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THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

Earlier today, I had the pleasure of giving the keynote address at the Association for Women in Science's National Summit on Innovation and Entrepreneurship. I thought you might find my talk of some interest and attach a copy for your information.

Yours very truly,

Janet Napolitano
President

Attachment

cc: Chancellors

As prepared for delivery

President Janet Napolitano
Keynote Address
National Summit on Innovation and Entrepreneurship
Association for Women in Science
Oakland Marriott City Center
Oakland, CA
September 22, 2015

Thank you. And thank you all for inviting me to be here today. It was a long journey to join you from my office…across the street…so I appreciate the warm welcome.

I want to thank the Association for Women in Science for convening this important National Summit on Innovation and Entrepreneurship. I am pleased that the University of California, in partnership with the California Life Sciences Association and HBA, joined AWIS in hosting this day-long dialogue.

Much of that dialogue has been focused around a central challenge AWIS has identified, one that our society as a whole faces. And that challenge is this:

The need to develop inclusive, fiscally-responsive systems to drive research excellence, feed long-term economic growth, and fuel innovative solutions to global challenges facing all of our citizens.

I'd like to exit the stage before sundown, so I will not address this challenge in its entirety.

What I *will* do is spend some time talking about what the term "innovation" means in the context of public research universities like the University of California—and by extension, what that means for the challenge AWIS has identified.

A fundamental purpose of the University of California is to create an environment that fosters both opportunities and risks.

There are opportunities for undergraduates to become the first person in their families to earn a college degree.

There are intellectual risks for graduate students to take as they explore their own original thinking on established fields of study.

There are opportunities—and risks—inherent to multi-year research projects in the health sciences, or to multi-institution research projects in renewable energy, or astrophysics, or national security.

And there are the opportunities and risks that exist when researchers pursue innovative solutions to various challenges—and when they pursue potential commercial applications for those solutions.

Let me tell you about one UC researcher who exemplifies those opportunities and risks. Her name is Christine Ho.

Ho studied Materials Science and Engineering at UC Berkeley. As a newly arrived undergraduate at UC's oldest campus, Ho knew she wanted to do something in that discipline, but she did not yet know what specific path she would take.

During her sophomore year, Ho saw a help wanted ad for a research position. The ad called for an undergraduate who would undertake research in two labs—one run by James Evans, a Professor of Materials Science and Engineering, and one run by Paul Wright, a Professor of Mechanical Engineering, and at that time, the director of CITRIS at Berkeley.

CITRIS stands for the Center for Information Technology Research in the Interest of Society. Put simply, CITRIS is an incubator for remarkable and influential ideas and potential prototypes. There are four CITRIS locations—one at UC Berkeley, and the others at UC Davis, UC Merced, and UC Santa Cruz.

Professors Evans and Wright were at work on a multidisciplinary project focused on wireless sensing systems. Ho applied to the help wanted ad, and soon joined the project, too. She was assigned to a graduate student who was researching microbattery design, and the different ways in which microbatteries could be fabricated.

And it was here, as Ho says, that she "discovered a personal calling in developing new energy storage technologies."

After the graduate student with whom she had been working received his doctorate, Ho assumed leadership of the research project while undertaking her own Ph.D. in Materials Science and Engineering. Microbatteries continued to fascinate her. She was particularly intrigued by the research puzzle that manufacturing and using these microbatteries posed.

You see, the kind of batteries found in our laptops and smartphones, for example, are lithium chemistry batteries. Lithium batteries are made up from rare earth materials, which bodes poorly for our environment in the long-term. They are also highly reactive, and often need to be protected in such a way that adds extra bulk and size to the products that contain them. And while there are thin-film lithium batteries, these typically have a more limited capacity, and are expensive to make.

Ho pondered these fundamentals as she pursued her Ph.D. And at one point she decided it would be worth doing a brief fellowship in Japan to see if she could gain some new insights into the challenges these batteries presented. But when Ho arrived in Japan, she discovered that the lab where she would be working possessed neither the tools nor the resources to work with lithium battery materials.

So Ho turned to a different kind of battery technology:

Zinc.

Ho knew that zinc was a cheap battery technology that had been around for a while. She knew that zinc was both plentiful and environmentally benign. And she also knew that at the time, the biggest problem with zinc batteries was that they were not rechargeable. This is because zinc batteries tend to grow tree-shaped dendrites over their metal electrodes. These dendrites eventually short the battery, and prevent it from working.

But Ho had an idea. It was a profound idea that would lay the foundation for an incredible innovation:

Instead of trying to alter the zinc, what about altering the electrolyte inside of the battery?

And so Ho did just that. She removed the zinc battery's traditional liquid corrosive electrolyte, and replaced it with a polymer film. That polymer film prevented any dendrites from growing over the battery's electrodes. With that simple yet

powerful innovation, Ho created a rechargeable zinc microbattery. And it is a battery that can be printed cheaply on regular industrial screen printers.

Back in California, Ho developed her battery further at the Nanofabrication Lab at CITRIS, the incubator Professor Wright had directed. She also enrolled in a class at UC Berkeley's Haas Business School. There, she connected with a former high school classmate. Together, they entered the batteries in a couple of UC Berkeley entrepreneurship competitions—which they won—and ultimately raised 75,000 dollars. They also won a major 250,000 dollar grant from the University of California Office of the President Proof of Concept program.

With this funding, Ho and her co-founder launched the company Imprint Energy. Professors Evans and Wright, who started working with Ho back when she was a Berkeley undergraduate, both serve as advisors to Imprint Energy today. It is headquartered in Alameda, not far from here, and was just named one of the 50 smartest companies by the MIT Technology Review.

Dr. Ho's story is an inspiring one for anyone who works at a research university like UC. And we at UC are doing our part to make sure that the future Dr. Hos have the environment they need to take risks on innovations like flexible, rechargeable batteries—and just as significantly, that they have the opportunities to receive the appropriate credit and compensation for the risks they took.

That is why two years ago, I launched the University of California Innovation, Entrepreneurship, and Technology Commercialization Initiative. The goal is to steer cutting-edge discoveries at the University of California through our research labs and out into the global economy. Put simply, it is to accelerate the translation of ideas and inventions into products and services.

At the same time, we at UC want to foster an innovative and entrepreneurial university culture to encourage and facilitate the creation of new industries that improve our health, change the way we do in business, and enrich our lives.

Fortunately, the University of California already has a well-developed track record in the arena of innovation and entrepreneurship.

The University is home to 27 incubators and accelerators. Last year alone, UC research led to more than 85 start-ups, and nearly 1800 new inventions. That's almost five new inventions a day. And companies founded to commercialize UC technologies generated 14 billion dollars in revenue.

We are doing everything we can to maximize these numbers, and all that they represent—from unprecedented ideas to unparalleled inventions, and from the creation of new jobs to the creation of entire new ways of living.

We are also investing our own money in our own good ideas. This past summer, we launched the first primeUC competition, which will award 300,000 dollars to winning start-ups in the health sciences. And earlier this year, our Board of Regents approved the creation of a new 250 million dollar fund. Its sole purpose is to provide seed money for direct investment into student and faculty inventions.

But translating ideas and inventions into products and services is just one element of the innovation phenomenon at UC.

Imagine, for a moment, that the University of California were a Tesla Model S.

(Bear with me.)

Tesla is a company that sets the bar for innovation in automobiles. In fact, Tesla is currently innovating at such a high level, that last month *Consumer Reports* announced that the all-wheel drive version of the Tesla Model S had busted its rankings system because the car does things—and does things so well—that most cars do not.

(By the way, four years of in-state tuition total at UC is more than $50,000 cheaper than the lowest-priced model of this car…but I digress.)

Now, instead of one engine, this version of the Tesla Model S has two motors. This is one of the features that makes this car so unique and so powerful.

If the University of California were a dual-motor Tesla Model S, then the various endeavors of the Innovation, Entrepreneurship, and Technology Commercialization initiative would constitute *one* of those two motors.

The Tesla motors are powered by electricity. And at the University of California, education is the electricity. It is the education of the rising generations; of the future scientists and scholars who will create the new knowledge necessary for innovation; and of those who will, in turn, transmit that new knowledge to the future innovators.

In a Tesla vehicle, one could argue that electricity is where opportunities and risks most closely intersect. Figuring out how to best harness and maximize that electricity was Tesla's game-changer. And at UC, education is where opportunities and risks also most closely intersect.

A student named Ana Arteaga is just one example of this. Her story illustrates the specific mix of opportunities and risks that exists at this University.

Ana grew up in a low-income family in Merced. As a high school student, she took a big risk. She thought science was something "scary." But she put her fears aside, and decided to take place in a program called Project SEED. Project SEED finds spots for thousands of low-income students—nation-wide—in hands-on summer research experiences. And it placed Ana in the lab of UC Merced Professor Erik Menke.

Ana ended up enjoying her summer work in the Menke Lab. She was drawn to the group's research on solar cells. She learned, as she said, that science isn't scary—it's fun. So she took another risk. Even though no one in her family had graduated from college, Ana decided to apply to UC Merced.

UCM gave Ana the opportunity to earn a bachelor's degree in Chemistry—which Ana did. She graduated in May. And then she took another risk. This fall, she enrolled as a Ph.D. student in Material Chemistry at Oregon State University.

Ana says, and I quote, "if it wasn't for the opportunities and mentorship I have received from various faculty and staff at UC Merced, I would not be where I am today."

From this vantage point, the roadmap for Ana's future reaches in many different directions. Maybe she will pursue basic research in Chemistry. Maybe she will pursue an innovative solution to a major societal challenge. Maybe she will teach future innovators. Perhaps she will do all of these things—and more.

The point is that Ana's education at UC Merced is a foundation for countless future possible innovations. Without the electricity of education, innovation goes nowhere.

It is imperative that we never lose sight of the critical role that public research universities like UC play in the sphere of innovation. They are the only institutions in our society where vast numbers of students—many of them low-income, like

Ana—can pursue research opportunities, explore new ideas, and take intellectual risks while they earn a college degree, and begin the process of becoming the researchers and innovators of tomorrow.

And so if we want a society rife with robust innovation, then we need to make sure students like Ana have a place at UC, receive a high quality education at UC, and then have the time and space to pursue the ideas and innovations that arise in the course of their research efforts, whether at UC or elsewhere.

This brings me to the final point I'd like to make today.

Again, if UC were a dual-motor Tesla Model S, then one motor would be made up of the myriad efforts and endeavors that fall under the Innovation, Entrepreneurship, and Technology Commercialization initiative.

The other motor would be made up of basic research.

At UC, basic research is undertaken in a vast and intricate range of disciplines—from the humanities to agriculture to the hard sciences.

Basic research is fundamentally innovative. It re-shapes our understanding of the world in which we live. It provides a shared knowledge base for all scholars and researchers. And it is often the first step in the journey towards innovative solutions that ease and eliminate global challenges. But even though basic research is fundamentally innovative, it is necessary and appropriate that entrepreneurship and technology commercialization do not always follow the pursuit of it.

And here I want to tell you about a bioinformatician named David Haussler. He is a scientist at UC Santa Cruz. In the late 1990s, he joined the Human Genome Project.

The quest to map and understand the more than three billion base pairs of DNA that make up the human genome was one of Holy Grail caliber. Not long before the turn of the millennium, it galvanized scientists around the world into joining the public international consortium known as the Human Genome Project.

The pursuit was not limited, however, to this publicly-funded international group. A private corporation called Celera Genomics decided to join in on the hunt, too—and soon the quest became a race.

You see, Celera made clear that it would seek intellectual property protection on its findings. And although the Supreme Court has since ruled that genes cannot be patented, at the time that decision lay more than a dozen years in the future.

If Celera mapped the human genome before the consortium did, then it would essentially become a gatekeeper to the human blueprint, charging or restricting access to anyone who wished to study it. In anticipation of crossing the finish line first, Celera filed place-holder patent applications on thousands of genes.

But the consortium was not to be deterred. At Santa Cruz, Haussler assembled a self-described "scrappy" team of computer scientists. The Celera team was better funded, and had the most powerful computer cluster at the time outside of military use. Still, Haussler and the Santa Cruz scientists were determined to outpace them. To do so, they had to work off of data that resembled, as Haussler said, the pieces of a giant jigsaw puzzle.

They set to work. One genius graduate student on the team stepped in and wrote a new program assembly that accelerated their efforts. In fact, this grad student coded this program so furiously that Haussler said he had to "ice his wrists." Then the Santa Cruz Chancellor and the Dean of Engineering pitched in. They "hastily purchased" 100 desktop computers, so that the team could conduct their first assembly as soon as the data were ready.

The Santa Cruz team worked through long nights, and on weekend after weekend. And ultimately, the international consortium, led in this final lap by Haussler and his team, *did* beat Celera…by just three days.

A few days after that, on June 26th, 2000, the White House announced that the consortium had completed the first "working draft" of the human genome. And one week later, on what David Haussler called the most exciting day of his scientific career, UC Santa Cruz published the entire human genome sequence on the web—without restriction, and free for all to see and to study.

It was, as Haussler said, "humanity's first real glimpse at its own recipe."

There is a clear and undeniable need in our society for start-ups and corporations, incubators and venture capital firms to translate the work of researchers into products and services.

There is also a clear and undeniable need for institutions, like public research universities, that educate the future experts, foster opportunities for the creation of new knowledge, and give the space and time necessary for intellectual and innovative risk-taking.

And it is our collective responsibility—whether we are policy makers, business leaders, university administrators, or innovators—to ensure that these institutions never cease to fulfill this role, so that we can tackle the global challenges, drive the research excellence, and fuel the long-term solutions our society needs.

Thank you.