers can easily meet and discuss their work, thanks to ubiquitous meeting areas, whiteboards and shared lab spaces.

The facility's design incorporates glass liberally, as walls for

**(See BUILDING on page B4)**

### Celebrating the institute

The Biodesign Institute at ASU will officially open the doors to its new facility during a special event Dec. 14 at 8:30 a.m.

The event will feature remarks from ASU President Michael Crow and Biodesign Institute Director George Poste. The featured speaker at the event will be John Marburger, director of the Office of Science and Technology Policy for the Executive Office of the President of the United States.

There will be an open house and tours of the facility from 10 a.m. – noon.

# Putting the design in Biodesign

## Institute's 10 research centers develop novel approaches and applications for real-world issues

### Center for Protein and Peptide Pharmaceuticals

Using advanced drug design, researchers at this center are working on engineered proteins and peptide analogs (molecules of similar structure) of natural biomolecules for treating a broad spectrum of diseases. These diseases – including vascular disease, cancer, chronic wounds and stroke – affect large segments of society and are leading causes of mortality in many countries.
Center director: **Colleen Brophy**

### Applied NanoBioscience Center

At the Applied NanoBioscience Center (ANBC) research is focused on the incredibly small: materials and phenomena at the nanometer scale. The goal at ANBC is to apply advances in nanoscience, molecular biology and genomics to a new generation of enabling biological tools based on nanoscale technologies. These tools will be used to better understand disease and develop useful tools at the molecular level.
Center director: **Frederic Zenhausern**

### Center for BioOptical Nanotechnology

Researchers at the Center for BioOptical Nanotechnology integrate biomolecular sciences (biology at the molecular level) with materials engineering and solid-state electronics to develop the next generation of biosensors, implants, pharmaceuticals, novel biomaterials and nanoscale power sources. Applications for the biosensors include medicine, environmental monitoring/remediation and agriculture.
Center director: **Neal Woodbury**

### Center for Neural Interface Design

At the Center for Neural Interface Design, scientists are investigating technologies and novel therapeutic interventions to improve motor and cognitive functions for people with central nervous system disease or injury. Their approaches integrate nano-microtechnology, neuroscience, information and systems sciences, advanced materials and rehabilitation engineering for persons with severe physical disabilities.
Center director: **Jiping He**
This center will be located in the second Biodesign Institute building.

### Center for Bioelectronics and Biosensors

This center focuses on interfacing three advanced technologies – nanomaterials, biomaterials and electronic transducers – with the goal of developing enhanced biosensors. These biosensors will be used in disease diagnosis, ensuring the safety of food products, and providing surveillance and environmental monitoring. The new devices will deliver the diagnostics information in a fast, simple and inexpensive manner, facilitating point-of-care clinical analysis and field testing applications.
Center director: **Joseph Wang**

### Center for Single Molecule Biophysics

Single-molecule biophysics lies at the confluence of molecular medicine and nanotechnology. At this center, scientists are using nanotechnology to study physical processes on which life is based using the simplest model systems – those that exist on the level of a single molecule or several molecules. By doing this, researchers plan to gain a better understanding of gene regulation, molecular signaling and molecular transport in cells that will lead to improved biosensors and other new technologies.
Center director: **Stuart Lindsay**

### Center for Rehabilitation Neuroscience and Rehabilitation Engineering

Engineers and scientists at this center are designing and developing technology to offset the effects of traumatic injury or neurological and movement disorders such as spinal cord injury, orthopedic injury or Parkinson's Disease. Its multifaceted approach seeks to investigate the effects of trauma and disorders of the nervous system, to replace damaged or lost functionality, or to repair the system using advanced adaptive devices and therapeutic techniques.
Center directors: **Ranu Jung and James Abbas**
This center will be located in the second Biodesign Institute building.

### Center for Environmental Biotechnology

This newly formed center will feature a large, multidisciplinary research operation aimed at developing microbiological systems that capture renewable resources, use them and minimize pollution. The work at the center will focus on combining engineering with microbiology and chemistry, to reclaim polluted water and generate energy from waste substances.
Center director: **Bruce Rittmann**

### Center for Infectious Diseases and Vaccinology

Research at this center will focus on basic bacterial and viral infectious disease processes, and on the design and use of vaccines and protein therapeutics to combat infectious diseases, including newly emerging pathogens and potential biowarfare agents. The goal is to devise new and effective ways of producing advanced vaccines and therapeutics – such as through the use of recombinant attenuated bacteria and viruses, and genetically modified plants – and transfer this technology to the developing world to help fight diseases.
Center directors: **Charles Arntzen and Roy Curtiss**

### Center for Evolutionary Functional Genomics

The goal of this center is to understand how the genes and genomes of humans and other organisms change over time; and to determine how genes interact with each other to develop a single fertilized egg cell into a complex adult animal with trillions of cells. Researchers are developing new methods and easy-to-use computer software for the analysis of genomic databases in this quest.
Center director: **Sudhir Kumar**

The grand stairway in the Biodesign Institute helps give an open feel to the building's interior.

# Building fosters communication, collaboration

(Continued from page 1)

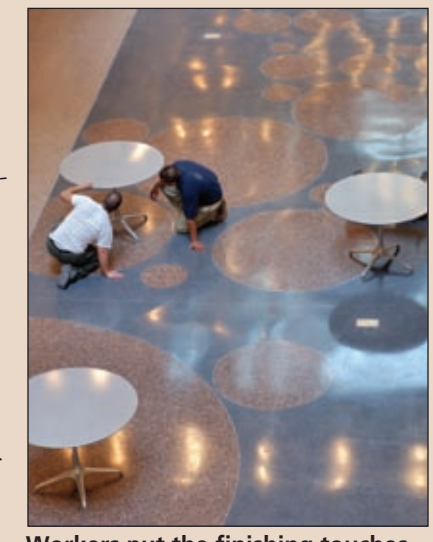
the labs and offices and to further build on the idea of openness and light. The offices and labs are designed so that every team member can enjoy exterior views and sunlight.

The lab space, designed for maximum flexibility, includes 11-foot modules and wheeled cabinetry that can quickly be configured depending on the project. No individual is permanently assigned to a research space, allowing resources to be shifted when needed.

The lower level features the institute's laser lab, which will house its most sensitive instrumentation and equipment. Using features such as 16-inch concrete slabs, extra support columns and low carbon-steel shielding, the level has been specially designed to reduce vibration and electromagnetic interference.

Despite all of the glass, the building was designed to be environmentally friendly, with a system of window shading that is programmed to track the sun for maximum efficiency. On the exterior, any rain runoff from the roof will be funneled directly to the plants surrounding the building.

The landscaping will feature distinct zones of plants native to Arizona. The end result will be a dramatic eastern gateway to campus.



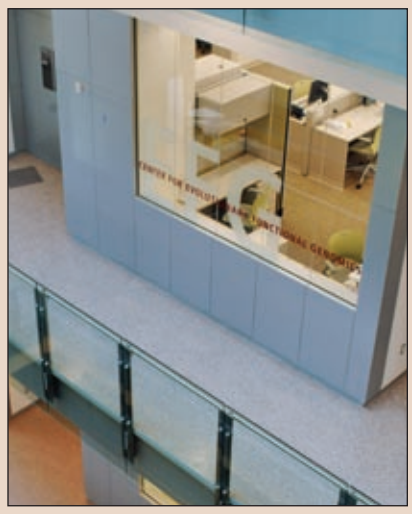
Workers put the finishing touches on tables in the atrium of the Biodesign Institute facility.

The building is the first of four interconnected buildings that comprise the institute's master planned site, bordered on the west by McAllister Avenue and to the south by Terrace Road.

This first building is funded by ASU research money and proceeds from the voter-approved Proposition 301. A second building of equal size is under construction just north of the first. Its construction cost of $73 million is being funded by a research infrastructure appropriation passed by the legislature in 2003. The second facility is scheduled for completion in the fall of next year.

Three additional buildings are planned but have not been funded or scheduled for construction – two 220,000-square-foot research buildings and a 30,000-square-foot conference center.

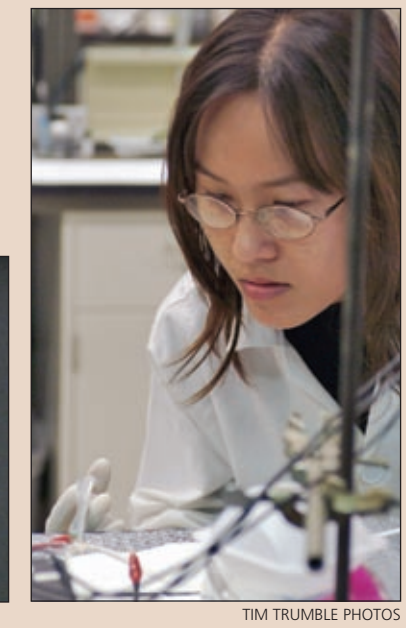
*Campbell, with Marketing & Strategic Communications, can be reached at (480) 965-7209 or (garycamp@asu.edu).*



Offices in the Biodesign Institute will be open, with large windows to foster the idea of collaboration.

Chemical Engineering graduate student Travis Yarlagadda works in one of the Biodesign Institute labs making nanostructures to be used for detection and small circuitry. The workspaces in the labs are completely modular and can be rapidly reconfigured.

At right, below: Chemistry graduate student Weena Siangproh works in a lab in the new Biodesign institute lab developing a system for monitoring contaminants.



TIM TRUMBLE PHOTOS

# Institute, facility draw world-class researchers to ASU

***By Gary Campbell***

The Biodesign Institute at Arizona State University is more than just the premier research entity of its kind. Along with other major research initiatives at the university, it serves as a major driver of the university's intellectual economy and a draw for some of the world's top researchers.

To put it simply, world-class researchers need a world-class home.

Since recruitment for the institute began in earnest in 2004, the institute has drawn several internationally known "stars." This influx of new thinking adds to the already formidable group of researchers in place at the institute and the university, builds research capacity and enhances the university's reputation nationally.

Bruce Rittmann

The operations of these new researchers also include dozens of research staff who are rising stars in their own right. Positioning the university to draw these kinds of researchers and research organizations has been an important focus of ASU President Michael Crow and a major component of the vision for the Biodesign Institute.

One of the newest hires to ASU and the institute is Bruce Rittmann, a professor of civil and environmental engineering in ASU's Ira A. Fulton School of Engineering. Rittmann, a fellow of the National Academy of Science, joined the university and the institute this year to build the new Center for Environmental Biotechnology at the Biodesign Institute.

Rittmann, formerly with Northwestern University, will direct a large, multidisciplinary research operation at the Biodesign Institute aimed at developing microbiological systems that capture renewable resources and also minimize environmental pollution. His work, which combines engineering with microbiology and chemistry, can be used to reclaim polluted water and generate energy from waste substances.

"We need to change our point of view concerning what society now treats as wastes," Rittmann says. "To make society more sustainable, we need to capture these valuable resources, and microbial systems often are the best way."

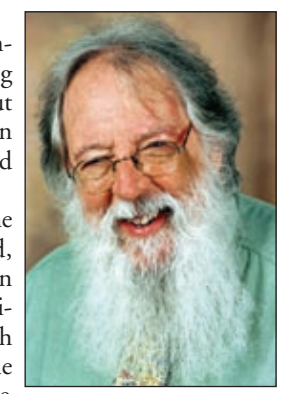
Another top researcher, Roy Curtiss, joined ASU in the spring to co-direct the Center for Infectious Diseases and Vaccinology.

Curtiss, also a National Academy member, is known for his groundbreaking research into how viruses jump from animals to man, as happened with the SARS virus. Being able to predict the pathway of disease into humans could allow prevention of this increasingly serious global problem.

Curtiss brings with him a team of 40 infectious disease researchers. Moreover, his hire sparked interest from a number of other exemplary researchers from a variety of fields.

"When someone of Dr. Curtiss' caliber chooses to come here, others sit up and take notice," says George Poste, director of the institute.

Poste embodies the example of the institute's drawing power. Crow talked Poste out of his plans for retirement in 2003 with the promise and potential of the institute.



Roy Curtiss

"George Poste is one of the leading scientists in the world, and there is no better person to build the Biodesign Institute into a world-class research center that will benefit the state, the nation and the entire world," Crow says. "George is a scientific genius with a compassion for humankind that inspires those around him to do great things to make the world better."

Poste, a model of the multidisciplinary scientist, brings expertise in disciplines as diverse as molecular biology, pharmaceutical development, and biosecurity. From 1992 to 1999, he was president of research and development and chief science and technology officer at the multinational health care company SmithKline Beecham, during which he was instrumental in 29 successful drug and vaccine registrations in the United States and internationally. Most recently, he was chief executive officer of Health Technology Networks, a consulting group based in Scottsdale and suburban Philadelphia specializing in the application of genomics and computing in health care.

Poste earned a doctorate in veterinary medicine in 1966 and a Ph.D in virology in 1969 from the University of Bristol. He has received honorary doctorates in law and science for his contributions to international health policy and is board-certified in pathology.

He is a Fellow of Great Britain's prestigious Royal Society and a Founding Fellow of the UK Academy of Medical Sciences.

Since serving at ASU, Poste has been nationally recognized as the Scientist of the Year for *R&D Magazine.*

"It's my goal that we will pioneer new approaches in both research and teaching," Poste says. "By forging an extensive network of alliances, both on- and off-campus, the Biodesign Institute is becoming a dynamic intellectual and economic resource for ASU, the state and the nation."

*Campbell, with Marketing & Strategic Communications, can be reached at (480) 965-7209 or (garycamp@asu.edu).*