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**Notes for panel discussion: Women with Disabilities, and STEM education and workforce.**

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Good afternoon. I am honored to be part of this panel and to have an opportunity to spend a few minutes addressing an issue about which I am passionate: women, disabilities, and STEM.

I want to briefly discuss two premises: why science needs women with disabilities and why women with disabilities need science. Then I will talk about programmatic issues involving STEM education and STEM careers for women and girls with disabilities and describe three suggestions for promoting access and success for women and girls in STEM.

First, Why does science need women with disabilities?

The world is depending on science to make discoveries and design innovations that will solve many of the social and material problems that face our world. From oil-eating microbes, spray-on paint that contains tiny solar collectors, mathematical concepts to discover new biological molecules for a range of diseases and calculating their effectiveness, the fields of science and engineering will lead us into a positive future.

And the work of providing a better future through science and technology will take all the person power we can recruit. The world cannot afford to ignore a potential Madame Curie, a Mary Leakey, or a Maria Mitchell, the first US female astronomy professor. Barbara McClintock, who won the Nobel prize in 1983, is one of the most famous crogeneticists in the world. Grace Hopper, innovator in computer language. Carol W. Greider, the 2009 Nobel in physiology who has dyslexia.

Who are the scientists who will make up the future workforce in STEM? In the US, women make up 22% of the science and engineering workforce. Women are 30% of the science and engineering candidates for advanced degrees. Individuals with disabilities are 1% of the recipients of advanced STEM degrees, even though 20% of the population of the US has a disability as defined by the Americans with Disabilities Act of 1990. Despite progress, this is still a glaring disparity both in STEM education and the STEM workforce. So it looks like the future STEM workforce is mostly male and is almost exclusively males without disabilities.

This is alarming for several reasons:

Reason #1. The loss of creative, talented minds in the important endeavors of discovery and innovation delimits the potential of science to make our world a better, safer, cleaner, healthier, more interesting place.

Overlooked pool of scientifically talented individuals.... Problem-solvers

Women scientists have made significant contributions to discovery and innovation. Individuals with disabilities have contributed to scientific discoveries – think Einstein and Edison.

The National Science Foundation (NSF) believes that a diverse STEM workforce, one that represents all perspectives and experiences is essential. NSF's commitment to broadening participation is embedded in its Strategic Plan through a variety of investment priorities committed to preparing a diverse, globally engaged science, technology, engineering, and mathematics (STEM) workforce. 20% of the population of the US has some form of disability, 14% of all employed persons have a disability, and 5% of employed scientists and engineers have disabilities.

Why do women need science education and careers?

Reason #2 for alarm about the lack of women with disabilities in the STEM field is this – women need science education and careers. When the STEM doors are closed to women with disabilities, they are shut off from very fulfilling and economically advantaged careers. The average wage for a biochemist or biophysicist in 2008 was \$82,840. Scientific and technical analysts earn \$40 an hour. The median annual income for women in 2008 was \$35,745.

Women with disabilities are likely to receive less education than both non-disabled women and men with disabilities. Sex role stereotyping is more pervasive when students have disabilities.

Men with disabilities are twice as likely to have jobs as women with disabilities and 42% of men with disabilities are in the workforce compared to 24% of women. Only 12% of women with disabilities are in the workforce full time.

**What are we doing at NSF related to women, disabilities, and STEM?**

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 to promote science innovation, research, and education. With an annual budget of about \$6.9 billion (FY 2010), NSF funds approximately 20 percent of all federally supported basic research conducted by America's colleges and universities. In many fields such as mathematics, computer science and the social sciences, NSF is the major source of federal backing. There are three programs within NSF that focus on STEM and women/girls or students with disabilities. These are part of the Human Resource Development Division.

The first program, *Research in Disabilities Education (RDE)*, seeks to broaden the participation and achievement of people with disabilities in all fields of science, technology, engineering, and mathematics (STEM) education and associated professional careers. The RDE program has been funding this objective since 1994. Projects also investigate effective practices for transitioning students with disabilities across critical academic junctures, retaining students in undergraduate and graduate STEM degree programs, and graduating students with STEM associate, baccalaureate and graduate degrees. Research project results inform the delivery of innovative, transformative and successful practices employed by the Alliances for Students with Disabilities in STEM to increase the number of students with disabilities completing associate, undergraduate and graduate degrees in STEM and to increase the number of students with disabilities entering our nation's science and engineering workforce.

The Research on Gender in Science and Engineering (GSE) program supports efforts to understand and address gender-based differences in science, technology, engineering, and mathematics (STEM) education and workforce participation through research, the diffusion of research-based innovations, and extension services in education that will lead to a larger and more diverse domestic science and engineering workforce. Typical projects will contribute to the knowledge base addressing gender-related differences in learning and in the educational experiences that affect student interest, performance, and choice of careers; how pedagogical approaches and teaching styles, curriculum, student services, and institutional culture contribute to causing or closing gender gaps that persist in certain fields.

The goal of the National Science Foundation's (NSF) ADVANCE program is to increase the representation and advancement of women in academic science and engineering careers, thereby contributing to the development of a more diverse science and engineering workforce. ADVANCE encourages institutions of higher education and the broader science, technology, engineering and mathematics (STEM) community, including professional societies and other STEM-related not-for-profit organizations, to address various aspects of STEM academic culture and institutional structure that may differentially affect women faculty and academic administrators. As such, ADVANCE is an integral part of the NSF's multifaceted strategy to broaden participation in the STEM workforce, and supports the critical role of the Foundation in advancing the status of women in academic science and engineering.

**There are two Issues related to access and success in STEM education and careers for women with disabilities:**

1. The social construction of disability.... The medical model of disability sees disabilities as a tragedy resulting from an impairment within the person... this would indicate that the person needs to be “fixed” or “rehabilitated” .... If, instead, we adopt the social model of disability, we understand that a person may have a physical or cognitive impairment, but that it is building without ramps, computers with readers, classrooms without microphones or chemistry labs without wide doors that delimit ability. This model of disability is important because it tells us if we should fix a person or remove barriers.... .. example: making an emergency shower accessible may simply involve adding a chain. Or making adjustments in the height of equipment. Others are more complicated –such as various assistive devices, voice recognition software, visual alarms and printers that output Braille.
2. The stereotype of who is a scientist..... There are many misconceptions about the ability of those with physical or learning disabilities to succeed in science and engineering. These misconceptions or stereotypes can deter young people with disabilities from pursuing careers in STEM and can limit job opportunities for both those who obtain degrees and those who develop disabilities later in life. Young people can be discouraged by parents, teachers, and others from pursuing careers in STEM.

NSF and other organizations are working to address these issues as well as others involved in assuring access and success in STEM. In answer to the question, What can we do?, I have 3 suggestions. For each suggestion I have examples from projects funded by NSF and activities by other organizations – some supported by philanthropic organizations, educational organizations, or advocacy groups for women/girls, individuals with disabilities and science and engineering.

1. Work to assure that STEM education is available and accessible for ALL. The Foundation for Science and Disability (stemd.org) provided grants to students with disabilities who are conducting research in STEM fields. NSF’s Research in Disabilities Education program is funding a virtual space for high school and college students with disabilities to enter for virtual tutoring, mentoring, and social networking. Their teachers and professions can enter the same space for training, professional development, and resources. K-12 schools and universities are using Universal Design for Learning in math and science classes to accommodate education for students with disabilities. The National Institutes of Health offers awards to encourage individuals with

disabilities to pursue bio-medical, behavioral, clinical or social science research careers. The National Institute on Disability and Rehabilitation Research and the Office of Special Education and Rehabilitative Services are parts of US Department of Education. They fund research and program development related to education of individuals with disabilities and to identify effective strategies to enhance opportunities for individuals with disabilities to engage in productive work and live independently.

#0962380: (ENG) undergraduate design project to aid persons with disabilities to improve their quality of life; teaching engineering as well as awareness of disabilities issues in undergraduate engineering students; they think this will attract women and individuals with disabilities to the field of engineering.

#1036637 (GSE) Gender and science proficiency for English language learners. Research to discover and describe the conditions and experiences that impact science learning for female ELL adolescent students in urban middle schools.

#0930896: (RDE) improving STEM learning for students with learning disabilities using interactive cyberenabled workspaces for high school students. The focus is on learning chemistry and physics.

2. Work to eliminate stereotypes and misconceptions based on gender and disability. WAMC, a public Radio Station, has funding from the Research in Disabilities Program and the Gender in Science and Engineering program at NSF to develop radio broadcasts about women in science and women with disabilities in science. High school and university STEM programs are working with parents and students to stress the potential rewards of a STEM career, and to address their concerns about safety and acceptance. Feminist advocacy groups are promoting pro-math and science games and toys for girls. Businesses are providing disability etiquette training. Most advocates insist of “people first” language, except **for the deaf and the blind.**

#0819436: (SBE) addresses out concerns for stereotypes in encouraging women w/d to enter scientific careers. The research study looks at status and stigma and it will look at markers such as gender, age, education, and disability status.

#0940599: (CISE – computer and information science and engineering) [WWW.2](#), a wide web for women.... Establish communities of women in computing... serve as role models, do mentoring, provide information and encouragement.

#1039546 (DRL) Using dramatic play, Theatre of Social Engagement, to look at the ways in which gender, ethnicity and class effective identity and career choices in STEM, especially in information technology and computer science

3. Use the information we know about teaching girls and individuals with disabilities to provide a maximal education. Women and girls with disabilities should benefit from the more than 2 decades of research about girl and science and math, about the education of students with disabilities, and about gifted education. We know that working on problems related to community and nature promote interest and achievement in STEM learning for girls. We know that well-organized teaming promotes achievement for girls, minorities and students with disabilities. We know that when students are mentored or taught by someone who is “like them”, self-concept as a scientist is improved. We know that often same-sex classes in math are beneficial for girls. We need to advocate for the use of these proven practices and we need to practice them ourselves.

#0833969. (RDE). How does using an interactive illustrated 3D dictionary of math terms and definitions promote the math achievement of elementary and middle-school students who are deaf and hard of hearing and whose first language is sign.

#1023911 (SBE) Research about the effects of single-sex high schools in reducing the gender disparities in STEM learning and interest.

## **Conclusion**

To wrap up my remarks, I want to reiterate I am concerned about the joint issues of women and girls, disability, and STEM education and careers for several reasons. First, the make-up of the scientific workforce is crucial to solving problems that face our world; and that workforce should not exclude the best and the brightest because they happen to be women with disabilities. Second is a social and economic justice reason: women with disabilities do not have parity in educational opportunities or educational achievement; nor do they have the social and economic rewards that come with a STEM career. And finally, women with disabilities need to be included in the STEM workforce because there are jobs in those fields, and because those jobs are relatively high paying.

To increase the accessibility and success of women with disabilities in STEM education and careers, we must continue to advocate for equity and justice. But we must also work to assure that STEM education is available and accessible for ALL,

work to eliminate stereotypes and misconceptions based on gender and disability, and use the information we know about teaching girls and individuals with disabilities to provide a maximal education.