

AAUW

WHY SO FEW WOMEN IN SCIENCE?

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LINDA HALLMAN: Good morning, everyone. Hopefully this mike will not cause you ear problems. As an ex-musician, I value my hearing very much so I will protect you as much as I can. I'm Linda Hallman. I'm the AAUW executive director and I'm absolutely pleased to welcome you here today for this briefing on our latest research report, "Why So Few? Women in Science, Technology, Engineering and Mathematics."

I think a lot of you know AAUW. You'll find that there are reports on all the chairs.... If you want it in multiple copies, you can take them with you and at any time, you can come to us and ask for more or you can download the report off of our website.

Those of who know AAUW know that we have more than 100,000 bipartisan members across the United States, we have 1,000 branches across the country and 500 college and university partners.

Supporting women and girls in science, technology, engineering and mathematics has truly been a part of our mission since we were founded in 1881. Throughout our history, AAUW has encouraged women to study and work in these traditionally-male fields, investing millions of dollars in graduate fellowships and grants, and engaging in research, programming and advocacy to break through barriers to women, for women, in these fields.

Drawing on a large and diverse body of research, this report, "Why So Few?" provides compelling evidence of the environmental and social barriers that continue to limit women's participation in the science and math fields. Funding for this report was provided by the National Science Foundation and some of our most generous AAUW members.

Today, we are really proud to share the findings from this report and to hear from Dr. Carol Greider, who is a biologist at Johns Hopkins University and, last year, won a Nobel Prize. We are also proud to say she is an AAUW member.

It is now my pleasure to turn the program over to Christianne Corbett, who will discuss the findings from the report. Christi is a research associate at AAUW and a co-author of the report. And before coming to AAUW, she worked as a legislative fellow for Rep. Carolyn Maloney, and was a mechanical design engineer in the aerospace industry. Christi?

CHRISTIANNE CORBETT: Thank you, Linda. I'm happy to be here today to share with you all the findings from our report, "Why So Few? Women in Science, Technology, Engineering and Mathematics."

As most of you know, women have made tremendous progress in education and the workplace over the past 50 years, and that's in science and engineering as well. As this chart shows, this is the percentage of employed professionals who are women in selected STEM fields. So STEM is the acronym most of you know for science, technology, engineering and math.

From this chart, you can see that in 2008, women made up over half of working biological scientists. But over here on the other end, they made up fewer than 7 percent of working mechanical engineers.

The purpose of this report is to explore this question of why so few? So based on interviews with top researchers and a review of the large body of academic literature on gender and science, “Why So Few?” presents eight research findings that present evidence on the nurture side of the nature/nurture debate.

Each of the findings demonstrates that social and environmental factors clearly contribute to the underrepresentation of women in these fields. Today, I’m going to talk a little bit about each of the findings – some in more depth than others; some I will only touch on briefly in the interest of time.

So the first finding comes out of research from Dr. Carol Dweck, who is a psychologist at Stanford University. And she looks at beliefs about intelligence. She finds that believing in the potential for intellectual growth in and of itself actually improves outcomes.

So Dr. Dweck’s research provides evidence that a “growth” mindset as opposed to a “fixed” mindset benefits girls in math and science. And here’s a table that lays out the difference between a “fixed” mindset and a “growth” mindset.

Individuals with a “fixed” mindset believe that intelligence is static and inborn. It’s something that you’re born with. In contrast, individuals with a “growth” mindset believe that intelligence can be developed through effort.

So these different outlooks lead to a number of different characteristics. Individuals with a “fixed” mindset are susceptible to a loss of confidence when they encounter challenges because they believe that if they’re truly smart, things will come easily to them and they won’t have to work hard. If they do have to work hard at something, then they tend to question their abilities and they’re likely to give up.

Individuals with a “growth” mindset, on the other hand, show a far greater belief in the power of effort. In the face of difficulty, folks with a “growth” mindset – their confidence actually grows because they feel that they’re learning by challenging themselves.

These findings are particularly relevant for girls and women in STEM because encountering obstacles and challenging problems is the nature of scientific work. It’s really the whole purpose. I mean, if these problems were easy, they would have been solved already. So the whole purpose, the whole name of the game is challenge. So when girls and women believe they have a “fixed” amount of intelligence, they’re more likely to lose confidence when they run into these inevitable challenges and difficulties.

Now, this is true for all students but particularly relevant for girls in math and science where negative stereotypes persist about their abilities. And we’ll talk a little more about stereotypes in a minute.

There are a number of steps that we can take to foster a “growth” mindset in children. And here are some of the recommendations that we make in the report: First is just to teach children that intellectual skills can be acquired. So Dr. Dweck’s research shows that when girls are taught that their intelligence can grow through effort, that they actually score better on math tests and they also say that they’re more interested in taking more math in the future. So just explaining this to them, that in fact you’re not – you don’t have a given amount of intelligence; you can actually develop your intelligence.

The second is to praise children for effort, so this is something that is easily implemented. That’s one thing I like about this one. And I actually have done it with my son; he’s just two. And when he does something quickly, my first reaction was to say, oh, look how smart you are. But that’s actually a “fixed” mindset message. Rather, what Dr. Dweck’s research points to is to say, wow, you worked really hard and you did it; you really tried and you did that. And to actually praise the effort and the things that take him a little longer – that take the kids a little longer to do – those are the things that you really want to praise. So praising children for effort.

And the last one is about talented-and-gifted programs. The recommendation we make is that they should send the message that they value growth and learning. So the term “talented and gifted” can kind of convey a “fixed” mindset – just the terms – like somebody’s been “gifted” with something. But rather than emphasizing that, what we encourage these programs to do is to emphasize that they are about developing abilities, not about people who have been born with something as opposed to people who have not.

Our second finding is about the power of stereotypes. So you may think that stereotypes that boys are better at math and science than girls, that those are a thing of the past. But that’s not actually true. In fact, research by Dr. Joshua Aronson, a psychologist at New York University, shows that negative stereotypes about girls’ abilities in math and science persist. In fact, when these stereotypes are brought to the attention of test-takers, it can actually reduce girls’ scores – reduces girls’ performance.

And this is through a phenomenon known as stereotype threat. And it’s one of the most robust findings in the psychological literature on this topic. It has been replicated hundreds of times. And it’s not only true for gender; it’s true for race as well.

So bringing to mind, a stereotype can actually reduce peoples’ performance on tests. Fortunately, when test administrators tell students that girls and boys are equally capable in math, the difference in performance essentially disappears.

Our third finding is about gender differences in self-assessment in math and science. And this is research by Dr. Shelley Correll, who is a sociologist at Stanford University. And Dr. Correll first became interested in gender differences in self-assessment when she taught chemistry to high school students before earning her graduate degree.

So as a high school chemistry teacher, she realized that no matter how well the girls in her classes did, she had trouble convincing them that they really had much scientific aptitude.

And in contrast, no matter how poorly the boys in her class did, they continued to believe that they were very good at chemistry. (Chuckles.) So this was just something that sparked her interest. It's just an anecdote.

But once she went back to graduate school, she delved into this because she thought, maybe there's something going on here. And she analyzed a data set of 16,000 high school students and found that in fact among those students with the same mathematical past achievement – same grades, same test scores – boys assessed their abilities higher in math.

And an interesting thing is that, that was not true for verbal abilities. Girls actually assessed their abilities higher. So it's not across the board that boys think that they're better at something. But for fields that are considered to be masculine, like math, boys assess their abilities higher.

So Dr. Correll then took this idea into the lab and did – she did an experiment. And she found that women assess themselves as less competent in, quote, unquote, “male fields,” even when a male field is fictitious.

So in this chart, women are shown in green and men are shown in purple. And this is a self-assessment of ability by gender. So in her experiment, she told certain – she told half the group that men are better at this task. It was a fictitious task. And in that case, men assessed themselves about 14 percentage points higher than women. For the other group, she said there's no gender difference in doing this task. And as you can see in the chart – the bar is on the right – men and women then assessed themselves pretty much on par.

So in the same experiment, participants were asked, how high would you have to score on this fictitious ability to think that you have high task ability? And these results are shown here. So when subjects were told, men are better at this task – again, you can see women's score in green, men's in purple – women said they would have to score around 89 percent to believe that they were good at this task. Men, on the other hand, said they would have to score on average around 79 percent to think that they were good at it. And so that's a difference of 10 percentage points.

Now, over on the right, among the folks told that there is no gender difference in performing this task, men and women said they'd have to score just about the same – 82, 83 percent – to think that they were good at it.

So when you think about these findings as it relates to math and science – subjects considered to be masculine – it suggests that women believe that they have to be better at these subjects in order to think that they're good at it than men believe they have to be. So girls' lower self-assessment in math in combination with this higher standard can help to explain why fewer girls and women aspire to these fields.

So we make a few recommendations and I'll just talk about two here: First is that educators can set clear performance standards. The same letter or number grade may signal

something different to girls and boys. And girls may need to be reminded that a B in a very difficult course is a grade to be proud of.

And second, girls are less likely than boys in high school to believe – to make a connection between their high math and science grades and the idea that maybe they should become an engineer or they should become a computer scientist, just because those are masculine-type fields.

So what we can do is to help girls make that connection, that their high grades in math and science in high school are not just a requirement and something they have to do to get into college, but that they are an indication that these girls might be well-suited to any number of scientific or engineering professions.

The fourth finding presented in the report is in the area of spatial skills learning and describes research showing that spatial skills can be relatively easily learned and improved with training. So one of the largest gender differences in cognitive abilities is found in the area of spatial skills, with boys and men consistently outperforming girls and women, especially in the area of mental rotation, an example of which is shown here.

So this is just to give you an idea for those of you who aren't familiar with mental rotation, kind of what it is. So does anybody want to answer that question? Oh, I heard it. D. That's right. Yes, that's right. The answer is D. So this is an example of what we mean by mental rotation. And spatial skills are considered by many people to be important for success in engineering and other scientific fields.

And they're often considered to be innate. And this is research by Dr. Sheryl Sorby at Michigan Tech. And she said that among her colleagues – she's an engineering professor – and she said that among her colleagues, many of them believe – she's found that many of them believe it's innate because it's something that many of these folks learn very early on.

So Dr. Sorby's research, which she's conducted over a decade at Michigan Tech with first-year students, shows that among students how come in and fail this test of mental rotation – they take a short course and they consistently improved from scoring about 50 percent at the beginning to about 80 percent after – it's like 28 hours of training total, something like that. So it's not a big investment. But these skills can be learned.

So what can be done to help children develop their spatial skills? We make a few recommendations in the report, one of which is just to encourage children and girls in particular to play with building blocks like LEGOs or Erector Sets and even just drawing can help kids to develop their spatial skills. Also putting objects into different places like puzzles – that kind of thing can help kids develop their spatial skills.

So the foundation for a STEM career is laid early in life, but scientists and engineers are really created in colleges and universities. And findings five and six that we present in the report are about college climate. They present research by Doctors Barbara Whitten, Jane Margolis and Allan Fisher and this research demonstrates that small improvements by college physics and

computer science departments can add up to big gains in female student recruitment and retention.

One example of a small improvement that STEM departments can make is to provide a broad overview of the field in introductory courses. And this is something that I experienced firsthand while studying engineering. When I went into that, I asked my advisor for a class like this so that I could determine what type of engineering to study. And he said, well, actually, there's not a class like that. Engineering 101 is a computer programming course, which is fine, but so – but there was – and that's what I did. I went and took a computer programming course, then went on to various other technically focused classes and that's how you got your degree.

And that was not uncommon. My experience was not uncommon. It still is not uncommon, but I have since learned that my alma mater, which is the University of Notre Dame, has implemented a broad course, in part to retain more women and recruit more women into the fields and many other universities are doing that as well. So the idea is just to have a course at the beginning to let students know really what can they do with this degree. That's something that we recommend.

Colleges and universities can likewise attract more female science and engineering faculty if they improve their departmental culture. So this is research by Dr. Cathy Trower at Harvard University that we profile in the report. And it provides evidence that women are less satisfied with the STEM academic workplace and more likely to leave it earlier in their careers than their male counterparts.

A couple of the things that we recommend that departments can do is to implement mentoring programs and to implement effective work-life balance policies for all faculty members.

So our seventh finding is on implicit or unconscious bias. Research by Dr. Mahzarin Banaji – a former AAUW fellow, we're proud to say – at Harvard University finds that most people associate science and math with male and humanities and arts with female. And one interesting thing about this is that implicit bias is common not only among people who say that they think that men are better at math and science, but even among folks who believe that women are – who say that they believe women are just as good at math and science, but unconsciously many of us still have these biases.

So it affects not only individuals' attitudes towards others, but it may also influence girls' and women's likelihood of cultivating their own interests in math and science. So we recommend taking this test. Anybody can take it. It's freely available on the Web. It's at implicit.harvard.edu. And it can help folks to identify and understand your biases, so that you can work to compensate for them.

I very highly recommend going to this website. There is very interesting – it's not only gender and science. There's also gender in the workplace. There's biases about age, biases about race. There's all these tests you can take. It takes like 20 minutes to take the test and it's

illuminating. And you also then find out how many people scored, you know, said that they did associate these two things or not.

So I recommend that and we recommend that in the report. And one of the other things we recommend is that if you find that you do have biases – and most people do – you can take steps to address them, like simple steps such as just learning more about female scientists and engineers or actually Dr. Mahzarin Banaji – (chuckles) – herself has pictures in her office of women in science and engineering professions, which seems like a funny thing to do. Like how could that work? But it actually does help to reset your biases if you continually see something, then you think, oh, that’s how things are. And so that’s another thing that we recommend.

And then the final finding that’s presented in “Why So Few?” shows that not only are people more likely to associate math and science with men than women, but people often hold negative opinions of women in masculine positions – quote, unquote, “masculine positions” – like scientists or engineers.

And this is research by Dr. Madeline Heilman at New York University. And her research shows that people judge women to be less competent than men in male jobs – in what they consider male jobs, unless these women are clearly successful in their work. And when a woman is clearly competent in a masculine job, she is then considered to be less likeable. So it’s kind of a double bind – because obviously both competency and likeability are important for success in the workplace.

So one thing that we recommend here is that if women and men in science and engineering know – just to know that this bias exists, again, they can – that’s the first step to counteracting it. And it may also help women specifically in these fields to know that if they encounter social disapproval in their role as a computer scientist or a physicist, that it’s likely not personal – and that there are actually things that they can do to counteract it.

So I’ve given you just a very brief look at the findings in the report and I hope you all take a copy and read the details of the studies, which I wasn’t able to get into much today, but that are very interesting. The PDF is also available at AAUW.org. You have to click on the “Learn” tab and then the “Research” tab and then you can get to the PDF. So I know that we’re all honored that Dr. Greider is here today to tell us about her experience as a very successful female scientist, so I’ll end here. Thank you. (Applause.)

MS. HALLMAN: Thanks, Christianne. That was really terrific. We will have time for questions at the end of the presentation. Our next speaker is Dr. Carol Greider, who will discuss her experiences as a woman in science. Dr. Greider, as I mentioned earlier, is an AAUW member and serves as the director of molecular biology and genetics at the John Hopkins (sic) Institute for Basic Biomedical Sciences.

There she continues her groundbreaking work on telomerase, a cellular substance that she co-discovered while in graduate school. That 1984 discovery earned her a Nobel Prize last year, an honor she shared with her former mentor, Elizabeth Blackburn of University of California-San Francisco – (applause) – and Jack W. Szostak of Harvard Medical School and the Howard

Hughes Medical Institute. Dr. Greider and Dr. Blackburn are the first pair of women to ever share the prize. We are thrilled to have her with us today, Dr. Greider. (Applause, cheers.)

CAROL GREIDER: Well, it's a pleasure to be here. About six months ago, winning the Nobel Prize thrust me into the spotlight as a spokesperson for women in science. And of course, I'm just one data point in many of those graphs that you saw up here. And although these issues about women in science and the STEM fields have always been important to me, I wasn't an expert in the field at all, so I felt like I wasn't really the appropriate person to be answering questions about this. And so along comes the AAUW and gives the report that now has a lot of those answers. So I think that I was wishing that there would be something that I could point to and we now have that, so I'm very happy about that.

So I thought I would just tell you a little bit briefly a little about my path and then some of the things that I've encountered along the way in my career. So just as background, I'm a native of California. And I grew up in Davis, California, and I did my Ph.D. at UC-Berkeley. And when I went to Berkeley, it was 1984 when I went there – or sorry, I arrived in – what year would it have been? (Laughter.) Nineteen eighty-four (1984). That's correct.

And at the time, the class that was the incoming class was about 50 percent women. So it wasn't unusual for me to have colleagues around that were women. As you saw on the chart, in the biological sciences, there do tend to be more women in the field.

So in my graduate work, working with Elizabeth Blackburn, we discovered this enzyme telomerase, which then 25 years later was awarded the Nobel Prize. And the reason that it takes usually about 25 years for that kind of an award is that the fundamental science that we did 25 years ago was really the core – answering a core, basic question, but over the intervening 25 years, the implications of that science come out. So the medical implications – our lab and many other labs made the medical implications clear. And that's why it's about 25 years usually between an actual discovery and then these kinds of awards.

So after I graduated from UC-Berkeley, I then went to Cold Spring Harbor Laboratory on Long Island, where I worked for 10 years and set up my lab, began taking graduate students and post-docs and really learned what it was like to be a research scientist. And after 10 years of working at this research institution, I then moved to Johns Hopkins University, where I established my research lab again with students and post-doctoral fellows working together and six years ago I was then appointed as the department chair at Johns Hopkins in the molecular biology.

And along the way, I had two wonderful children. So I've also had the opportunity to see what it's like to sort of balance the issues of being a scientist with raising two children at the same time.

So I've had a little bit of an opportunity to reflect really over the last several months about some of the issues when I've talked at presentations of women scientists and heard other stories from other women scientists at Hopkins. And I think that my path, of course, is unique.

We each have our own unique path. And you know, that doesn't mean that other people don't have other experiences.

But I feel that for my own self, I was kind of pre-selected to be a scientist. And what I mean by that is that I was somehow developed early on in my childhood the ability to put on blinders and just go forward. And I attribute this, in part, because I was dyslexic as a child and I had a lot of trouble in school.

And in order to succeed, I just had to say, I'm just going to do it and not listen to other people telling me I could or couldn't do it. And I think that that really played a major role in my career progress because it was just natural to me to just put on blinders and go forward. So I didn't feel like there was really any kind of impediment in my scientific career as I went from a graduate student to a post-doc to a faculty member and then to a department chair because I was always just used to putting on the blinders and going forward.

However, I am a scientist and once I got to Johns Hopkins and started talking more to groups that were studying the issues that were facing women scientists, I started to actually look at the data and realized that just because I don't feel like I experienced any overt bias in my career, doesn't mean that there isn't something going on out there.

And there were a number of studies along the way that did suggest that there were obstacles for women in science. And then when you actually look at the numbers, you know, I realized that although, when I was a graduate student, there were 50 percent women in my class, and as a post-doctoral fellow, there were about 50 percent women.

But then you get to the level of an assistant professor and there, it was more like around 30 percent women in the biological sciences. And then the full professor is up to 10 percent and then as a department chair at Johns Hopkins, that's a very, very small percentage. So I started to see that there probably were reasons for that.

And people had been suggesting that oh, it's a pipeline issue. There aren't enough women coming into the field and so they just haven't gotten up to that top point. But when I looked at all of the data, it said clearly that it wasn't a pipeline issue, but probably it was a leaky pipeline issue.

There are enough coming in, but they're leaking out at various, different steps. And so I could clearly see those issues that were going on. And so although I was really pre-selected by my coping skills, that doesn't mean that something isn't going on. And of course, there are different issues for different fields. I think what might be occurring in engineering could be somewhat different than it is in biological sciences but clearly, here, it's a leaky pipeline.

And so what are the issues – that, as far as I can tell, they are probably very subtle. I haven't really heard too many discussions about really overt discrimination, although of course, there are anecdotes. But I think that the evidence that there are subtle cultural issues which we've heard about a little about in the report, the environment in departments as well as people's unconscious bias that they don't even necessarily know about.

For instance, if you go to a scientific conference, one of my male colleagues may be introducing people in his laboratory to other people at that conference and he may feel just a little bit more comfortable introducing his male graduate student because there was a certain comfort level there than he is his new female graduate student. And those kinds of very subtle, unconscious biases can really contribute to connections that people make.

So it's very clear to me that it doesn't have to be that there are overt blocks that smaller, more subtle issues can really play a role. So I'm really here today to support others and to try and make people a little bit more aware of these issues because I really believe that diversity matters – diversity of all kinds.

And if I want to have really excellent faculty at Johns Hopkins in my department and if it were mostly male colleagues that were coming through, applying for the job, then since women and men are 50 percent, then the brain power and the kind of approaches that you bring to these issues, you're going to be excluding 50 percent of the possible angles and ways of looking at things.

So I think that for both the issue of men and women as well as many other kinds of diversity, ethnic diversity and racial diversity, that it's very important to have more voices at the table. And the more different angles that you can apply to things. So that's why I think that it matters, not just out of fairness for certain people, but because really, the future depends on being able to bring as much brain power to many issues as we can.

So one of the things that I've realized in hearing about this and sitting on various committees is that culture change is difficult. If we think about the fact that there are subtle issues in culture of how people interact that are contributing to these barriers, how is it that you can actually change culture.

And I'm here with all of you and all of you with this report to discuss those kinds of issues, but I think that change can be made. I know that in my own experience over the past 25 years, I've noticed that a change that occurred because of a regulation that the National Institutes of Health put in actually made a difference.

So when I was a junior faculty member, I would routinely go to scientific conference and be one woman of 40 on the panel of speakers at the conference. And again, at the time, I just had blinders on and I just went and gave my talk and said it's just about the science. But then, I did kind of look around and say, why are there so few women on the panel?

Well, the NIH, then, instituted a rule, if you were to get funding for your scientific conference, you had to show the gender diversity of the invited speakers that you were planning to invite and you have to write a little paragraph saying how it was that you were going to try to be more inclusive to women. And they actually decided not to give funding to certain groups that didn't include any women on their panels.

So there are some things that can be done, perhaps small steps, but that may make people aware. I certainly heard conversations of colleagues that were organizing meetings that they were grouching about you know, why do I have to do this? Why did I just get this phone call saying that our conference doesn't have enough women in it? How am I ever going to get women?

And I just sat there and well, he's thinking about it now and he wasn't thinking about it before. So it helped in the awareness. So I think that there are steps and so I'm just here, really, to learn from you all and to say that maybe if we work together, we can hope to make some of these changes. Thank you. (Applause.)

LISA MAATZ: . My name is Lisa Maatz. I'm the director of public policy and government relations for AAUW and we're going to run the Q&A here real quickly. I did want to say, before we got started, just a few notes because I wouldn't be a good lobbyist if I didn't. We did send out our public policy recommendations to everyone and I hope you got that handout.

I wanted to make sure that I noted one in particular for you because it reminds me of the example that Dr. Greider just gave us of what was going on at NIH and how the tweaking of a simple rule – a simple regulation about who got funding really had an impact in terms of representation of women at NIH-funded events.

And this is the one where we talk about using Title IX as a way of helping to improve the lot for women and girls in science, technology, engineering and math. You know, I think sometimes when we talk about Title IX, people most often think of sports, right? And that's not unusual. What we need to remember is that Title IX is really about all aspects of federally funded programs.

If you have a federally funded educational program, you must not discriminate based on sex. It's as simple as that when it comes to Title IX. And so in many respects, what AUW is trying to do in coalition with some other folks and working with some friends on the Hill and in the administration is to say, look, we already have a great tool available to us to actually start pushing and really supporting girls and women going into these STEM fields.

So for instance, if we use Title IX, one of the things that we can do is that NIH, NASA, Department of Defense, all these different groups that get research funds, that get funding from the government, can be asked to do Title IX compliance reviews. The Department of Education, Office of Civil Rights can actually go in and also do compliance reviews to make sure that they are following not just the letter of the law, but the spirit of the law as well.

And so the thing that I really want to remind folks in this room is that in some respects, while we have some great recommendations from AUW's report, from the "Beyond Bias and Barriers" report, one of the things that we already have available in our toolbox is strong and that is Title IX. So that's a great opportunity for us to think about moving forward.

The other thing I wanted to note is that there has already been some attention being paid to this issue, as you know, and we're very excited that just recently here at the House Science and Technology Committee markup, Rep. Eddie Bernice Johnson was able to get an amendment in the America COMPETES Act reauthorization that looks at, specifically, women in STEM.

One of the things, in particular, that it would do is looking at grant support for federally funded researchers who have care-giving responsibilities and provide funding if there is an interim funding where they can't continue their research.

I mean obviously, Dr. Greider knows cells aren't going to stop dividing – (chuckles) – things aren't going to stop happening in your research if you have care-giving responsibility, but you can have some funds from the government to help you do that and cover that space so that you continue your research, so that your findings remain strong and viable, but that you, also, can continue with whatever is going on in your life path.

So I think those are particularly important things for us to note. The ADVANCE program as well, is very important. And so there are some things in place, but we need to continue to think about specific activities and how even using existing tools, we need to make sure that we're requiring folks to do the things that they need to do.

Data collection is also very key in this because if we don't have the statistics, you saw a lot of what was going on with the AUW report was relying on other research. If we don't have those statistics, we really can't tell where we're improving and where we need to do better. So let me stop there and see what kinds of questions that you might have for the panel.

I know, for me, I'm pretty excited. This is the first time I've been in the room with a science Nobel Prize winner. So I can't imagine that there aren't questions for her, but if you have questions for Dr. Greider or for Christianne Corbett about the report, please. Yes?

Q: (Inaudible) – from Rep. Bobby Scott's office, but I'm also an academic. And whenever I read the COMPETES act, I immediately – (inaudible) – the fact that the National Science Foundation had so much power in granting grants.

There's been a problem with the National Science Foundation for a long time – (inaudible) – their bias and who they give grants to and who they give studies to, especially in academia, you really, you know, more quantitative than qualitative, that kind of issue. And it really concerned me that here, we are having this act where they're giving away a lot of the money and granting a lot of the money.

Is the National Science Foundation doing better than they – has been done before? Are we holding them accountable for what they're supposed to be doing? I noticed that since they helped fund this report, I believe you said that, and that's great. And I think you've seen it in certain areas, but are we holding the National Science Foundation accountable for gender and diversity issues?

MS. MAATZ: Well, you know, one of the things that I would say to that is that you know, NSF's ADVANCE program is wonderful and I really feel like there's a great spirit there in terms of wanting to move forward on these issues and really working specifically to try and improve the lot for women and girls in STEM fields.

The other thing I would say is that one of the things that's in the Eddie Bernice Johnson amendment that just went through talks about data collection by demographics field, award type, budget request, review score, funding outcomes and so forth for applications for research to NSF so that we can get a better sense of exactly who's applying and who's being awarded these grants.

So I really applaud Rep. Johnson for being such a – well, you know, a lot of this is coming from the National Academy's report, 2007 report, "Beyond Bias and Barriers" that was chaired by Donna Shalala. And they had a whole host of recommendations, some of which are encapsulated in the Johnson amendment that's in the America COMPETES Reauthorization Bill. So we're happy about that.

But there are still some things to do. And it was, quite frankly, Donna Shalala who said you know, I am the president of a Division I school. I can tell you exactly where we're at when it comes to Title IX and sports. I know what's going on with my football team – (chuckles) – I know what's going on with my volleyball team. I can tell you all of that. But I have no idea where my school stands when it comes to Title IX and STEM, right? Isn't that fascinating?

Now, part of the reason for that is that there is something called the Equity in Athletics Disclosure Act which requires colleges to report data. We all know that sunlight can be the best disinfectant, right? And so when you have to report data, it kind of forces people to take a better look at themselves when they see the data they're sending in.

So part of what we're trying to do with the stuff from "Beyond Bias and Barriers" is put some of that data requirement in there as well so that schools have to do similar kinds of reporting that hopefully turns the mirror back on themselves the same way that Dr. Greider said earlier, you know, and turn the mirror back on those planning committees when they were told by the NIH that they didn't have enough women.

The reality is it wasn't that there weren't women that they could ask. It was just that – it's in many respects, human nature to ask your comfort zone, to ask the sphere that's closest to you. And so all we're doing here – we're not, you know, we're not requiring quotas, we're not saying you have to do – what we're saying is think a little more broadly. Think outside the box.

If you do that, you would be surprised at how many more folks you can include. And the reality here, of course, is that we do have a shortage in these jobs. We need people to fill these jobs. And one of the things that we know is that if we could get men and underrepresented minorities into these fields in the same proportion they're in the population as a whole, that actual shortage would go away. So that's part of what we want to do as well, is to create that opportunity.

And the other thing I would say – and then we want to get another question – is that this isn't just a feel-good issue. We're not just saying this because it's the right thing to do or it's the good thing to do or it's the fair thing to do or, oh, woe is women; we're being discriminated against. We're saying this, yes, because women deserve an equal shot, but also because, quite frankly, this is a national competitiveness issue. This is about global competition. This is about homeland security. This is about having people on our soil who can do the work that we need done so that we are competitive in a global marketplace.

If we don't have those people here, that's going to be an issue not just for our economy but for our homeland security. And it's as simple as that. So you know, beyond the whole fairness issue, which I think is important, at the same time, this is much broader and much bigger than that.

Let's go for another question. Yeah?

MS. CORBETT: Can I say one thing? I just want to say about NSF that this was funded by the gender in science and engineering divisions. So they have an entire division that gives out millions of dollars every year for this. So at least within that one division they are doing quite a bit. And every year we go to the joint annual meeting for NSF, which is a meeting of about a thousand folks who have gotten grants within gender and minority/racial diversity grants to improve racial diversity and gender diversity in science and engineering.

So they are doing quite a bit. I'm not sure within the – you know, if you get a grant to do chemical research or biological research. I'm not sure what their requirements are. I know a few folks who were going to come here from – is there anybody from NSF here? . Do you want to say anything about it?

MS. : Probably not. I'm in the office of legislative and public affairs, so probably not the best person to speak to the breakdown but I think they're really addressing those, kind of – (inaudible, off mike).

MS. CORBETT: Yeah, there definitely is quite a bit of effort there. And I'm not sure if it goes across the foundation but there is – they are doing quite a bit.

MS. MAATZ: All right, yes?

Q: Hi, I'm Susan Rees from Wider Opportunities for Women and it strikes me that some of the gender stereotyping begins in elementary and secondary school. And I wonder if any of you know whether or not schools of education prepare teachers in ways that stress that they should stress to their students that girls are just as capable as boys?

MS. HALLMAN: That's one of the reasons why this report is being adopted throughout the nation. Many schools are coming to us for – just for this reason. They want to hear more. Even the PTA is coming to us. So there's a lot left to do.

MS. MAATZ: The other thing that I would say is that, you know, in schools across the country there are colleges, in terms of their preparation of teachers. They look at this issue with varying degrees. I mean obviously, AAUW in some respects started this with our “How Schools Shortchange Girls” years ago. And this is, in some respects, I think, a good follow up. We do know that teacher bias can have an impact. What I am fascinated by is that, apparently, also there’s some recent research out there that talks about how a teacher’s own confidence in a particular issue can have an impact as well.

So that if you have a woman who is teaching math and the students are able to pick up on the fact that she’s not especially confident in teaching math, which I think sometimes happens in our schools because you end up having English teachers having to teach math because, you know, they’re laying off and they only have so many folks and, you know, classroom sizes are big and all those other issues. The students will pick up on that and the girls, in particular, will think that it has something to do with gender. So that if my teacher is a girl and can’t do it then I’m a girl and I can’t do it as well either. That research is recent and just came out.

So it is something for us to think about. I know schools try to pay close attention about content preparation but I think it can be particularly important in these aspects. Catherine?

CATHERINE HILL: I was just going to add that I think a lot of the work that we looked at is about the subtle aspects. It’s not the overt people saying, you know, Barbie doesn’t say math is too hard for me now. But today, you know, she’s a computer scientist.

But what they don’t get at is the subtle forms of, you know – which are our own anxiety levels, for example, are shared with the kids around us. So that’s where the unbiased – the implicit bias work that we had looked at – we really think – recommend that schools take a look at that so teachers can be thinking about their biases they may not even know they have.

MS. MAATZ: That’s Dr. Catherine Hill everybody, one of the co-authors of AAUW’s report and director of our research department. Yes?

Q: My name is Judy – (inaudible). I’m normally a professor and I’m spending my year on sabbatical on the Hill. And I’d like to question the – (inaudible) – on the NSF because there’s DARPA, there’s the HSARPA, there’s IARPA and there’s E-ARPA. And there were 37 grants afforded by E-ARPA and, I admit, even though I actually have two jobs now – so I haven’t looked through all of them. But I did look through the first seven and there are no female leads. I mean this is why – (inaudible) – not found a full professor yet. NSF says – they report gender. NIH, they’re telling me wonderful things.

DARPA, DHSARPA, E-ARPA, IARPA it – complete my thoughts and I saw the presentations by the gentlemen who ran ARPA and he said, I went and got the best. I went to Stanford and MIT and we all know what bastions of feminism Stanford and – (laughter) – sorry.

Is there any possibility – you know, how can we expand as a movement because this is just abysmal. I spent quite a bit of time trying to determine if there was a single, you know, top-level PI on those 37 grants and I couldn’t find it. So the invisibility is really problematic. And is

anybody working on the administration about – with the administration about this in high levels at all? I mean, is there anybody in OSTP that – (inaudible)?

MS. MAATZ: There was going to be somebody from the administration here. Is somebody here that would like to speak to that? I know a little bit about what they're doing.

Q: And they didn't show up. (Laughter.)

MS. MAATZ: Well, I mean, they actually did come to the other event that we had OSTP and quite frankly, the White House Council on Women and Girls, have been doing a lot looking at STEM issues. This is actually an issue of particular interest to not only the president, but to Education Secretary Arne Duncan as well. And I would also say, I think you're absolutely right, it needs to go beyond NSF. It needs to go to all, as I said, all agencies that provide funding to education institutions because then what we have is a Title IX issue.

And this is where we really, from an AAUW perspective, want to look at what have we done within athletics that has worked so well that we can transfer and think about doing in STEM? You know, we have seen like a 900 percent increase in the number of girls playing high school sports. Imagine if we could do that in the number of girls taking AP calculus, taking AP physics. That would be huge. So as I said, part of it is simple data collection, right? And so we're working on that. But the other part of it, truly, is – following the spirit of the law – there're a lot of folks out there that don't even know that they come under Title IX's rubric. And so some of that, I think falls back on to Congress.

And we've seen this happen successfully, Sen. Wyden put in specific directives that NASA had to do Title IX compliance reviews. For the first time, they really thought of it. Now, they actually have a model program for how to do it, right? So part of it is that Congress can prod and use the tools that are already available that I think can be really useful. Let me see if there're folks on the panel that want to address that as well – especially some of the other agencies, Dr. Greider, I don't know what kind of funding you have come across or if you had to answer specific questions about the gender make-up of your research teams or anything in terms of how you've gotten your funding,

MS. GREIDER: Well, that's all been through the NIH and I was mentioning that they have been pushing back on that – at least in the area of the conferences. I'm not sure what they're doing in terms of data and in terms of who is getting the grants and those sorts of things. I'm not aware of that. I just don't know.

MS. MAATZ: Right. Right, okay. All right, yes?

Q: My name is Ruth Iriyat (ph). I'm with the Association of American Medical Colleges in their diversity policy and programs cluster. And I came here today because I'm really interested in understanding the ways that diversity and women's issues can learn from one another. And I know that they've been learning from one another over the years but, specifically, where our cluster's moving in the direction of is – and I've found some words that were very similar such as “attract” versus “improve” and “retain”?

So we're also moving in the direction of, how do you also allow them to thrive? And I noticed some of the wording, also, that talked was about – I can't remember it right now. But a lot of the wording is along – is in ways very – (inaudible) – strategically. And so I'm really wondering, where are you sending folks to help actually doing the whole – (inaudible) – smacking them on the hands kind of thing?

Where are you sending folks for capacity-building assistance rather than, you know, putting them through a review that can be a little bit abrasive and rub them the wrong way but to really support them and also in a more welcoming way?

MS. CORBETT: So you're talking about colleges in particular?

Q: We work with medical schools and academic health centers, which have many of the similar issues in that. And so looking at the literature, you're dealing with some of the very similar issues.

MS. CORBETT: Yeah. And there are – well, I just went to a conference just two weeks ago for folks who are – women in engineering – it was specifically for engineering, but women in engineering and minorities in engineering – departments. They have, you know, offices at many different colleges and universities. And they had their conference together because there are so many ways that the work is similar. When you're trying to support folks who might feel like they don't necessarily belong there.

They don't feel like they're similar to their peers in some certain way. And so there are – I think there is a lot of work, a lot of synergy there. We – our last report was "Where the Girls Are" and it was all about, kind of, how things that help girls, help boys. Things that help white kids, help black kids. It's – there are a lot of commonalities there. So definitely, I think, your point is correct. What we – in terms of colleges though and places of education, what we really – the place that we are encouraging folks to go is to these women in engineering – or, I'm sorry – or women in science or minorities in science offices. They're the people on the campuses who are really focused on this. So that's what I can say about that. I don't know if anybody else had anything –

MS. : But we could also just quickly add the work we did on chapter, I think, seven, where we looked at the, you know – (inaudible) – research which compared, you know, what are the physics departments that are graduating a lot of women? What are they doing right?

What are the physics departments that are typical? What's going on there? How do those two differ? We looked at computer science departments and said, well, the computer science departments that are graduating a lot of women, what are they doing right and likewise those that are doing sort of average jobs?

So I think that would be an area. Similar kinds of work, I'm sure, have been done in the area of race and ethnicity. You know, where do we see the graduates? What are, for example, historically black colleges doing right in terms of STEM? And what can other colleges learn

from those experiences? And some of it's going to be really little: things like having a lab, a student lab; having an interactive course that is that – Christie talked about. So I think that there are some really – what we try to stress is there are really small changes that can be made that can have a, you know, big effect.

MS. MAATZ: The other thing is that – I hate to keep going back to the Johnson Amendment, but this is just some good news coming down the pipe, keeping it through – if we're able to keep this provision in throughout the legislative process. But the other thing that this program would do is require OSTP to work with the professional societies. So the women and minority professional societies within the STEM fields to provide training to, you know, program officers and department chairs and the folks who are doing the review panels because again, I just love the example that Dr. Greider gave us. A lot of times, when you just raise the awareness, when you simply say, you should be looking for these things and here's simple ways to do them, people will.

It's not necessarily always a conscious thing, quite frankly; it's literally just what they're used to and what they're comfortable with. And if you can give some really hands-on, useful tools, that can be really useful.

MS. HALLMAN: I can point out another thing. When I was with the American Medical Women's Association as their CEO, we obviously worked hand-in-hand with AAMC. And the importance of mentoring, not just for female physicians, but even within the specialty areas of certain areas that – you know, some things, they were more than welcome; in other specialty areas, they were not welcome at all. And the importance of mentoring and the professional societies – as Lisa just mentioned, the professional societies trying to run good programs and help with these areas makes all the difference in the world.

Q: So are there coordination strategies that you guys are gleaning, in terms of that, and pooling them together as a composite place for people to go? I mean, I'm just concerned that there's this big task that needs to be – (inaudible, off mike) – and everyone's scattered everywhere, including their own –

MS. HALLMAN: ...We certainly – we don't have anything specifically coordinated in what you're talking about, and we are not that much in – at AAUW – focused much on the medical schools, in particular. But there are a lot of other resources, and we do have a lot of resources on our Web site. And I suggest you maybe give us a buzz and maybe we can talk a little bit more about how we might look toward the future with this.

MS. MAATZ: The other thing is that this will evolve. I mean, quite frankly, for a lot of us in this room, we've been looking at and concerned about STEM issues for years, but in terms of having an administration that's really focused on this, it's fairly new. There was an initiative under former President Bush at the Department of Education and this administration has made that even more robust, but that was a very new thing. So keeping that in mind, as well, that some of this is going to evolve as our resources evolve and as our tools evolve, is going to be, I think, important to keep in mind as well. I saw some other hands. Yes?

Q: Yes, hi. I'm Ashley with Afterschool Alliance. I actually have a question – I mean, I really appreciate your recommendations about doing more – (inaudible) – programs, but I was wondering, you don't make any mention of private collaborations, like within the private sector, such as, you know, Intel or Lockheed Martin, or whatnot.

And I know there's been a huge interest, in terms of corporations trying to get more summer programs going, and I know for a fact that, like, Intel did a great, huge science research, and opened it up to all high-school students and whatnot. And that was a really great success. But have they themselves been tackling the issue of girls in STEM?

MS. MAATZ: I can't speak specifically to Intel, but Christi might want to talk about the National Girls Collaborative Project and how we work with companies through that.

MS. CORBETT: Yeah, that's true. There are – Intel is a great example of a company that really has put a lot of money into this issue and a lot of effort into it, and Lockheed Martin, as well. A number of companies are doing it. It's not something that we specifically talk about in the report. But one thing that AAUW is involved with is the National Girls Collaborative Project, as Lisa mentioned.

And I don't know if you're familiar with that, but it's funded, also, by the National Science Foundation, and it's basically a big database online, where anybody who's working on something like what you're talking about – after-school programs or any programs focused on girls in science and engineering – can go in and put in their information. And it's kind of like, sort of like match.com – (laughter) – for folks interested in helping girls in science and engineering.

So companies are there; organizations like the Afterschool Alliance; AAUW branches; Girl Scout troops; anybody who wants to get together and do these things. So somebody who might need funding, like maybe an AAUW branch, would be interested in finding out who in their area is interested, like maybe a company, like Intel, and then they can get together. So it's just kind of a place where you can go to look and see who cares about this in my area. So that's one thing we can do, but certainly, I think companies have a big part to play in this.

MS. MAATZ: There's also the president's Educate to Innovate program. You know, he's got a whole lineup of private corporations that are part and parcel of this effort, along with the not-for-profit side of the fence. So there is a real move toward this, and I know that when he introduced this program, he specifically called out the fact that women – more women need to be – and girls need to be encouraged to go into these programs. So you might want to check more about the Educate to Innovate program and how those corporations are getting aligned with the progress. Yes?

Q: I'm Andrea – (inaudible, off mike). I advise Sen. Kay Bailey Hutchison on commerce and IT issues. And you mentioned the America COMPETES reauthorization. (Inaudible) – a little bit further along on it than we are. But as we're working on that bill, are there specific items other – (inaudible) – think should be addressed, either you think that they

should be – (inaudible). Is there something specific, other than – (inaudible)? What else can we – (inaudible)?

MS. MAATZ: Right, yeah. There's actually a lot that can be done. Some of it will be – some of it's America COMPETES Act; others, quite frankly, will come under EFCA reauthorization. So when we talk about improving teacher training and when we look at ensuring that we're teaching science throughout the grade levels, not just middle school and high school, that we are measuring not just math and reading, but also looking at some of the sciences, that they redo the whole accountability measures – I mean, all that is kind of up in the air. But a lot of it, I think, is absolutely an EFCA thing.

One of the things that we would love to see that could come under America COMPETES is, you'll recall the whole report that spawned America COMPETES was the "Gathering Storm," right – "Rising Above the Gathering Storm." And so part of what we have always recommended, if you look at that particular report, which had kind of this analysis of where we were at, in terms of the STEM pipeline in this country and scientific innovation and so forth, and found that we were really behind in many respects and that there was this growing problem.

Unfortunately, that particular report, believe it or not, didn't talk about women and minorities. It was a very, kind of, narrow-minded report, for all that it came out with some very interesting and, quite frankly, scary conclusions about how far behind we are. So one of the things AAUW has been advocating – there's already a request in for a report to do, kind of, "Rising above the Gathering Storm" for minorities, so that's already there.

But we would love to have one on women, because what's been done with "Beyond Bias and Barriers" was useful, but that was only for academics. As we know, a lot of them fall out of the pipeline. Some of them stay in science; some of them do other things, like our own Christi here. So it just depends on what happens, in terms of how it works.

So having that report, in some respects, replicated, but looking at women – and quite frankly, I think women and minorities need to be looked at together, would be my preference, because I think there's a lot of overlap and double-binds going on there that we really need to address. And it is a workforce issue. It absolutely is a workforce issue. So that's one that I think would be particularly good for America COMPETES.

Some other things that I think could be interesting have to do with strengthening the programs for postsecondary study and careers. This is specifically an America COMPETES program. There was a pilot program in the last one that really, I think, did some good work that I think we could expand and make permanent. And I'm happy to talk to you about that in more detail after, but so there is some specific recommendations that I think would work for America COMPETES. Yeah?

Q: Yeah, I'm Sue – (inaudible, off mike) – Foundation, another source of information that has a lot of research – (inaudible). But my question was for Dr. Greider. I was wondering if you could give us a little bit more insight on how you were able to keep your motivation – you know, you said you kept your blinders on. Who may have helped you? What was the role of

your parents and your teachers to help you keep motivated and focus on achieving and doing well in science?

MS. GREIDER: Well, I think motivation just comes from being excited about something. That was really how I thought about it. I was never somebody that said, you know, I have a 20-year plan and that, you know, when I was in high school, I was going to be a professor at Johns Hopkins one day. It wasn't that. It was always, what's the next, most interesting thing? So I graduated from high school and was kind of interested in biology.

So I went and majored in biology, and then found a mentor that got me into a research lab. I tried four different research labs. And once I landed in one that was really exciting to me, which was the biochemistry lab, I thought, wow, I'm really having fun here. And so, how can I keep having fun? And I looked around me and talked to the people around me, and what they did was, they went to graduate school.

So I applied to graduate school because I was having fun doing what I was doing. So it was just at each step, then – I went to graduate school and had great success there, and that was a lot of fun. And so I thought, what's the next step? So it was really talking with people around me at each stage. There wasn't any, sort of, grand plan along the way. And that, then, allowed me to go in somewhat different directions and to always be able to follow my interest, which I'm grateful for. And the way things work in academia makes that very rewarding.

In my field, if I can get a grant to do something I'm interested in, then I can go and do it. Nobody has to say, you have to do X, Y or Z, or follow a particular path. I can go and do that and have that freedom. So it's the rewards that came along at each step that kept me going to the next step.

MS. MAATZ: Yes?

Q: Hi, my name's Diana Delfin (sp) and I'm with the Afterschool Alliance. I just wanted to ask you personally – I want to take you a step further back and ask you what was your experience like – you know, your K-12 experiences like, you know, being in the school system, and what were the STEM opportunities for you then, and like, what motivated you? Like, you asked the same question – you know, what motivated you then to continue excelling at what you do and continue your interest towards there? Did you have, like, a mentor in high school or, like, what motivated you?

MS. GREIDER: I think that's a question that I really haven't been able to reflect on too much, because I really feel like in high school and elementary school and junior high and high school, I was just focused on trying to go forward. As I mentioned, I was dyslexic. I was taken out and put into, sort of, remedial classes. I always felt like I had to work extra, extra hard to get things done.

I had a sort of mental mindset of myself that I was kind of the stupid one in class. And so I really don't recall having, you know, any particular event that happened. I was just trying to go forward. And once I hit late junior high school and then high school, and I realized what the

game was, in terms of getting good grades, and then I could have a feeling that, well, maybe I wasn't so stupid after all, and then got straight A's all the way through high school, then it was a self-rewarding kind of situation.

So I would do that. I would go to my classes because I was learning interesting stuff, but also getting the reward of the feedback of getting the good grades. And so it got into a better cycle. But again, I didn't have, like, you know, a particular mindset that I wanted to do something or a particular person that said, you should do X, Y or Z. It was just trying to accomplish the next thing and just being, you know, open to getting excited by things.

Q: The second part of the question: Were you involved in any after-school programs, like in elementary –

MS. GREIDER: I was not involved in any after-school programs. I was a paper carrier. I delivered newspapers for six years. (Laughter.) And when I went back to Davis, they said to me, were you really a news carrier for – because, you know, I needed to learn money for after school. So I didn't participate in any kind of after-school programs except delivering the newspaper.

MS. MAATZ: All right, one last question here because we need to close it out. Dr. Greider, I was wondering if you just might, to help us close this out, talk about what advice you would give to young women and girls who are interested in these careers moving through their education – things that might be useful for them to know to be successful.

MS. GREIDER: Yeah, what I always say is to follow what you love. And find people that will help you do whatever it is that you really want to do. And if somebody says, well, that's not for girls or that's not something – question that. And if you really want to do something, it's really rewarding to be able to follow that. And there really are ways to go forward, and getting help, talking to people – there are, now, many programs that are out there, and I think they can be very helpful for girls.

MS. MAATZ: Wonderful, wonderful. I think, is a great way to end this particular briefing. Thank you so much for coming today. We hope that you will contact AAUW as you look at things through a legislative lens and a policy lens. We are here to help. And we appreciate your attention. Thanks so much. (Applause.)

(END)