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House Judiciary Subcommittee on Courts, Intellectual Property, and the Internet

"Lost Einsteins: Lack of Diversity in Patent Inventorship and the Impact on America's Innovation Economy"

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My name is Professor Ayanna Howard and I am an innovator, entrepreneur, leader, and international expert in robotics. Currently, I am the Linda J. and Mark C. Smith Professor and Chair of the School of Interactive Computing at the Georgia Institute of Technology. I have also served as the Associate Director of Research for the Institute for Robotics and Intelligent Machines, Chair of the Robotics Ph.D. program, and the Associate Chair for Faculty Development in the School of Electrical and Computer Engineering at Georgia Tech.

From 1993-2005, I was at NASA's Jet Propulsion Laboratory where I held the titles of Senior Robotics Researcher and Deputy Manager in the Office of the Chief Scientist. I hold a degree in engineering from Brown University, a M.S. and Ph.D. in Electrical Engineering from the University of Southern California, and an M.B.A. from the Drucker Graduate School of Management.

After leaving NASA in 2005, I entered academia and started up my own robotics research lab at Georgia Tech. My research concentrates on advancements in robotics, assistive technologies, and artificial intelligence, which has resulted in over 250 publications. My innovations are focused on designing socially-interactive robots to address the therapeutic and educational needs of children with disabilities. In 2013, I founded Zyrobotics, a Georgia Tech spin-off company, which designs AI-powered STEM tools and learning games for children with diverse learning needs. My research has been supported by various agencies ranging from NASA, the National Science Foundation, Intel, Grammy Foundation, Exxon-Mobil, Microsoft, and the Georgia Research Alliance. Despite all these successes, I only hold three patents, which will be the subject of discussion later.

I regularly consult and sit on the advisory boards of a number of organizations concerned with robotics, AI, and workforce development. My work has also been highlighted through a number of awards and articles, including highlights in *Vanity Fair, USA Today, Upscale, Black Enterprise*, and *TIME Magazine*, as well as being recognized as one of the 23 most powerful women engineers in the world by *Business Insider* and one of the Top 50 U.S. Women in Tech by *Forbes*.

I'd like to now focus on my experience with the patent system. I do consider myself an innovator and an entrepreneur. Invention is core to what I do. I have hardware and software merchandise currently selling on the market. I have productively deployed robot systems in the homes of children with special needs. I have successfully translated research from an academic lab into commercial products. And yet, I only hold three patents. Findings from the U.S. patent office

have shown that, even though there have been gains in female participation in science and engineering occupations and entrepreneurship, there has not been a corresponding increase in female patent inventors. My story corroborates with this claim. My first patent application was filed in 2003, while I was still a graduate student. I was working with a small startup company and designed an encryption system based on fingerprint biometrics to secure the transmission of digital information, which could range from full-length feature films to music recordings to even electronic medical records. Given that neither of us had great financial resources, we put together the application and filed. We eventually dropped pursuit of the application after our patent claims were denied. After all, in the word of logic, a rejection means just that - patent denied!

It wasn't until 10-years later, in 2013, that I pursued my next patent. And the only reason that came about was that I needed to submit a provisional patent in order to compete for an NSF program called I-Corps. NSF I-Corps is basically a program that teaches academics how to rethink how their research impact could go beyond paper publications to having a larger societal and commercial impact. To compete, academics had to have university-derived IP that was produced from an NSF grant. At that time, I'd developed, with my students, a device that enabled children with motor disabilities the ability to interact with tablet devices without requiring pinching, swiping, or touching – which could be difficult for a child with limited upper arm mobility. I quickly had a provisional patent submitted through Georgia Tech (in 2012) so that I could successfully compete for the NSF grant, which we were then awarded.

A year later, in 2013, when the provisional patent was to expire, I'd requested Georgia Tech to move forward with filing the patent application. After much discussion, they finally agreed to file. Although, it's now 2019, and almost six years later, it still hasn't been granted.

So, what about the other patents that have been granted? Well, I discovered a bit of a trick. Hire a great patent lawyer. When Zyrobotics, the Georgia Tech spin-off was founded, it licensed the IP from that first filed patent. Given that I knew, to be competitive, the company had to possess its own IP, we hired an extremely talented patent attorney (that was a Georgia Tech grad and worked with academic startups). Although quite expensive, we secured two patents within a two-year time frame. And, I finally understood how the process worked – how the back-and-forth dance with the patent examiner evolves, how denial really means find another way, and another way, and another; and how persistence can eventually lead to success. Unfortunately, the price-tag is not very sustainable for a startup company in the education space. I also think it's not that sustainable for an academic institution, in which the return on investment is not well-defined.

So, given my personal experience in this space, it comes as no surprise that women still comprise a small minority of patent inventors. Reports state that U.S. female-founded startups raised just 2.2 percent of venture capital investment in 2018. Without sufficient capital, how then would you prosecute a successful patent application given that the price-tag is so high? It's a lose-lose situation given the current state-of-affairs.

Is there anything that I can think of that would have possibly made this journey a bit easier earlier in my career? Or enhanced my positioning in terms of laying claim to my inventions and having broader impact? As a young women engineer, having a patent expert that was able to communicate its importance to scientists and provide a hands-on curriculum for going through

the process of the patent application would have been a start. But, now, I believe, given the current state-of-affairs, a more robust pro bono patent attorney/agent program for small businesses and individual inventors would immensely help inventors compete in this patent world. It would also help level the playing field just a bit more for women and other underrepresented entrepreneurs.

In closing, I appreciate the Committee's attention to this topic. I stand ready to answer your questions and work with you on moving forward to help create a patent system where more researchers like myself can find success navigating the ins and outs of pursuing a patent.