Women in Science and Engineering: What the Research *Really* Says

A panel discussion co-sponsored by WISELI and the Science Alliance.

Thursday April 14, 2005

Biotechnology Center Auditorium, University of Wisconsin – Madison

"What is the Current Status of Women in Science and Engineering Fields at the UW – Madison?"

Chancellor John Wiley, University of Wisconsin – Madison

Well, you're never supposed to begin a talk with an apology but I'm loosing my voice, I have a sore throat, headache, and a weak knee, so I'd rather be sitting. That's okay, that's okay I'll persevere. Let's have a little bit of a change of pace here, I don't do research in this area, so what I'm going to do is much more personal.

I have been interested in science for as long as I can remember, since I was a very small child – always interested in knowing how things worked, why they are the way they are, focused on observation and data. I suppose it was pretty natural that I went into the sciences.

I thought I'd begin, you know the older you get the more you tend to put whatever it is you're involved in, in some kind of a historical perspective. And that's what I thought I

would start by doing. And I will give apologies to those of you who were present at a session on the same topic last weekend. I see Bassam Shakhashiri here, who organized it. You're going to hear pretty much the same thing I said there.

Increasingly I find myself being if not the oldest person in the room, at least one of the oldest, and so I'll start by telling you I went to high school in the fifties – 1956 to '60. And as I was thinking about what I would say for last weekend's event, I tried to recall what it's been like all the way along through my career. I remember in the high school days – and I went to a high school that was really remarkable – we had two years of Chemistry, two years of Biology, a year and a half of Physics, half a year of electronics, and five years of math in a four-year period. [And I had] very good teachers. These were WWII veterans who were in graduate school when the war broke out and they were all Ph.D. candidates who were A.B.D., all but dissertation, they were very near the end. After the war, they didn't want to go back to graduate school so they went into high school teaching. So I learned Chemistry from a chemist and math from mathematicians, and so on.

Anyway, back then I can remember there were twenty-five or thirty boys who were very keen on science – we were sort of a club – and two girls. None of the teachers were women. The two girls did not major in science when they went on to college. I don't know what happened to them. I tried to remember my undergraduate years. I was an undergraduate at Indiana University from '60 to '64. [I] majored in Physics. I don't

remember a single female student in any of my classes nor a single female professor, not just in Physics but in any course I took as an undergraduate – any course, in any subject.

I came here for graduate school, from ‘64 to ‘68, in the Physics Department. There were again two women students. Both of them finished their PhDs, neither of them ever actually worked as a physicist. I don’t remember how many males there were, but it was 100 or so. Willy Haberly in the audience may remember back in those days. Again, no women faculty in Physics, in fact I didn’t take a single course at Wisconsin that was taught by a woman faculty member.

After I left, I went to Bell Telephone Laboratories in New Jersey where there were about 2,000 scientists and engineers. I don’t remember a single woman among them. There probably were some, but so few that they were the rare exceptions and their presence required some kind of explanation or rationale because they were so few. I do remember – I was in solid-state physics – all of us studied papers written by Ester Conwell and Lutwig Wesselhaus, the only two women in this country working in those fields. And, again, they were the anomalies, not the rule.

When I joined the faculty here, in 1975 in engineering, Electrical Engineering, there were about 220 faculty members, one of whom was a woman. She was not an engineer though, she taught English. She taught Communication for Engineers: how to write a sentence that actually is a sentence, which is unusual for male engineers. There were fifty faculty

in my department, no women, that's Electrical and Computer Engineering, and very, very few women students. Again, they were anomalies.

Now, through out that entire period – that takes you over about a forty-year period – through out that entire period I don't remember anyone ever considering that this was any kind of a problem for science and engineering. To the extent that anyone commented on the absence of women at all it was Summers-type comments, like, "Well that's just the way it is." Or, "Women aren't interested in these subjects," or, "Women don't have aptitude for it." Or, "Women are math-averse and so therefore they can't go into physics and engineering," and so on. [They made] hypothetical arguments about gender differences of one sort or another. As I said thought, I can't remember anyone ever observing that it might be a problem for the field itself.

But think about it, it really has to be a problem for science and for engineering. Through out that period, white males, which was the overwhelming dominant experience, the dominant world that I've just described, constituted less than thirty-nine percent of the people in this country and far less than that worldwide. And yet we were drawing all of our science and engineering talent from that restricted pool. How can science and engineering do that and believe that its achieving all its out there to achieve?

Males are a little more than fifty percent of the population in ages up to forty and considerably less than fifty percent over forty. Men kill themselves and each other at a

much higher rate than women do, and so gradually women come to dominate one way or another.

Most of what I'm going to say basically is just confirming everything you've heard up until now. But let me say that there were lots of women whose papers we read from outside the US. There was one woman in particular, by the name of Birgen Hublock. [She was] a Russian woman [and] a solid-state scientist who was probably the most prolific material scientist in history. And we read lots of her papers.

So why do I say it's a problem? I have only begun to hint at that. If Maxwell had been a woman, would Maxwell's Equations be any different? No they wouldn't. But the fact of the matter is that almost all of the science and engineering that we have today was developed by white males. And what questions were asked, what questions were considered to be important and needing investigation were determined, culturally, by the people who were themselves scientists.

The observational fact is, I told you that I'm very hung up on observational facts and data, at least fifty percent of the creativity and aptitude for science and talent pool in the world resides in female brains. And I said that pretty carefully, I said at least fifty percent. I didn't say it was fifty percent exactly. I didn't say it's more than fifty percent. I said it's at least fifty percent.

Why would I say that? Observation. I will challenge all of you in the next month or so to watch the papers and look when the local high schools publish pages and pages of pictures of the valedictorians and the honors students and the award winners. What are you going to see? You're going to see mostly female faces. In high school, girls outperform boys substantially. I can tell you, after fifteen years in central administration here, most of the applications we get for college are from females. Most of the students we admit are female. Right now, our undergraduate student body is fifty-five percent women, forty-five percent men. Some people might think that's a small difference. That's an enormous difference.

All the differences I'm going to tell you are huge even if they sound small. The grades of women at UW-Madison, undergraduate level, are 0.18 GPA higher than men. That's averaged over 20- or 30,000 cases. Point one eight might sound small, but when you think of the restricted range of grades – the average is about three point zero and it ranges from high twos to four – a 0.18 difference is enormous.

Now when I tell people that someone almost always says, "Oh but here's why." They have an explanation. Academics are very good at hypothesizing. If you present them with any data, any observational fact – it doesn't matter what it is – they will have a reason for it, immediately. And that's a good thing; we're all good at hypothesizing, we just shouldn't take it too seriously and refuse to see the data. So, for example, they'll say, "Yeah, but that's understandable because men predominate in the hard sciences and the quantitative fields and its hard to get high grades there and women are in the soft

sciences, the social sciences, humanities where they get all A's. And so, that's why there's an 0.18 difference." And then I point out that, well yes but in engineering women have a statistically significantly higher GPA than men - and about the same level, about 0.18. And then they say, "Oh yes, but that's because only the smartest and most aggressive and self-confident women go into engineering and so you're comparing the best women against average men." And so I say, okay, well then if that's true how do you explain the fact that women greatly outnumber men in nursing and also outperform them in nursing or human ecology or in letters and science, where the numbers are more equal about fifty-five [to] forty-five, same as the university as a whole? It's true across the university.

It's true, I will tell you now – cut to the chase – freshman, sophomore, junior, senior, graduate school, professional school, in all majors from Astronomy to Zoology, women outperform men by statistically significant amounts. Now, if you go online and look at the data for any one semester, I'm sure you can find an occasional case, say in Astronomy, where that semester there were three women and six men and it happened in that semester, that what I just said is reversed. But if you aggregate enough, a large enough N, what I just said is always true in this university and across the country. Every academic administrator at the central campus level will tell you this. It's a very stable result.

Not only that, but women [also] have higher graduation rates than men. About eighty-two percent of our starting freshman women will graduate within six years. We use six-year

graduation rates because that's the standard across the country not because it really takes that long to graduate. So, eighty-two percent will graduate within six years, [but] only seventy-eight percent of the men [will]. Women will graduate faster then men. About fifty-five percent of the women will graduate in four years or less. About forty percent of the men graduate in four years or less. At the other tail of the distribution, 6.7 percent of the women take longer than five years to graduate. [On the other hand,] eleven and a half percent of the men take longer than five years to graduate. All these numbers are based on very, very large Ns and they're very stable.

So the mystery to me, and this has been well known for a long time, the mystery to me is why it took so long for anyone including women to recognize the under-representation of women in science and engineering is a problem for science and engineering and not just an equity or a gender-equity problem for women.

So, Jo asked me to say a few words about where we are today, I'm going to focus on faculty and administration. I could talk about various gender effects across the campus and other aspects of this, but let me just focus on the faculty.

I told you what it was like when I came in '75 in Engineering. Back in those days, the percentage of women faculty across the campus was just a little over ten percent. In 1989 – and that number will become significant in a minute – it was fourteen percent. Today it's about twenty-eight percent, so we've about doubled in the last fifteen years. That varies; in the Physical Sciences it's about twelve percent, that's the lowest. And in the

Humanities it's forty-one percent, that's the highest. The rate of progress is actually fastest in the physical sciences because the basis is so low – if you start at zero and have one that's a huge percentage increase. Right now we have twenty-five women faculty in engineering out of 175, that's fourteen percent. So that's pretty consistent with the physical sciences as a whole. So we're making progress, [though] not nearly as fast as anyone would like. I could say almost the exact same things about racial and ethnic diversity across the country.

But I'd like to end by asking you to do a thought experiment and also, by way of giving credit where credit's due. Imagine if you will, a long photo gallery that's chronologically ordered that shows the faces, the pictures of all the top administration of this University from 1848, when it was founded, to this year. And you can probably imagine what that would look like. And when I say top administrators, I mean the chancellor or president, it used to be called president, the vice chancellors, and all the deans. There are about twenty such positions on this campus. There weren't always twenty but there are about twenty today. What you would see is a very, very long 142-year string of white, male faces. That's what it would look like.

Starting in about 1989, you would see the first female Chancellor. That was Donna Shalala. From '89 to the present, what you would see is a Vice Chancellor for Research and Dean of the Graduate School was a woman. The Vice Chancellor for Legal Affairs [and the] first ever Dean of Pharmacy [were women]. [The] first ever Dean of Education, was a woman. I don't know who that is yet, but our short list for Dean of Education is

only three people and they're all women, so I'm sure the next dean will be a woman. Three different female Dean of Students, two female Deans of Nursing – by the way, the few female faces you would have seen historically would have been Nursing, Dean of Students occasionally, not always, and Human Ecology, which used to be called Home Economics, that was often a female dean. You would see an African-American Dean of Law, an African-American Vice Chancellor for Student Affairs, an African-American Vice Chancellor for Administration, a Hispanic Dean of Education, an Asian-American Dean of Human Ecology – a male, an American Indian Dean of Letters and Science, an American Indian Dean of Students, an Asian-American Dean of Students.

What that would look like if you looked at this photo gallery, would be almost all white males until 1989 and then an explosion of diversity. As homogenous as we are still today, it's been an explosion in the last fifteen years. It would look like somebody flipped a switch in 1989 and transformed the institution. And that's what happened and Donna Shalala is the one who flipped the switch and really transformed the institution. So if you want to give credit somewhere for real progress on diversity, that's where you should start. At any one time, those few twenty positions are not going to reflect the full diversity of society. But over a plausible time period, you'll see enough diversity that you'll be able to convince yourself that we are in fact making progress.

Finally, just a couple of comments that were stimulated by things that earlier speakers said. I think in her introduction Jo said something about music. I'd like to tell you a personal story that really affected me. I have a stepdaughter who is interested in music. In

fact, today she's a very good violist. One time when she was about this old – however old that is, young – she walked into the room where I was working on some homework and I was listening to a CD, and she heard the music and asked me, "Who wrote that?" I said that was Fanny Mendelssohn. She said, "You mean Felix?" I said, no it was Fanny it was a sister. And she burst into tears because she had been seeing in her classroom pictures of all the great composers on the wall. She didn't believe women could compose music. That's a very telling story. And that really goes to the point of what some of the earlier speakers told you about.

Finally, I'd like to mention something that we should all be concerned about. One of our retired faculty members who's taken it as his mission in life to return this to an all-white institution has filed a suit against us to prevent us from using any kind of race-based scholarships, the Lotten grants, which are approved by the Legislature and we've been using them for years to try to address the lack of diversity on this campus. We're going to fight this in court, but his argument is that we're really doing a disservice – one of his arguments is that we're doing a great disservice to minority students by having race-based scholarships and "lowering the bar" as he will put it. He's referring to statistically average lower ACT and SAT scores, primarily. "Lowering the bar" and letting in unqualified minorities and then flunking them out in higher numbers, that's the essence of his argument. I used to think he really believed it, I don't think so anymore. I think he's got a different agenda, which I won't go into. But, I'm here to tell you that we never have done anything of the kind. Every single student who is admitted here is admitted because he or she, we are confident, can succeed.

Now, the graduation rate for minority students is lower. The graduation rates I told you earlier are around eighty percent for all students, for all undergraduates. For minorities it's about fifty-five percent. That difference is very troubling. Fifty-five percent here [while] the nationwide average is less than twenty-five percent. So we're doing better than most schools, but we don't do nearly as well with our minority students as we do with majority students. If you look at the data carefully, that difference persists across all incoming indicators. In other words, if you match majority and minority students for ACT score, GPA, class rank, the gap still exists. What that tells me is that the performance difference or the graduation rate difference is not due to ability or academic preparation, it's due to what we're calling the campus climate or what earlier speakers referred to as the inherent disadvantage of being identifiably, visibly different and having to overcome that barrier.

So I'll end there, I actually went a few minutes over, Jo, but will be happy to answer questions along with Molly.