

# **Creating change: an open-dialogue about educational and institutional barriers in STEM education?**

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# What are characteristics of change?

- **Takes time**
- **Different levels (individual, group, institutional)**
- **Involves risk taking**
- **Resistance because of the unknown**
- **External vs. internal forces**
- **Temporarily vs. long-lasting/transformational**

# One model of change

## adopted from smoking cessation in medicine

<b>Stages of change</b>	<b>Description</b>
<b>Stage 1: Precontemplation</b>	<b>Unaware that a problem exists</b>
<b>Stage 2: Contemplation</b>	<b>Aware that a problem exists and thinking about making a behavioral change in the future</b>
<b>Stage 3: Preparation</b>	<b>Feeling confident that making a change is possible and planning to make a change in the immediate future</b>
<b>Stage 4: Action</b>	<b>Making a change</b>
<b>Stage 5: Maintenance</b>	<b>Continuing to engage in the new, desirable behavior and avoiding relapse</b>

Source: Modified from Carnes et al. (2005)

# **Situation in the STEM fields**

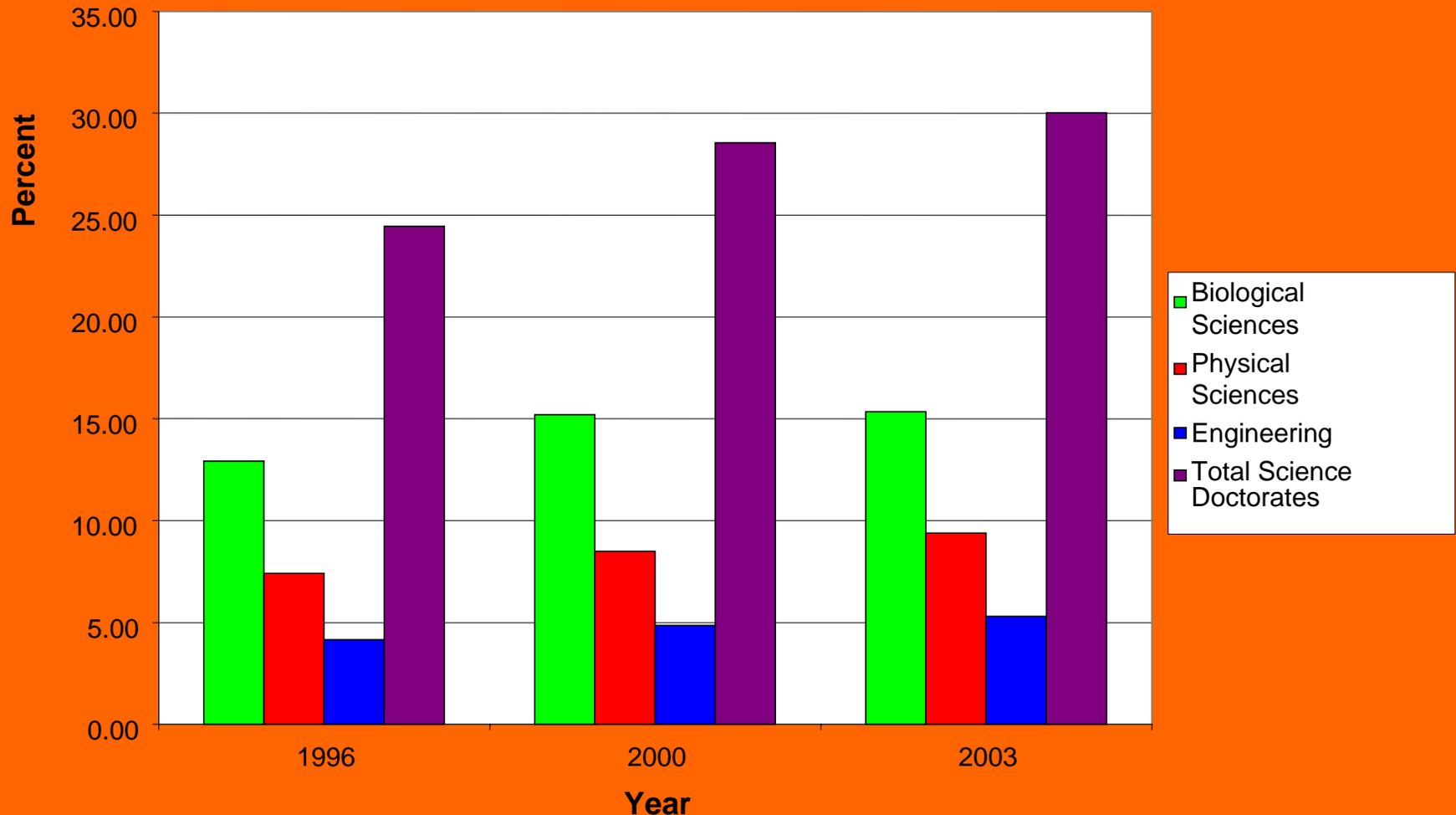
- **Multi-faceted, multi-leveled and must be addressed on different levels**
- **Focus for today on institutional level**
- **Need to move away from interpreting the women as the problem (deficiency model, “pipeline” theory) towards institutional change and disciplinary cultural changes**
- **One evidence for this shift is that in 2001 NSF initiated ADVANCE, a program for transformational change on the institutional level**

# **Identified barriers on the institutional level**

- **Lack of role models/encouragement**
- **“chilly” climate in departments and at institutional level**
- **Unconscious bias and stereotyping**
- **Work/family issues**
- **Unsuccessful Recruitment and advancement strategies**

# Results from case study at UW-Madison

- Underrepresentation of women in the STEM fields exist nationally as well as at UW-Madison



## **Results cont.**

- **Upward trend of female faculty hiring at UW-Madison over the last decade in the sciences**
- **In biological and physical sciences and engineering, women in 2000 earned less than men. In 2003 and 2005 the picture holds still true, despite a few exceptions in physics, math, astronomy, chemical and electrical engineering**
- **Only few women are in leadership positions, sometimes department chairs but hardly any other administrative positions**

# Results cont.

- Number of female faculty members decreases the higher the career level in academia, first rank at UW-Madison is an exception

Discipline	Career Level (women in %) (FY2002)									
	Ph.D.		Asst. Prof.		Assoc. Prof.		Full Prof.		All ranks	
	National	UW-M	Top 50	UW-M	Top 50	UW-M	Top 50	UW-M	Top 50	UW-M
<b>Biological Sciences</b>	45.63	11.59	30.20	52.17	24.90	23.53	14.80	9.86	20.20	20.72
<b>Physical Sciences</b>	26.65	2.59	17.02	20.36	14.88	19.52	6.92	8.47	10.04	11.03
<b>Astronomy (FY2004)</b>	22.88		22.00	50.00	16.50	0.00	9.50	16.67	12.60	18.75
<b>Chemistry (FY2003)</b>	33.42		21.50	25.00	20.50	0.00	7.60	5.56	12.10	9.09
<b>Computer Science</b>	15.27		10.80	12.50	14.40	50.00	8.30	7.41	10.60	11.43
<b>Math</b>	26.90		19.60	14.29	13.20	14.29	4.60	2.44	8.30	5.45
<b>Physics</b>	14.78		11.20	0.00	9.80	33.33	4.60	10.26	6.60	10.42
<b>Engineering</b>	17.02	3.60	17.58		12.35		3.73		8.38	
<b>Chemical</b>	24.98		21.40	0.00	19.20	14.29	4.40	0.00	10.50	5.88
<b>Civil</b>	17.90		22.30	no data	11.50	no data	3.50	no data	9.80	no data
<b>Electrical</b>	12.13		10.90	14.29	9.80	0.00	3.80	4.55	6.50	5.13
<b>Mechanical</b>	10.93		15.70	no data	8.90	no data	3.20	no data	6.70	no data

Source: Nelson (2005)

<b>WISELI Program</b>	<b>Goal</b>	<b>Description</b>	<b>Outcome</b>
<b>Workshop for Search Committee Chairs</b>	More equity in hiring process -> creating a diverse pool of applicants	Training for running effective and efficient faculty by using the discovery approach	Piloted by NSF fund and now offered through the Office of the Provost across campus
<b>Climate Workshop for Department chairs</b>	Understand climate in department, develop strategies to address climate issues, and implement strategies for climate change	3-part workshop based on concepts of active learning with small groups, learning from each other, conducting a small survey in own department	Valuable for participants, implement changes and met their goals. Facilitator becomes involved in problems -> emotionally draining/time
<b>Life Cycle Research Grants</b>	Help faculty and academic staff with permanent PI status at critical junctures in their research career	Provide funds for faculty and academic staff with major life crisis (e.g. major health issues)	Pilot by NSF fund -> now institutionalized as Vilas Life Cycle Professorships Program
<b>Celebrating Women in Science &amp; Engineering Grants Program</b>	Promote participation and advancement of women in science and engineering	Provides funds to enhance seminar schedules or create new workshops, symposia, lecture series, max. award is \$3000	Awarded 57 women speakers since 2002, seems to be successful but how do you measure visibility?
<b>Work satisfaction Survey</b>	To gain a better understanding of issues related to quality of work life for faculty	Has different sections, Questions are not overtly about gender	Baseline “climate survey” in 2003 to build ground for much evaluation; 60.2% return rate; follow up survey in 2006 with 56% return rate
<b>Documentary Videos</b>	Creating a documentary video to disseminate in a more public way the transformation of the UW-Madison campus	1. video: History and Beginnings of WISELI (Year one), 2. video: Highlighted WISELI Programs, 3. video: UW-Madison	Increased visibility on campus, first video won two bronze “Telly Awards” in 2004, available on Research Channel, last video expected in early 2007

# Conclusion

- **Underrepresentation of women in the STEM field is a reality despite slight improvements**
- **Women are not in positions to make decisions to shape directions and initiate change in the institutional culture**
- **This case study shows disparities in ranks, salaries and numbers of women in leadership positions in the STEM fields, which might be possible institutional barriers for women**
- **WISELI might be a agent for change, time will tell, but creates atmosphere to talk about problem as a prerequisite for change**

# **Recommendation for institutional changes**

- **Long-term commitment of university leaders and administration**
- **Modification in recruitment and advancement initiatives for women faculty**
- **Improvements of institutional policies and practices, e.g. tenure process, child care, partner hiring, health care, mentorship program, education of faculty on stereotyping and unconscious bias**
- **Exploration of the theoretical framework of institutional changes to gain a better understanding how improvements at the institutional level could happen more rapidly**

**Dialogue - maybe during  
dinner?**

**Now it is time for Carmen  
Faymonville with her  
2007 Engineering Education  
Task Force Report**