

Annual State of Research Address

Creative Partnerships, Meaningful Impact

Colleagues, friends, and distinguished guests,

Good morning. Thank you for joining us today. I'm Caroline Whitacre, senior vice president for research. I am delighted to be here this morning to talk about the amazing research and discovery that takes place at Ohio State. Every day, I am inspired by the talent, creativity and passion of the more than 5,000 researchers whose contributions and impact extend beyond the boundaries of our six campuses.

Look around the room. What do you see? I see faculty who are at the forefront of discovery, devoting time, energy and passion to their students and to the work they are dedicated to. I see staff working tirelessly to support the enterprise of discovery. I see students discovering something new about the world around them. And I see community members, industry partners and foundations working in tandem with the university to change lives for the better.

To quote a true American hero, the late Senator John Glenn, "If there is one thing I've learned in my years on this planet, it's that the happiest and most fulfilled people I've known are those who devoted themselves to something bigger and more profound than merely their own self-interest." His words resonate with me because they define the Ohio State research enterprise. Everyone in this room is contributing to a greater cause.

We all want to contribute—to positively impact our field, science and humankind. If research in the future is to have that meaningful impact, we have to look beyond "business as usual." We need to do this for two reasons. First, the issues that we face are becoming more global and complex, and they will require us to form new and unusual collaborations to tackle them. Second, to overcome the challenges in an increasingly tight and uncertain funding arena, we will have to engage all stakeholders in unlikely partnerships to find novel ways to fund future research endeavors.

At Ohio State, we have key resources in place to build these partnerships. University researchers are already receiving noteworthy recognition for their creative discovery and outstanding activities. Let me share with you some examples of the accolades earned by faculty and students over the past year.

Maura Gillison was elected to the National Academy of Medicine for her work in establishing the link between human papillomavirus and a subset of head and neck cancers.

Clark Spencer Larsen was elected to the National Academy of Sciences for his research on the history of the human condition during the last 10,000 years of human evolution from a health, quality of life and lifestyle perspective. These are among the most prestigious honors an American scholar can receive.

Linda Saif was named to the 2016 National Academy of Inventors. This is a professional distinction accorded to academic inventors who have patents and have promoted an environment of entrepreneurial activity. Katrina Cornish and I were named to the same academy in 2015.

Shayne Piasta was among 102 researchers in the U.S. selected to receive the Presidential Early Career Award for Scientists and Engineers. This is the highest honor bestowed by the U.S. government on early career science and engineering professionals. Her research focuses on early literacy skill development in young children.

We continue to see faculty members elected to the American Association for the Advancement of Science, an organization dedicated to advancing science for the benefit of all people. The 2015 and 2016 inductees are Irina Artsimovitch, David Bromwich, James Cogdell, Christopher Jaroniec, Ken Lee, Mark Peeples, Barbara Sue Ryden, Shari Speer and Guo-Liang Wang. Ohio State has one of the largest contingents of AAAS fellows of any university in the country.

John Herbert received the Humboldt Research prize from Germany's Alexander von Humboldt Foundation for his research to improve the accuracy of traditional quantum chemistry calculations.

Next we have Susan Olesik who was named one of 2016's Top 50 Women in Analytical Science by the Analytical Scientist. This first all-women power list featured scientists from academia and industry from around the world.

Ten Ohio State faculty members were named to Thomson Reuters' 2016 list of Highly-Cited Researchers, a measure of the worldwide impact and influence of an individual's research. They are William Abraham, Hojjat Adeli, Clara Bloomfield, John Byrd, Carlo Croce, Hesham El Gamal, Rattan Lal, René Stulz, David Weinberg and Hui Zhang.

The title of Distinguished University Professor was conferred on John Byrd for his work in cancer, Peter Culicover for his research in linguistics, and Tina Henkin for her work in microbiology.

Alice Conklin, Scott Gaudi, Douglas Kinghorn, Brian McHale, René Stulz and John Volakis were named Distinguished Scholars by the university, recognized for their exceptional accomplishments and substantial compilation of research.

We are also privileged to have so many talented young faculty at the beginning of their careers who are already earning accolades for their ideas and discoveries. There are 14 faculty members I would like to recognize.

Marcello Canova, Yuejie Chi, Adriana Dawes, Ashwini Deo, Maryam Ghazisaeidi, Ian Krajbich, Chuan Xue and Wei Zhang received National Science Foundation Faculty Early Career Development (CAREER) Program awards, the top award given by the National Science Foundation to junior faculty.

Abraham Badu-Tawiah received an Early Career Research Program Award from the Department of Energy's Office of Basic Energy Sciences.

Mahesh Illindala and Jenifer Locke were among 47 U.S. engineers and scientists who received Young Investigator Program awards from the Office of Naval Research.

Hanna Cho and Stephen Niezgoda received DARPA or Defense Advanced Research Projects Agency Young Faculty Awards.

And Arnab Nandi received an Institute of Electrical and Electronics Engineers Technical Committee of Data Engineering Early Career Award.

And we must certainly recognize the extraordinary achievements of our student researchers.

Two graduating seniors received Ohio State's inaugural President's Prize, the highest university recognition bestowed on exceptional students committed to social change. Margaret Griffin will tackle food insecurity by making farm produce more readily available to children living in areas with inadequate access to fresh foods. KayMesha Knox will create pathways for teenagers from low-income families to pursue post-secondary education.

Ross Vasko and Lagnajit (Lucky) Pattanaik were named Goldwater Scholars, the most prestigious national award for undergraduate researchers in science, math and engineering.

And Ilhan Dahir became Ohio State's sixth Rhodes Scholar for her commitment to empowering refugee communities around the world.

Ohio State students also excelled in many team competitions.

The Venturi Buckeye Bullet 3 team set a new world record for electric land speed vehicles with a two-way average top speed of 341.4 miles per hour at the Bonneville Salt Flats track in Wendover, Utah.

The EcoCAR 3 team won year two of the four-year advanced vehicle technology competition hosted by the U.S. Department of Energy and General Motors. The competition challenges 16 North American university teams to redesign a 2016 Chevrolet Camaro to reduce its environmental impact, while maintaining the vehicle's high performance characteristics. Remember that three years ago, Ohio State won it all

as EcoCAR2 National Champions in a similar competition to redesign a Chevrolet Malibu.

Nima Dahir, Jackson Frazier and Abd Al-Rahman Traboulsi won the Resolution Social Venture Challenge, a competition to inspire undergraduate students to propose impactful solutions to pressing social issues around the world. The team is working to empower adolescent refugee youth in the U.S.

Clearly, at Ohio State we have all of the tools—the creative minds, the expertise, the experience and the world-class facilities—needed to discover innovative solutions to complex problems. But, the path forward will require exploring uncommon territory to create those new and unexpected collaborations and partnerships.

Because of the changing funding landscape, these partnerships will become much more important. Funding for research and development (R&D) as a percentage of the federal budget continues to decline, reaching a 50-year low of less than 4 percent in 2016.

So we need to be more resourceful in navigating this funding landscape. First, we need to continue to look for creative ways to fund our research endeavors. And second, we need to be smarter and more strategic about the research proposals that we submit. This is where resources like the Industry Liaison Office and the Proposal Development Office are really helping us move forward.

Let's take a look at the funding picture for our own research portfolio at Ohio State. New research award dollars for 2016 are up by about 7 percent over the previous year. There has been an upward trend in research award dollars for the past four years. Notice that the largest segment of our research awards by far is from federal sources.

FY 2017 is shaping up to look even better. In the first half of FY 2017, our new awards increased over the same period in 2016. At this point in the year, we are seeing an increase in new NIH awards of 24% and in new NSF awards of 10% compared to last year. We hope that this trend continues, and are confident that it will, as our researchers continue to forge novel, unique and sometimes surprising new collaborations.

The knowledge landscape is going to become increasingly interconnected as we move forward. In order to address the true complexity of today's most pressing issues, collaborations among researchers, federal agencies, industry and community stakeholders from multiple disciplines with differing perspectives will be critical. Research in the future will need to be viewed as an act of collaboration for the greater good.

The good news is that a whole lot of research at Ohio State is already collaborative. We are beginning to reap the rewards from the Discovery Themes—the university's most ambitious academic effort. More than 500 faculty and staff are engaged—accelerating innovation and solving global problems.

The Discovery Themes were designed to be transformational. We are not simply generating discoveries in four thematic areas (food production and security, energy and environment, health and wellness, and the humanities and the arts). We are creating a culture that will inspire a new model of research and teaching—a culture that nurtures novel partnerships and engages all stakeholders.

Within each of the four themes, we are focusing on specific topics that align best with our strengths. In health and wellness, priority areas are chronic brain injury and infectious diseases. In food, the areas are agricultural transformation and foods for health, specifically metabolomics. In energy and environment, the priorities include materials and manufacturing for sustainability and sustainable and resilient economy. The first area identified—translational data analytics—underpins all areas. The newest area—humanities and the arts—is in the process of defining their priority focus areas.

Here is just one example of how we are leveraging our research strengths. Within the Infectious Diseases Discovery Theme, faculty from across the university are coming together to focus on antibiotic resistance.

Alba Clivati McIntyre and Mo Karamoko, from the Industry Liaison Office's Business Intelligence and Mapping unit, have created a visual representation, or heat map, of all of the research activities taking place within this space. The map enables us to identify

clusters of researchers as well as research capabilities in antibiotic resistance. We can see where gaps exist. And we can see opportunities to catalyze collaborations.

Thus far, 82 faculty have joined Ohio State in the Discovery Themes over the past three years. This has led to increased community engagement and student success. By bringing together faculty who might never have been connected or inspired to work together, we are shaping a new culture and establishing a new model of collaboration.

While these inwardly facing collaborations are important, we need to cast a wider net. We need to look outside the university to build collaboration models that engage external stakeholders. That means bringing together the people, teams, networks, organizations, industry partners and community members—those people or groups who don't typically align with our individual goals—to embrace new ways of working together.

This morning, I would like to highlight a few of the many collaborations and new partnerships that Ohio State researchers are embarking on. In other words, I would like to focus on “not the usual suspects” because sometimes, the most amazing results come from those unexpected partnerships. And the outcomes from these types of collaborations often are much greater than the sum of their parts.

Let's start by talking about a big win for Ohio State, the city of Columbus, and the Central Ohio region.

One of the university's greatest achievements in the past year is the Smart Cities partnership that will help develop Columbus into a go-to place for intelligent transportation systems. Headed by the City of Columbus, Smart Cities comprises an unprecedented mix of corporate and non-profit partners, including the City of Columbus, Ohio State, Battelle, CoGo Bike Share, COTA, the Columbus Partnership, Clean Fuels Ohio, Columbus 2020, the Chamber of Commerce, Experience Columbus, the Mid-Ohio Regional Planning Commission, the Ohio Department of Transportation and Rev1Ventures; and international names including AT&T, Car2Go, General Motors, IBM and Uber.

Carla Bailo, assistant vice president for mobility research and business development, leads the effort for Ohio State.

Smart Cities will pilot projects in four distinct types of districts as shown on the map—residential in Linden, commercial at Easton, downtown and logistics.

In this partnership, researchers and their collaborators will develop technology solutions to address obstacles that low-income residents face when using transportation, smart corridors that improve transit service and efficiency, and real-time traffic and parking data systems to improve the movement of freight and minimize disruptions associated with major events or incidents. Expect to see expanded use of smart and electric vehicles, autonomous shuttles and a comprehensive emphasis on smart growth.

We will also likely see people and organizations from far and wide coming to central Ohio to explore the future of mobility. The distinctive mix of Smart Cities partners and local facilities makes this area a unique resource in mobility research nationally, including our own Transportation Research Center, which serves as a proving ground for new technologies; the Sports Pavilion Automotive Research Complex; and the technology focus of the City of Dublin and the Northwest 33 Innovation Corridor.

The outcomes of the multifaceted Smart Cities collaborations will go beyond driverless cars and new apps. They will result in impact in the form of improved access, mobility, and opportunity for all Columbus residents. And every person in our community will benefit from that.

And just two weeks ago, Ohio State was named one of 18 institutions across the nation to be designated as a Beyond Traffic Innovation Center by the U.S. Department of Transportation. The center will bring together researchers, students and thought leaders to build a transportation system that can stand up to a population expected to increase by 70 million people in the next 30 years.

Sometimes the solutions to pressing social problems are less reliant on technology and more dependent on analysis of human behavior and social interaction. For example, Natasha Slesnick from education and human ecology and her collaborators brought

together university scientists and community social service collaborators to reach a truly underserved group—homeless teens.

Natasha is the founder of Star House, the only research-based drop-in center for homeless teens in the country.

Star House enabled Natasha and her collaborators to reach out to teenagers and young adults who are disconnected from services—in settings such as abandoned buildings and libraries. Their finding that drop-in centers may be more effective in helping homeless teens than overnight shelters has the potential to assist communities with aiding the most at-risk kids.

Yet another unusual partnership is seen in the Agricultural Data Coalition, founded in part by Scott Shearer, in food, agricultural, and environmental sciences. Twenty-first century farming is accomplished using high-tech equipment and tools that generate massive amounts of data. The Agricultural Data Coalition is building a national online data repository to help farmers better control, manage and maximize the value of the data they collect. From real-time information on crop conditions to growing alerts and recommendations, this information will help growers take full advantage of all that precision agriculture has to offer.

One of the key differentiators here at Ohio State is our commitment to international partnerships. Our relationship with Brazil and the São Paulo Research Foundation is resulting in some unique research partnerships that span disciplines and cultures.

Both Ana Paula Alonso of molecular genetics and H. Lisle Gibbs of evolution, ecology, and organismal biology received seed support through a joint Ohio State/São Paulo Research Foundation funding opportunity. Ana, along with co-investigator Jason Slot of plant pathology, are working to better understand how plants promote beneficial fungi and how fungi interact with each other to affect plant defenses. Lisle is working to determine how key innovations with the venom system have contributed to diversification in the 2,500 species of advanced snakes.

Both Ana and Lisle were able to build on their seed funding and get support from the National Science Foundation's Dimensions of Diversity campaign. The campaign aims to transform how we describe and understand the scope and role of life on Earth by 2020—a body of knowledge our Ohio State researchers and their Brazilian peers will most definitely contribute to. These faculty were able to take seed funding and expand their projects to win major NSF awards.

Citizen science is yet another example of unusual partnerships, as well as an effective way to gather data while increasing the public's knowledge about science. Ayaz Hyder from public health and Andrew May from engineering are tapping into our city's vast youth resources to gather data for an NSF-funded air quality study.

Hilliard City School students are working to fabricate and deploy a wifi-enabled air quality sensor network that will monitor traffic-related pollutants. Data gathered will be sent to a cloud computing system that will provide real-time air quality information to the public.

Best of all, Hilliard students will use this information to develop outreach activities that will educate other students about local air quality—amplifying the impact of the program and igniting an interest in science and the environment for young people.

Sometimes the people whose livelihoods are in jeopardy from an unclean ecosystem are among the first to step up and take action. That was the impetus for a group of Lake Erie charter fishermen—concerned about harmful algal blooms and the impact it could have on their business. They approached the Ohio Environmental Protection Agency several years ago.

Now, Ohio State's Stone Lab research coordinator Justin Chaffin works with about 10 charter boat captains who collect weekly water samples in the Western Lake Erie basin. When the captains drop off their samples, researchers provide them with data from the previous week's collection—giving them science-based information on Lake Erie water quality that they can share with their customers, while the scientists can continue to

expand their understanding of how we can improve water quality in the lake. Talk about a win-win for academia *and* industry.

Air and water contaminants may be the most talked-about types of pollution, but noise can have harmful consequences that affect learning, quality-of-life, biodiversity and health. Larry Feth in speech and hearing is engaging citizen-scientists in the Columbus community to map Columbus' noise levels in his effort to educate the public, policy-makers and scientists.

Citizens can download a free app that measures the noise level of their location and tags the file with GPS coordinates. The Columbus Soundtrack project will be the first measurement-based, comprehensive noise map of an American city—a project that will give us all a better understanding of the impact of noise on our lives.

Inside Ohio State, we are applying this same kind of creative thinking to build new disciplinary partnerships across the university. When mathematics meets biology, dance meets science, or astronomy meets philosophy—we can begin to look at the world in a different way. And, this “collective diversity” will help us find opportunities for collaboration that are “less obvious.”

One of the more intriguing collaborative institutes Ohio State hosts is the Mathematical Biosciences Institute which will celebrate its 15th year of impact in 2017. Established in 2002 through a National Science Foundation grant, the institute fosters an international community of researchers who tackle a wide range of issues in the biological and biomedical sciences but with a mathematical focus. Each year, new topics are studied by a cadre of postdocs from all over the U.S. and the world. Examples of topics have included neuroscience, cancer and cell signaling. Farrah Sadre-Marandi's research in modeling human disease is leading to a better understanding of nucleic acid/protein interaction in HIV-1. Punit Gandhi studies spatial patterns in biological systems, including vegetation patterns in semi-arid regions that are thought to arise in response to limited resources. And Reginald McGee investigates how mathematics can lead to a better understanding of signaling pathway dynamics in leukemic cells. The institute's

work is as fascinating as it is limitless, and we look forward to seeing where the next 15 years take us.

Physics, philosophy and astronomy go hand-in-hand in a project spearheaded by Christopher Urban, assistant professor of physics at Ohio State Marion.

“The Revolution in Cosmology and Fr. Georges Lemaître’s Hidden God” examined Lemaître’s work as an astrophysicist and priest in the early 20th century. His research helped lay the groundwork for the Big Bang Theory and also produced some of the most fascinating interactions between science and faith in the last century.

Support from the Battelle Engineering, Technology, and Human Affairs Endowment enabled Chris to develop new coursework and public lectures exploring not only Lemaître’s scientific accomplishments, but also the religious dimension of his work.

And how about academics meets athletics? At a university well known for its athletics prowess—and in a national culture in which sports play such a prominent role, Ohio State’s Sports and Society Initiative is taking the lead in the study of how amateur and professional sports impacts the economy and society.

The work is truly interdisciplinary—with leadership from Lucia Dunn and Trevon Logan in economics, Chris Knoester in sociology and Nicole Kraft in communication, and involving other university entities as diverse as neuroscience, social work and recreational sports.

From discussions about the ethics of Native American mascots and compensation for college athletes, to research on sports betting markets and college football scandals, the initiative provides a platform for students and faculty to examine some of the most important issues in sports today.

It’s not every day that engineers and social workers engage in common dialogue. But that is exactly what happens in Tech4Community. Led by Kevin Passino in engineering and John Clapp from social work, Tech4Community engages engineers, social workers and community members to bring technology to the most underserved populations in

Columbus. Joining with non-profit partners such as Open Shelter, Worthington Food Pantry, and Catholic Social Services, the group identified how technology could help the homeless heat their tents in the winter and prepare food; how food pantries could improve logistics; and how to teach computer skills to those seeking employment.

A team of researchers spanning nearly every college on campus comprises the Decision Sciences Collaborative. Led by Ellen Peters in psychology, the collaborative is working to develop basic theory in decision making to help people improve their decisions, and ultimately their well-being, in the face of the deluge of information they are presented with each day.

The team is investigating such things as – How do we make the best financial decisions?; When do teams outperform individuals in making the best decisions?; How can we better package medical information to help patients in their decision making? The answers to questions like these will ultimately benefit all of us who are drowning in information overload.

Sometimes it is the artists among us who create the most unexpected collaborations. Thanks to art professor Michael Mercil, Ohio State may get its own wind farm in the heart of campus. He hopes to build a 500-square-foot green-energy park that includes a 70-foot-tall wind turbine, possibly on a site adjacent to the Wexner Center. Electricity generated by this project could support the creative endeavors of the Wexner Center and the university as a whole.

This would be the third installment of Michael's Living Culture Initiative, which has embodied Ohio State's founding mission as a land-grant institution focused on the agricultural, mechanical and liberal arts.

Partnerships with the Wexner Center; art; Energy and Environment; Food, Agricultural, and Environmental Sciences; and funding from Battelle are making this project possible—and we can't wait to see the results.

And finally, when looking for unmatched creativity and incredible results arising from unusual collaborations, look no further than Ohio State's exemplary student body.

Take Marie Lamantia, for example, a double major in pre-medicine and dance. Marie received a Pelotonia Fellowship for her study, “It Takes Two to Tango: Argentine Tango Practice as an Intervention for Cancer Survivors”—a dynamic program for cancer patients suffering from chemo-induced peripheral neuropathy, a condition that leads to balance issues.

Volunteer patients from The James practiced the tango twice a week, while Marie captured data including the amount of a patient’s sway on a balance board—a major indicator of risk for falling. By the end of the 10-week session, patients’ sways had decreased by 56 percent—showing just how powerful an impact art and movement can have on our physical health, and making the case for inquiry at the intersection of seemingly disparate fields.

Our students don’t always use terms like “interdisciplinary” or “cross-collaboration”—but they are naturals at working together to solve problems. Ohio State’s hackathon evidences all that is possible when the brightest young minds converge and let their creativity shine.

When Arnab Nandi from engineering and Meris Mandernach of University Libraries launched Ohio State’s first HackOHI/O in 2013 with 100 participants, they likely had no idea it would grow to become Ohio’s largest hackathon with 750 students from 26 universities in 2016, and more than \$8,000 in prizes.

During HackOHI/O, students spent 24 hours building more than 100 technology projects that would solve a problem or meet a need in the marketplace. Over 100 judges from industry and academia awarded winning projects including, among others:

- a website to help people with disabilities learn whether businesses and public spaces are accessible
- a web platform that uses machine learning to classify political news as having a left or right bias
- a visual representation to help the hearing impaired experience music

- and an app that helps you find the nearest parking spot. Wouldn't that be a nice thing to have on a busy campus morning?

A dynamic new space at the Nanotech West Research Laboratory on Kinnear Road is inspiring undergraduates working in the Center for Design and Manufacturing Excellence. With just a few walls, group work areas and energizing colors, the Materials Innovation space fosters unique collaborations between students, faculty and external partners. The result? Innovation.

Already, engineering undergraduates Tyler Bair, Andrew Merz and Phillip Merz have built an interactive feature in the space that mimics the work of 3D printers on a 2D wall surface. A large-scale plotter attached to the wall allows users to program an image to be drawn on an erasable surface in minutes. The plotter has drawn the Mona Lisa, a rocket ship and the Block O. With plans to create a smartphone app that can convert an image to a drawing on a wall, this trio is taking full advantage of the center's resources to create breakthrough technologies.

It's one thing to innovate—but something else altogether to get your innovations to the marketplace. That's where I-Corps@Ohio comes in. Modeled after NSF's successful I-Corps program, I-Corps@Ohio helps faculty and graduate students validate the market potential of their technologies and launch start-ups.

One research team that completed the seven-week inaugural program included Santosh Dhakal, a graduate student in the Food Animal Health Research Program, and Renukaradhya Gourapura, associate professor in the veterinary preventive medicine program at the Ohio Agricultural Research and Development Center. They developed a nanoparticle-based swine influenza vaccine that could add up to significant savings for pork producers. I-Corps@Ohio connected the team to feedback from potential customers that is helping them rethink how the vaccine is administered.

As more research teams benefit from the expertise of I-Corps@Ohio, we will likely see even more Ohio State technologies finding success in the marketplace—and that is a

tremendous achievement for our students, faculty and those whose lives are improved through their innovations.

CONCLUSION: As we have seen today, discovering innovative solutions to complex problems requires bringing together people and ideas in unusual and creative ways. As members of the Ohio State research community, we count on you to create new paths that are a roadmap for the future, and to take that roadmap beyond the confines of our campus. Move outside of your comfort zone. Reach out to people you don't know. Strike up conversations with potential collaborators. Look to new models to support your research. Who might you partner with that you never considered before? Together we can collaborate in new ways that push the boundaries of discovery and can change the world.

To quote author Tony Robbins, "The only limit to your impact is your imagination and commitment."

And now it's time to recognize three individuals who have indeed turned their imagination into impact.

INNOVATOR OF THE YEAR AWARDS

I would like to invite Matt McNair, vice president for economic and corporate engagement, to join me on stage for the awards presentation.

Let's begin with the 2016 Student Innovator of the Year.

The Student Innovator of the Year award recognizes innovation and entrepreneurship among our students that have contributed to the development or commercialization of a new technology.

I would like to recognize the outstanding students nominated in this category who exemplify the innovators of the future. Please stand as I call your name. Kindly hold your applause until all names are called.

- David Butcher

- Breton May
- Jacob Mendlovic

Thank you. You may be seated.

The 2016 Student Innovator of the Year is passionate about using innovative engineering solutions to solve real-world problems. The award goes to **Jacob Mendlovic**, a recent Ohio State honors graduate with a degree in mechanical engineering and a minor in nuclear engineering.

Jacob is the primary inventor of a patent pending technology that does electrochemical imaging of below ground biomasses and fuel. He developed a microscale platinum wire probe that uses intrinsic electrochemical properties to create images of subsurface biomass structures.

The probe could provide farmers with information about soil conditions that would help them select crops resistant to drought and make adjustments to planting and irrigation techniques. National Park monitors could use the probe to analyze tree and biomass health, helping to mitigate wild fires. The Office of Energy and Environment sees potential for this technology to identify trace chemicals from fracking applications in water.

Please congratulate Jacob.

The Innovator of the Year and Early Career Innovator of the Year awards recognize researchers who are working actively to promote commercialization of university intellectual property, through invention disclosures filed, patents applied for and/or received, technologies licensed or spinoff companies formed.

The Early Career Innovator of the Year exemplifies our up-and coming innovators. Please stand as I call your name:

- Shahid Nimjee
- Anupam Vivek

- Lise Worthen-Chaudhari

Please give them a round of applause.

The 2016 Early Career Innovator of the Year uses the art, math and science of movement to integrate the creative arts with rehabilitation science. The award goes to **Lise Worthen-Chaudhari**, research assistant professor in physical medicine and rehabilitation and associate director of the Human Motion Analysis and Recovery Laboratory.

She and her team developed an interactive computer program called Embedded Arts for patients receiving occupational, recreational or physical therapy to recover from traumatic brain injuries, strokes and spinal cord injuries. The program uses motion capture technology to highlight the personal nature of prescribed rehabilitative movement and to document the recovery process. Movement detected by lightweight sensors is translated on a computer screen as an abstract painting.

Lise's technology has been licensed to Columbus-based Rekovo – a company whose mission is to “bring innovative ideas to the health care market that are both affordable and create tremendous positive impact.” The ultimate goal is for patients to be able to use this program at home to continue their therapy.

Please congratulate Lise.

The Innovators of the Year nominees have demonstrated the spirit of innovation by creating products, services or goods that benefit society. Please stand as I call your name.

- Bharat Bhushan
- Michael Freitas
- Daral Jackwood
- Dehua Pei

- Doug Scharre
- Chandan Sen
- Yael Vodovotz
- Yuan Zheng

Please give a round of applause to this exceptional group of innovators.

The 2016 Innovator of the Year has been a leader in robotics research for more than 35 years. This year's award goes to **Yuan Zheng**, professor of electrical and computer engineering.

In 2014, Yuan developed the Circular Wave Drive (CWD), a compact and co-axial gear head that allows for speed reduction in rotational motions. Speed reducers represent 36% of the total cost of an industrial robot. Yuan's CWD was developed as a replacement for the traditional harmonic gears used widely in the robotics industry. This invention could mean the formation of a new market of ultra-fast, high-precision steering and automation beyond robotic joints.

IKOVE, a local venture capital company, licensed his technology from the university in 2015 and founded a start-up company called CWD LLC. One U.S. patent and one international patent have been filed. Funding from the Ohio Third Frontier's Technology Validation and Start-up Fund was used to design and fabricate a prototype CWD. Yaskawa of Japan, one of the four largest robotics companies in the world is investing in the company for further development of the technology.

Please congratulate Yuan.

Each of our winners today has demonstrated the spirit of innovation by creating products, services or programs that benefit society. Let's give all of our nominees and awardees one final round of applause.

Thank you for joining us today and for the tremendous impact you are making at Ohio State and beyond. Please join me across the hall at Woody's Tavern to continue the celebration of our Innovators.