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2017 Golden Goose Keynote Address
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325 Russell Senate Office Building

Thank you, Julia. And thank you to the AAAS, AAU, and all of the sponsors and organizers of this inspirational event. My thanks also to Senator Coons for your strong support for science and for this event, and for being here today. I want to add my congratulations to this year's awardees.

I'm honored to have the opportunity to address this distinguished group about scientific research, something that I'm passionate about and that is so important to the nation's future.

The Golden Goose award is a chance every year to open our minds, shake off any cynicism and remind ourselves of the enormous and often unpredictable promise of science. It's an opportunity for all of us to recommit to ensuring that the U.S. remains a beacon for scientific discovery.

We all know that former Senator William Proxmire's Golden Fleece Awards were given to projects, including scientific research projects, that on the surface seemed useless or ridiculous. But superficial scrutiny risks killing "the goose that lays the golden eggs."

So, here's a project with a suspiciously funny-sounding title -- the "marshmallow test." Raise your hand if you think that the "marshmallow test" got a Golden Fleece Award. Who thinks it got a Golden Goose Award? Turns out that the research was recognized as a Golden Goose winner in 2015.

In that experiment, preschoolers were offered a choice between getting one marshmallow immediately, or two if they were willing to wait, and researchers observed all the inventive ways kids managed to take their minds off the treat sitting in front of them. The "marshmallow test" paved the way for a whole body of work on the importance of delayed gratification to later success, and how delayed gratification might be instilled.

I might add that this is a great example to use for the Golden Goose award, which is all about the delayed gratification. The point is that we support science even though it may not pay off until years later.

Okay, let's try a different research topic. How about this one: "the chemistry of sandwich compounds"? This seems fitting for a lunchtime speech, right? Raise your hand if you think it got a Golden Fleece? Okay, Golden Goose? Well, that research actually won the Nobel Prize in Chemistry, and ended up being of great importance to the chemical industry.

The original compound became a substitute for lead in gasoline, and related chemicals are now being used to help develop new medications. But even when the researchers were awarded the Nobel Prize back in 1973, no one thought their discovery would have much commercial significance. The Nobel press release said of the chemists' work, and I quote, "practical applications...are not very obvious – it is a prize in 'chemistry for chemists.'"

It's important to remember that it wasn't just luck or happenstance that caused the U.S. to be a leader in this kind of basic, discovery research – and a leader in capitalizing on it. After World War II, the U.S. set out consciously to build a research system that would support long-term work.

The system they built remains the envy of the world.

The heart of that system was – and is – a partnership between the government and universities, for the benefit of the American public. Innovation is the driver for much of our economic growth, and basic research is an engine of that innovation, generating new ideas, spin-off companies and advances that can make us safer and healthier, and improve our quality of life.

But the U.S. also supports science for a related, but less tangible reason. Science is an enterprise that is inherently about the future – it's about knowing things tomorrow that we don't

know today, about increasing our understanding of the world, which, we hope, will enable us to live better, more fulfilling lives. Science is a concrete expression of confidence and optimism.

That confidence, and faith in human curiosity continues to bear fruit. Think of the long-term support of the National Science Foundation for LIGO: the Laser Interferometer Gravitational Wave Observatory. In the past year LIGO detected collisions of massive black holes. These cosmic cataclysms produced ripples in the fabric of space – gravitational waves, the existence of which were first predicted in 1916 by Albert Einstein in his theory of general relativity. Congress first approved LIGO in the early 1990s, taking a big leap of faith for a risky endeavor with no guarantee of success.

While opening up a completely new way for us to observe the universe – by listening rather than seeing – LIGO is also spawning novel techniques and technologies with numerous applications – and not only in physics. Already, spinoffs are emerging in scientific disciplines that have nothing to do with black holes or the fabric of the universe. Just two weeks ago, biomedical researchers

published a paper describing how they had used technology developed for LIGO to add crucial precision to a new method to grow a person's own stem cells into bone grafts. This application could revolutionize the treatment of severe bone injuries, and mean the difference between someone being confined to a wheelchair or retaining mobility using a prosthetic leg.

The work of the Golden Goose awardees we honor today also exemplifies the benefits that flow from our national investments in discovery research. Who would have predicted that Kaichang Li's fascination with mollusks would eventually bring us a commercially viable alternative to cancer-causing glue adhesives? Who would have known that Lotfi Zadeh's seemingly obscure mathematical concepts that he called "fuzzy sets" would end up being used in over 16,000 patents with applications ranging from HVAC systems to medical devices? And one could scarcely have predicted that the mystery of massive frog die-offs would be solved by Joyce Longcore's obsession with fungi, and the shared fascination with "creepy, crawly things" of Elaine Lamirande, Don Nichols, and Allan Pessier.

One ingredient needed to keep this system thriving is money – patient capital in the form of government support for research that is risky or removed from immediate application. There is simply no player other than the government equal to the task of ensuring that the U.S. has a thriving basic research enterprise. No other institution has the capacity or the incentive to fill that role.

But funding is obviously just one ingredient for scientific success; another crucial factor is attracting a steady stream of talented individuals into research.

Scientists can emerge from any background, and we must make sure that our young people know that.

My own story is instructive. I grew up in the Pennsylvania coal country. Both my grandfathers were miners. I left my hometown to pursue my passion for science, which has been, and continues to be a wonderful adventure.

I am far from unique in my humble beginnings. A former member of the National Science Board is a first-generation American whose father was a shoe salesman. This former Board member found his way into engineering through mathematics and a love for the trumpet. Another of my Board colleagues was born to a farmer and a beautician and followed an unlikely path to becoming a scientist.

Recently, the National Science Board met with a young man who shared his circuitous path into science with us. Talented but rebellious as a teenager, by his late 20s, he found himself stuck in a job that barely paid the bills, but he had a yearning to work on more challenging problems. Thanks to support from NSF's community college programs, this young man won an internship at NASA's Jet Propulsion Laboratory. He is now well on his way to fulfilling his dream and contributing to America's science and engineering story. And he is "paying it forward" – he founded an organization that gives community college students a chance to build leadership skills, conduct undergraduate research, and work with public school students who are interested in STEM careers.

We need to make stories like this more common. And we can only do that if students know that science is not something closed off to them if they don't come from some privileged precinct, or if they are women, or minorities.

And there's no conflict between that goal and ensuring that the U.S. continues to attract the best students and faculty from around the globe. Our country needs to remain a magnet for the best and for those striving to become the best. If our leadership erodes, we will lose both the talent we attract from overseas and the opportunities we offer to those born here.

Our universities, like our government officials, also need to think harder about how to ensure that the benefits that flow from research permeate our entire society. That is a challenge today in our era of economic stratification and rapid technological change.

But no one will be better off if we cede our advantage in research to others.

To keep that advantage, we also need to make sure the U.S. doesn't weaken a third ingredient of our scientific success, freedom of inquiry. Science has thrived in this country because of our democratic values, and some of the greatest U.S. scientists have come to this country fleeing despotic regimes.

Science cannot prosper if researchers fear attack for honest work that leads to uncomfortable conclusions. Scientific results must always be open to question and probing, and society should always be able to discuss the ethical, social and economic implications of scientific work. But researchers should not be expected to produce results that accord with any particular agenda.

So, there's no secret to making sure the goose keeps laying the golden eggs – it takes patience, sustained funding, a broad talent pool and open inquiry – all things that are easier to enumerate than to provide.

But I'm optimistic. I'm optimistic because I'm a scientist. I'm optimistic because we are building on a history of success. I'm optimistic because of gatherings like this one, which every year brings together a bipartisan group of officials and scientists who are working to strengthen the U.S. scientific enterprise. I'm optimistic because of the kinds of scientists and scientific work we honor with the Golden Goose award. And I'm optimistic because science is linked to a fundamental human trait, curiosity.

I look forward to continuing to work with all of you in this room and our supporters and colleagues throughout this country who are responsible for the U.S. continuing to be a world leader in science. Thank you.