

ARIZONA HOUSE OF REPRESENTATIVES
Fifty-first Legislature – Second Regular Session

**COMMITTEE ON HIGHER EDUCATION AND
WORKFORCE DEVELOPMENT**

Minutes of Meeting
Wednesday, February 26, 2014
House Hearing Room 1 -- 10:00 a.m.

Chairman Dial called the meeting to order at 10:12 a.m. and attendance was noted by the secretary.

Members Present

Ms. Alston
Mr. Coleman
Mr. Larkin

Mr. Saldate
Mr. Stevens
Mr. Thorpe

Mr. Orr, Vice-Chairman
Mr. Dial, Chairman

Members Absent

None

Committee Action

None

Chairman Dial stated that research and spinoffs from research play an important role in Arizona's economy.

Presentation: Jobs2020: Powering Arizona's Economy Through Research

President Eileen Klein, Arizona Board of Regents (ABOR), acknowledged the presence of student regent, Valerie Hanna. Due to technical difficulties with a video presentation, she indicated that she will send the Members a website link to continue watching the video; the website also contains the 2014 Annual Research Report for the three universities. She related that in 2003, the Legislature authorized approximately \$500,000 in bonds, which increased the universities' research portfolio by approximately 50 percent, led to the creation of over 100 new companies in Arizona and new companies continue to be produced. It is imperative for the universities to remain competitive so ABOR is seeking \$1 billion in new research infrastructure investment for which similar results are anticipated. The ability to recruit and retain top flight researchers depends on ensuring that the universities have the infrastructure to collaborate with other great minds.

President Michael Crow, Arizona State University (ASU), related that there are two principal reasons the universities are involved in research: first, to produce state-of-the-art people, i.e., learners, which is essential to workforce preparation; and second, new infrastructure is necessary for Arizona to be competitive. ASU is being reconstructed as a research enterprise built around three principal themes: interdisciplinary, focus on use-inspired scholarships and partnerships. ASU has a partnership with the Mayo Clinic, a national research and healthcare delivery association, in educational programs, research programs, advancement of new concepts, expansion of the company's presence in Arizona and other items.

He stated that ASU is a latecomer to the research-intense university arena, not becoming a research university until after 1980. The ASU Enterprise has grown by a factor of four since 2003. He introduced Dr. Sethuraman "Panch" Panchanathan who started multiple companies in the U.S. Last year, a venture capital firm in California invested \$53 million in ASU spinout companies in Arizona. He and "Panch" are going to Los Angeles to work on furthering the ability to gain access to venture capital from California and other places around the world for companies grown, developed and spun out in Arizona.

Dr. Sethuraman "Panch" Panchanathan, Senior Vice President, Knowledge Enterprise Development, Arizona State University, advised that ASU now ranks 15th in the country for universities without a medical school in terms of research performance. As the youngest research university, to accomplish such a task in a very short time takes a tremendous amount of intensity, competitiveness and high-quality faculty and students, which is what ASU possesses in large numbers. He made the following points:

- In terms of faculty, ASU attracted Dr. Joshua LaBaer, Founder/Director of the Harvard Institute of Proteomics. He has been at ASU four years and developed tremendous partnerships, including Mayo Clinic, garnered \$65 million new dollars to Arizona, hired 150 people in his lab and spun out companies, intellectual property disclosures and patents.
- Regarding intellectual property disclosures, Arizona is ranked tenth in the country, fourth for universities without a medical school in terms of the number of patents, and rising fast in terms of impacting the national arena, as well as the State of Arizona.
- From a student perspective, the *Wall Street Journal* conducted a survey of employers and asked where qualified graduates are found. ASU ranked fifth nationally, including all public and private universities, which is a huge testimony to the training process at ASU.
- Regarding patents to spin outs, a number of investments were made by venture capitalists in Arizona; over \$88 million last year alone in ASU technologies and discoveries. Over the last 10 years, ASU has had \$400 million in investments from venture capitalists for technologies developed at ASU.

Dr. Panchanathan provided the following handouts:

- Statistical information (Attachments 1-5)
- Video of people discussing what ASU is doing for the region and them as they advance their technologies (Attachment 6)

Dr. Panchanathan introduced David Wade, Chief Executive Officer, Pollen-Tech, one of the spin outs nurtured by an entrepreneurship initiative. He noted that ASU provided space for the company in SkySong and a small amount of seed capital.

President Crow advised that the seed capital was provided by private philanthropists.

Dr. Panchanathan added that Pollen-Tech is about mechanical pollination, augmenting what bees are able to do, in terms of increasing agricultural production.

David Wade, Chief Executive Officer, Pollen-Tech, related that Pollen-Tech invented a process and filed for two patents and an international patent in the last six months to pollinate crops mechanically. Not only is it helping to solve the problem of bees dying, but it is cheaper and better than bees. In the last field test, there was a 6.5 percent yield increase in the same field over almond trees that were not treated, which translates into approximately \$400 to \$500 per acre for the farmer. In California, the company has been testing with the three largest growers in the world. ASU has given the company the ability to reach into many disciplines such as agriculture, biosciences and electronics. Part of the process involves charging the pollen grain with about 1,100 volts of electricity, which makes the pollen seek out the stigma of the flower. It does not have to be hit directly, but from six to eight inches away, and the plant is pollinated effectively and economically.

He related that about one-third of everything people in the world eat is pollinated by insects. This process is starting to be heard about in the agricultural community. He has talked to the largest blueberry grower in the world, peach growers and he has been invited to Turkey and Chile. Without the initial Gadsden grant from the philanthropist associated with ASU and support of the incubator at SkySong, it would not have been possible to start this company.

President Crow conveyed that ASU has millions of bees, which are one of the most social insect groups. Social insect studies will enhance understanding of how to do mechanical pollination and devise devices. ASU is actually mocked for this, but ASU also has a scientist who works with ants. These are unbelievable scientists and now engineers are needed to work with them. He responded to a question about venture capital, mentioning that one of the companies that spun out of a single engineering faculty member's lab involves lithium air battery technology; it is an up and coming export company for which the economic impact is incalculable.

Mr. Thorpe asked if Pollen-Tech would be placed in jeopardy if the University of Arizona (UA) solves the problem of bees dying. Mr. Ward responded that the impact of mechanical pollination is much greater in crop yield increases, risk mitigation and security issues than pollination by bees because a farmer can control when pollination happens. He noted that almond growers spent \$276 million last year to rent hives from as far away as Australia and, in Wilcox, bumblebees are being brought in from the Netherlands to pollinate tomatoes. People in China can be seen on Google applying pollen on apple trees with a brush and are desperately in need of this kind of technology, so he is starting to talk to them.

President Ann Weaver Hart, University of Arizona (UA), stated that Arizona faces competition and, if the new knowledge economy is not invested in, the state will be left behind because it is the future of society. UA alone has an \$8.6 billion annual economic impact to the state and its

research and graduation education programs are among the best in the world (Attachment 7). The excellence at the UA attracts the development of top companies, employs Arizona workers at high wages and creates economic opportunity. In order to effectively compete with other states, Arizona needs to be at the forefront. Investing in new research infrastructure through the bonding proposal will advance UA's critical research mission and the economic role it plays in the state. In addition, the request for the modest investment of \$15 million in mission-critical funding will guarantee that the UA continues to play a vital role in higher education and industry (Attachment 8). She introduced Dr. Fernando Martinez, Dr. Erica Corral and Steve Trussell.

Dr. Fernando Martinez, Executive Director, BIO5 Institute for Collaborative Research, University of Arizona, related that he moved to the U.S. to take advantage of opportunities it can offer. He is an active researcher, scientist and physician. He said there are three main elements that relate not only to BIO5, but the research enterprise at UA:

- Passion to solve problems and improve the life of people of Arizona - Each year, 1,000 children in Arizona and almost 90,000 children in the U.S. are born with extremely severe developmental delay. Dr. Michael Hammer is dedicating his years of knowledge relating to genome analysis in humans to solving the problems of developmental delay and his accomplishments in a few years have been extraordinary. At the other extreme are cognitive problems associated with aging. Dr. Carol Barnes is a recognized leader in this field in the U.S. and is contributing significant knowledge.
- Knowledge and technology in order to know how to solve problems - He treats children with cystic fibrosis, a genetic disease that 10 years ago was called lethal. It is possible to cure this disease in the next 20 to 30 years, and with genomic and proteomic technology at BIO5, it will be possible to address other diseases, not only from the brain, but other important organs of the body. In BIO5, there is also a \$100 million 10-year project funded by the National Science Foundation (NSF) involving the use of informatic technology to match agricultural products with the soil in which they grow best.
- Entrepreneurship - It is necessary to transform the knowledge and passion into products. The business office at BIO5 has established a relationship with entrepreneurs and venture capitalists that will transform discoveries into products that can solve problems.

Dr. Erica Corral, Associate Professor, Materials Science and Engineering, University of Arizona, invited the Members to visit her lab in Tucson. She related that she joined the UA faculty five years ago in order to work with students and pursue her passion for developing materials that can withstand extreme environments. The materials she works with, unlike metals, will not melt at temperatures above 1,000 degrees Celsius or 3,200 degrees Fahrenheit. She has been able to generate many exciting new materials that people are interested in using. For example, she will be meeting with Honeywell's Aerospace Engine Component Division because these materials have high strength, high toughness and retain those properties at high temperatures so applications in automotive or aerospace engines enhances efficiency. She has been able to secure external funding to continue programs and invest in training of students. She said she worked with a Ph.D. student, Dr. Luke Skywalker, on a project involving the use of graphene inside ceramic to enhance its ability to resist fracture. The original project started with a NSF grant. Honeywell was interested in the results and how the materials can be used in an engineering application. The lab has huge high temperature furnaces that actually use direct current to generate heat to consolidate materials at high temperatures.

Chairman Dial said he has always been interested in space elevators. Dr. Corral responded that when she was a graduate student, she was involved in making a carbon nanotube elevator to space. It has been 10 years since she started and now cables are being made out of carbon nanotubes that Boeing is using to lower the weight of aircraft.

Mr. Orr indicated that he will coordinate a tour of her lab through his office and asked anyone interested to contact him. He questioned how the state paid for the lab and BIO5. Dr. Corral answered that her startup package contained an investment from the UA. No manufacturer in the U.S. made the furnace she needed so she worked with a manufacturer to make a furnace at a reasonable price. She was also able to get a good deal on equipment, and from there, external grants were secured.

Steve Trussell, Executive Director, Arizona Rock Products Association (ARPA), said ARPA represents the manufacturers of aggregate materials, which are sand and gravel, and construction materials for roads and foundations. ARPA also manufactures cement, asphalt, Redi-Mix concrete, limestone, lime and gypsum. ARPA employs about 12,000 employees and supplies materials for 220,000 end users. He stated that he is very excited about the partnership ARPA has had for the last 20 years with the UA School of Mining and Geological Engineering. Dr. Mary Fulton makes presentations at mining caucus meetings on innovations and research going on at UA and provides mining-specific industry updates. She has been more than willing to spend time with ARPA personnel on regulatory issues and she has a huge staff of impressive, competent and highly-revered individuals. He discussed programs at UA that have been helpful to ARPA and projects in which ARPA is partnering with the UA. He noted that approximately 60 percent of ARPA's workforce is approaching retirement age and many highly-qualified people are obtained from the UA. He provided the following handouts:

- Description of the Lowell Institute for Mineral Resources (Attachment 9)
- *Arizona's Mining Industry: Proud History, Bright Future* (Attachment 10)
- Letter to Raina Maier, professor at UA, regarding the partnership, importance of grant funding and continuing that relationship (Attachment 11)
- Invitation to UA's Center for Environmentally Sustainable Mining Profile Event on April 4, 2014 (Attachment 12)

Mr. Trussell responded to questions concerning the caliber of UA graduates, the smelting process and an interdisciplinary approach to students in K-12.

President Hart responded to questions about the interdisciplinary approach at UA and the salary of graduates in the mining and engineering programs.

President John Haeger, Northern Arizona University (NAU), stated that NAU's research mission involves \$46 million per year in combined federal dollars and public service-type activities on part of the institution. It brings the best faculty NAU can find in national and international recruiting and the best students to be educated in fields needed for the 21st century economy. One research building alone allowed NAU to keep Dr. Paul Keim and his team of researchers who work closely with the federal government on issues related to bioterrorism and the Center for Microbial Genetics and Genomics (MGGen). At the same time, the state recruited

Dr. Jeffrey Trent to start the Translational Genomics Research Institute (TGen), which now has a branch in Flagstaff. Those bring jobs into the economy and the research is important to the citizens of Arizona. He introduced Dr. David Wagner who works with Paul Keim and does research on infectious diseases and Dr. Wally Covington who runs the Ecological Restoration Institute and will talk about the dangers and solutions to forest fires.

Dr. David Wagner, Associate Professor of Biology, Associate Director, Center for Microbial Genetics and Genomics, Northern Arizona University, stated that Dr. Paul Keim is the Director of MGGen and TGen North, which is based in Flagstaff. MGGen is best known for identifying the specific strain of Anthrax that was mailed in letters in 2001. Subsequently, large sums of funding became available to conduct bioresearch and new regulations were implemented regarding possession, use and conducting research on potential bioterrorism agents, called select agents. The new regulations required specific laboratory conditions, with which the NAU laboratory at that time was not in compliance, although it was grandfathered in. Their group became highly sought after around the country; NAU was willing to build new laboratory space to meet their needs and comply with the new select agent regulations, which was key in keeping the research group at NAU. The new Applied Research and Development (ARD) Building includes a new BioSafety Level 3 (BSL-3) select agent laboratory.

He related that the annual operating expenses at the MGGen Center and TGen North are paid by federal research grants. The funding provides high-paying jobs with benefits for all full-time employees and beginning employment opportunities and training for students in high-tech techniques, who are highly sought after by graduate schools, professional schools and industry.

Dr. Wagner noted that multiple patents are generated based upon their intellectual property from research, one of which is a startup company called PathoGene. It was spun off with assistance from the Northern Arizona Center for Entrepreneurship and Technology, which licensed material from NAU and TGen on research focused on Valley Fever and Methicillin-resistant *Staphylococcus aureus* (MRSA). The group focuses on local health problems and has used many of the approaches developed in biodefense in a public health setting. A new junior faculty member was recently hired who focuses exclusively on Valley Fever; the new BSL-3 laboratory was crucial in the recruitment of that individual. He discussed a new collaboration with the Flagstaff Medical Center (FMC) to use state-of-the-art genetic and scientific techniques developed at NAU and TGen to better understand and address public health issues in Flagstaff.

He related that the state has gotten publicity because of MGGen's part in the Federal Bureau of Investigation's investigation into the Anthrax letter attack, identification of the likely source of cholera outbreaks in Haiti to peacekeepers from Nepal and the recent publication of a high-profile paper on an analysis of 1,500 year-old victims of the first great plague pandemic for which there were over 400 global media hits, all mentioning NAU and Arizona. He added that in order to continue to grow research in Arizona, largely with federal research dollars, the state needs to invest in infrastructure to make the research possible. He invited the Members to visit the lab and talk to the students.

Dr. Haeger related that NAU recently signed a contract with the FMC, Northern Arizona Health Care and NAU to share data, scientists and doctors to better treat diseases in northern Arizona, which will be an interesting collaboration.

Dr. Wally Covington, Regents' Professor of Forestry; Director, Ecological Restoration Institute, Northern Arizona University, stated that the welfare of the state is fundamentally dependent upon what happens in the forested areas. In 1975, a huge forest fire was 2,000 acres; now the fires are 500,000 acres in size and a serious threat, not only to natural resources, but to life and property. This year is one of the driest and the outlook for forest fires and rangeland and grass fires is gloom.

He advised that the Ecological Restoration Institute was established by ABOR in 1997 to address the problems of declining forests and woodland health. Since 2000, the state spent \$8.7 million in internal funding through NAU and brought in over \$35 million in federal contracts and grants. The funding is used to fund undergraduate and graduate students at the three universities. In addition to classroom education, the Institute provides continuing education to help people understand the new and innovative way to approach wildland management, and workshops and educational outreach. Salt River Project (SRP) is concerned about what is happening to the watersheds and reservoirs that are filling in from erosion that occurs after large-scale fire events, so the Institution is working with SRP and the Four Forest Restoration Initiative, a 2 million-acre treatment area in the high country of Arizona, to develop ways to maximize resource benefits and minimize resource costs associated with fire across landscapes.

In response to a question, Dr. Covington advised that the fires affect water quality, water availability and air quality. He noted that Arizona is seen as the national leader in forest restoration; the National Forest Service recently indicated that all of its new forest plans will be built around a restoration concept, which is due to the work that has been done at the three universities.

Chad Heinrich, Vice President of Public Affairs, Greater Phoenix Chamber of Commerce, related that during the 125 years the Chamber has existed, there have been "boom" years, "bust" years and recovery years, which continues to occur. Investment in research infrastructure and the request from the regents and their vision requires a new level of thinking, but it can result in an exponential increase in the economic base, the success of Arizona and jobs for Arizona citizens. He noted that the downtown landscape in Phoenix changed for the better with increased economic activity, growth and significant outcomes because of the research and innovation going on.

President Klein thanked the Members for this opportunity, noting that she is grateful these talented individuals chose to share their talents with Arizona. Behind them are thousands of other key researchers working in areas fundamental to the economy to help illustrate the point that universities are not only about imparting knowledge but about creating knowledge and driving the economy. She said she looks forward to working with the Members toward a successful conclusion.

Chairman Dial thanked everyone for the excellent presentations.

Without objection, the meeting adjourned at 12:10 p.m.

Linda Taylor, Committee Secretary
March 18, 2014

(Original minutes, attachments and audio on file in the Chief Clerk's Office; video archives available at <http://www.azleg.gov>)