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# Defining and Measuring Successful Career Outcomes



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**University of Chicago, April 6, 2006**

**Biological and Physical Science Divisions**

# Overview



- 1. Common assumptions have shaped our approach to thinking about career outcomes and to defining career success.**
- 2. Are “deviant” PhD careers unsuccessful careers?**
- 3. Are PhDs working in areas outside of their doctoral education unsuccessful and dissatisfied with their employment? Are they using their scholarly skills?**

# The context: CIRGE research



1. Research on quality outcome measures for PhD programs: **national career path analyses of PhDs** – *not (yet?) Education Doctorate*
2. Action/evaluation research of **innovative and international doctoral programs** – **IGERT at UW**
3. Research/monitor **international trends in doctoral education** – **biannual conference, development of pilot programs on “international” leadership workshops for UW doctoral students**

# Common (*incorrect*) US Assumptions about US PhDs



- 1. All PhD students want to become academics.**
- 2. The “best” PhD students do become academics.**
- 3. Science PhDs who pursue an academic career path reach this career goal at a relatively young age**

# Common (*incorrect*) Assumptions about US PhDs



- 4. PhD recipients' career paths are linear and smooth.**
- 5. Everybody can take the best job offered.**
- 6. Children detract women from the pursuit of an academic career.**
- 7. Academics enjoy the highest job satisfaction.**

# Empirical Findings from Three US *PhDs –10+ and 5 Years Later Studies*



## 1. **PhDs—Ten Years Later** (*surveyed 1997*) MELLON FOUNDATION AND NSF FUNDED

61 US universities, 6 disciplines

Survey population: 5,864      response rate: **66%**

- Biochemistry
- Computer Science
- Electrical Engin.
- English
- Mathematics
- Political Science

## 2. **PhDs in Art History – Over a Decade Later** (*surveyed in 2002*) GETTY GRANT FOUNDATION FUNDED

54 US universities, all art history PhD programs

survey population: 725      response rate: **70%**

# 3. Social Science PhDs – 5+ Years Out 2005 FORD FOUNDATION FUNDED



**64 universities, 6 disciplines, 50% response rate**

**Anthropology, Communications, Geography**

**History, Political Sciences, Sociology**

- **Career goals at start and end of PhD education**
- **Career paths and salary**
- **Job search and job satisfaction**
- **Evaluation of doctoral education**
- **Usefulness of doctoral education**
- **Family and Career**

**Graduate Deans will receive their institutional data in  
the April 2006**

# Common Assumption 1



**All students who you pursue a PhD  
want to become professors.**

# Career Goal at PhD Completion and Tenured 10-14 Years Later

	(1)		(2)		(3)	
	% Wanted to Be Professor		% Tenured of (1)		% Tenured of All PhDs	
<b>Bio-Chemistry</b>						
<b>Computer Sc.</b>						
<b>Electrical Engin.</b>						
<b>English</b>						
<b>Mathematics</b>						
<b>Political Sc.</b>						

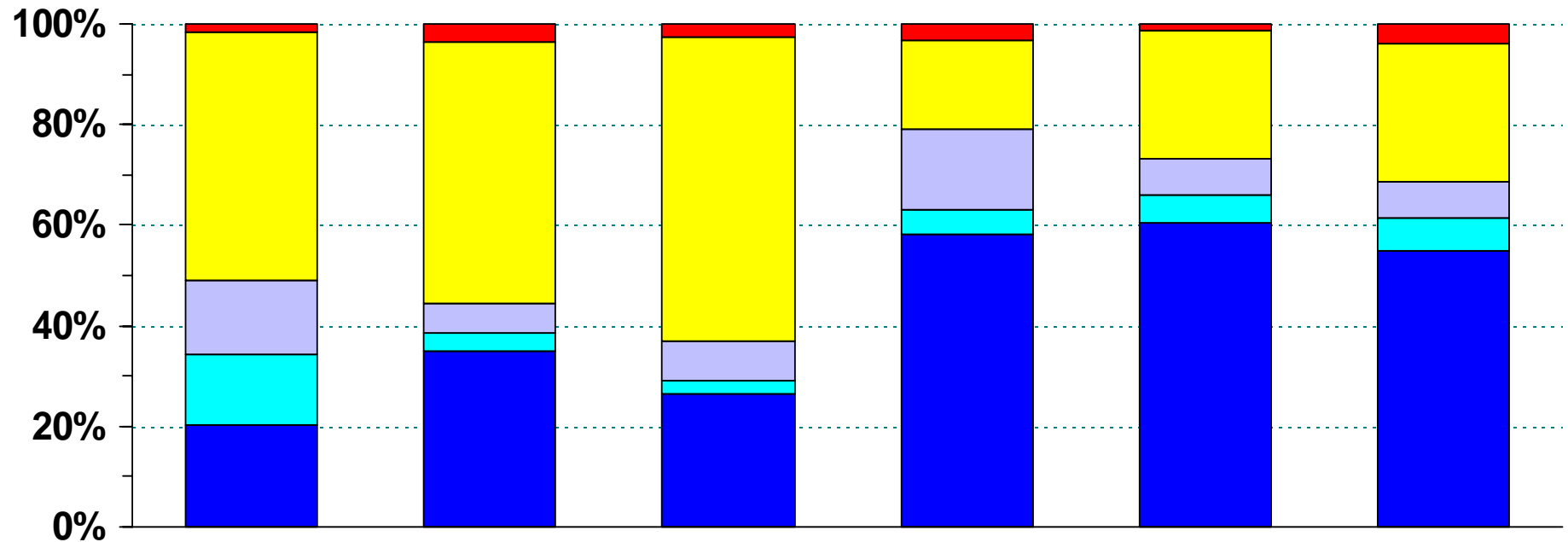
# Career Goal at PhD Completion and Tenured 10-14 Years Later

	(1) % Wanted to Be Professor		(2) % Tenured of (1)		(3) % Tenured of All PhDs	
Bio-Chemistry	<b>32</b>		<b>34</b>		<b>19</b>	(605)
Computer Sc.	<b>46</b>		<b>61</b>		<b>34</b>	(282)
Electrical Engin.	<b>19</b>		<b>67</b>		<b>22</b>	(328)
English	<b>81</b>		<b>64</b>		<b>55</b>	(767)
Mathematics	<b>54</b>		<b>73</b>		<b>54</b>	(522)
Political Sc.	<b>72</b>		<b>66</b>		<b>53</b>	(455)

# Employment at Survey, 1996/97 10+ Years after PhD



■ Tenured   
 ■ Tenure Track   
 ■ NTT/Acad.Other   
 ■ BGN \*   
 ■ Both Sectors



Biochem.

Comp.  
Sci.

Elec.  
Eng.

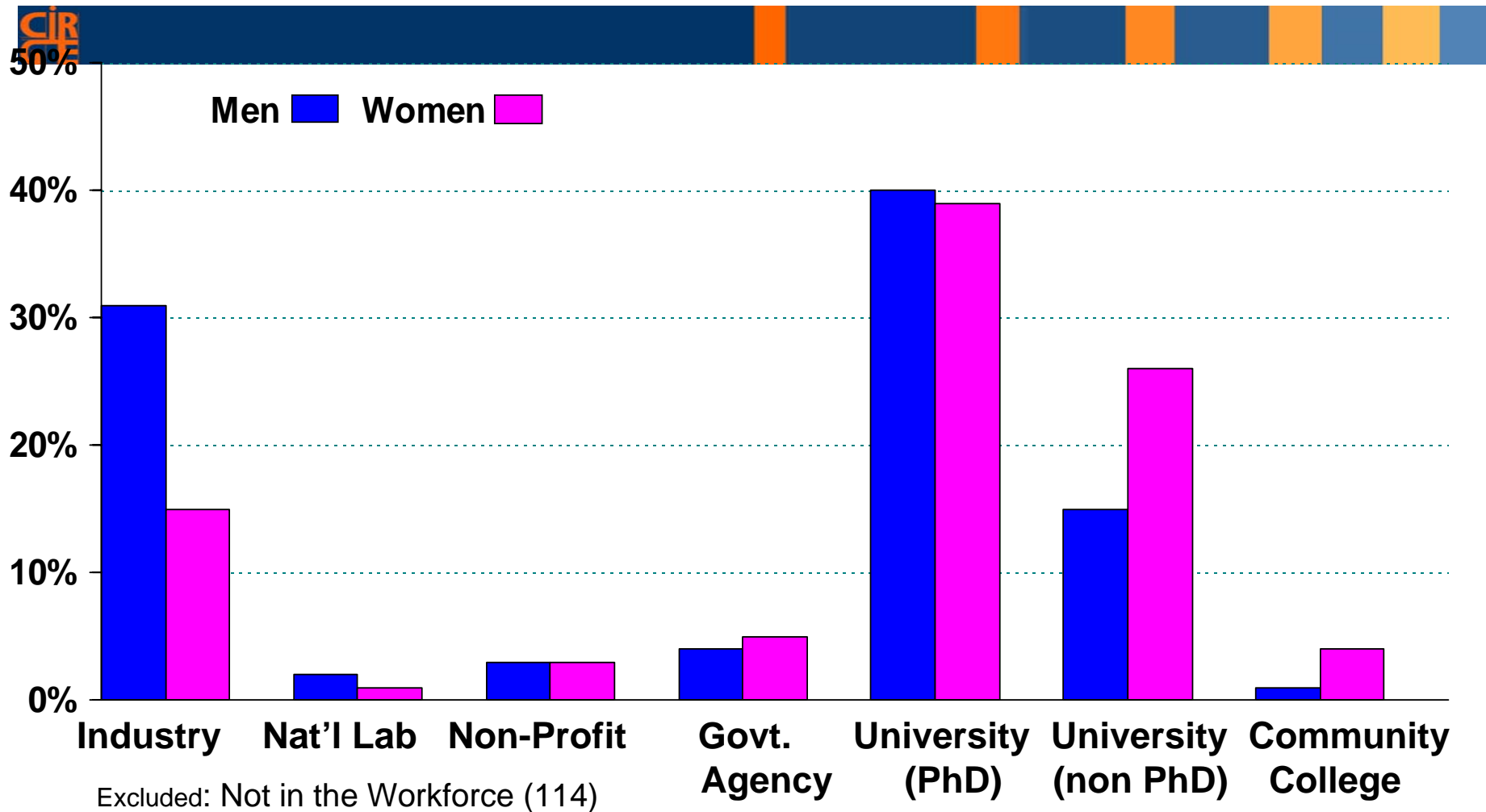
English

Math.

Poli.  
Sci.

\* B = Business  
 G = Government  
 N = Non-profits

# Selected Employers 10+ Years Later by Gender



# Common Assumption 2



**The “best” PhD students do  
become professors**

**measures: short time-to-degree  
many publications**

# Common Assumption 2

## The “best” become professors



Short time-to-doctoral degree and number of publications only mattered significantly for **English** and **political science PhDs**.

These factors did **NOT** matter for **biochemists, electrical engineerings,** and **mathematicians**. Time-to-degree mattered for computer scientists (logistic regression analysis).

# Common Assumption 2

## Mentoring is the key to success



**Mentoring** had influence on being a tenure-track faculty at the first job only for **biochemists** and **mathematicians**.

**(logistic regression analysis)**

# Common Assumptions the “best” and mentoring



What mattered most is the **RANK** of PhD-granting program.  
However in fields with an **attractive job market outside academia, computer science and electrical engineering, RANK did NOT matter significantly.**

# Common Assumptions 2

The “best” become professors



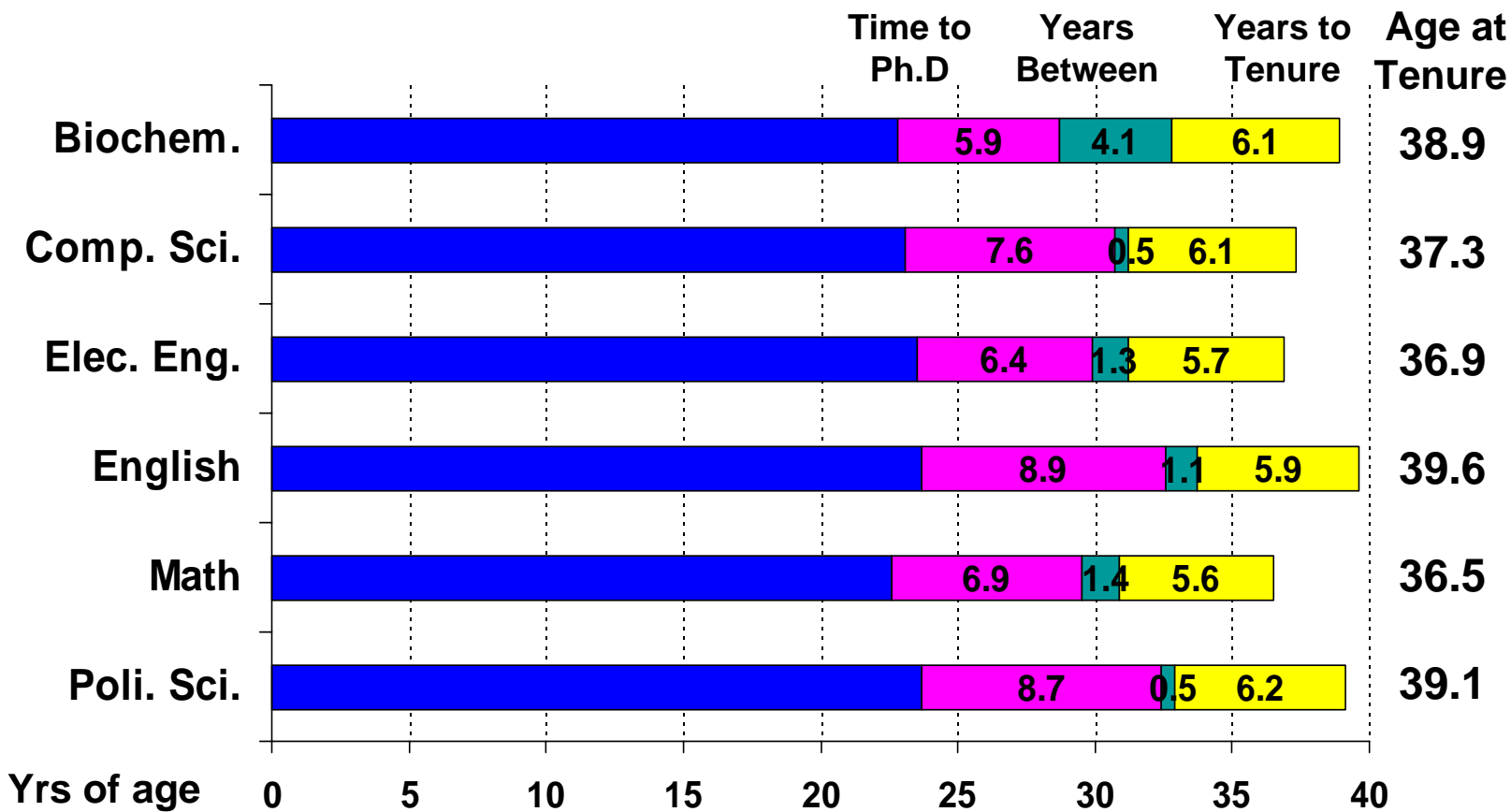
However, **RANK** of PhD program significantly mattered for those whose first job was in a tenure-track position in a **top quartile NRC ranked** program, except for **electrical engineers** and only moderately for **computer scientists**.

# Common Assumption 3



**Science PhDs reach the professoriate at a relatively young age**

# Age at Tenure by Field



# Postdoctoral Appointments



<b>Major Field</b>	<b>% Doing Postdoc</b>	<b>Median Years</b>
<b>Biochemistry</b>	<b>86</b>	<b>3.8</b>
<b>Computer Sc.</b>	<b>7</b>	<b>1.6</b>
<b>Elec. Eng.</b>	<b>9</b>	<b>1.6</b>
<b>English</b>	<b>8</b>	<b>2.0</b>
<b>Mathematics</b>	<b>31</b>	<b>2.5</b>
<b>Political Sc.</b>	<b>9</b>	<b>1.5</b>

# Number of Postdoctoral Positions and Average Total Time in Postdoctoral Positions



Postdoctoral Appointments	Biochemistry		Mathematics	
	86% of PhDs do Postdocs	Mean Total Time (yrs) in Postdocs	31% of PhDs do Postdocs	Mean Total Time (yrs) in Postdocs
One Only	60%	3.0	60%	1.8
Two	31%	4.5	29%	3.1
Three	7%	6.9	8%	4.7
Four	1%	8.5	3%	3.8
Five	1%	–	None	–

**N=564**

**N=234**

# First and Last Postdoctoral Settings



	<b>Biochemistry</b>		<b>Mathematics</b>	
	<b>First</b>	<b>Last</b>	<b>First</b>	<b>Last</b>
<b>University</b>	<b>82%</b>	<b>74%</b>	<b>92%</b>	<b>85%</b>
<b>National Lab</b>	<b>3%</b>	<b>4%</b>	<b>3%</b>	<b>6%</b>
<b>Government Agency</b>	<b>5%</b>	<b>7%</b>	<b>2%</b>	<b>1%</b>
<b>Non-Profit Org.</b>	<b>7%</b>	<b>7%</b>	<b>2%</b>	<b>3%</b>
<b>Industry</b>	<b>3%</b>	<b>7%</b>	<b>(1)</b>	<b>4%</b>

Note: "Other" type of employment is not shown in this table:  
 1% of Biochemistry Last Postdocs and 1% of Mathematics  
 First and Last Postdocs are categorized as such.

# Postdoctoral Appointments By Gender

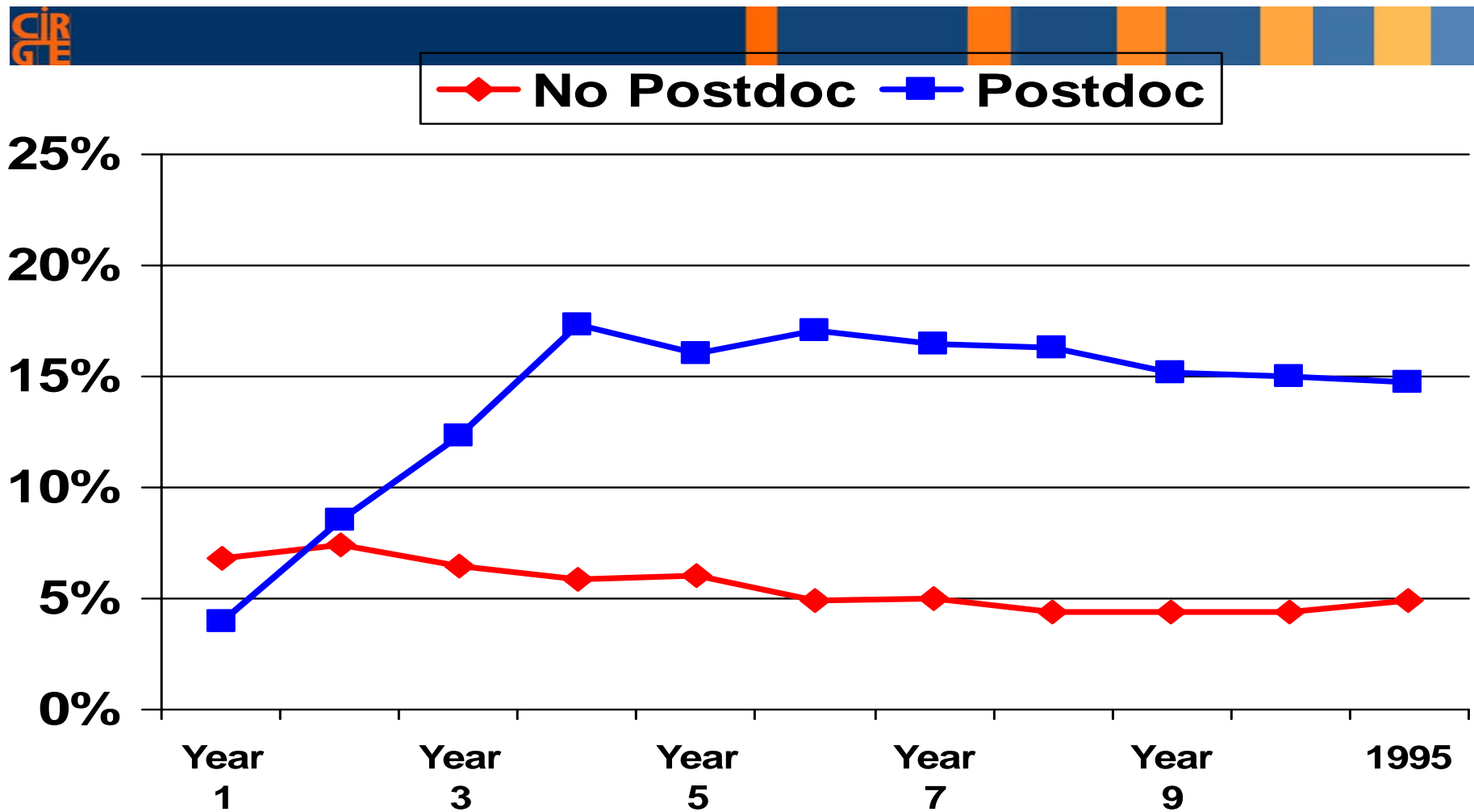
	<u>Biochem</u>		<u>Math</u>	
	♂	♀	♂	♀
<b>% doing postdoc</b>	<b>87</b>	<b>89</b>	<b>35</b>	<b>35</b>
<b>Average # of postdocs</b>	<b>1.5</b>	<b>1.6</b>	<b>1.6</b>	<b>1.4</b>
<b>Mean years spent in postdoc</b>	<b>4.1</b>	<b>4.7</b>	<b>3.3</b>	<b>2.5</b>
<b>Median years spent in postdoc</b>	<b>3.5</b>	<b>4</b>	<b>3.5</b>	<b>2</b>

# Major Reasons for Choosing Postdoctoral Appointments



Major Reasons	Biochemistry				Mathematics			
	First Postdoc		Last Postdoc		First Postdoc		Last Postdoc	
	M	W	M	W	M	W	M	W
Necessary Employment Step	76%	76%	59%	49%	57%	35%	56%	(2)
Additional Training	38%	38%	22%	11%	46%	53%	25%	(2)
Training in Another Field	42%	45%	42%	44%	7%	–	6%	–
Specific Organization	10%	6%	14%	11%	16%	(3)	29%	(3)
Specific Person	32%	33%	36%	36%	23%	(5)	38%	(3)
Only Acceptable Employment	11%	9%	24%	22%	31%	(5)	22%	(2)
Specific Geographical Area	17%	29%	30%	52%	16%	35%	20%	(5)
Location Worked for Both Spouse and Self	21%	38%	38%	66%	15%	50%	17%	67%

# % of Mathematicians Who Wanted to Be Professors and Worked as Professors in 1982 NRC Top-Quarter Institutions by Postdoc

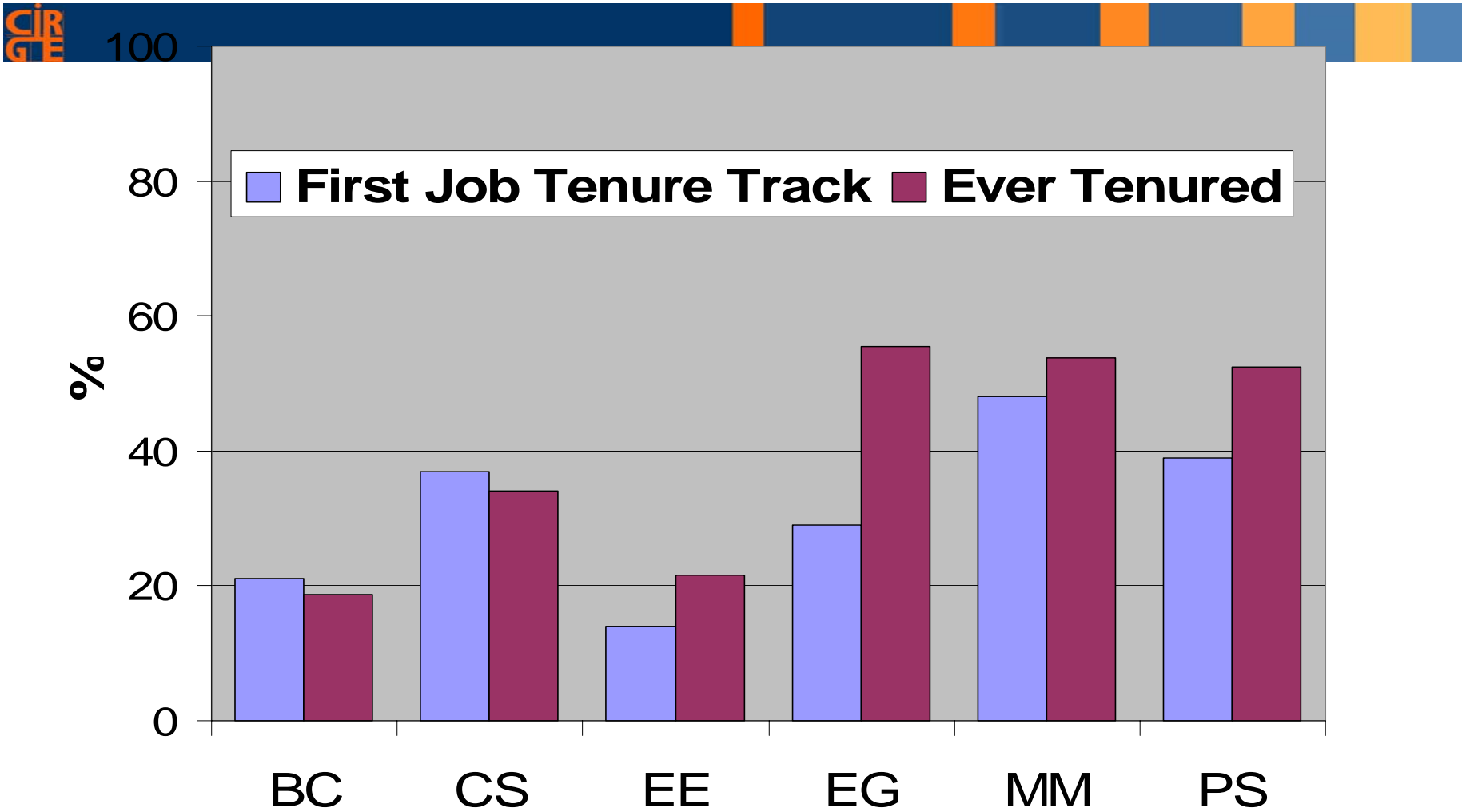


# Common Assumption 4



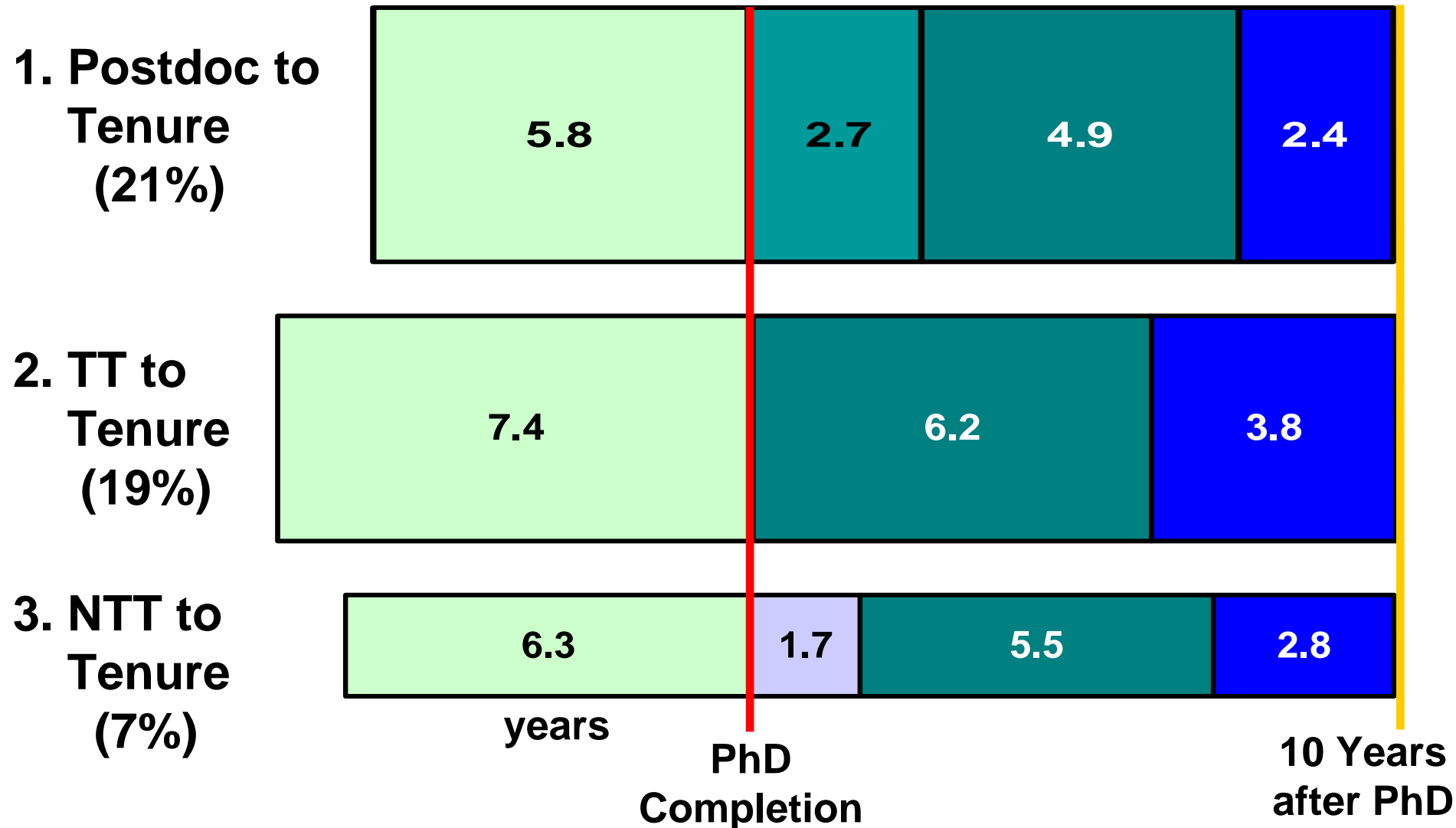
**PhD recipients' career paths  
are linear and smooth**

# % PhDs First Job Assistant Professor and Ever Tenured



# Academic Trajectories: Mathematics

□ PhD   □ Pdoc   □ NTT   □ TT   □ Ten.



# Three Major Trajectories: Computer Science



**Percent  
of Total**

## 1. Faculty

TT to Ten (108)



**28%**

## 2. Determined BGN Employees

R & D (76)

**20%**

Mng./Exec. (45)

**12%**

**35%**

BGN Other (10)

**3%**

Acad to BGN (32)

**8%**

## 3. Movers

BGN to Acad (14)

**4%**

**17%**

Back and Forth (18)

**5%**

Trajectory 1: Under 2yrs. BGN.

Trajectory 2: Under 1yr. Acad.

Trajectory 3: Over 2yrs. BGN and over 1yr. Acad.

# Common Assumption 5



**Everybody can take the best  
job offered**

# Educational Level of Partner of PhDs by Gender (all fields)



## Women in the Survey

Partnered with PhD/Lawyer  
or Medical Doctor: **61%**

## Men in the Survey

Partnered with PhD/Lawyer  
or Medical Doctor: **27%**

# Educational Level of Spouse by Gender and Field



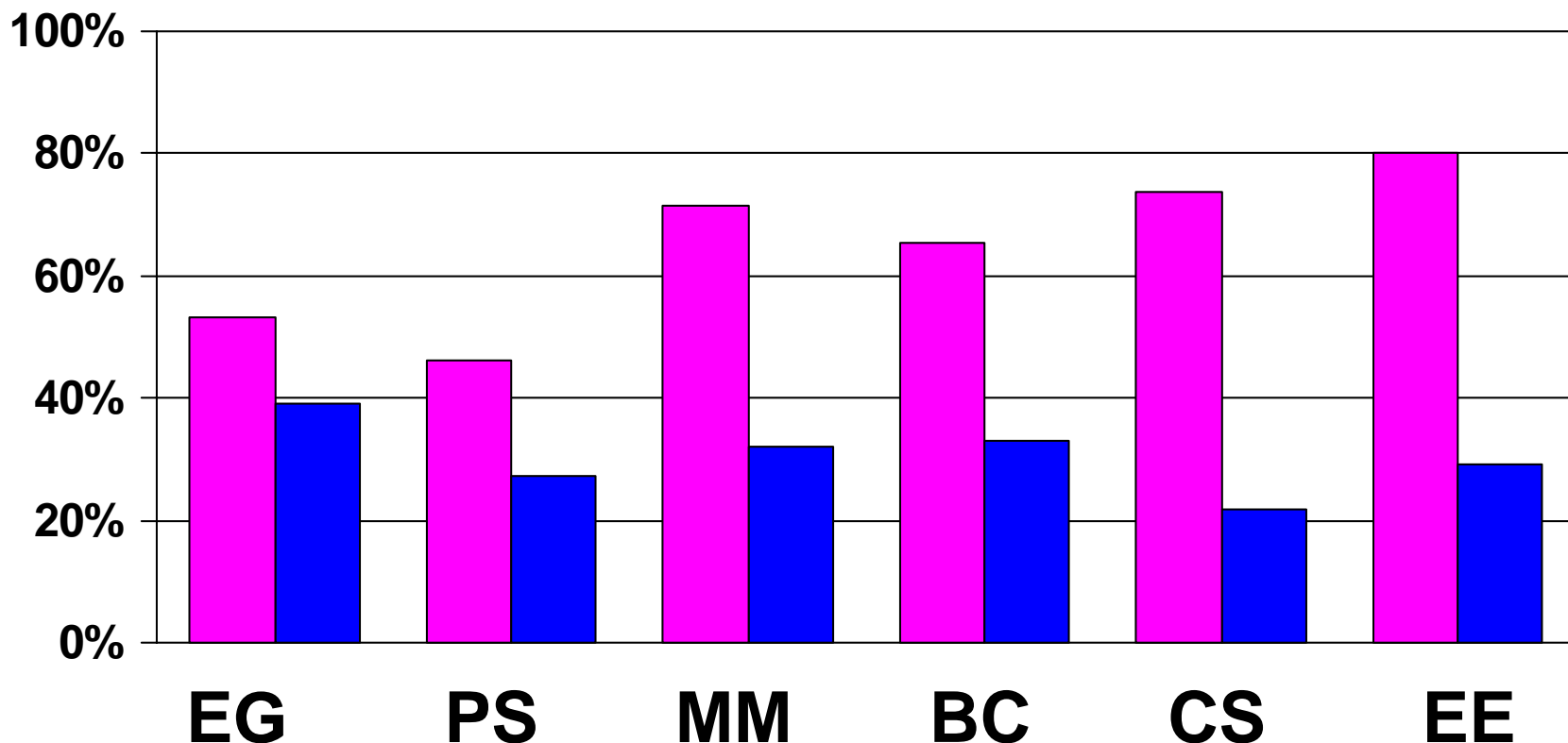
AT PhD completion married **women/ men**  
BIOCHEMISTS had spouses with PhD/JD/MD  
(1997): **75% / 24%**

AT PhD completion married **women/ men**  
MATHEMATICIANS had spouses with  
PhD/JD/MD (1997): **84% / 25%**

# “Good Opportunities for My Partner” Very Important in First Job Choice

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Married Women Married Men



# Common Assumption 6



**Children detract women from  
the pursuit of a faculty career**

# Who Influenced the Career Path?

## *Art History*



	Women	Men
<b>Partner</b>	<b>44%</b>	<b>26%</b>
<b>Children</b>	<b>38%</b>	<b>13%</b>
<b>Taking Care of Relatives</b>	<b>13%</b>	<b>4%</b>

# Ever Tenured by Family Trajectories and Gender: *Art History*



	Women	Men
<b>Single w/o Children</b>	<b>53%</b>	<b>54%</b>
<b>Stable Relationship w/o Children</b>	<b>52%</b>	<b>76%</b>
<b>Stable Relationship w/ Children</b>	<b>38%</b>	<b>81%</b>

# Common Assumption 7



**Faculty enjoy the highest job satisfaction**

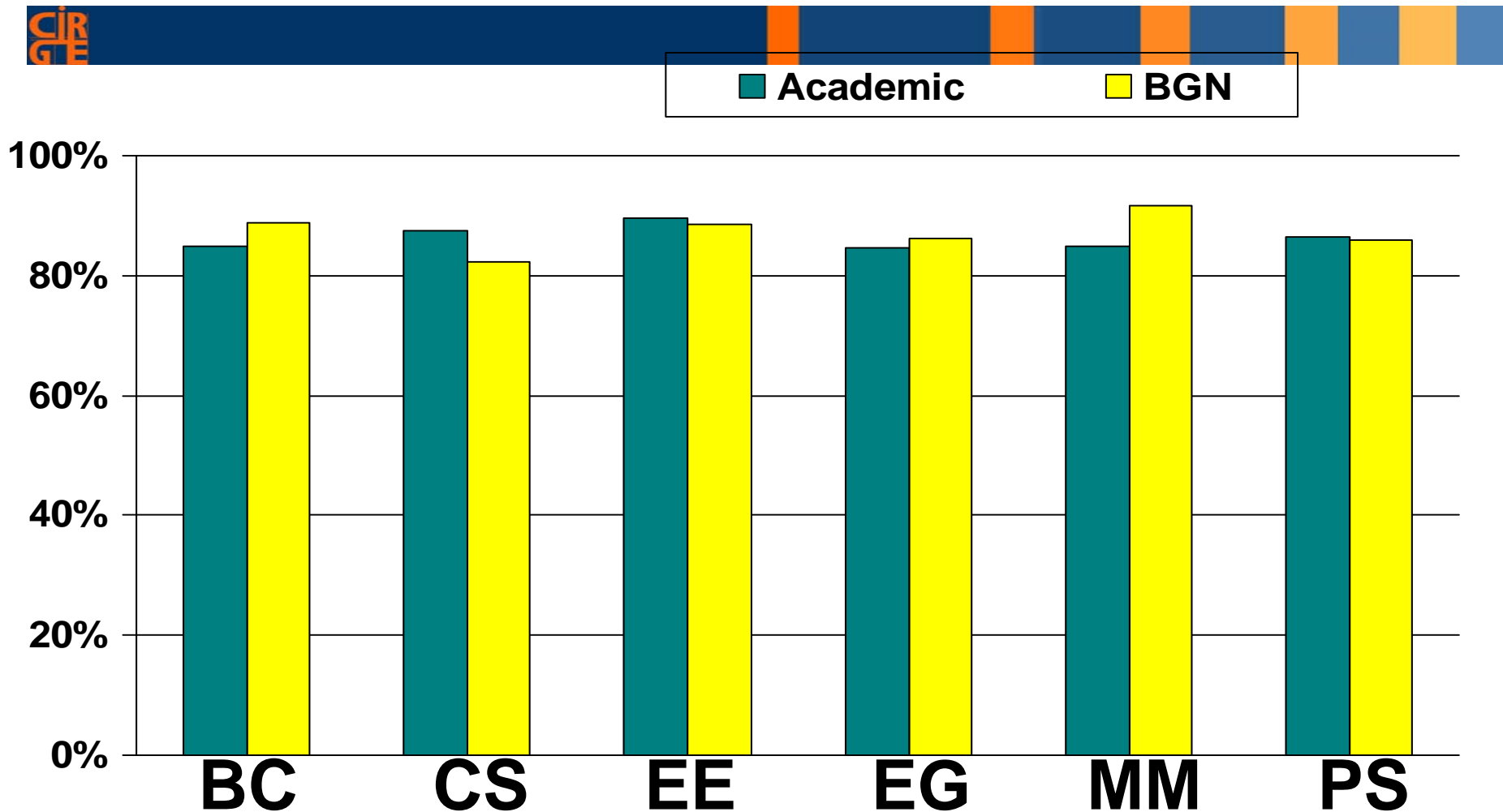
# % Very Satisfied in Job at Time of Survey (*All Fields*)



	Rank	%	N
<b>BNG manager/executive</b>	<b>1</b>	<b>40%</b>	<b>243</b>
<b>Academic administrator</b>	<b>2</b>	<b>39%</b>	<b>54</b>
<b>Acad. researcher</b>	<b>3</b>	<b>28%</b>	<b>54</b>
<b>Tenured academic staff</b>	<b>4</b>	<b>26%</b>	<b>851</b>
<b>BNG researcher</b>	<b>5</b>	<b>24%</b>	<b>430</b>
<b>Administrators</b>	<b>6</b>	<b>22%</b>	<b>54</b>
<b>Temporary academic staff</b>	<b>7</b>	<b>18%</b>	<b>131</b>

# Are “deviant” PhD careers unsuccessful careers?

# Overall Current Job Satisfaction\* by Sector



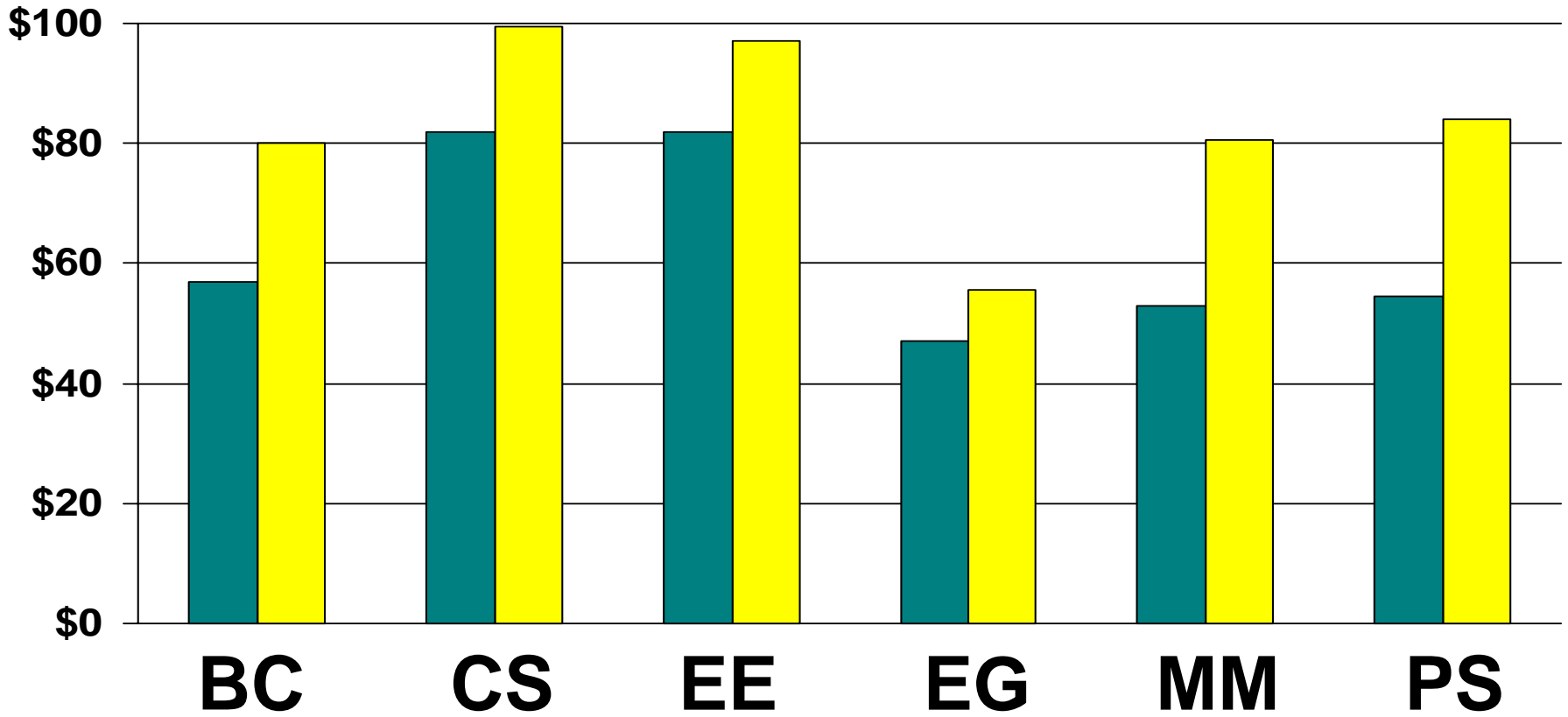
\*Satisfaction="Very Satisfied" + "Fairly Satisfied"

Source: CIRGE, University of Washington: AGS, "Defining Successful Careers," State College 9-26-2005

# Total Median 1995 Salary



Thousands



**Excluded: Not in the workforce, part time, working outside US.**

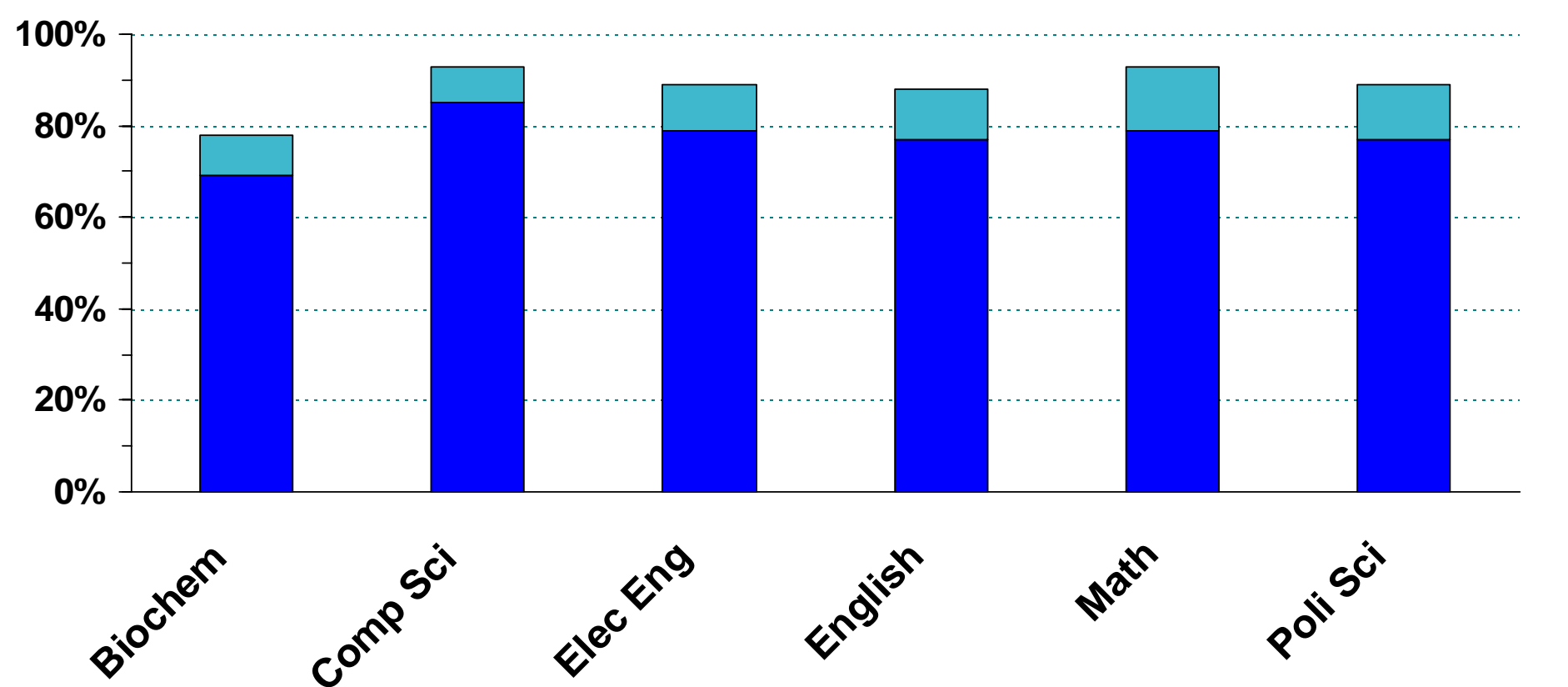
Source: CIRGE, University of Washington: AGS, "Defining Successful Careers," State College 9-26-2005

# Would you do the Ph.D. again?



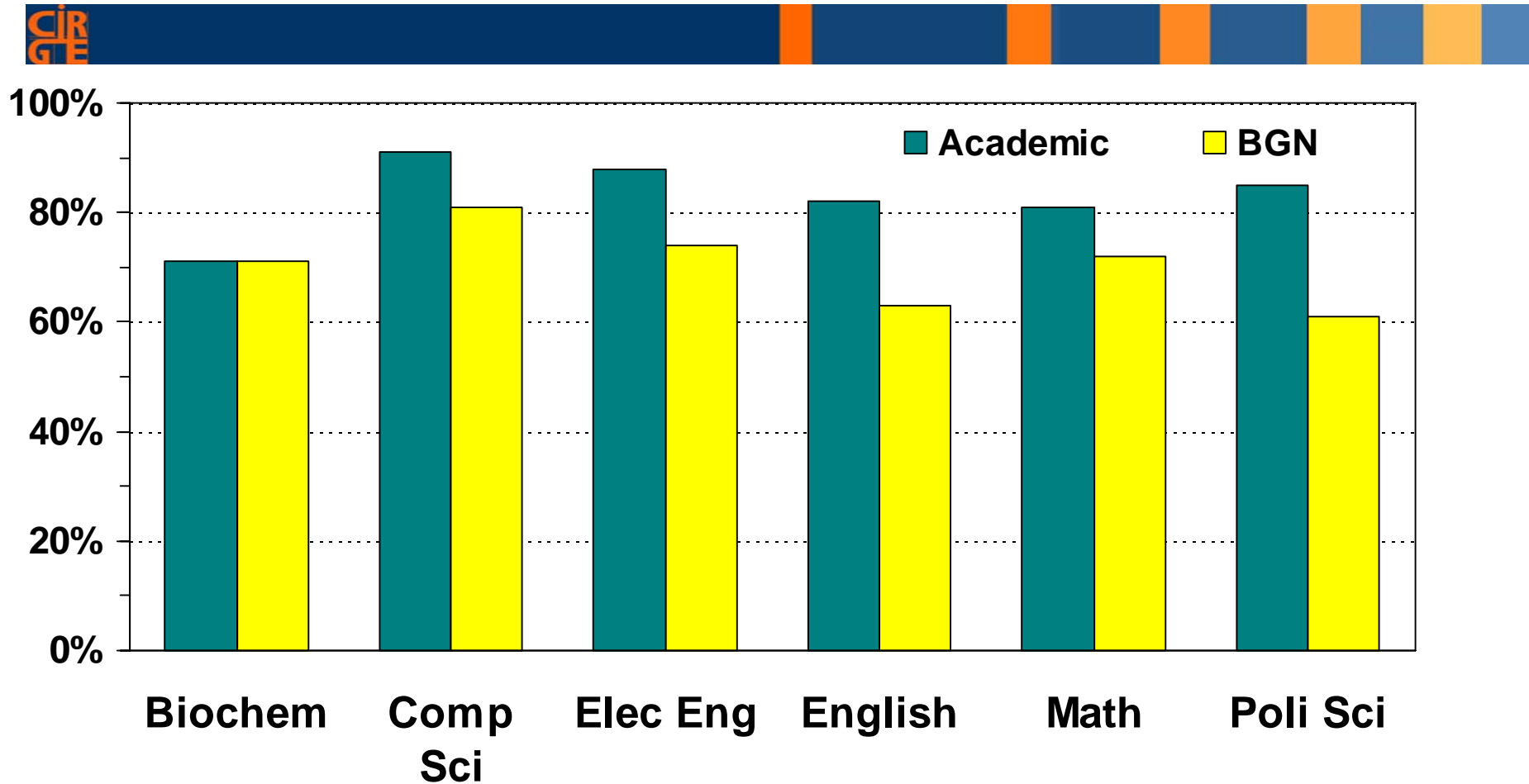
■ Yes, Same Field

■ Yes, Different Field



# Would you do the Ph.D. again?

## Yes: In the **Same Field.**



# What are criteria for measuring program effectiveness?



## Traditional Criteria

1. % national fellowship holders
2. Recruitment of diverse student body
3. Reasonable Time to degree
4. Low attrition rate
5. Student satisfaction
6. Placement

# Further Measurement criteria



- 1. Job search experience**
- 2. Current job satisfaction**
- 3. Retrospective analyses of the quality of the doctoral education**
- 4. PhD recipients' opinions of the usefulness of their doctoral education**
- 5. Recommendations for current students and current programs.**

# Are we preparing our PhDs for the Future?



**The context:**

**Globalization  
and the knowledge economy**

# Countries that prepare for the Knowledge Economy



## Increase of PhD production + Governmental Financial Support (Examples)

- **Europe:** Bologna Agreement (3.2 % of GDP for R&D)
- **Canada:** Increases PhD production
- **Australia and New Zealand:** Active recruitment of international PhDs
- **Japan:** Increases PhD production

# Is the Traditional Doctoral Program Suited to the Demands of the New Economy?

## Issues raised internationally



- 1. Disciplinary versus interdisciplinary**
- 2. Individual versus collaborative**
- 3. Producing relevant versus esoteric knowledge**
- 4. Preparing for academic and non-academic jobs**
- 5. Preparing for use and (critical) attitude towards the new technology**
- 6. Preparing PhDs to become leaders that think and act globally and locally**

# Characteristics of Doctoral Education for the 21<sup>st</sup> Century



1. It prepares PhDs to work in **interdisciplinary groups** ( provide general epistemology course “how do we know what we know, and what do we regard as evidence?”)
2. It integrates **professional skill building**
3. It Introduces **collective advising**
4. It integrates **team work**
5. It includes **international collaborations** into the doctoral program

# Characteristics of Doctoral Education for the 21<sup>st</sup> Century



6. It encourages **multiple flows** of students and research collaborations (north/south, rich/poor)
7. It re-introduces **foreign language** requirement (disadvantage with English only, and hierarchy)
8. It prepares for **leadership** (and makes one's own limitation transparent and acceptable)
9. It initiate **world citizenship education**

# Characteristics of the Innovative Doctoral Programs

in the US and World-wide



They:

1. Are **problem-oriented, inquiry-based, theme-based** rather than discipline oriented, **multidisciplinary** research programs (maximum 10 years existence)
2. Prepare for **academic and non-academic careers**, via connections to outside world (internships, professionals connected to program)
3. Make **professional socialization** (ethical values and norms of the field) **explicit** via multiple mentoring

# Characteristics of the Innovative Doctoral Programs



4. Include **professional skills training of the field** (presenting at conferences, teaching, publishing, grant writing)
5. **Team work** is an explicit component of program (dissertation may include collectively written chapter)
6. **International program components** are encouraged (curriculum includes international collaboration with other doctoral programs)
7. Program proposals are reviewed for funding through an **academic peer review scheme**

# Examples of Innovative Doctoral Programs



1. **German (DFG) Graduiertenkolleg (GRAKO): 1989**
2. **Australian Cooperative Research Center Training Program (CRC): 1990**
3. **US (NSF) Integrated Graduate Education and Research Trainee Program (IGERT): 1997**  
125 programs at 65 universities, 5 year funding  
\$2.5 million per program, student stipends
4. **Many European and Japanese Graduate Schools (doctoral research centers)**

# Thank you!



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