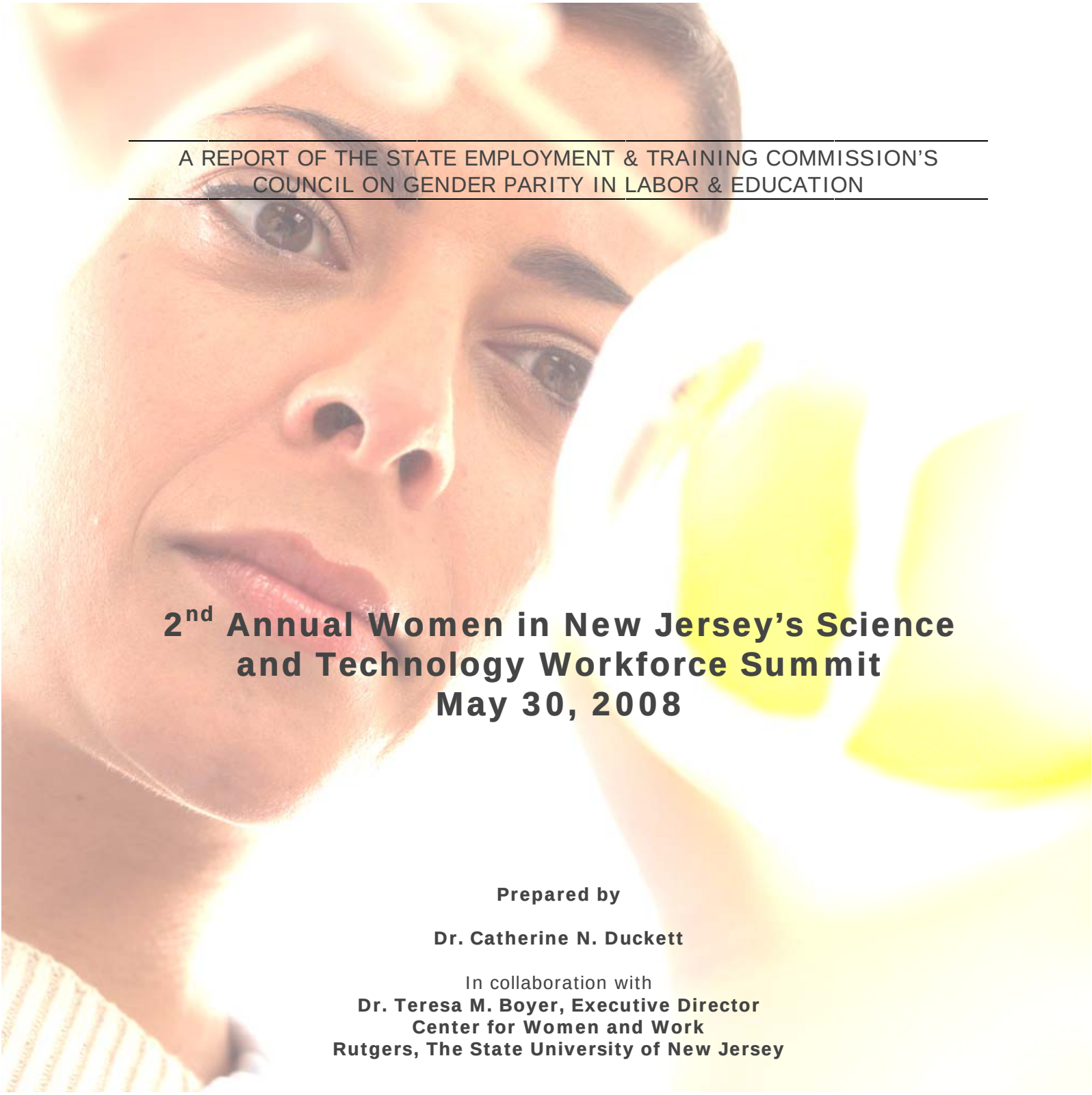

A REPORT OF THE STATE EMPLOYMENT & TRAINING COMMISSION'S
COUNCIL ON GENDER PARITY IN LABOR & EDUCATION

2nd Annual Women in New Jersey's Science and Technology Workforce Summit
May 30, 2008

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New Jersey's Council on Gender Parity

Established within the State Employment and Training Commission (SETC), the New Jersey Council on Gender Parity is the only one of its kind in the United States created by legislation to address issues of gender disparity in labor and education. It first met eight years ago and has provided the state with leadership on gender equity issues important to its economic and workforce development. The agenda for the work of the Council was set at its first meeting, including a review of occupations with both gender barriers and identified labor shortages in New Jersey. Five critical fields identified in an early report for the Council are building trades, financial services, health care, law, and technology. Since that time, the Council has published 13 reports, made numerous policy recommendations, and held 6 public forums covering three of the five areas – building trades, health care, and technology. Copies of Council reports are available on the SETC web site (www.njsetc.net).

The appropriation for the Gender Parity Council also funds gender equity experts to work directly with State Departments to assist them in the implementation of programs that attend to the needs of women. This is a unique role that does not exist in any other form in our state government. Through these and other initiatives, the New Jersey Council on Gender Parity in Labor and Education has made tremendous strides in the advancement of equity in the State.

Bio-1 WIRED

Bio-1's goal is to make Central New Jersey (CNJ) the next "hot spot" for the global bioscience industry, by creating more high-quality, high-paying jobs and an even more highly skilled workforce. The five-county BIO-1 partnership is named for the Route 1 corridor from Rutgers to Princeton, around which most of CNJ's biotech firms are clustered. The CNJ region, comprising Hunterdon, Mercer, Middlesex, Monmouth, and Somerset counties, has received $5 million, available under the Workforce Innovation in Regional Economic Development (WIRED) program from the United States Department of Labor, Education and Training Administration (USDOLETA). The WIRED grant will be used to transform the rich array of existing bioscience education and training and economic development initiatives into a world class bioscience talent development system.

The partnership has its roots in an initiative created by Governor Jon S. Corzine as part of his statewide economic strategy. This is the third WIRED investment in New Jersey, making it "the most WIRED state" in the U.S.

Center for Women and Work

As the research arm of the Gender Parity Council, the doctoral-level staff at the Center for Women and Work has collected data, conducted research, and produced all reports and public forums for the Council, and also makes presentations within the state and on the national level about the Council. The CWW also works closely with the New Jersey State Employment and Training Commission (SETC) and the Council to follow occupational trends in New Jersey and identify current or potential inequities.

Additional Event Co-Sponsors

Bergen County Technical Schools
www.bergen.org

Center for Women and Work, Rutgers University
www.cww.rutgers.edu

DeVry University
www.devry.edu

Division on Women, New Jersey Department of Community Affairs
www.state.nj.us/dca/dow

Fairleigh Dickinson University
www.fdu.edu

New Jersey Center for Teaching and Learning
www.njctl.org

New Jersey Chamber of Commerce
www.njchamber.com

New Jersey Department of Education, Office of Math and Science Education
www.nj.gov/education

New Jersey Eastern Pennsylvania & Delaware Higher Education Recruitment Consortium
www.njepadeherc.org

New Jersey Neuroscience Institute
www.njneuro.org

New Jersey State Employment and Training Commission
www.njsetc.com

New Jersey Statewide Systemic Initiative, Rutgers University
hjttp://njssi.rutgers.edu

Nontraditional Career Resource Center, Rutgers University
www.ncrc.rutgers.edu

Office for the Promotion of Women in Science, Engineering and Mathematics Rutgers University
http://sciencewomen.rutgers.edu

Rutgers School of Engineering, Office of Student Development
www.osd.rutgers.edu

Stevens Institute of Technology
www.stevens.edu

WIRED Bio-1
www.Bio-one.org

Women In Engineering IEEE- Institute of Electrical, Electronics and Engineers
www.ieee.org

Overview:

Women have made tremendous inroads in the science and technology workforce over the last two decades. They have increased their education participation levels at both the secondary and post-secondary levels, and have increased their representation in many occupations within these fields in the New Jersey workforce. The New Jersey Gender Parity Council has addressed the issue of women's participation and advancement in this field as one of its first initiatives though public forums, reports, and original research. The Council continues this work in an effort to raise the public dialogue in New Jersey, as well as create effective policy to increase women's participation and advancement in this important sector of New Jersey's economy.

The concern for increasing the participation of Women in Science and Technology fields is not new (see Valian 1998) and has deep roots in New Jersey: in 1982 New Jersey native James Johnson, a freelance writer, published an article "Can Computers Close the Educational Equity Gap?" documenting inequalities in American schools (Johnson 1982). Johnson was concerned about the low representation of women in the sciences. Since then many of the inequalities in education of women offered by American society, the public schools and university systems have been redressed (Saunders 2005). However, inequalities in participation in science remain. The National Academies of Sciences report, *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering (NAS 2007)*, documented continuing problems faced by women in science, engineering, and mathematics fields. The report details the various biases and barriers that a female interested in science encounters in each stage of her education. The report also documents the fact that women who do enter science often leave the profession. For example, the total number of women students in college majoring in STEM disciplines has increased over the last four decades to reach almost equal numbers to those of men, however, the percentage of women on faculties of engineering, math, and the physical sciences remains small (NSF, 2000; Long, 2001; Nelson and Rogers, 2005; NAS, 2007). In a review of recent studies, Strenta and his colleagues (1993) found that the persistence rates of men in S.M.E. majors varied between 61% for highly selective institutions to 39% for national samples, and between 46% and 30% for women. (Strenta et al, 1993).

The percentage of women scientists in corporations is also low, a fact that is being addressed by many corporations in New Jersey, through the implementation of extensive programs to promote and retain women scientists (for example, see L'Oreal website). Because women are entering science, engineering and technology fields in lower numbers than men at all levels of the educational pipeline (Alper 1993; National Center for Education Statistics, 2006), then many leave after scientific training, the US is left with a dearth of trained female scientists and engineers (NAS, 2007).

The Gender Parity Council of the State of New Jersey is tasked with "ensuring every individual the opportunity for education and training that leads to high-demand, high-skill careers regardless of one's gender." Careers in Science and Technology are high paying careers (Bureau of Labor Statistics 2008) that also generate economic growth for the state (see Heldrich Center study in Resources). Moreover, growth in Science, Technology, Engineering and Math fields (STEM) are priorities for New Jersey's economy. For this reason the Science and Technology Subcommittee of the Gender Parity Council is concerned with finding workable solutions to educational and workforce issues that will increase the number of women in the NJ Science and Technology Workforce. To this end, last year, 2007, the Gender Parity Council organized the first annual summit on Women in New Jersey's Science and Technology workforce with the stated goals of bringing together professionals from all walks of professional life relating to the education, training and employment of women and girls in STEM in our state to generate recommendations to the Council for increasing the participation in the NJ STEM workforce. The second annual summit had the same objective to generate workable recommendations to the Gender Parity Council but to refine the recommendations based on the discussions at the first summit. The recommendations at the first summit focused on the retention of scientists that have already been trained via mentoring and improving work place climate and on interesting women and girls from our state by improving the visibility of science careers through the mass media and better linkages between education and careers as well as through improving STEM education generally.

Second Annual Summit on Women in New Jersey's Science and Technology Workforce

The Gender Parity Council's Second Annual Summit on Women in New Jersey's Science and Technology Workforce took place on May 30, 2008 at The Conference Center at Mercer in West Windsor, New Jersey with more than 150 representatives from government, industry, K-12 schools, academia and community-based organizations in attendance. The summit was organized with co-sponsorship from BIO-1, a US Department of Labor Workforce Innovation in Regional Economic Development (WIRED) initiative focused on investing in a world-class workforce in the central NJ area by fostering a high-skill ecosystem of Bio Science talent, ultimately driving innovative advancement in education and industry. The 2007 summit sponsor, the Office of Promotion of Women in Science, Engineering and Mathematics (WiSEM) at Rutgers joined seventeen other co-sponsors (See appendix A), representing a broad range of organizations with a stake in increasing women's participation in this sector of the workforce. The event was organized in three main parts. The first plenary portion summarized the findings from the first summit and focused on the presentation of research findings in areas that impact Women in New Jersey's Science and Technology Workforce or Educational system as suggested by the findings of the 2007 summit. The second portion was composed of breakout sessions where participants participated in the discussion of five topics suggested by the previous summit relating to increasing women's recruitment, retention and advancement in these fields. The final plenary session summarized each breakout session and suggestions for future policy and research actions.

After a general welcome by Gender Parity Council Chair, Dianne Mills McKay, Catherine Duckett, Associate Director of WiSEM welcomed the audience to introduce the structure for the event and how it related to the previous summit, setting the stage for the keynote speaker and panel members to present their findings. Duckett presented the results of the first summit, and reminded the audience that in breakout sessions in 2007 dedicated groups of professionals discussed: Recruitment and Retention, Work – Life Balance, Media and Cultural Perceptions of Women in Science and Technology, Perceptions of Career Pathways in the Sciences, and Mentoring- "K-to Gray". From these discussions and plenary sessions in 2007 a strong need for the

dissemination of best practices and recent research emerged, and this influenced the councils' choices of speakers for the plenary session and keynote that immediately followed.

Keynote Speaker Linley Erin Hall: "What's Holding Women Back from Careers in Science?"

Freelance writer Linley Erin Hall, author of *Who's Afraid of Marie Curie?* and a chemistry graduate of Harvey Mudd College, presented her research on the challenges facing women in science and technology, particularly discrimination and the issues surrounding work-family balance. Using the stories of several female scientists and engineers, Hall discussed the typical career path, highlighting the points when women tend to drop out. Hall stressed that although recruitment into science and technology fields is increasing, "Too many women who are interested in these fields receive a 'women not welcome' message and take their talents elsewhere." She encouraged both men and women to keep speaking out about both their problems and successes rather than to lapse into silence, which may exacerbate the loss of women in science and technology fields and contribute to their sense of isolation.

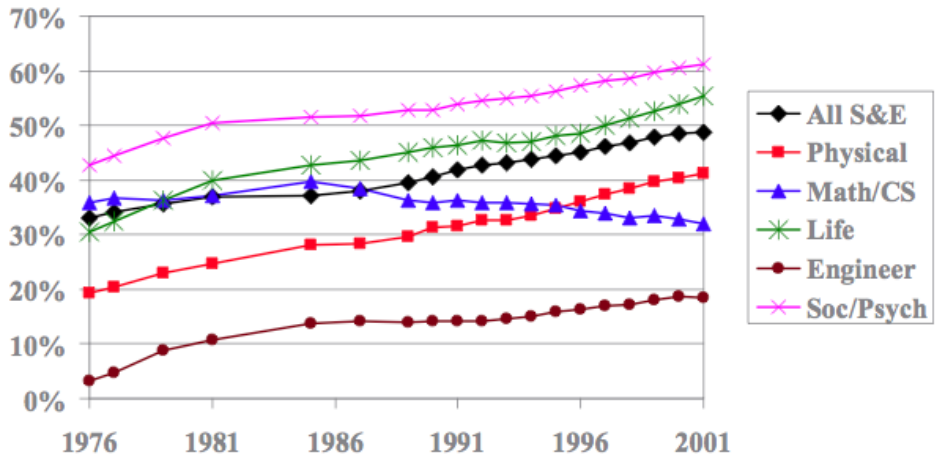
Plenary Panel Session: "Moving Beyond the Data"

This session was moderated by Dr. *Mary Murphree, Ph.D., Senior Advisor,* Sloan Center on Innovative Training and Workforce Development and Center for Women & Work, Rutgers, The State University of New Jersey and included presentations by panelists, Dr. *Robert Goodman, Science Chair,* Bergen County Technical High School, Dr. *Evelyn Hanna Laffey, Assistant Dean and* Director of Women in Engineering Programs, School of Engineering, Rutgers, The State University of New Jersey and Dr. *Ellen Spaldo, Assistant Professor of English and Director of Writing,* Metropolitan Campus, Farleigh Dickinson University.

Dr. Bob Goodman presented the innovative science curriculum at Bergen County Technical High School the "*Progressive Science Sequence*", a mathematical rigorous version of a "Physics First" approach. This is a very successful curriculum in which all students first enroll in a mathematically rigorous Physics course, which is taught using only algebra (not trigonometry) and then progress on to Chemistry and then to Biology.

This is in sharp contrast to the conventional secondary school curriculum that gives those courses in the opposite order and maintains that you need trigonometry to teach physics appropriately. It also contrasts with those "Physics First" programs that are based on a conceptual physics course in the first year. Dr. Goodman highlighted the success of this curriculum for all students, especially young women. Goodman contrasted the Bergen County participation rate of females in AP courses with the NJ norms, in all cases Bergen county students exceeded the state norms, in Physics AP's both the B and C tests Bergen county had 14.5 times the state norm! Bergen County also had 2 times the state norm in Biology, 3 in Chemistry and an amazing 18 times the participation in Computer Science. Dr. Goodman attributed this to a positive attitude towards women in the computational sciences and that introductory physics and mathematics are introduced in a logical order; he suggested that other institutions might benefit from offering this confidence-building curriculum themselves. This approach is detailed in Goodman and Etkina (2008), which was distributed to the audience.

Dr. Evelyn Laffey presented data on the percentages of young women studying various sciences in High School, entering College and graduating from college in the last two decades. It is well known that there is a loss of women studying sciences across all fields between high school and College graduation, and still fewer women in Computer and Information Sciences than in Life Sciences, for example (see www.nsf.gov/statistics/). Although women have increased dramatically at the faculty level much progress needs to be made. For example: women were about 1% of full-time tenured or tenure-track faculty in engineering in 1979 but in 2006 this percentage had only risen to 11% (http://www.nsf.gov/statistics/infbrief/nsf08308/). However, not all fields are showing increases even the modest ones mentioned. Dr. Laffey also presented data graphically illustrating declining rates of women earning degrees the quantitative sciences as compared to the increase in young women taking undergraduate degrees in the life sciences, Math/Computer Science and Engineering show loss of graduates, see table below, Bachelor's degrees earned by females in the US. Laffey exhorted the summit participants to consider these data in their breakout sessions in the afternoon.



Source: Dept. of Health, Education, and Welfare, Office for Civil Rights; National Center for Education Statistics.
Note: Chart refers to bachelor's degrees earned by U.S. citizens / permanent residents at U.S. institutions.

Dr. Ellen Spaldo encouraged summit participants to *'Mentor in Optimism'* with a detailed presentation of her award winning mentorship practices (http://inside.fdu.edu/prpt/spaldoaward.html). Dr. Spaldo explored the components and foundations of effective mentoring practice and reviewed the elements and expectations of successful mentoring for both mentor and protégé. Foundations of Effective Mentoring Practices for both mentors and mentees include: Enthusiasm for mission, philosophy, objectives; interest in current and emerging trends; openness to new ideas, sharing ideas, change, constructive criticism; vision, including -planning & organizational skills and creative use of chaos; leadership and trust, and as well as a willingness to express uncertainty. From her own experiences Spaldo cited comments that her mentees had made about her mentorship in the past to illustrate the strengths of a good mentor. "I always felt heard and cared about"; Spaldo describes the importance of fully engaging with mentees and a truly open door policy. "I was mentored in both traditional and surprising ways" illustrates her habit of building community with her mentees and using all social opportunities for mentorship. Her mentoring was described as "Orchestration of interconnected projects" to illustrate that the spirit of collaboration and making the mentee/mentor bond be one of team-work and problem solving was essential to successful mentorship. Dr. Spaldo also urged mentors to listen for solutions coming from the mentees and not to feel the need to supply all the solutions. Spaldo also acknowledged that mentoring needs to be valued

and recognized because mentors (even excellent ones like herself) do burn out. A summary of Spaldo's PowerPoint presentation is attached in Appendix B.

After the plenary panel, Dr. Teresa Boyer, Executive Director of the Center for Women and Work and one of the summit's organizers, presented a summary of the 2007 summit. (The final report can be found on the New Jersey SETC website). Dr. Boyer used the findings of the last summit to introduce the five areas of in-depth discussion that breakout groups last year decided needed further discussion and refinement to be developed into policy recommendations to the gender parity council. These are listed below; Boyer exhorted the assembled professionals to begin their discussions over lunch.

The five topic areas for the afternoon breakout sessions were:

- Improving Mentoring Practices: How to Implement Effective Mentor Training Programs to Influence Girls/Women to Persist in STEM Fields
- Using Multi-Media Marketing to Promote STEM Careers
- Impact of Workplace Climate on the STEM Workforce
- P-16 STEM Education (including issues related to the perceived and real gender gaps)
- Connecting Education and Careers

Discussion Breakout Sessions

The afternoon session was organized into five breakout sessions where participants were encouraged to engage in detailed discussions of each topic. Each session was staffed with professionals with some expertise in that topic area, who were tasked with facilitating discussion, serving as technical resources and focusing conversation on concrete recommendations to the Gender Parity Council. Although the topics of each session had been announced and participants asked to register for a discussion topic, each participant was free to attend the session that appealed to them after the mornings' discussion. For example, although 23 people registered to attend

the session on 'Improving Mentoring Practice', 28 people including discussion facilitators were present.

Improving Mentoring Practices: "How to Implement Effective Mentor Training Programs to Influence Girls/Women to Persist in STEM Fields" had 23 registrants including Moderators/ Discussants: Catherine Duckett, Bonnie Diehl, Henry Harms, Keyana N. Tennant, Beth Tracy, Mary Trigg.

To start this session, Dr. Bonnie Diehl distributed a handout and gave a brief introduction to best practices in mentoring, different types of mentoring and misconceptions about mentoring. The most significant mentoring misconception noted was the need for a good mentor to be very knowledgeable or to 'have all of the answers. This idea led naturally into the next presentation led by Beth Tracy on 'coaching skills for mentors,' which relies on the 'coach' asking leading questions to allow the mentee to discover the best answer for them. An annotated bibliography was provided, which is publically available at:
(www.advance.arizona.edu/MENTORING_ANNOTATED_BIBLIOGRAPHY.pdf).
Other topics discussed included:

- The importance of formal vs. informal mentoring
- Methods for students to acquire informal mentors
- Which mentoring programs in New Jersey are working well and can be used as models, for example, the Rutgers WINGS program (http://ruwings.rutgers.edu/)

The mentoring group generated the following ***recommendations***:

- Form a Task Force for Mentoring in New Jersey with the following specific agenda:
  - Generate a clear working definition of mentoring that defines the relationship between mentoring and retention of women in STEM fields in New Jersey. A statement of recruitment (awareness) should also be included.
  - Develop a fellowship program that would conduct the following research:
    - Cull best practices in mentoring directly applicable to the state of New Jersey. See for example:

    http://www.mentoring.org/find_resources/elements_of_effective_practice/

        - Create an inventory of current New Jersey mentoring programs in practice.
    - Based on the research generated by the research fellows, recommend to the Gender Parity Council implementation strategies for formal mentoring programs in New Jersey containing built-in outcomes assessment tools.

Impact of Workplace Climate: had 12 registrants and the moderators/discussants were Deb Paul, Gilda Paul, Sondra Sen. This group decided to focus on work-life balance aspects of workplace climate. They reviewed and discussed the policies vis a vis a Family Friendly Work Place of the 100 Best Managed Companies and came up with the following best practices encouraged by these companies. Discussion centered on the following topics:

- Telecommuting
- Compressed work week (flexible hours, summer hours)
- Job Sharing
- Creating formal woman's network programs
- Formalized mentoring programs for woman
    - mentors should be recognized, valued and rewarded (especially in academia)
- Day Care (back-up care, elder care)
- Formal leave policy for maternity, paternity and elder/family care

The primary workplace climate ***recommendations*:**

- Frame issues of work-life balance need to be as a business issue, not a gender issue.
- Show that policies are equally good for men and woman – as a work-life balance benefits all (Drago 2007).
    - It's good for the company; otherwise there are retention issues.
    - Employees are more productive if they are not stressed and sleep-deprived.
    - Fewer law suits based on discrimination (e.g., promotion opportunities)

Improving P-16 STEM Education: had 23 registrants and was moderated by Sandra Alberti, Bob Goodman, Evelyn Laffey, Ellen Mappen and Aleta You. This group focused on answering the following three questions:

- How do you engage students in STEM and where do you start? (See Tindall & Hamil 2004)
- How do you change stakeholders' attitudes (parents, teachers, administrators, guidance counselors) to encourage all students, including underrepresented populations, to study physics, calculus, computer science, and engineering?
- How do you introduce students to the variety of careers that are available that require the study of physics, calculus, computer science, and engineering?

Following a lively and far reaching discussion this group made several recommendations in two basic categories, recommendations to change the curricular and formal educational system, and to change the social or informal educational system. The most important was to reorder the curriculum so that students can build on prior knowledge of physics in chemistry and of physics and chemistry in biology.

The P-16 curricular and educational ***recommendations***:

- Reorder classes (Physics preceding Chemistry, which precedes Biology)
  - Modular Math- Algebra, Geometry, Trigonometry, Statistics/Calculus each year Algebra in Middle School
- Encourage critical thinking at early grades; reflect/apply time
- Practice inquiry-based science ("Do" real science)
- Recommend/require faculty to empower each child to explore roles as leaders/initiators of study/work in STEM classes.
- Require science and math for teachers and students in lower grades
- Training of Teachers:
  - Create a 5-Year Professional Masters degree with joint specialization in Education, Math, Science, etc. (see: http://sciencemasters.org/)
  - Create a specialization in urban education
  - Provide 5-year grants for students to major in education in exchange for teaching in urban districts

- Require that New Jersey Professional development hours be in the teacher's specialty (at least certain percentage %)
- Give Non-Specialists more STEM training:
  - Need some specialty development
  - Develop cross-curriculum "to-go" lessons

Social and counseling ***recommendations:***

- Start guidance earlier to talk to students/families about careers that require STEM classes.
- Focus professional development of guidance counselors more specifically on directing STEM course choice to align more specifically with achieving "personal best" of students
- Use popular culture items that the students have (love) to introduce science/math
- Publicize list of STEM classes needed for college admission and ultimate success early on in their high school careers (See 'role models' under 'resources' below)
- Expose students to careers through field trips, mentoring, internships.
- Create interest in STEM careers through "Bring a Scientist to School day", Career Days, Participation in Science Fairs, programs of non-traditional career resources, summer internships in science and engineering at high school level, Project SEED (American Chemical Society)
  - Recommendations for Parents:
    - Explore ways to convince parents to encourage their children in mathematics and science even though they may not have experienced success in their own education
    - Create an entertaining and participatory Family Science Night
    - Create a Homework Safety Net- parents receive "Inquiry Prompts" to assist without having to know the answer
    - Change attitudes through a Parent University and Parent Career Education

Using Multi-Media Marketing to promote STEM Careers had 10 registrants and was moderated by Terri Boyer, Dana Egrecsky, Dianne Mills McKay, and Ethne Swartz. Discussion focused on how to capitalize on the many resources available in multimedia formats, and to best draw youth to science and tech careers through their familiarity

with these venues. Participants were able to explore some examples of multi-media resources promoting careers, including the NJ Chamber of Commerce's "Learn. Do. Earn." campaign.

Multi-media ***recommendations***:

- Create recommendations for business and corporations that are planning and implementing marketing and recruiting campaigns based on best practices.
- Build off successful models—such as LearnDoEarn.org to focus on STEM careers
    - Form an ad-hoc subcommittee to work on this
- Link all websites, school cable channels, adaptable formats like video, audio, etc. and disseminate broadly to collaborative organizations (all science teacher professional organizations, state agencies, school sites, radio, etc.)
- Create Facebook Profiles—with stringent guides that personalize STEM careers (see http://sciencewomen.rutgers.edu/profiles/?q=browse&b=stories & resources below for some examples)
    - All content that has our endorsement must provide accurate and realistic information about education requirements and career paths.
- Connect media that focuses on seeing and hearing with *doing* something in the classroom, in your community, or at home.
- Partner with major media outlets to create the REAL "CSI", "Bones","Numb3rs", etc., capitalizing on their popularity to provide real career information.

Connecting Education and Careers had 42 registrants including moderators/ discussants: Mary Ellen Clark, Diane Donnelly, Erin Dwyer, Connie Ellis, Judith Formalarie, Forough Ghahramani, Robert Marracciono, Kathryn Uhrich, and Larry Winters.

This large group focused the discussion on the following questions:

- At what point should science and technology career education begin with students?
- What is the best strategy for encouraging females or underrepresented students to consider STEM careers?
- What are outreach programs that your organization participates in? Do you participate in college career fairs? Do you offer programs and internships to

college students, high school students, high school educators?

- What is the most important thing that the Council on Gender Parity in Labor and Education should recommend to the state of New Jersey with regards to this topic?

A summary of the discussion is below:

- There is a strong need for building and establishing networks between industry, academia, k-12 education, and government
- While it is important to develop programs to attract and retain students in STEM through PUSH mechanisms from middle school to High School, to community college, to college, through graduate school, it is as important for industry to develop the PULL for these students to want to go there from college.
- Technology literacy is important for more than just people working in STEM fields, everyone needs to be technology savvy to succeed
- It is very important for college students to receive industry experience external to his/her educational institution prior to graduation
  - Challenges include:
    - There is not always a formal mechanism for placing students in summer internships
    - It is difficult to find connections and opportunities
    - For graduate students, it is difficult for department to let go of a productive researcher for a period of time
- Media helps shape interest in certain fields (ex: Forensic Science)
- Challenges in linking k-12 education and industry
- It is difficult to design a good research project for a high school student – High school teachers need help.
- There is a legislative agenda to tap into for STEM
- A suggestion is to approach lobbying groups for organizations, foundations versus the corporation (ex: Bristol Meyers Squibb Foundation)
- It is important to allow students to experience science versus focusing on AP courses and exams
- Mentoring network of peers, faculty advisors, industry professionals is important in helping students build a strong sense of self

Linking Careers to Education ***recommendations***:

- Develop network of connections for students to industry, e.g. internships, residential programs, connections with startups for college students (graduates and undergraduates), link college programs to SBAs.
- Use the media and web to promote careers and influence students and their influencers
    - Provide information on the many levels and paths of career opportunities in a particular industry (for example, one does not have to be a PhD research scientist to work in the pharmaceutical industry)
    - Provide the relevance of education to specific careers
    - Promote the economic benefits of specific careers
        - E.g. Career Ladder, provide salary range for specific careers and career opportunities up the ladder
- Reach out to parents, this is strongly recommended.
    - Provide education and influence about significance of certain careers
- Develop courses that are career/industry focused

  Ex: Bio-Business course at Biotechnology High School in Monmouth County
- Develop and promote connections between local industry and K-12 educators
    - Provide a contact list at industry
    - Industry Mentors
        - Ex: Human Genome Project Mentors as provided by NCBI for all locations across the country; Industry professionals willing to speak at schools and universities
    - Industry Advisory Boards for Colleges
    - Local Industry Speakers Bureau
    - Industry Participants for Thesis committees
    - Provide Industry internships for teachers
- State of New Jersey should provide incentives for local industry to connect to schools and universities
- Promote stronger dialogue between corporations and academia about emerging trends and skill set requirements

Final Plenary

At the end of the afternoon session, all five break-out sessions presented their recommendations to the assembled company. Interestingly, all sessions but one formally recommended the need for mentorship or better support and recognition for mentors; the session on media promotion recognized the need for role models to showcase careers in STEM, a linked concept. Each of the groups mentioned that the formation a subcommittee, working group or task force assembled by experts might be the logical next step in making more concrete and detailed recommendations to the state of New Jersey for improvement of the status and participation of women in the New Jersey Science and Technology Workforce.

The New Jersey Council on Gender Parity in Labor and Education will share the recommendations made in these sessions with the New Jersey State Legislature, and with appropriate State Agencies. In addition, the Council plans to host a third summit on Friday, June 5, 2009 at the Conference Center at Mercer in West Windsor, to continue this important work.

Resources and References

Internet Resources by Topic

General Workforce Development and US Statistics

NSF 2000 Science & Engineering Indicators; Appendix Table 1-10
http://www.nsf.gov/statistics/seind00/access/c4/c4s6.htm

NSF higher Education indicators in STEM 2008
http://www.nsf.gov/statistics/seind08/c2/c2s4.htm

Thirty-Three Years of Women in S&E Faculty Positions
http://www.nsf.gov/statistics/infbrief/nsf08308/.

New Jersey

Summary of the 2007 Summit on Women in the NJ Science and Technology Workforce
http://www.cww.rutgers.edu/edu_career_dev.html).

Study of the workforce needs of New Jersey's pharmaceutical and medical technology industry, 2006-2007
http://www.heldrich.rutgers.edu/Research/ResearchDetail.aspx?id=968

Education

National Academy of Science Board on Science Education
http://www7.nationalacademies.org/bose/

Commission on Professionals in Science and Technology
http://sciencemasters.org/

Council of Graduate Schools. 2007. *Graduate Enrollment and Degrees 1996-2006*.
http://www.cgsnet.org/portals/0/pdf/R_ED2006.pdf.

Florida Association of Science Teachers, Best Practices for Science Education,
http://www.fastscience.org/documents/legislative/FAST_Best_Practices_for_Science_Education.pdf

Higher Education Research Institute
http://www.heri.ucla.edu/

National Center for Education Statistics
http://nces.ed.gov/

Mentoring

Rutgers Women's Mentoring program
(http://ruwings.rutgers.edu/)

Mentornet is an E-Mentoring Network for Diversity in Engineering and Science.
http://www.mentornet.net/

Mentor.org has many resources for establishing mentoring programs
http://www.mentoring.org/find_resources/elements_of_effective_practice/

Troops to Teachers, the mentor connection:
http://www.dantes.doded.mil/dantes_web/troopstoteachers/mentor/mentor.asp?state=NJ&name=NEW%20JERSEY&graphic=1

Annotated bibliography, this extensive and well annotated document contains a comprehensive selection of references for mentoring adults specifically in academia published before 2006.
www.advance.arizona.edu/MENTORING_ANNOTATED_BIBLIOGRAPHY.pdf

Miscellaneous

Dr. Bob Goodman, Presenter http://njmonthly.com/articles/towns_and_schools/a-new-twist-on-science-education.html

Dr. Ellen Spaldo, Presenter
http://inside.fdu.edu/prpt/spaldoedge.html

LearnDoEarn.org

L'Oreal Corporation Women in Science Fellowship and promotional program
http://www.loreal.com/_en/_ww/for-women-in-science.aspx

Role models and careers

Autobiographical stories/women in science at Rutgers.
http://sciencewomen.rutgers.edu/profiles/?q=browse&b=stories

Women in Science at the Chicago Field Museum
http://www.fieldmuseum.org/exhibits/exhibit_sites/wis/main_page.htm

Biographies of Distinguished women Past and Present in all fields
http://www.distinguishedwomen.com/subject/field.html

The women of NASA (National Air and Space Administration) women from Science administrators and astrophysicsts to shuttle flight support and technical writers are profiled: http://quest.nasa.gov/women/intro.html

Biographies of women in Mathematics
http://www.agnesscott.edu/lriddle/women/women.htm

Work-life balance

The Work-family newsgroup is moderated by Pennsylvania State Sociologist Bob Drago
http://lser.la.psu.edu/workfam/

Sloan Work and Family Research Network
http://wfnetwork.bc.edu/policy.php

When Work Works: a project on workplace effectiveness
http://familiesandwork.org/3w/about/project.html

Other Resources and Blogs

Gender in Science specialist Dr. Patricia Campbell-Kiebler's blog, which also has an excellent general resources page for women in Science: http://www.fairerscience.org

Dr. Suzanne E. Franks: http://scienceblogs.com/thusspakezuska/

Women-Related Web Sites in Science/Technology, Dr. Joan Korenman, one of the best general women in science resources on the web.
http://userpages.umbc.edu/~korenman/wmst/links_sci.html

Dr. Peggy Kolm :http://sciencewomen.blogspot.com/

Dr. Alice Pawley an Engineer, http://scienceblogs.com/sciencewoman/

Stories of and from women in science, engineering, technology and math:http://scientiae-carnival.blogspot.com/

Female science professor: http://science-professor.blogspot.com/

Useful academic references

Alper, J. 1993. The pipeline is leaking women all the way along. *Science* 260: 409-411.

Baker, D.R. and Scantlebury, K. (ed.) 1995. *Science "Coeducation": Viewpoints from Gender, Race and Ethnic Perspectives*. National Association of Research in Science Teaching, Columbus, Ohio.

Ceci, S. J, and Williams, W. M. (Eds.). 2007. Why aren't more women in science?: top researchers debate the evidence. American Psychological Association. Washington. D.C.

Committee on Women Faculty in the School of Science. 1999. A study on the status of women faculty in science at MIT. *The MIT Faculty Newsletter, Special Edition* (March) Volume XI, no. 4.

Council of Graduate Schools. 2007. *Graduate Enrollment and Degrees 1996-2006.* http://www.cgsnet.org/portals/0/pdf/R_ED2006.pdf.

Drago, R. 2007. *Striking a Balance: Work, Family, Life*. Dollars & Sense, Boston.

Dyer, C., Montelone, B. A. 2007. An Institutional Approach to Establishing Professional connections. Pp. 48-61. In: Stewart, A.J., Malley, J. E. and Lavaque-Manty, D. (*Eds.*). *Transforming Science and Engineering: Advancing Academic Women*. University of Michigan Press. Ann Arbor.

Etzkowitz, H., Kemelgor, C. and Uzzi, B. 2000. *Athena UnBound. The Advancement of Women in Science and Technology*. Cambridge Univ. Press. Cambridge.

Fox, M. F., Cotrella, C., McDowell, D. and Realff, M. L. 2007. Equity in Tenure and Promotion. Pp.170-186. In: Stewart, A.J., Malley, J. E. and Lavaque-Manty, D. (*Eds.*).

Transforming Science and Engineering: Advancing Academic Women. University of Michigan Press. Ann Arbor.

Goodman, R., Etkina, E., 2008. Squaring the Circle: A Mathematically Rigorous Physics First. The Physics Teacher, 46:(4)-222-227

Hall, L.E. 2007. *Who's Afraid of Marie Curie: The challenges facing women in Science and Technology*. Seal Press, Emeryville, CA.

Hawkesworth, Mary, Balliet, Barbara, Hetfield, Lisa, Morgan, Jennifer and Robbins, Lilian. 2005. Feminist Interventions: Creating New Institutional Spaces for Women at Rutgers University. Pp. 83-107. In: Hartman, Mary, Wall, Cheryl and Brown-Glaude, Winnifred, (*Eds.*). *Reaffirming Action: Designs for Diversity in Higher Education: Report to the Ford Foundation on Phase One*, June 2003-July 2005. Institute for Women's Leadership. New Brunswick.

Johnson, James P. 1982. Can computers close the educational equity gap? Civil Rights Quarterly Perspectives, 14(3), 20-25.

Kidd, J. M., Jackson, C. and Hirsh. W. 2003. The outcomes of effective career discussion at work. Journal of Vocational Behavior 63: 119-133.

Lederman, D. 2007. More doctors of philosophy (and science). Inside Higher Ed Nov. 21, 2007. /news/2007/11/21/phds. Washington, D.C.

Long, J. Scott, Ed. 2001. *From Scarcity to Visibility. Gender Differences in the Careers of Doctoral Scientists and Engineers*. National Academy Press. Washington, D. C.

Marasco, C. A. 2006. Women faculty gain little ground. Chemical & Engineering News 84: 58-59.

McKay, Patrick F., Avery, D. R., Tonidandel, S., Morris, M. A., Hernandez, M. and Hebl. H. R. 2007. Racial differences in employee retention: are diversity climate perceptions the key? Personnel Psychology 60: 35-62.

National Science Foundation (NSF). 2000. *Women and Minorities in Science and Engineering*. NSF 00-327. National Science Foundation. Washington, D. C. (See also NSF reports released in 1986, 1992, 1994, 1996, and 1999).

National Academy of Sciences. 2007. Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering. Committee on Maximizing the Potential of Women in Academic Science and Engineering, & Committee on Science, Engineering, and Public Policy. National Academies Press. Washington, D.C.

Nelson, D. J. and Rogers, D. C. 2005. *A National Analysis of Diversity in Science and Engineering Faculties at Research Universities*. http://cheminfo.chem.ou.edu/-djn/diversity/briefings/Diversity. Norman, Oklahoma

Rabinowitz, V.C. and Valian. V. 2007. Beyond Mentoring. Pp. 96-115. In: Stewart, A.J., Malley, J. E. and Lavaque-Manty, D. (*Eds*.). *Transforming Science and Engineering: Advancing Academic Women*. University of Michigan Press. Ann Arbor.

Ramos, I. and Benítez, S. 2007. Advancing Women Science Faculty in a small Hispanic Undergraduate Institution. Pp. 243-261. In: Stewart, A.J., Malley, J. E. and Lavaque-Manty, D. (*Eds.*). *Transforming Science and Engineering: Advancing Academic Women*. University of Michigan Press. Ann Arbor.

Relaff , M. L., Colatrella, C. and Fox, M. F. 2007. Interconnected Networks for Advancement in Science and Engineering. Pp.62- 78. In: Stewart, A.J., Malley, J. E. and Lavaque-Manty, D. (*Eds.*). *Transforming Science and Engineering: Advancing Academic Women*. University of Michigan Press. Ann Arbor.

Rosser, S. V. 2004. *The Science Glass Ceiling. Academic Women Scientists and the Struggle to Succeed*. Routledge. New York and London.

Sadker, M., D. Sadker, 1994. *Failing at Fairness: How America's schools cheat girls.* New York: Simon and Schuster.

Saunders, J. 2005. Gender and Technology in Education: A Research Review http://www.josanders.com/pdf/gendertech0705.pdf

Seibert, S. 1999. The effectiveness of facilitated mentoring: a longitudinal Quasi-Experiment. Journal of Vocational Behavior 54: 483-502.

Stewart, A.J., Lavaque-Manty, D. and Malley, J. E. 2004. Recruiting women faculty in science and engineering: Preliminary evaluation of one intervention model. Journal of Women and Minorities in Science and Engineering 10: 361-75.

Stewart, A.J., Malley, J. E, and Lavaque-Manty, D. 2007a. Faculty Recruitment: mobilizing Science and Engineering Faculty. Pp. 133-151. In: Stewart, A.J., Malley, J. E. and Lavaque-Manty, D. (*Eds.*). *Transforming Science and Engineering: Advancing Academic Women*. University of Michigan Press. Ann Arbor.

Stewart, A.J., Malley, J. E.,and Lavaque-Manty, D. (*Eds.*). 2007b. *Transforming Science and Engineering: Advancing Academic Women*. University of Michigan Press. Ann Arbor.

Strenta, C., Elliott, R., Matier, M., Scott, J., R. Adair. 1993. *Choosing and leaving science in highly selective institutions: General factors and questions of gender.* Report to the Alfred P. Sloan Foundation.

Tindall, T., and B. Hamil. 2004. Gender disparity in science education: the causes, consequences and solutions. *Education* 125(2):282-295.

Trix, F. and Psenka, C. 2003. Exploring the color of glass: letters of recommendation for female and male faculty. Discourse and Society 14: 191-220.

U.S. Department of Education, National Center for Education Statistics, 2005–06 Integrated Postsecondary Edu-cation Data System (IPEDS), Fall 2006.

Valian, V. 1998. *Why So Slow? The Advancement of Women*. The MIT Press. Cambridge, Mass.

Xie, Yu, and Shauman, K. A. 2003. *Women in Science. Career Processes and Outcomes*. Harvard University Press. Cambridge.