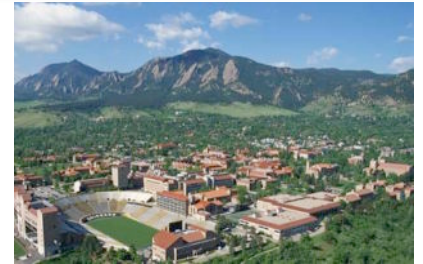
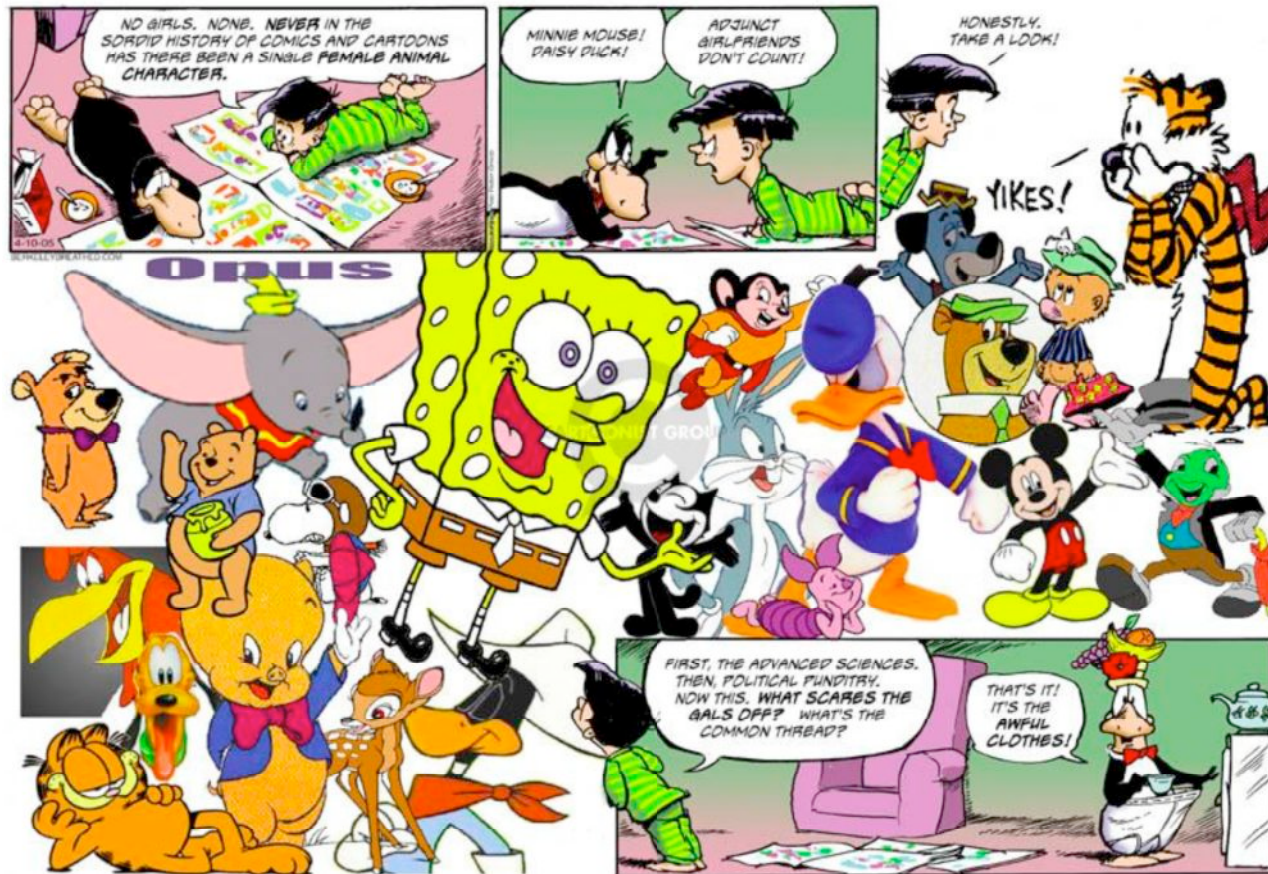


My Motivation for Interest in Graduate Curriculum and Climate for Women

- Earned undergraduate degree abroad
- Served on many CSWP Site Visits to Improve the Climate of Women in Physics
- Former Associate Chair for Graduate Studies at University of Colorado Boulder (3 years)
- Spent 4 years in an Electrical Engineering and Computer Science Department and survived!
- Member of NSF Physics Frontier Center and NSF Engineering Research Center
- Co-owner of small laser company with my husband
- Co-advise 16 graduate students with my husband (1/3 women)

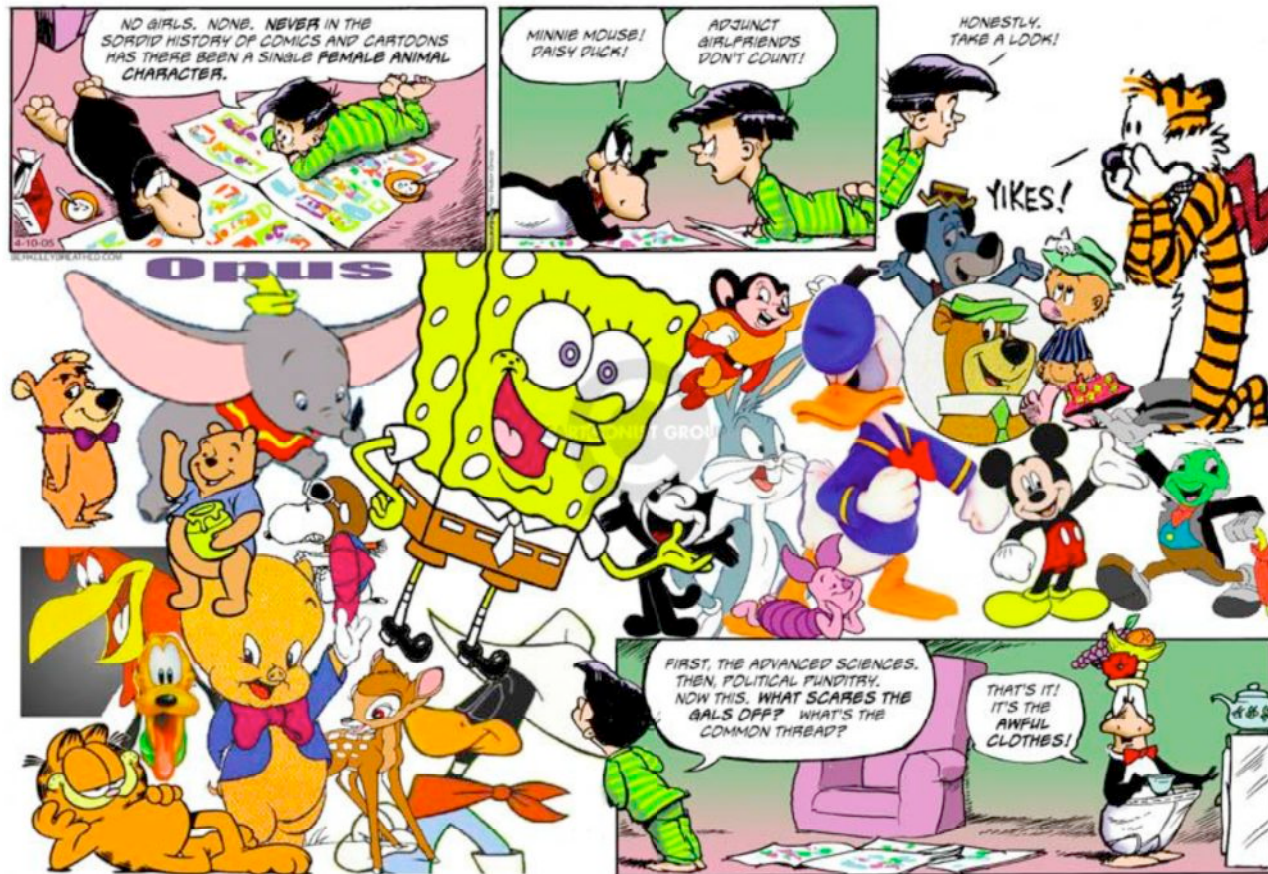


What Climate Problem?



What Climate Problem?

Issue 1 - Image, Culture, Lack of Info., Difficulty fitting in



Issue 2 - Misinformation among university and industrial players



Price Tag - \$50M to diversify Harvard faculty

OPINION

★ THE DENVER POST 7B



SUMMARY

5

TABLE S-1 Evidence Refuting Commonly Held Beliefs About Women in Science and Engineering

Belief	Evidence	Where Discussed
(1) Women are not as good in mathematics as men.	Female performance in high school mathematics now matches that of males.	Chapter 2
(2) The matter of “under-representation” on faculties is only a matter of time; it is a function of how many women are qualified to enter these positions.	Women’s representation decreases with each step up the tenure-track and academic leadership hierarchy, even in fields that have had a large proportion of women doctorates for 30 years.	Chapter 3
(3) Women are not as competitive as men. Women don’t want jobs in academe.	Similar proportions of men and women science and engineering doctorates plan to enter postdoctoral study or academic employment.	Chapter 3
(4) Behavioral research is qualitative; why pay attention to the data in this report?	The data are from multiple sources, were obtained using well-recognized techniques, and have been replicated in several settings.	Chapters 2-5
(5) Women and minorities are recipients of favoritism through affirmative-action programs.	Affirmative action is meant to broaden searches to include more women and minority-group members, but not to select candidates on the basis of race or sex, which is illegal.	Chapter 4
(6) Academe is a meritocracy.	Although scientists like to believe that they “choose the best” based on objective criteria, decisions are influenced by factors—including biases about race, sex, geographic location of a university, and age—that have nothing to do with the quality of the person or work being evaluated.	Chapter 4
(7) Changing the rules means that standards of excellence will be deleteriously affected.	Throughout a scientific career, advancement depends upon judgments of one’s performance by more senior scientists and engineers. This process does not optimally select and advance the best scientists and engineers, because of implicit bias and disproportionate weighting of qualities that are stereotypically male. Reducing these sources of bias will foster excellence in science and engineering fields.	Chapter 4

continued

Not just Larry - Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering



ISBN: 0-309-65454-8, 346 pages, 6 x 9, (2006) Committee on Maximizing the Potential of Women in Academic Science and Engineering, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine

TABLE S-1 Continued

Belief	Evidence	Where Discussed
(8) Women faculty are less productive than men.	The publication productivity of women science and engineering faculty has increased over the last 30 years and is now comparable to men's. The critical factor affecting publication productivity is access to institutional resources; marriage, children, and elder care responsibilities have minimal effects.	Chapter 4
(9) Women are more interested in family than in careers.	Many women scientists and engineers persist in their pursuit of academic careers despite severe conflicts between their roles as parents and as scientists and engineers. These efforts, however, are often not recognized as representing the high level of dedication to their careers they represent.	Chapter 5
(10) Women take more time off due to childbearing, so they are a bad investment.	On the average, women take more time off during their early careers to meet their caregiving responsibilities, which fall disproportionately to women. But, by middle age, a man is likely to take more sick leave than a woman.	Chapter 5
(11) The system as currently configured has worked well in producing great science; why change it?	The global competitive balance has changed in ways that undermine America's traditional science and engineering advantages. Career impediments based on gender or racial or ethnic bias deprive the nation of talented and accomplished researchers.	Chapter 6

the traditional model to an inclusive model with provisions for equitable and unbiased evaluation of accomplishment, equitable allocations of support and resources, pay equity, and gender-equal family leave policies. Otherwise, a large number of the people trained in and capable of doing the very best science and engineering will not participate as they should in scientific and engineering professions.

Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering



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Issue 3 - Tradition and Culture in US

Table 11. Percent of physics bachelor's degrees awarded to women in selected countries: 2-year averages.

	% Bachelor's to women	Avg # of Bachelor's per year, both sexes
Turkey	39	2,219
Greece	34	588
France	33	3,256
South Korea	30	2,189
Sweden	29	55
Latvia	26	12
Australia	21	182
United Kingdom	21	1,755
Norway	21	72
USA	21	3,770
Taiwan	20	825
Slovenia	19	26
Estonia	18	20
Mexico	18	162
Denmark	17	95
Japan	13	3,314
The Netherlands	12	206
Germany	9	2,173
Switzerland	9	206
19 Countries	24	21,125

1998-99 data are presented for countries in blue. For all other countries, 1999-2000 data represented. To be included, countries had to provide appropriate data from reliable statistical agencies.

Compiled by AIP Statistical Research Center.

Issue 4 - Lack of role models

Table 6. Percent of faculty positions in physics held by women, 1994, 1998 and 2002.

	1994 %	1998 %	2002 %
Academic Rank			
Full professor	3	3	5
Associate professor	8	10	11
Assistant professor	12	17	16
Instructor / Adjunct	N/A	N/A	16
Other ranks	8	13	15
Type of Department			
PhD	5	6	7
Master's	7	9	13
Bachelor's	7	11	14
Overall	6	8	10

AIP Statistical Research Center: 2002 Academic Workforce Survey.



Faculty Diversity

Too little for too long

by CATHY A. TROWER and RICHARD P. CHAIT

<http://www.harvard-magazine.com/on-line/030218.html>

Role Models!

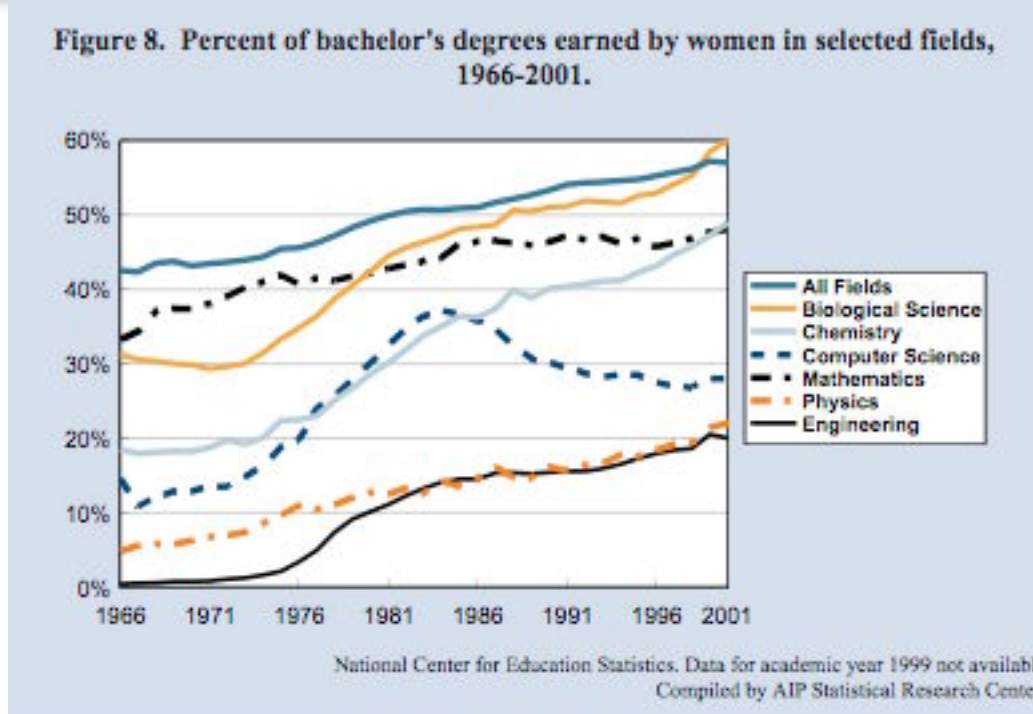
THE GOLDEN RULES: Best Practices for Recruiting and Retaining Women in Physics
(<http://www.aps.org/programs/women/reports/bestpractices/index.cfm>)

“The mark of a successful departmental climate for women is one in which the enthusiasm and ambition of the women undergraduates is transformed smoothly into successful and ambitious women graduate students, with dynamic, forging-ahead female postdocs, energetic junior women faculty, and productive, happy, senior women faculty who all serve as positive role models.”

Graduate School can be a tough learning environment for women!

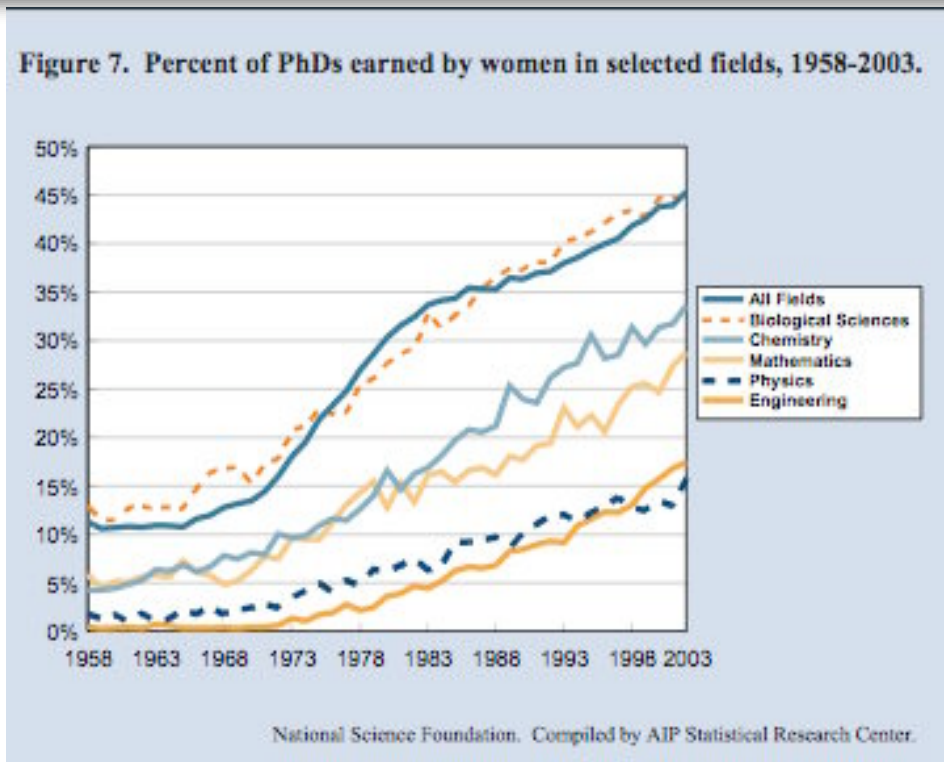


Why should we care about Climate?



- Most undergraduate degrees being earned by women!
- Physics and engineering data comparable (comparably low, math better)
- Increasing technical workforce of US must involve attracting more women to STEM
- Need women to be empowered and well educated to fully achieve their dreams

Why should we care about Climate?



- Many graduate degrees being earned by women!
- Physics and engineering data comparable (comparably low, math better)
- Increasing technical workforce of US must involve attracting more women to STEM
- Need women to be empowered and well educated to fully achieve their dreams

Why should we care about Climate?

- Students expect good climate
- Best students will be selective - so schools have to respond to stay competitive in academic marketplace
- Better climate in physics departments will maintain excellence in physics and international competitiveness



American Physical Society Sites: [APS](#) [Journals](#) [PhysicsCentral](#) [Physical Review Focus](#)

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Programs

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Education
International Affairs
Physics for All
Women in Physics
Workshops & Meetings
Scholarships & Internships
Publications & Reports
Speakers Program
Site Visits
Female Friendly Physics Graduate Programs
Resources
Minorities in Physics
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Female Friendly Physics Graduate Programs

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Survey by the Committee on the Status of Women in Physics

The APS [Committee on the Status of Women in Physics \(CSWP\)](#) has compiled a survey of graduate programs in physics that should be helpful to those interested in assessing the climate for women at various graduate schools. Department chairs (or their assignees) were asked the five questions below. The responses, for each institution, can be obtained by clicking on the name below. Note that the responses are written by department chairs (or their assignees), so the APS and CSWP assume no responsibility for the accuracy of the information submitted.

The questions are:

1. How many tenure-track or tenured faculty -- male/female?
2. How many graduate students? -- male/female?
3. Is there a family leave policy for graduate students? If so, describe.
4. Is there family health insurance available for graduate students? Is it included in the stipend?
5. In a paragraph, please describe why someone applying to graduate school who is interested in a female-friendly department should choose your institution.

The institutions listed are below. If you are a department chair, and would like to add (or change) your institution's contribution, please e-mail Sue Oswell (women@aps.org) for the website address where data can be entered.

151 total surveys as of today

[Arizona State University \(Physics and Astronomy\)](#)
[Auburn University](#)
[Baylor University](#)
[Boston University](#)
[Brandeis University](#)
[Brigham Young University \(Physics & Astronomy\)](#)
[Brown University](#)
[Caltech](#)

Pages For:

CSWP Site Visits to Improve the Climate of Women in Physics

Indiana University	2007	UC San Diego	1998
JILA/Boulder *	2006	Princeton University	1998
Univ of Michigan	2005	Columbia University	1997
NIST/Gaithersburg *	2005	CU Boulder	1997
NIST/Boulder *	2005	Caltech	1996
Iowa State University	2005	SUNY at Stony Brook	1994
Univ of Washington	2004	Univ of Texas/Austin	1994
Colo. School of Mines	2004	Stanford University	1994
Univ of Arizona	2004	Harvard University	1994
Purdue University	2003	Univ of Rochester	1994
Univ of Minnesota	2003	North Carolina State	1994
Durke University	2003	Michigan State `	1993
Ohio State University	2003	Univ of New Mexico	1993
Argonne National Lab	2002	Kansas State	1993
Univ of Wisconsin	2002	RPI	1992
Univ of Iowa	2002	Williams College	1992
NASA/Goddard	2002	U. Illinois at Urbana	1992
Univ of Maryland	2001	U. Pennsylvania	1991
William & Mary	2000	Bryn Mawr College	1991
UCAR/NCAR *	2000	Unviersity of Virginia	1991
Penn State Unviersity	2000	University of Maryland	1990

Climate for Women in Physics tended to be worse in departments where no curriculum reform had occurred in decades

Issue 5 - Some departments do not see connection between climate and effectiveness in educating

- **Senior female faculty are marginalized, paid less, have less space, and sometimes discriminated against and therefore are not in a position to serve as good role models or promote change in department**
- **Students/female faculty have no recourse when faculty misbehave since there is poor accountability**
- **Male faculty are passive - benefit from existing system**
- **Sometimes senior university administration are passive, unable or unwilling to help or intervene**
- **Students and junior male faculty learn to accept flawed system**
- **Lack of ethics, fairness, respect, accountability to society**
- **Denial of all of the above**
- **No pressure to change**

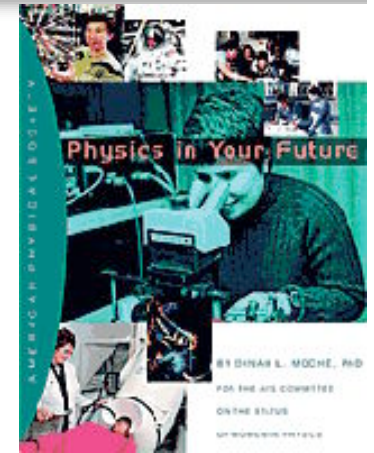
Laudable Strengths - Dream Dept.!

- **Senior and junior female faculty are present and leading aggressive research groups**
- **Critical mass of female postdocs and students also present**
- **Female postdocs and students have high career aspirations**
- **Talented department chair builds trust and broad, open, hiring plan within the department**
- **Male faculty accept, support and mentor female students/faculty**
- **Senior university administration willing to fund targeted diversity hires**
- **Attention to ethics, respect, fairness, accountability to society**
- **Female faculty paid equitably, with access to same space, resources and promotion as their peer male faculty**

CSWP Site Visits - What Matters for a Good Climate

- Critical mass of students, postdocs and faculty
- Supported and positive female faculty and female postdoc role models
- High expectations for all students, good mentoring
- Family leave, childcare on campus for faculty, postdocs, students
- Cultivate a sense of community
 - Friendly informed faculty
 - Student lounge
 - Student organization with elected representatives involved in department affairs e.g. student reps on committees, attending faculty meetings
 - Picnics, pizza, holiday party where everyone attends
 - Positive image on web page
- Respect and attention to ethics for everyone
- Charismatic and positive department chair
- Willingness to change and experiment e.g. **Modern and Flexible Curriculum**

Good Management!



Modern, flexible curriculum!

CSWP Site Visits - Best Practices

<http://www.aps.org/programs/women/reports/bestpractices>

1. Develop a modern, updated, graduate curriculum and exam sequence that prepares students for the 21st century. This might include flexibility to pursue research in applied areas or interdisciplinary areas of physics such as optics or biophysics, or to take courses that will be of use to them for careers in industry (e.g. business, computing). Departments should compare their examination schedule and core course offering with their peer institutions, to make sure that they are providing a choice in graduate education appropriate for the 21st century. A large number of required core courses may need to be evaluated, as well as a large number of preliminary examinations. The presence of either of these in the curriculum tend to delay the best students from participating in research, extending the time to the Ph.D. degree, and demoralizing students needlessly.
3. Look for ways to provide mentoring and career advice for graduate students who want to pursue career paths other than teaching and research. Possible venues might include bringing alumni back to campus for talks and meetings, holding annual career days, and/or arranging mentoring sessions with visiting seminar or colloquium speakers. Careers in industry/national labs/other should not be viewed as second rate.

CSWP Site Visits - Best Practices

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2. Provide opportunities for informal student-faculty interaction e.g. coffee-hour, annual picnic, holiday party etc.
3. Look for ways to provide mentoring and career advice for graduate students who want to pursue career paths other than teaching and research. Possible venues might include bringing alumni back to campus for talks and meetings, holding annual career days, and/or arranging mentoring sessions with visiting seminar or colloquium speakers. Careers in industry/national labs/other should not be viewed as second rate.
4. Expect the same high achievement level from female and male students. Female students should also have high aspirations for themselves. To increase the aspiration level of the female graduate students if needed, every effort should be made to provide role models and encouragement to these students. While hiring more women faculty and postdocs is the best solution, bringing in female alumni and speakers from other institutions is also helpful.
5. Target recruitment of women graduate students in order to increase the applicant pool of female candidates. It is likely that the currently enrolled students can help with recruiting efforts.

CSWP Site Visits - Best Practices

<http://www.aps.org/programs/women/reports/bestpractices>

6. Provide structured opportunities for students to socialize in various groups. While this is beneficial for all students, it is particularly good for women graduate students who, because of their small numbers, sometimes have trouble finding each other.
7. We recommend an annual meeting or informal lunch between the Department Chair or Assoc. Chair and the graduate students to provide an opportunity to discuss issues of concern, should they arise.
8. We recommend a suggestion box for student to provide anonymous feedback.
9. Provide an area for graduate students to meet.
10. An accessible ombudsperson should be available for graduate students.
11. Training for teaching assistants that covers sexual harassment and the importance of treating all students with respect should be available. A short seminar for faculty on these topics would be beneficial and is sometimes needed.
12. Leadership and training opportunities can be provided by allowing graduate students to serve on appropriate committees such as the graduate admissions committee etc.
13. Other leadership opportunities could be made available by supporting a physics graduate student association and developing roles for this body.
14. Communicate to everyone in the department why climate issues are important and how a welcoming and mutually supportive environment will help the department recruit and support the best students and faculty.

Maternity leave for graduate students



News, Views and Careers for All of Higher Education

Jan. 30

Making Room for Baby

By Lisa M. Krieger Mercury News

Stanford University on Thursday promised its women graduate students 12 weeks of paid maternity leave, a bold step aimed at attracting and retaining female intellectual talent. The policy -- believed to be the second of its kind among major U.S. universities -- also guarantees that new mothers can maintain full-time student status and eases their return to classwork, research, and teaching.

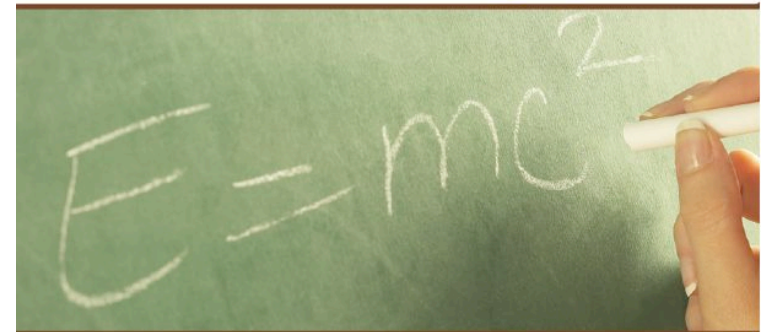
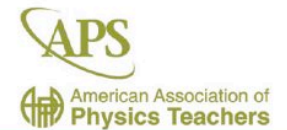
“It is vital to the nation that we retain those women who seek graduate degrees,” said Arthur Bienenstock, Stanford's vice provost and dean of research and graduate policy, who announced the policy at a meeting of the Faculty Senate, the university's legislative body. “Otherwise, we will lose our lead in innovation and ultimately our standard of living, as well as national security,” he said.

- MIT
- Stanford
- Colorado
- ??????

Task Force Report on Graduate Education in Physics

- ✓ Skills for Ph.D. students to know -
 - Technical expertise
 - Project planning
 - Communication
 - Public speaking
 - Writing
 - Teaching
 - Teamwork
 - Leadership
- ✓ Flexibility may be an increasingly important characteristic of physics Ph.D. programs.
- ✓ Keep time to Ph.D. within limits - especially important for women

Report of the
Joint APS-AAPT
Task Force



**GRADUATE
EDUCATION
IN PHYSICS**

October 5, 2005

Committee Membership

David Campbell, Chair
(Boston University)

Tom Appeltquist (Yale)

Renee Diehl (Penn State)

Joel Fajans (Berkeley)

J. D. Garcia (University of Arizona)

Jim Gates (University of Maryland)

Allen Goldman
(University of Minnesota)

Peter Jung (University of Ohio)

Michael Paesler
(North Carolina State)

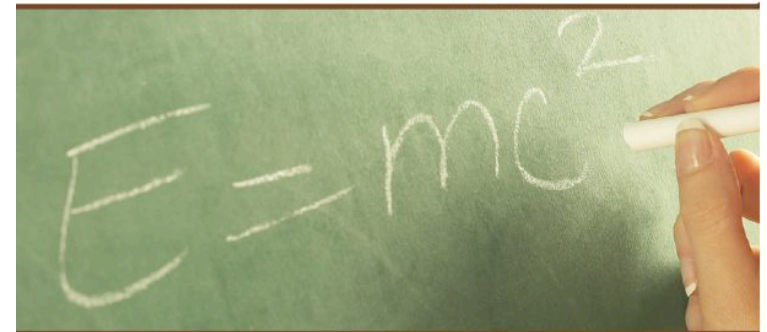
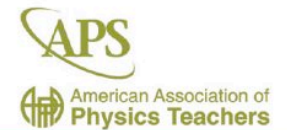
Task Force Report on Graduate Education in Physics

The TFGGE recommends that the Ph.D. physics core curriculum should consist of the material generally covered in a

- one-year course in E & M
- one-year course in quantum
- one-semester course in mechanics
- one semester course in statistical mechanics and thermodynamics.

Is a core of six courses sufficiently flexible for new areas that attract many women, such as biophysics?

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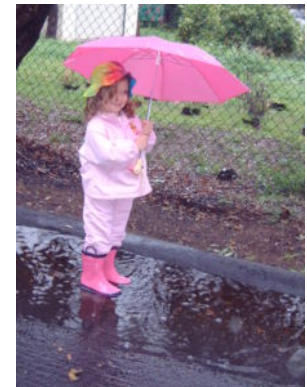
Michael Paesler
(North Carolina State)

Approaches for Interdisciplinary Degrees

Timely degree completion

- At CU, exploring a comprehensive program for very rapid transition to Ph.D. research, designed for completion in 5-6 years (most undergrads have REU experience)
- Three-part Comprehensive Exam that rapidly accelerates graduate students to Ph.D.
 - Comps I (5 core courses - NO comprehensive written exams)
 - Comps II (paper + presentation + questions on any topic)
 - Comps III (thesis proposal)

Year 1	Year 2	Year 3	Year 4	Year 5
Quantum Theory PHYS 5250-5260	Selected advanced courses (total of 5 additional courses beyond core)	Part III of Comprehensive Examination	→	Thesis defense
Electromag. Theory PHYS 7310-7320				
Statistical Physics PHYS 7230 or Mechanics PHYS 5210	Part II of Comprehensive Examination			
Teaching or Ph.D. Research	Teaching or Ph.D. Research	Amazing Ph.D. Research	Amazing Ph.D. Research	Amazing Ph.D. Research



Choice in Ph.D. Curriculum

Recognizing Interdisciplinary Curriculum Needs

Regular Physics Ph.D. Degree

Choose 5 of current 6 core courses for Comps 1

Classical Mechanics

Quantum Mechanics I & II

Statistical Mechanics

Electricity and Magnetism I & II

NOTE: Need additional 5 courses to complete Ph.D. degree



*Tom Perkins
biophysics
group at JILA*

Applied Physics Certificate Ph.D. Degree

5 courses specific to research area with Quantum, E&M common (1 semester)

Nano and Materials Science

Biophysics

Optics

Geophysics

Physics Education Research

Industry internships available in Optical Science and Engineering Program

NOTE: Need additional 5 courses to complete Ph.D. degree

Next Step - include exposure to entrepreneurship

Optical Science and Engineering NSF IGERT Program NSF Engineering Research Center in EUV Science and Technology

Industry Internship

Seminars from physicists in industry

Opportunities for leadership in student-run activities

More focus on skills set

Broader interdisciplinary curriculum and research

Can/should we broaden these ideas for regular program?

Perhaps added value for women? (e.g. KMLabs)

