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Katy Garmany, Editor



“What Balance?” Lessons from the AAS Special Work/Life Balance panel, January 11, 2011 in Seattle, WA

Blake Bullock, Northrop Grumman Corporation

It’s no secret things are changing. Despite a challenging job market and economy, employers are increasingly recognizing the impact work-life balance has on their productivity and ability to retain top talent. Research by Kenexa Research Institute in 2007* shows employees “who indicated more favorability toward their organization’s efforts to

support work/life balance also indicated a much lower intent to leave the organization.” The challenges of the astronomy workforce are no different. The lively AAS Special Session on Work-Life Balance featured panelists representing the breadth of our community, from senior to junior, from universities to private industry, job-creators to job-seekers, as well as parents, couples, and caretakers. (See a list of the panelists at the end) Panelists energized the audience with personal accounts of their own day-to-day and career-long challenges in seeking success both in the field and at home. We learned that employers and employees may not be as far apart as we may have feared; communication is key, and can often lead to unexpected favorable options for all parties.

Maintaining and supporting the skilled workforce of American astronomers is a strategic objective of the AAS, and by reaching out, sharing our experiences and lending a hand, we can work together to ensure we keep our field thriving and whole. Here we’ve captured just a few of the misconceptions and fears raised during our session that have lurked in our minds as we approach work/life balance as individuals in an effort to help support each other as a community.

Myth: There is *a* solution to the two-body problem.

Reality: There is only *your* solution to the two-body problem. It can be hard to find (or give) general advice on this topic, because everyone’s challenges are different, and every solution is individual and personal. Still, listening to the stories of astronomers who have found workable solutions to the two-body problem can shed insight and hope on your own situation, so seek out others and listen.

Myth: Our situation is unusual.

Reality: Many astronomers face two-body issues. 79% of married female physicists are married to another scientist, according to a survey by Laurie McNeil and Marc Sher. Even spouses with careers that appear relatively ‘portable’ (e.g., lawyers, engineers, entrepreneurs, etc.) are likely to have significant constraints on where they can live and still have a productive career. Many of our peers are in a similar situation. Dual-career issues are not personal or frivolous, but are fundamental to the future of astronomy.

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STATUS

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Published by the
American Astronomical Society
2000 Florida Avenue, NW, Suite 400
Washington, DC 20009

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What Balance *continued*

Myth: When applying for jobs, it's better to keep our two-body problem private until we have an offer in hand.

Reality: As the panel session progressed, it became clear that this is not always a straight-forward situation, and many factors could affect the outcome. Recognizing that the two-body problem is real and pervasive, some departments will work with applicants to find solutions, especially those with the resources (e.g. human, financial, and social). Some departments may see a two-body "problem" as an opportunity to land two talented contributors likely to stay.

However, other institutions may not have the means to address a second job search, and in some cases, this could be a deterrent. One participant shared a personal experience: they were told they were not made an offer, based on the fact that the institution could not address the two-body problem. This participant felt the interviewer unfairly removed the opportunity for them to potentially find a solution to the problem on his or her own, through soft money positions or something more creative.

As advanced negotiations evolve during the recruitment process, keep in mind the department and its culture needs to be a good fit for the candidate, not just the other way around.

Myth: There's no point in trying to make a long-distance relationship work in grad school or as a postdoc; it is doomed by travel expenses and long work hours.

Reality: If you and your partner are both astronomers, it may be possible to coordinate travel for conferences, talks, or observing runs. If only one of you is an astronomer, consider options for low-cost travel, for example flights with stopovers to a partner's city.

Myth: If my partner and I want to find postdocs in the same place, I guess we should just apply to some of the same cities and hope for the best.

Reality: With the large number of "named" fellowships now available, many departments and institutes have an increased ability to address the two-body problem at the postdoc level. Some are not just accommodating, but eager to do so, since this flexibility can help them attract top candidates that might otherwise go elsewhere.

Myth: It's hard enough for one person to find a good job, so couples will find it basically impossible to find two jobs, unless one member is ready to make serious sacrifices.

Reality: Being a couple on the job market may create opportunities. Employers will often try particularly hard to hire couples when at least one member is considered a highly desirable candidate for a job. In academia it is not rare for deans to create a second position for the other member of the couple, and indeed many universities have instituted official "spousal hire" programs with funds dedicated to the support of double offers (even when only one position was initially authorized and advertised).

Myth: Most male astronomers will be annoyed or impatient with their pregnant colleagues.

Reality: Having kids is not an exotic desire that needs to be grudgingly accommodated. While there will always be exceptions, many of our male colleagues

What Balance *continued*

are genuinely excited when our fellow astronomers have babies. As work-life balance trends shift throughout society, both men and women are challenging traditional paradigms. We may have more supportive colleagues than we think.

Myth: Astronomers working in private industry are stuck with long hours, inflexible bosses, and constant travel.

Reality: Many private companies are realizing the financial and strategic benefits of providing a flexible work environment in order to attract, retain, and motivate their workforce. Recent examples of popular changes include working-from-home policies and company-wide flexible work schedules. Of course there are times when work demands extra hours, but in general, there's a recognition that demanding around the clock "face time" in the office isn't sustainable, and isn't good for business.

Panelists:

- David Kaplan, Department of Physics, University of Wisconsin-Milwaukee
- Dawn Erb, Department of Physics, University of Wisconsin-Milwaukee
- Lauren Chomiuk, Harvard-Smithsonian Center for Astrophysics

- Jay Strader, Harvard-Smithsonian Center for Astrophysics
- Julianne Dalcanton, Astronomy Department, University of Washington
- Lynne Hillenbrand, California Institute of Technology
- Fred Rasio, Dept of Physics & Astronomy, Northwestern University
- Blake Bullock, Northrop Grumman Corporation

*Additional Reading:

Kenexa® Research Institute Work/Life Balance Study:
<http://www.kenexa.com/getattachment/39b37bc3-e901-4970-bfc1-1d6d893004dd/Kenexa-Research-Institute-Finds-That-When-it-Comes.aspx>

<http://chronicle.com/article/In-Defense-of-Spousal-Hiring/46480/>

http://www.ade.org/reports/spousal_hiring.htm



Science Cheerleaders Visit NASA – Positive Role Models or Return to Old Stereotypes?

Lynn Cominsky, Sonoma State University

In March, 2011, NASA Headquarters helped to celebrate Women's History Month by inviting "Science Cheerleaders" to share the stage with White House official Valerie Jarrett, NASA Deputy Director Lori Garver,

Astronaut Tracy Carver Dyson and Education specialists. You can read more about this event at the Science Cheerleaders web site: <http://www.sciencecheereader.com/2011/03/science-cheerleaders-perform-at-nasawhite-house-event/>. About 200 young women were in the audience to watch the choreographed dance performed by these scientists, science teachers and

engineers, and have some of their questions answered. The stated goal of the Science Cheerleaders is "to help challenge stereotypes and inspire young women to pursue careers in science, technology, engineering, and math." As a female scientist who receives NASA funding to do Education and Public Outreach (E/PO), I received a number of queries from community members who had read about this incident, and wanted to know my opinion on the event. To be honest, I had never heard of the Science Cheerleaders prior to this event, and therefore had no immediate reaction. I Googled them and discovered that their outfits are not particularly skimpy, and thought that perhaps they are intended to be part of the ongoing post-feminist movement where young women are encouraged to be successful but also fashionable. Sort

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Science Teachers Visit NASA *continued*

of like all those really attractive CSI-type women and medical doctors on television programs.

But, after looking at their website, I was still undecided so I asked a number of other E/PO professionals, scientists, practicing science teachers and readers of the CSWA listserv for their opinions. Below is a sample of the responses I received, with the names suppressed and extremely general descriptions of the people provided.

Male scientist: "Pretty much all of us have been working over the years to make our work environment as gender neutral as possible and at first glance this was a great step backwards. However, with some more thought I could see some logic in it. The "Cheerleaders" apparently do have college and advanced degrees and are working in professional scientific jobs. I can see that this might address some of the "Ugh, geek" response that girls might have about the whole STEM thing."

Female Educator: "I like the fact that the cheerleaders who are being used to represent this are actually STEM area college students, graduate students or working in the STEM field. I think this will be useful to show young ladies that you can be "cool" and "scantily clad to attract the guys" and still be intelligent and interested in the sciences. I believe this needs to be carefully done - but it does help dispel the myth that all science types are "geeks". It would be nice if the cheerleaders could not only discuss what their field is but also discuss the science (and there is some) behind cheering."

Male E/PO professional: "This seems a little bit horrifying. Cheerleaders epitomize the sorts of stereotypes about women and girls that most of us in science and education have been trying to get beyond. Events like this don't help with that. If it does encourage more young girls to go into science I think that's sad."

Female Educator: "Personally, I'm appalled. Maybe I'm old fashioned, but when are we going to stop making young women think that they have to dress scantily and look like this to be "cool"? Now we are going to tell young women and girls that they have to look "hot" to be scientists, too? From the viewpoint of healthy body image for young women and respect for women this is a huge step backward in my opinion."

Male E/PO professional: "I think they are great! Not as role models for future girl/women scientists but to show that being a scientist doesn't mean one cannot have diversified interests; that being a scientist doesn't mean

donning a lab coat and thick glasses, and being stuck behind a computer or microscope all day."

Female scientist: "I would like to point out that cheerleading promotes confidence and requires strength, agility, team work and positive energy. These are attributes that carry over into all aspects of life. It seems to me that people are intimidated by women who are attractive, intelligent and athletic. I find it refreshing to be able to balance a serious academic career with another demanding physical activity. Cheering is not about women supporting their male athletes, rather a group of men and women supporting their institutions. Being a cheerleader does not mean you need to be female either- our former president George W Bush was a male cheerleader."

Female E/PO professional: "Part of my *raison d'être* since I started teaching physics in high school was to break stereotypes of girls/women in physics. My belief is that one should be free to be whomever one wants, while still being smart and doing physics. One can be attractive, wear makeup, nice clothing, be a mother, and still do physics, and that is the role model that I always presented. I would propose that NASA also showcase women in science who do other art forms, such as music, ballet, ethnic dance, or visual arts. I'll be the first to volunteer for such a performance!!"

Female scientist: "I am rather appalled and slightly offended by this. Although I applaud the intention behind it -- teaching girls that scientists aren't just boring nerds -- I think the execution has much room for improvement, starting with the outfits. I don't believe women have to be scantily clad to be seen as beautiful (or even hot or sexy). Simply put, women in science careers who dress this way are less likely to be taken seriously by their male peers. (On the other hand, I think it's good that someone has decided science and scientists are worth cheering for; we are!)

Male E/PO professional: "Science Cheerleaders was started by a cheerleader. There are young women across this country that like/love/enjoy cheerleading. This will help reach them to let them know that if you choose to be an athlete you can also be intelligent/science-minded. The cheerleaders will do a good job to recruit/inspire like-minded women. There will always be those (especially men) who will only see cheerleading as something that "Barbies" do in order to "prance around," who cannot look past their "revealing clothing" and who think that the only purpose of cheerleading is to "represent a pretty narrow idea of beauty." At best, they are ignorant of what

Science Teachers Visit NASA *continued*

cheerleading is and say these things without thinking about the human beings they are referring to. At worst, they hurt with intent.”

So, there you have it. A complete range of opinions, from all different sorts of people in our astronomical community. My final opinion: I think it is fine to show

that many different types of people can be scientists and engineers. I think it is unlikely (although not impossible) that the Science Cheerleaders are turning people (of either gender) off to science careers. And if their enthusiasm, life stories and interviews can help convince even one girl that she too can do science, that can only be a good thing for science in general.

The Fourth International Conference on Women in Physics Stellenbosch, South Africa, April 5-8, 2011

Meg Urry, Yale University

Meeting in Stellenbosch

Since 2002, the International Union of Pure and Applied Physics (IUPAP) has sponsored a series of triennial international conferences on women in physics. The Fourth IUPAP Conference on Women in Physics (ICWIP4) was held last April in Stellenbosch, South Africa (<http://www.acitravel.co.za/event/index.php?f=index>; see conference photo below).

Roughly 250 delegates from more than 50 countries attended the meeting, including undergraduates, graduate

students, faculty, society members and industrial physicists. Many were from African countries that had not previously been able to participate in these international conferences, which were held previously in Paris (2002), Brazil (2005) and South Korea (2008). Two women from Egypt attended despite considerable political upheaval which ultimately led to the ousting of Hosni Mubarak.

The group Women in Physics in South Africa, in partnership with the South African Institute of Physics, hosted the meeting; the program was organized by IUPAP's Working Group on Women in Physics; and



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The Fourth International Conference on Women in Physics *continued*



Members of the U.S. delegation: (front row) Herman White, Renee Horton, Rhiannon Meharchand, Beth Cunningham, Luz Martinez-Miranda; (middle row), Ivy Krystal Jones, Susan Seestrom, Emma Ideal, Idalia Ramos, Meg Urry; (back row) Jarita Holbrook, Rachel Ivie, Elizabeth Simmons. Missing from this photo are Kim Coble, Sara Petty, Ted Hodapp, Cynthia Correa, Melissa Dancy, Elizabeth Freeland, Elaine Lalanne, Maria Ong, Sally Seidel, Michael Thoennesen and Apriel Hodari.

South Africa's Department of Science and Technology provided substantial funding for the event. A partial list of sponsors is at the end of this article.

South Africa's Minister for Science and Technology, Dr. Naledi Pandor, opened the conference with a ringing call to open doors for women, especially in developing nations. She highlighted some of the scientific initiatives now underway in South Africa, including two major astronomy projects: the SALT optical telescope, currently operating, in the Northern Cape province, ~380 km from Cape Town, and the Square Kilometer Array, a project which South Africa is particularly eager to host for the next decade. An SKA precursor array called Meerkat is now under construction in the Northern Cape area. As Dr. Pandor made clear, these projects are very high priorities for the South African government, which sees them as central to developing the science and technology sector of the South African economy.

As Dr. Pandor's speech came to an end, one of the wait staff who had circulated earlier offering drinks and hors d'oeuvres spontaneously began singing a Zulu song in praise of women, joined quickly by South Africans throughout the hall, including all the dignitaries. The air

vibrated with this rich and moving music, which visitors were later taught to sing themselves: "Maalibongwe, igama lama khosikazi, maalibongwe" (which roughly translates as "thank you, women, thank you"). It was thrilling when hundreds of women scientists later sang together, at the closing of the conference, but nothing compared with that first, spine-tingling rendition. We understood immediately that South Africans are working together to move past apartheid, to modernize, to improve education, and to develop as a nation among nations.

The US Delegation

The U.S. delegation—the largest country delegation, thanks to generous contributions from several of the delegates' institutions—included 26 scientists from all career levels, from undergraduates through senior leaders, both men and women, from academia, national labs, and the non-profit sector.

Several delegation members work in astronomy and astrophysics, including Meg Urry (co-leader of the U.S. delegation), Apriel Hodari (who was unable to attend the meeting), Kim Coble, Cynthia Correa, Sara Petty and Jarita Holbrook.

Other U.S. delegates included Bev Hartline (member of the IUPAP Working Group on Women in Physics), Beth Cunningham (delegation co-leader and head of the American Association of Physics Teachers), Melissa Dancy, Elizabeth Freeland, Ted Hodapp, Renee Horton (member of the IUPAP Working Group on Women in Physics), Rachel Ivie, Ivy Krystal Jones, Elaine Lalanne, Luz Martinez-Miranda (delegation co-leader), Rhiannon Meharchand, Maria Ong, Idalia Ramos, Susan Seestrom, Sally Seidel, Elizabeth Simmons, Michael Thoennesen, Elizabeth Henderson, Emma Ideal, and Herman B. White (more details are available at <http://www.uswip.org/4th/Delegation.html>).

Several delegates spoke or led sessions. Ivie, the keeper of statistics on women in physics and astronomy, spoke about the Global Survey of Physicists. Ong and Holbrook co-led the conference's first Gender Studies workshop and participated in a Women and Education poster session. Hartline led the workshop on Professional Development,

The Fourth International Conference on Women in Physics *continued*

in which Ideal gave a presentation on the US-invented Conferences for Undergraduate Women in Physics. Horton led the workshop on Gender Studies and the Role of Women in Physics. Urry was a panelist in the workshop on Improving the Workplace Environment for Women. Other delegates participated in sessions on Leaving and Entering a Career in Physics (Freeland has written extensively on this topic), Attracting Girls to Physics (Cunningham, Hodapp, Ramos and others are active in this), and Scientific Networking in Disciplines (Martinez-Miranda and Ramos led a session with Silvina Ponce-Dawson, from the IUPAP). Cunningham and Seestrom were panelists in the session on preparing for and entering leadership.

What Do Women Want?

One of the main goals of ICWIP4 was to ascertain the situation of women in physics around the world, and to compare across countries and cultures. The hope was to learn about effective ways to move toward gender equity, so that all citizens with talent in physics can thrive in the profession and contribute fully to their societies.

Following each ICWIP meeting, recommendations for increasing the participation of women in physics have been presented to and ratified by IUPAP and advocacy groups in the participants' home countries. One of the main recommendations developed by the United States delegation addressed the need for a better system of professional development for women physicists, beginning in college and extending throughout the full career. Mentoring plays a major part in this. Delegates also discussed how to attract and retain students in physics. *[note: the recommendations can be found at: <http://www.iupap.org/ga/ga27/Resolution%2012.html>]*

Another recommendation is to have IUPAP endorse increased collaborations between physicists and social science researchers to investigate the roles of gender in physics.

What Women Physicists Discussed

The conference featured a number of prominent speakers. Mae Jemison, the first African-American woman astronaut, talked about experiential science education, and arranged for plenary sessions to be videotaped. Dame Jocelyn Bell-Burnell, the British astrophysicist who first discovered pulsars as a graduate student in 1967, spoke about pulsars and extreme physics.

Cecilia Jarlskog, a Swedish scientist who found a relationship between the mass of an electron and the mass of a quark, talked about the universe and its smallest constituents, highlighting current mysteries in particle physics. YanLai Yan, a physicist from the People's Republic of China and winner of the prestigious Xie Xi-De Prize for physics, explained how physics is involved in ancient Chinese chime-bells.

The conference itself was an opportunity for professional development. Women networked with other physicists from around the world; it is common that new international collaborations begin at each ICWIP meeting. Sessions included talks about particle physics and an update on a global survey of women in physics.

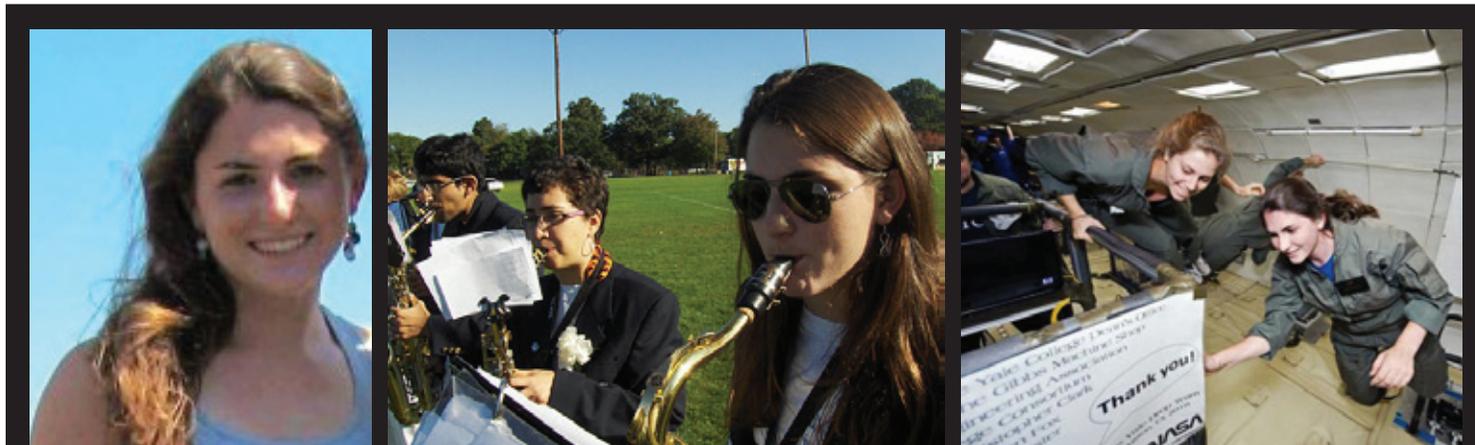
After the main conference concluded, a subgroup of the participants did an outreach activity for Middle school students from Stellenbosch. The event was sponsored by the South African Agency for Science and Technology Advancement (SAASTA), and the Academy of Science of South Africa (ASSAf), with promotional material to be distributed to the participants. There were so many volunteers that some had to be turned down. Participating from the United States were Mae Jamison, who spoke about her experiences of being the first African American Women in space; Beth Cunningham, who gave a laser demonstrations; Elizabeth Freeland, who spoke about pulsars; Elizabeth Simmons, who spoke about detecting ultraviolet light; and Luz Martinez-Miranda, who spoke about liquid crystals. Participants from the UK, Canada and Serbia also contributed to this activity.

A group from Yale University, including Meg Urry (Chair of the Physics Department), Emma Ideal (graduate student) and Michele Dufault (Yale College senior), posted webcasts of the plenary sessions, so they are accessible to a much larger audience than was able to attend the conference (thanks to the film crew that former astronaut Mae Jemison brought to the meeting). See <http://physics.yale.edu/4th-international-conference-women-physics>.

Michele Dufault was the critical person in this effort (see page 9). She enthusiastically took on the webcasting project so that women and men around the world would benefit from the conference. Ironically, she was too busy to attend the conference herself but somehow she made the time, in an already packed schedule, to download film, edit in viewgraphs, and post the results. A few days after the ICWIP meeting concluded, Michele was killed in a tragic shop accident at Yale. She is much missed.

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The Fourth International Conference on Women in Physics *continued*



Michele Dufault was an incredibly gifted young scientist with interests in astronomy (undergraduate research in the Urry group and a senior thesis on detection of dark matter) and oceanography (work on robotic exploration at the Woods Hole Oceanographic Institute). She was a passionate participant in activities to increase the number of women in science, including a local outreach program for middle school girls. She was the chief organizer of the annual Northeast Conference for Undergraduate Women in Physics, and even after her last conference, held at MIT in January 2011, was tirelessly mentoring the younger undergraduate women who were organizing on the next conference. She was also known around Yale for her saxophone playing in the quirky Yale Precision Marching Band, and for responding on a moment's notice to any request for help with physics homework. She had a universe of friends.

Michele's friends and family are still coping with this awful loss. Yale University created a \$100,000 scholarship fund for young women in science, and the Physics Department is spearheading a separate fund drive to support the NCUWP conference and summer research by a female Yale undergraduate in the physical sciences ("The Michele Dufault Summer Fellowship and Conference Fund"). Should friends wish to contribute, checks should be made out to Yale University, with a notation about the fund, and sent c/o Meg Urry, Physics Department, Yale University, PO Box 208120, New Haven, CT 06520-8120.

The Status of Women in Physics

Rachel Ivie reported preliminary findings of the Global Survey of Physicists (funded by the Henry Luce Foundation; see <http://www.aip.org/statistics/trends/highlite/women/global.pdf>). Nearly 15,000 physicists from 130 countries responded to the survey questions (in 8 languages), dominated by North Americans (32%) and Europeans (37%); roughly one quarter were women.

Women and men reported different experiences, in both developed and developing countries. Women were less likely to have participated in a professional conference, managed other scientists, served as an editor for a journal, reviewed grants, been on important committees at their home institutions, or advised graduate students.

Women were less likely than men to report adequate funding, office space, lab space, equipment, travel money,

clerical support and staff or students. Women also reported a less satisfactory relationship with their advisors than men did.

Men and women experienced family life quite differently. Women were far more likely to have a partner with a comparable level of education; men were more likely to have an unemployed spouse. 45% of women reported having a partner employed in physics, while only 15% of men did.

Women with children reported slower career progress, while men with children actually reported faster advancement. Women were three times more likely than men to report significant breaks or interruptions in doctoral studies, and twice as likely to report difficulty in finding quality affordable child care. 65% of the men responded that their work or career did not change significantly when they became parents, but only 32% of women said this.

The Fourth International Conference on Women in Physics *continued*

Women in less developed countries tended to have children earlier in their careers than women in highly developed countries. Women were twice as likely to report doing most of the housework than men were.

The news wasn't all bad. The good news is 89% of respondents said they would choose physics again.

The Status of Women Physicists in South Africa

South Africa emerged from an apartheid state not quite 20 years ago. The government and national institutions have placed a strong emphasis on the development of human capital, and are encouraging the development of STEM skills (Science, Technology, Engineering and Math). Holding a major international conference on women in science is a highly visible step toward gender equity, and the full inclusion of girls and women in the STEM enterprise.

“Physics is a wonderfully stimulating profession—it needs women—and women need physics,” said Professor Diane Grayson of the University of Pretoria, programme chair for the conference. “We must use this conference to highlight the exciting career paths that physics offers to women and remind people of the key role that physics play in our everyday lives and in many other professions—including engineering, medicine, telecommunications, environmental sciences and more!”

Professor Grayson pointed out that there is still a huge gender gap in physics in South Africa. “Far fewer women than men qualify as physicists and even fewer fill top academic positions in the field.” In 2010, all heads of university physics departments in South Africa were men, and only 24% of all the physics graduates were women. “This conference is an opportunity to explore why South Africa has so few women physicists and to look for solutions, drawing on the perspectives of participants from dozens of countries,” she added.

“We believe in starting young by making physics appealing to girls at school,” said Dr Mmantsae Diale, a physics lecturer at the University of Pretoria and chair of Women in Physics in South Africa (WiPiSA), an organization that works to attract girls to physics by providing role models and mentors for girls and female students. “It is also vitally important that teachers must give a clear message to girls that physics is relevant and accessible to them, and that it is not only for boys.”



U.S. team member Rachel Ivie going over her talk with Dina Izadi from Iran.

Final Thoughts

The diversity in the experiences of women physicists in different countries speaks to the role of culture in making career choices. Indeed, the fraction of physicists who are women varies widely in different cultures, sometimes in unexpected ways. Some of the most advanced countries, with strong family support systems—for example, Scandinavian countries—have some of the lowest percentages of women. At the same time, countries we might have expected to have strongly gendered expectations instead produce many women physicists (e.g., Argentina), although in some cases delegates from those countries suggested this might be due to the low economic status of physics compared to, for example, engineering.

In some developing nations, women still face open discrimination, and they also struggle with low levels of basic infrastructure like power, laboratory equipment and computers. More developed countries face issues like subtle, unconscious biases, or rigid expectations about what career trajectory constitutes success.

For many delegates, experiencing a commonality of interests—in science, in discovery, in the many mysteries

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The Fourth International Conference on Women in Physics *continued*



Delegates from African countries at the conference dinner.

to be solved in physics—across cultures and independent of particular obstacles, was the strongest result of the conference.

Across the world, progress in women's rights and opportunities has occurred when women band together in common cause. The physics world has proved slow to change, with only small increases in the number of women physicists over time. The former Executive Officer of the American Physical Society, Judy Franz, once noted, "At the rate we're going, we won't reach gender equity until late in the 21st century."

In the U.S., the fraction of women in physics at all levels is similar to what it was in astronomy 20 years ago, which is why a senior women astronomer like me is optimistic that analogous change can happen in physics. In astronomy, a turning point came in 1992, starting with the Baltimore Conference on Women in Astronomy (see <http://www.stsci.edu/institute/conference/wia/>) and helped by considerable expansion in astronomy and astrophysics in the ensuing decade.

Already the ICWIP conferences have given rise to new opportunities for women physicists from developing countries to start international collaborations with colleagues from developed nations. Tangible benefits for U.S. physicists are harder to enumerate but our delegation left the Stellenbosch meeting reinvigorated about addressing the issue.

I believe substantial change will require young women to stand up for their right to equality. They must be able to choose to have interesting, productive careers and raise a family, as men do. They must insist on equal division of labor at home, as polls tell us men do not. They must create the pressure so that unmet need gives way to possibility. I believe women in the vanguard, like Henrietta Swan Leavitt, Cecilia Payne-Gaposchkin, Margaret Burbidge, Vera Rubin, Judy Franz, Bev Hartline, and Mae Jemison, have opened doors for those following behind. Now they just have to step through the opening.

Plenary Session Videos and Links

Tuesday, April 5, 2011: <http://physics.yale.edu/icwip4-tuesday-april-5-2011>

- *Welcome and Opening Remarks* by Prof. Patricia Whitelock
- *Welcoming Address by the Executive Mayor of Stellenbosch*, Alderman Cyril Jooste
- *Speech by IUPAP Working Group*, Prof. Silvina Ponce-Dawson (Argentina)
- *Speech by ICSU-ROA*, Dr. Edit Madela-Mntla
- *Presentation by Alfred P. Sloan Foundation*: Dame Jocelyn Bell-Burnell, Prof. Beverly Hartline, Dr. Ted Hodapp
- *Opening Address by Minister of the Department of Science and Technology*, Ms. Naledi Pandor
- *Toast for Success of ICWIP 2011* by WiPiSA Chair, Dr. Mmantsae Diale
- The National Anthem of South Africa performed by the Local Organizing Committee
- 4th IUPAP International Conference on Women in Physics Photograph

Wednesday, April 6, 2011: <http://physics.yale.edu/icwip4-wednesday-april-6-2011>

- *Conference Opening*, Prof. Silvina Ponce-Dawson and Igle Gledhill (LOC Chair)

The Fourth International Conference on Women in Physics *continued*

- **Plenary 1:** *How Physics is Involved in Ancient Chinese Chime Bells*, Yan Lai Yan (Beijing, China)
- **Plenary 2:** *Pulsars and Extreme Physics*, Jocelyn Bell-Burnell (United Kingdom)

Thursday, April 7, 2011: <http://physics.yale.edu/icwip4-thursday-april-7-2011>

- **Plenary 3:** *The Use of Lasers and Phthalocyanines in Cancer Therapy*, Tebello Nyokong (South Africa)
- **Plenary 4:** *The Global Survey of Physicists: A Collaborative Effort Illuminates the Situation of Women in Physics*, Rachel Ivie (United States)

Friday, April 8, 2011: <http://physics.yale.edu/icwip4-friday-april-8-2011>

- **Plenary 5:** *Space Weather Phenomena in the Equatorial Ionosphere*, Archana Bhattacharyya (India)

Sponsors for the Conference included the American Physical Society, the American Association for the Advancement of Science, the Alfred P. Sloan Foundation, the National Science Council (Taiwan), the Council for Scientific and Industrial Research (South Africa), the Abdus Salam International Centre for Theoretical Physics (Italy), the Physical Society of Japan, the Japan Society of Applied Physics, the Korean Physical Society, the University of the District of Columbia (USA), the National Science Foundation (USA), and the Thomas Jefferson National Accelerator Facility (USA).



Unconscious Bias

Caroline Simpson, Florida International University

In the previous issue of STATUS (July 2011), the article by Schmelz & Knezek introduced the concept of unconscious bias, discussed its impact on evaluation and hiring, and presented ways to mitigate it. Although unconscious bias

effects can be subtle, their accumulation can add up significantly over time; or as Valian (1998, p. 4) puts it, “Mountains are molehills piled one on top of the other.” This is known as the accumulation of advantage and disadvantage (Valian 1998, p. 142-144). Minor slights tend to accrue, and have been shown to have major effects on salary, promotion, prestige, and advancement to leadership positions (Merton 1948; 1968).

Addressing unconscious bias and the resulting accumulation of disadvantage is important, because without intervention it becomes a positive feedback loop. An initial evaluation bias, for example, leads to an underestimate of performance (disadvantage) (Stewart

2009). This, in turn, leads to a lower success rate, which feeds back into the next evaluation cycle (accumulation of disadvantage). Work done by Martell, Lane, & Emrich in 1996 and described by Valian (1998, p. 3) demonstrates this: they created a computer model of an organization with eight levels of hierarchy, and populated the lowest level with equal numbers of men and women to start. Over time, a certain percentage was randomly promoted to the next level; however, they put in a bias of 1% in favor of promoting men. After many iterations, the population of the top level of the organization was 65% male. The 1% difference in ‘evaluation’ translated to a 15% difference in the resulting promotions. There is no such thing as an “unimportant” small difference because all of them add to the total. Valian (1998) states “...success comes from creating and consolidating small gains—successful people seem to know this.”

The feedback loop of accumulating disadvantage explains the observation that women speak less in public/professional settings than do men (Haslett, Geis, & Carter 1992). Because most women start at a slight disadvantage, they are less likely to be viewed as a serious professional

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and their ideas are less likely to carry weight. This leads to a loss of prestige within the group, which means the woman will be less likely to be listened to in the future as well. Women, often unconsciously, learn that it is better to be silent rather than to continue to accrue disadvantage.

The accumulation of advantage/disadvantage is directly related to the concept of unearned advantage pioneered by Dr. Peggy McIntosh (McIntosh 2009). She posits that there is a “line of justice” above which is the world of (unearned) privilege; for those who find themselves (due to birth, circumstances beyond their control, etc.) above that line, it creates subconscious mental attitudes of superiority and rightness. Below that line, one is not “suffering from”; instead, above that line, one is “free of.” People just absorb the ideas that come with being above/below the line of justice. Dr. McIntosh’s work began in the area of race, but she soon discovered it was equally applicable to gender issues. Examples of these attitudes are given in her article “White Privilege”: (nymbp.org/reference/WhitePrivilege.pdf). These include:

- I can, if I wish, arrange to be in the company of people of my own race/gender most of the time.
- I can be pretty sure of having my voice heard in a group in which I am the only member of my race/gender.
- I can speak in public to a powerful male group without putting my race/gender on trial.
- I am never asked to speak for all the people of my racial group/gender.
- I can be pretty sure that if I ask to talk to the “person in charge,” I will be facing a person of my race/gender.

People above the line of justice are free from the subtle burdens that continue to buffet those below the line. Continually finding oneself ignored in meetings, or being asked, “so, what’s it like to be a woman in science?” becomes, eventually, exhausting. Being seen as more than just a scientist, but also an ambassador or unofficial spokesperson for your race/gender (something one didn’t choose, but just IS), means people are not solely thinking of you as a scientist, but see you in these other roles as well. This lessens the impact of your scientific/professional message, and is an example of schema discord.

Schemas are the hypotheses we use to interpret social events, and are useful when we find ourselves in new/unfamiliar situations, or when meeting new people. We can quickly figure out how to behave by making a rapid assessment of someone by assigning her or him to a schema. Schema discord occurs when someone seems to match two different schemas. For example, because the highest levels of all prestigious professions are occupied primarily by men, the “professional” schema is associated with males. A professional woman, therefore, operates with a perceived discord between two schemas: female, and professional (male). Schema mismatch makes people subconsciously uncomfortable as they don’t know how to behave towards this person. Professional women can’t be too feminine or too masculine, as either of these will increase the schema mismatch, and therefore the social discomfort. Too feminine matches the successful professional schema less; and too masculine matches the female schema less (Valian 1998).

Women and men both utilize schemas without realizing how personal successes are viewed by each gender. A man’s professional success matches the masculine schema, so it is logical for him to take the deserved credit for his own success. However, because a woman’s professional success matches the masculine, not feminine, schema, she (and others) subconsciously either views herself as having masculine traits (success is masculine), or as having succeeded by luck or extraordinary effort. Therefore, relative to men, women see luck as more important for both success and failure. This is actually a rational conclusion for women, as they don’t benefit from their competence and effort reliably, due to unconscious bias. Research shows that women benefit less from the prestige of the institution where they get their training; men are promoted and tenured more quickly, make more money, and are overrepresented at senior levels. Women’s internalization of lack of credit, although logical, is detrimental: because cause and effect don’t operate if something occurs by luck, one can’t learn how to continue to be successful from a “lucky” event (Valian 1998).

It is clear that changing schemas is essential if we are to reduce the effects of unconscious bias and the resulting accumulation of disadvantage. Some remedies are suggested in the AAUW report “*Why So Few?*”. The report (which can be downloaded from www.aauw.org, with a webcast at <http://www.ngcproject.org/resources/webcastarchive.cfm>) drew on a large body of

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academic research to identify eight research findings in three areas: how social and environmental factors shape girls' achievements and interests in math and science, the climate of college and university science and engineering departments, and the continuing influence of bias. The findings include that girls are "harder on themselves" when assessing their abilities in "male" fields like science and math. This effect is demonstrated by a study that shows that when assessing their abilities to perform a task, girls' standards for how high they would have to score to "be convinced that you have high ability in this task" is higher than that for boys, when both are told that "men are better at this task." The remedy is to set clear performance standards, so girls will be less likely to rely on schemas to assess their abilities, and to encourage girls to take deserved credit for their successes so they can recognize their career-relevant skills (addressing the "luck" vs. ability issue discussed above).

A second finding is that despite considerable gains in math and science in the last few decades, negative stereotypes about girls' and women's abilities in these fields persist. These stereotypes (schemas) give rise to stereotype threat, which occurs in situations where a person fears that his/her performance will be evaluated based on a negative stereotype. The added stress can then, indeed, have a negative effect on performance. The example used is that of a female student taking a difficult math test: she may experience an "extra cognitive and emotional burden of worry" that if she doesn't do well, her poor performance will reinforce the schema that women are not good at math. (Author's note: I feel this pressure every time I give a public talk: I fear that if I don't come across as a good scientist, people will come away thinking that women can't be good scientists; not just that **I'm** not a good scientist.). The data show this effect strongly: when told "men perform better" on a challenging math test, women's scores decreased from 57% to 17% (Spencer, Steele, & Quinn 1999).

The remedy for stereotype threat is to reduce the stereotype: expose girls to successful female role models in math and science, and to teach them about stereotype threat. If the fear of being unjustly judged is removed, so is the effect. Stereotype threat is situational, so it can be mitigated by changing the situation. Girls score higher on math tests simply by telling them they can do well.

Ultimately, the solution for the effect of unconscious bias and the resulting accumulation of disadvantage is

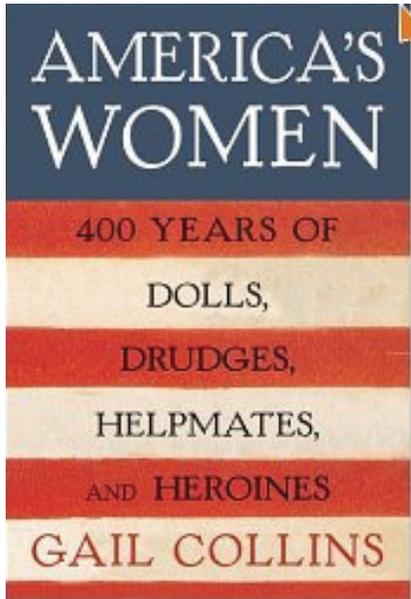
education: become aware of your own and others' biases and let others know that this is a real, not just perceived, threat—there are data! Schema discord will also diminish with greater percentages of women at high levels in prestigious jobs, which should therefore diminish the presence of unconscious bias on women in the workplace.

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America's Women: Four Hundred Years of Dolls, Drudges, Helpmates, and Heroines by Gail Collins, HarperCollins Publishing

reviewed by Joannah Hinz, University of Arizona



America's Women is a roller coaster ride through the milestones, large and small, of the women upon which this country was settled, built and developed. The chronicles of these fierce females elicit the same screams and cries, the same heart-in-mouth feeling, as every twist and turn of an amusement park ride. Each event is told in detail, beginning with the journeys of

pioneers of the Mayflower and ending with protesters of the 1970's. The same dizziness and weak-leggedness you might feel disembarking from the roller coaster occurs when a chapter ends. You're a bit breathless from having the wind full force in your face for that long, and you wonder if you are able to steady yourself before getting back in line for the next ride.

But that's the style of *America's Women*: detailing all the years and all the accomplishments at breakneck speed, leaving, if possible, no one out. And that requires zooming through sometimes dozens of names in each section, the ultimate overview of feminists and feminism over the centuries. To her credit, Collins not only covers women at the wild and desolate Western frontier, but also their sisters in over-crowded and impoverished Eastern cities. She focuses not only on white culture, but also on the plight of African-American women and their own unique and extraordinary journey. She takes up equally the causes of women's rights most famous leaders and those of the virtually unknown writers, teachers and housewives. It's impossible, in fact, to remember many of the names at all. There's a certain sadness to that, as each woman seems important in her own way, and you find yourself wanting to go back and discover more about each of them.

But to take only that sense of loss away from this book would be a mistake.

What's important about this book are the themes that pop up again and again in the historical American female experience. Each reader might settle on different themes, but the ones that stood out for me are listed below.

1. Women earn more rights when women's skills are most needed.

The times when women's rights leaped forward coincided with the times when circumstances necessitated the use of women in, up until then, unconventional ways. During times of war, especially the Civil War, many plantation owners and workers were off to fight for long stretches of time, leaving women to take care of farms and homes. In order for the plantations to continue and survive the war, more women had to learn to read, handle accounts, balance budgets and make major decisions about the running of the farms. Property laws in some places were altered; men going to war were more comfortable leaving their holdings to wives and sisters than to business partners. Women were more likely to keep the wealth in their own families, while business partners might sell off property or dispute claims if the owners returned from battle. Also during periods of war, women were allowed more freedom to travel alone to help with nursing and other medical duties on frontlines as the numbers of casualties increased and male personnel were overwhelmed. Such education and freedom was unlikely to occur under normal circumstances.

Likewise, when Wyoming desperately needed women in order to increase the population and visibility of the new territory, they extended the vote to women in order to attract them to settle there. All women above the age of 21 were given the right to vote, with no requirements on property ownership. Despite the federal government's threats to deny Wyoming statehood if they did not rewrite their constitution to revoke the vote, Wyoming remained steadfast, unwilling to deny the right to those women who had already resettled there. Congress eventually backed down.

In each of these cases, societal and legal rules were flexed, and women were depended upon to keep the country moving forward in times of crisis. Yet, after each crisis had abated, many of these regulations were repealed. Times of prosperity and comfort are not necessarily the most fulfilling for women.

America's Women: Four Hundred Years of Dolls, Drudges, Helpmates, and Heroines continued

2. Small things matter.

Collins has convinced me that sometimes seemingly small or trivial daily difficulties make huge differences in the lives of women. In much of Southern plantation life, the favored fashions from the larger American or European cities included enormous hoop skirts, mountains of fabric and delicate shoes. While perhaps not unreasonable for city living or cool climates, these clothes were prohibitive in the hot, humid and muddy South. Those who did not wear such attire were considered uncivilized and shunned by local society, yet those who did wear them were essentially trapped at home, unable even to walk through town or to neighboring families without difficulty, leaving them isolated intellectually and weakened physically. These were, of course, abandoned once women were called upon for more demanding duties during times of war.

Indoor plumbing had a remarkable effect on women's lives, especially the lives of those in the crowded multi-storied apartment buildings of New York and Chicago. To fetch water for any household chore required that women walk down as many as 10 to 15 flights of stairs to a main water well and back up again. This had an obvious toll on health due to the extraordinary effort and the fact that communal water also tended to bring about communal diseases. But it also had an impact on the amount of time that women spent on chores and not on, for example, starting small sewing businesses of their own or taking on part time work outside the home. Increased free time meant increased financial independence.

3. Writing and recording the female experience is important.

Much of what is in this book about the daily lives of America's women is taken not from legal documents or historical records, but from the diaries, journals and letters of the women themselves. Historical documents rarely give insight into the details of how people lived from day to day, and most of the American record is written by men. Therefore, it falls to letters from sister to sister to tell us basic things such as what household duties routinely were, how children were typically viewed and raised, and what women felt they were capable of compared to what their roles actually were. Excerpts of these writings are sprinkled throughout the book, personalizing the experiences of their particular eras. These letters also acted as conduits for advice and sympathy - a way of maintaining faith that things might gradually progress into more

freedom for women in the long term. We can only guess about those who were less educated or less fortunate and were unable to chronicle their lives in this way, and Collins rues that several times in the book in reference to minorities and to those who traveled long, difficult journeys to Western states. There are still missing pieces.

Women also used the outlet of literature to imagine roles for themselves that might have been impossible in reality. They wrote novels depicting tried and true heroines who traveled the country as teachers and governesses, solving mysteries, saving farms or rescuing children in emergency situations where men were not available. These books became enormously popular in the early nineteenth century, and, by the early twentieth century, the main characters in such novels had college educations, marriages and children, and still went off on adventures to run down criminals. In a sense, these novels were dreams out loud and served to fuel the imaginations of young women whose expectations for life were broadened compared to those of their predecessors.

Despite these recurring themes, I never found America's Women to be preachy or pedantic. It's sometimes funny, sometimes tragic, and always factual. And perhaps the most immediate reward from reading it is that each of the above themes could easily serve those of us attempting careers in science: show strength in times of hardship and persevere in times of prosperity; everyone counts, famous or not; small improvements are better than none at all; keep talking, blogging, tweeting, or facebooking your experiences, because this record serves multiple purposes. Meet with other women. Dream big. And don't give up. You're part of a long legacy of women who have overcome remarkable odds and lived in these pages to have their story told.

