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# Faculty Network and Workload Study (FNWS)

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- My Broad Research Agenda
  - understand how faculty networks shape our work experiences and scholarship
  - identify how faculty networks vary across gender, and the potential consequences of these differences
- Connection to ADVANCE-Nebraska
  - my work is part of the basic research component for our contractual agreement with NSF
    - it is the first application of social network analysis to understand faculty retention and promotion



PI, SVCAA Ellen Weissinger

Director, Mary-Anne Holmes, Earth & Atmospheric S.



# Overview for Today

## Part #1: Research collaboration at UNL

- Who collaborates more and with whom?
- Who is satisfied with collaboration opportunities?
- Are there gender differences?

## Part #2: Faculty network position within departments and academic climate perceptions

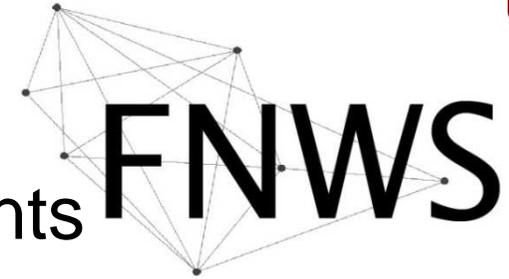
- What individual network characteristics are most strongly correlated with positive climate perceptions?
  - Do the associations differ across network type?

Acknowledgements:

Megumi Watanabe, Julia McQuillan and Jim Lewis



## Data



- 16 SoBSc and 26 STEM departments
  - 744 tenure-line faculty
- response rate
  - overall, 75.1% of faculty filled-out the FNWS Survey
- samples used in analyses today
  - respondent sample: 559 faculty in 42 departments
  - network sample: 732 faculty in 41 departments
    - lose 1 department to low response rate (<70%)



## Response Rate by College

<b>By College</b>	<b>Response Rates</b>	
	<i>Percent</i>	<i>N</i>
Arts & Sciences	78.4%	199
IANR	77.9%	180
Engineering	65.1%	82
Education	75.7%	53
Business	71.4%	45



# Who are the faculty asked to participate in the FNWS survey?

Demographic Characteristics	
Gender	<i>proportion</i>
Female	.23
Male	.77
Race	
White	.80
Asian	.16
URM	.05
Citizenship	
United States	.76
Non US	.24
Academic Rank	
Assistant	.35
Associate	.35
Full	.30

N=744 faculty in 42 departments



*non-respondents are more likely to be:*

- non US citizens
- minority men
- associate professors



## Part #1: Research Collaboration

- collaboration is beneficial for individual scientists and for scientific progress
  - sole-authors can produce high quality work, but not as quickly as collaboration teams
- rates of collaboration have increased - faster than the rate of publication

Presser 1980; Hara et al. 2003; McDermott and Hatemi 2010; Durden and Perri 1995; Newman 2004; Babchuk et al. 1999



## Part #1: Research Collaboration

- the extent of collaboration among faculty varies by discipline and gender
  - researchers in natural sciences, especially laboratory settings, are more likely to collaborate than the social sciences
  - women co-author less often than men
  - for both men and women, collaborators are more often of the same gender than opposite gender

Laband and Tollison 200; McDowell and Smith 1992; Kyvik and Teigen 1996



- ***Who is more likely to collaborate?***
  - we will explore differences in the amount of faculty collaboration across college and gender
- *understanding possible gender differences:* women are likely to have fewer collaborators than men, because...
  - women are occupational minorities within academia producing an outsider status
  - women do not fit “ideal worker” norms leading to competency biases toward women

Ridgeway 2011; Gorman 2005; Britton 2000; Acker 1990; Williams 2000  
Blair-Loy 2003; Mason and Ekman 2007; Williams, Alon and Bornstein  
2006; Cuddy, Fiske and Glick 2004; Kanter 1977 & 1980; Taylor 2010,  
Yoder 1991; Stichman, Hassell and Archbold 2010



## Types of research collaborators

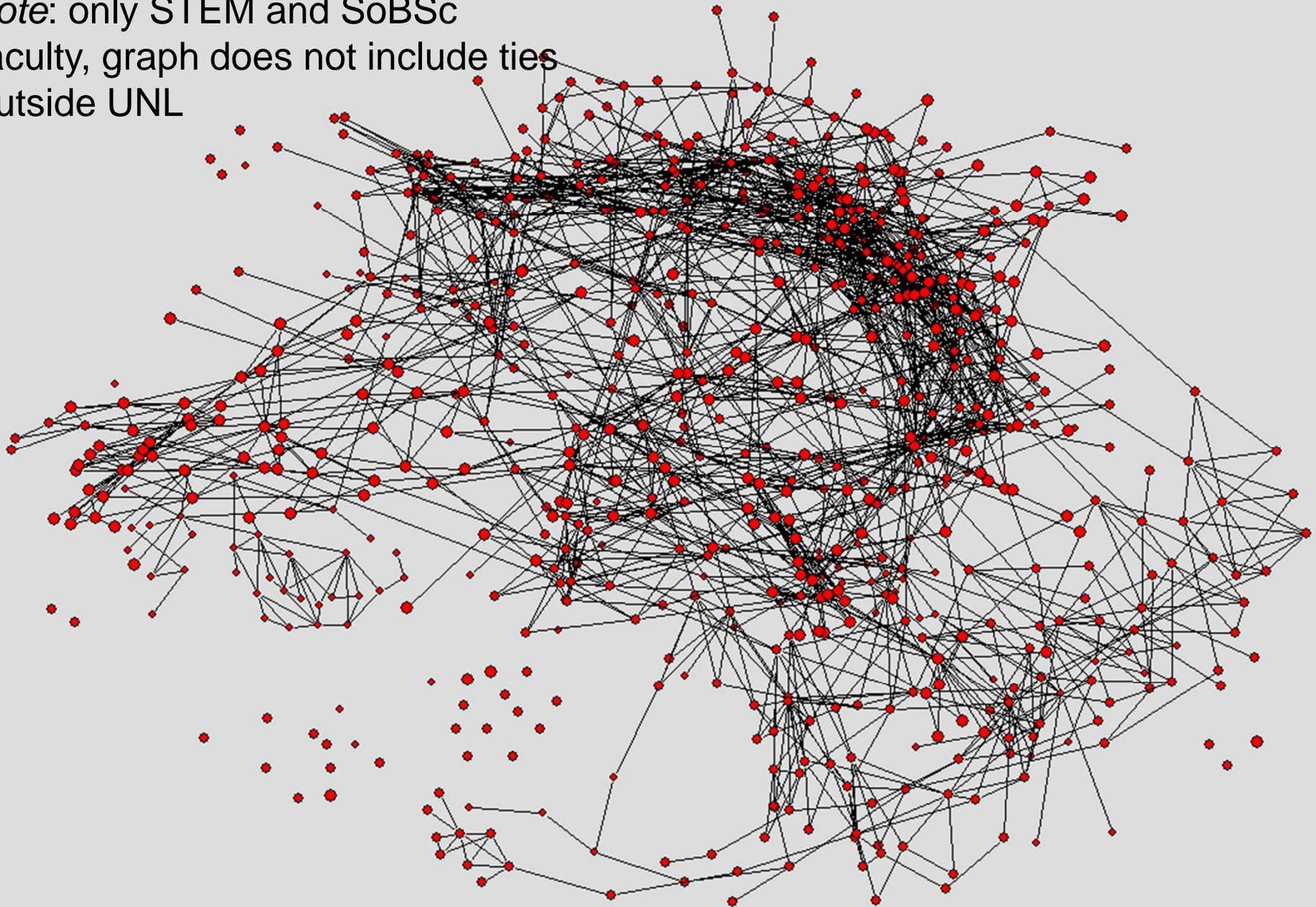
- survey participants identified who they had worked with on any type of research project in the past three years, distinguishing among collaborators:
  - within their tenure home department
  - within UNL, outside of tenure home department
  - outside of the university

<b>Collaborators</b>	<i>mean</i>	<i>std.</i>	<i>min</i>	<i>max</i>
Within Department	3.51	2.90	0	20
Across University	3.17	4.10	0	25
Outside University	5.01	5.68	0	30



# Faculty Research Collaboration Network at UNL

*note:* only STEM and SoBSc  
faculty, graph does not include ties  
outside UNL



## Research Collaborators by College

College	N	Collaborators		
		Within	Across	Outside
		Department	University	University
		<i>mean</i>	<i>mean</i>	<i>mean</i>
Arts & Sciences	195	3.07 *	2.41 *	4.67
IANR	175	<b>4.44</b>	<b>4.15</b>	<b>5.74</b>
Engineering	77	3.59	3.72	3.19 *
Education	52	3.08 *	2.44 *	4.77
Business	44	2.18 *	0.91 *	4.50

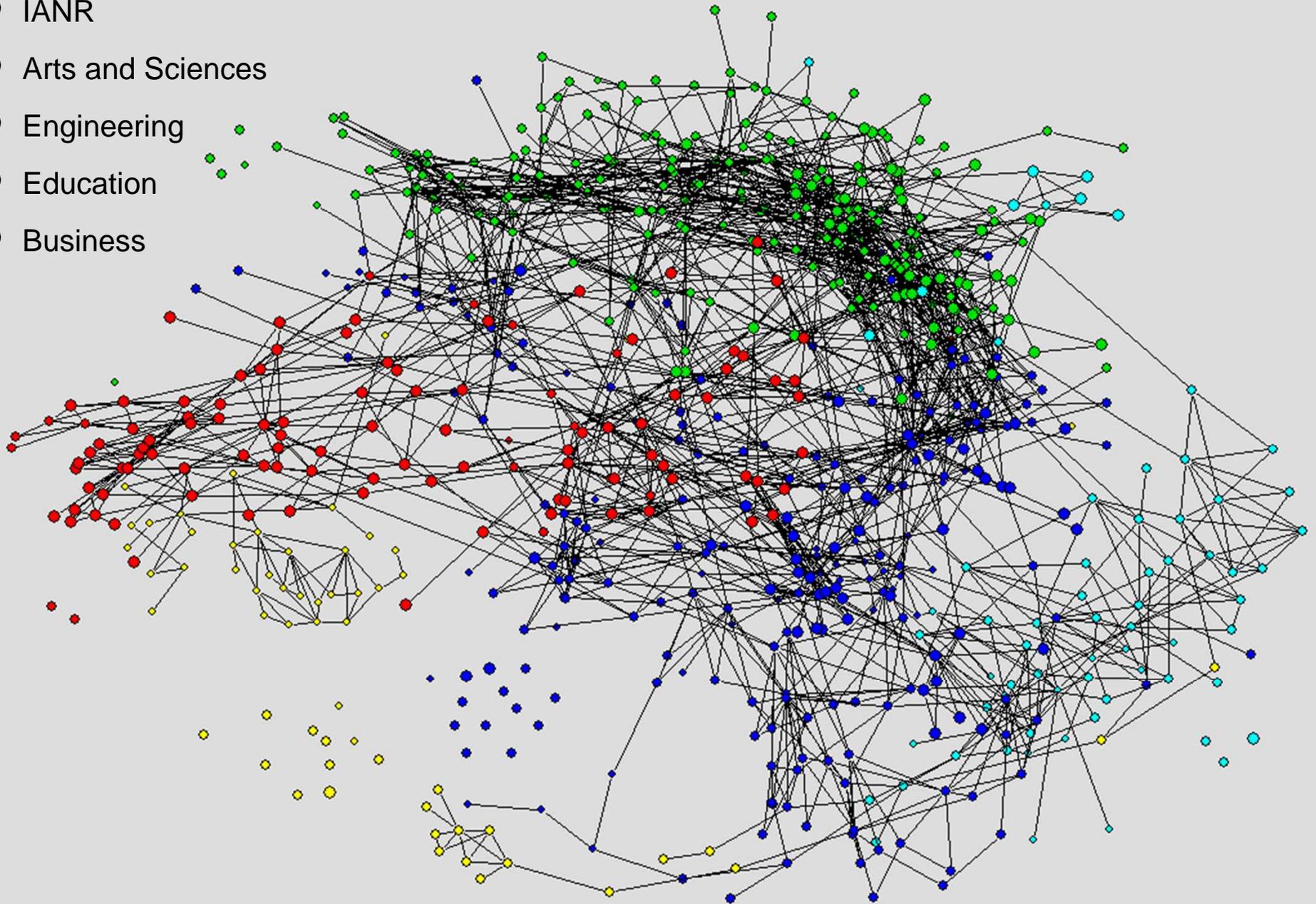
\* indicates significant difference from faculty in IANR

- faculty in IANR have the most collaborators

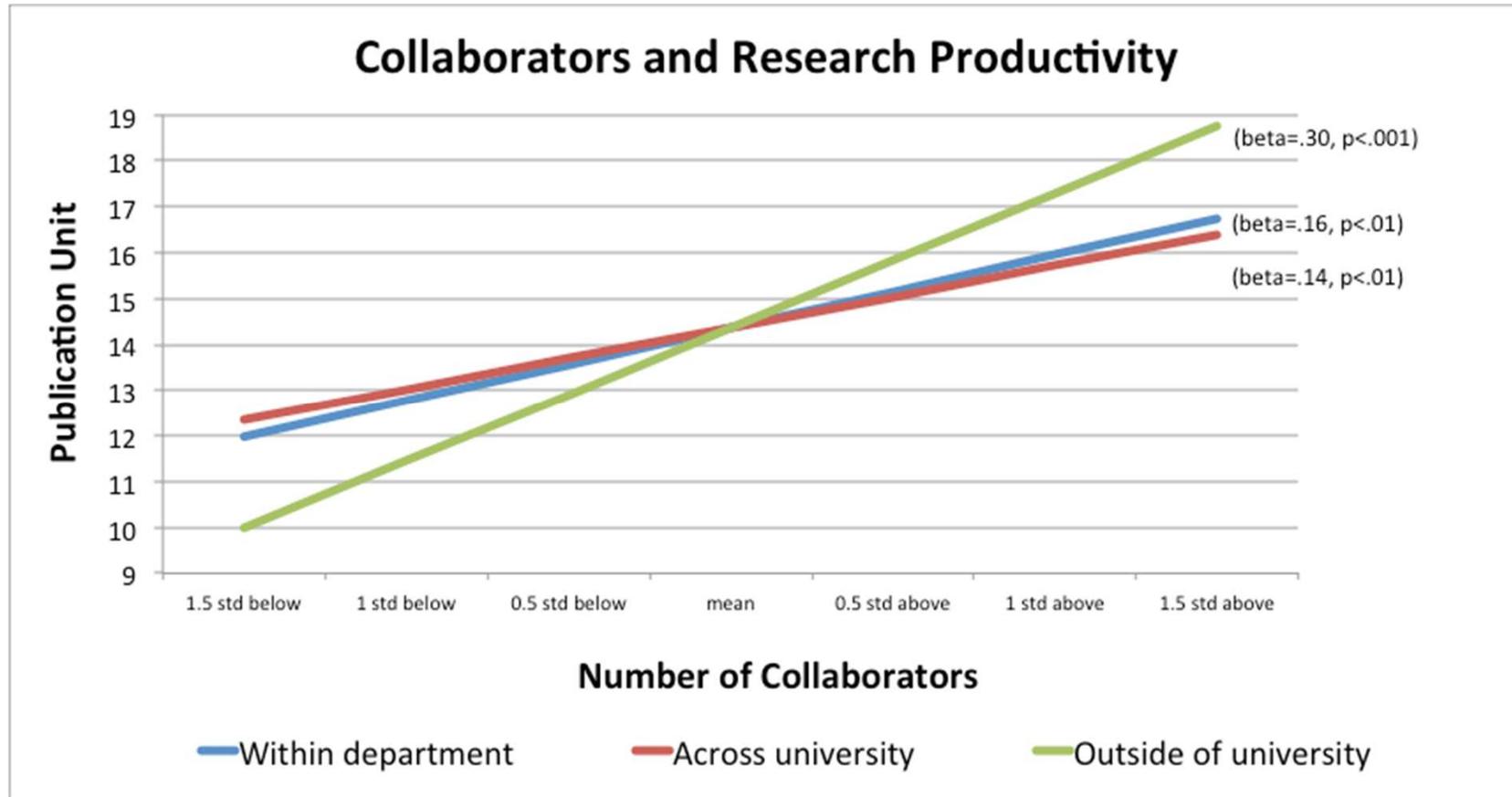


# Research collaboration across college

- IANR
- Arts and Sciences
- Engineering
- Education
- Business

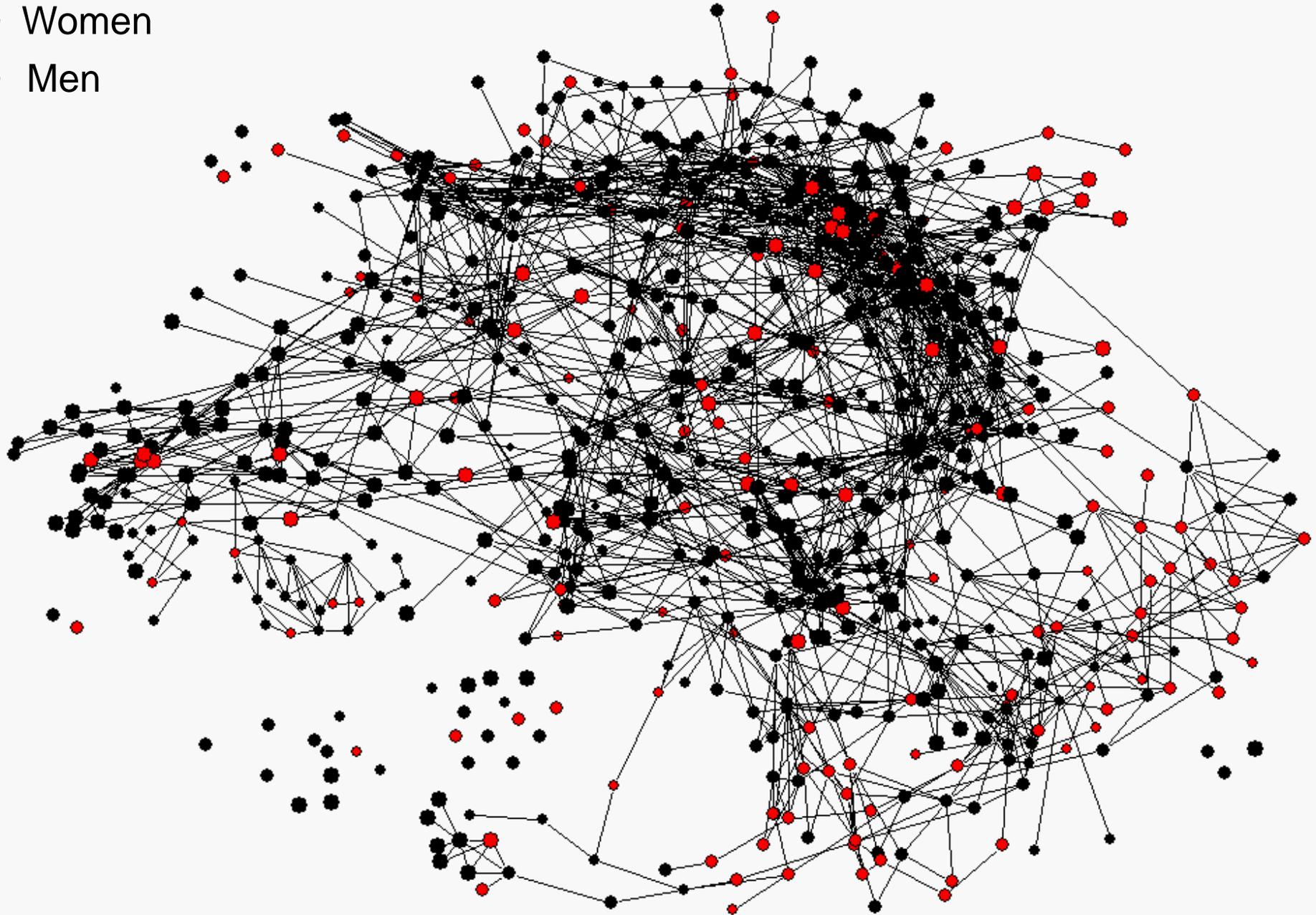


# Having more collaborators increases a faculty member's research productivity



# Research collaboration by gender

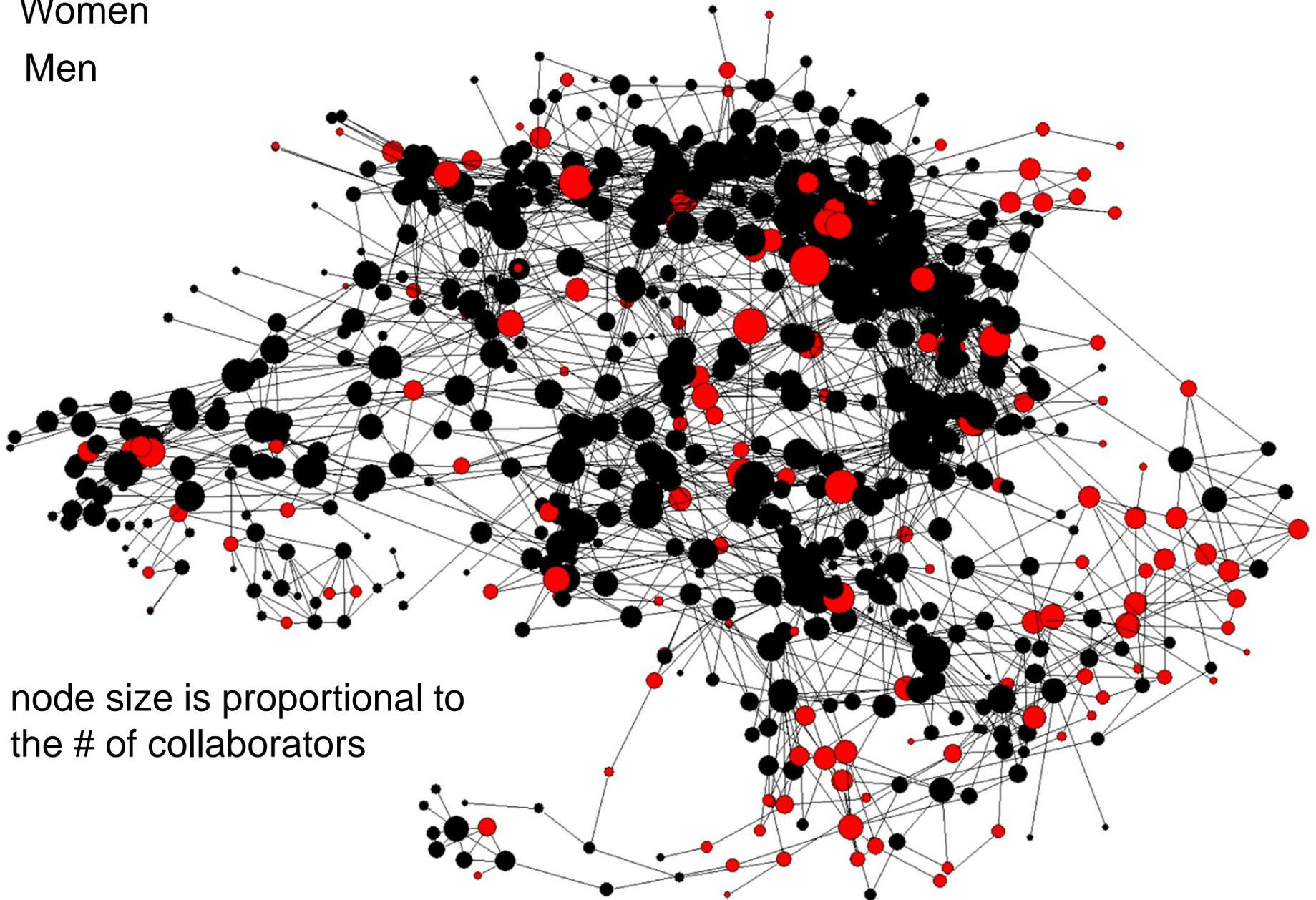
- Women
- Men



# Research collaboration by gender

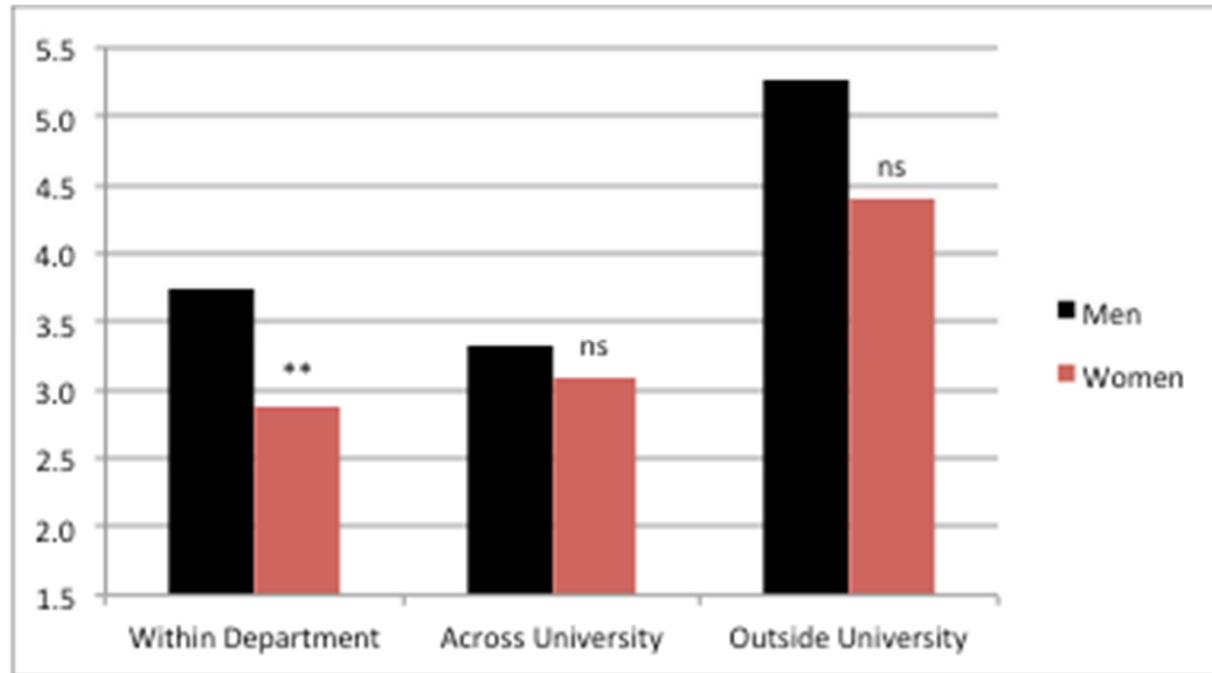
● Women

● Men



node size is proportional to  
the # of collaborators

# Gender Differences in Research Collaborators



*note:* analysis controls for years since degree, years at UNL, discipline, grant dollars, citizenship, and race.

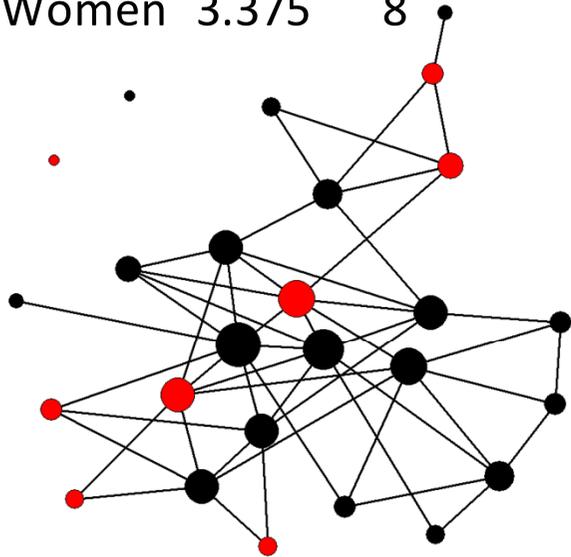
\*\*  $p < .01$ ; ns = not significant difference

- Women report about one fewer collaborators within their tenure home departments than men, but a similar number of collaborators across and outside the university

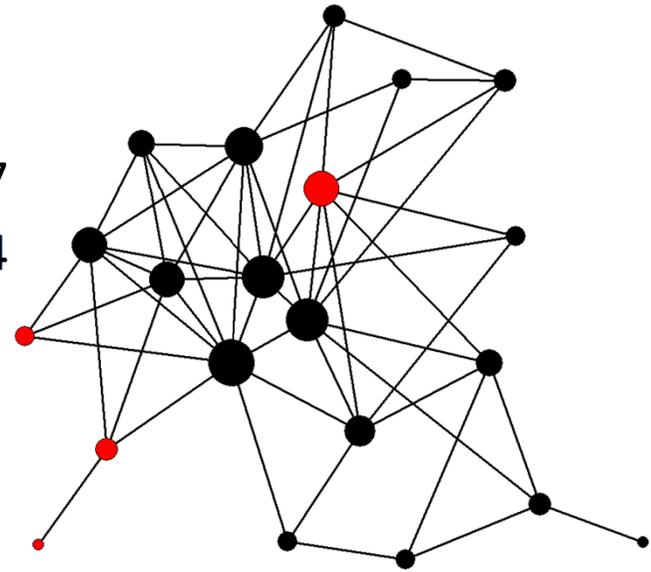


# Within department gender differences in collaboration

	<i>mean</i>	<i>n</i>
Men	4.278	18
Women	3.375	8

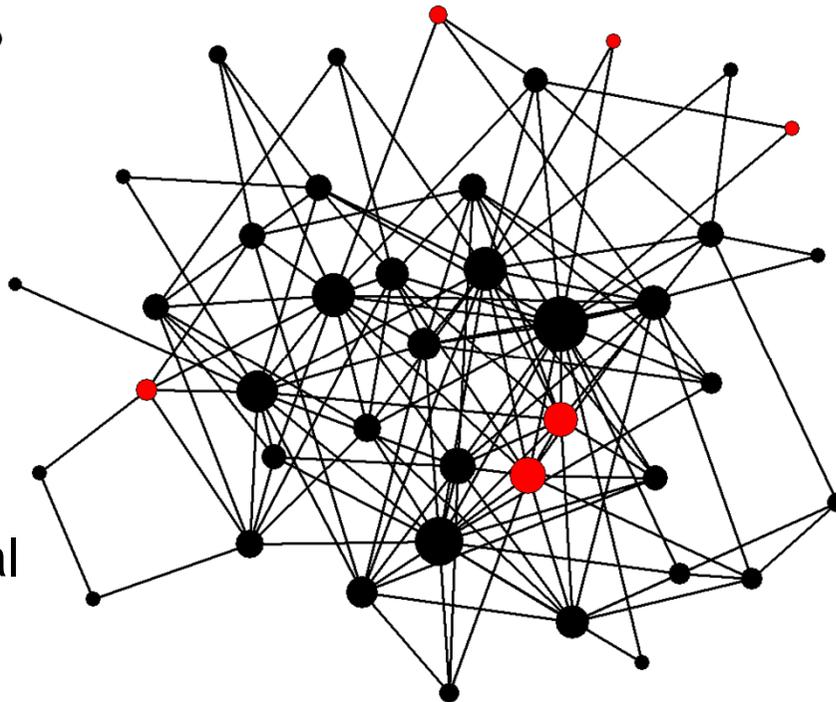


	<i>mean</i>	<i>n</i>
Men	5.353	17
Women	3.750	4



- Women
- Men

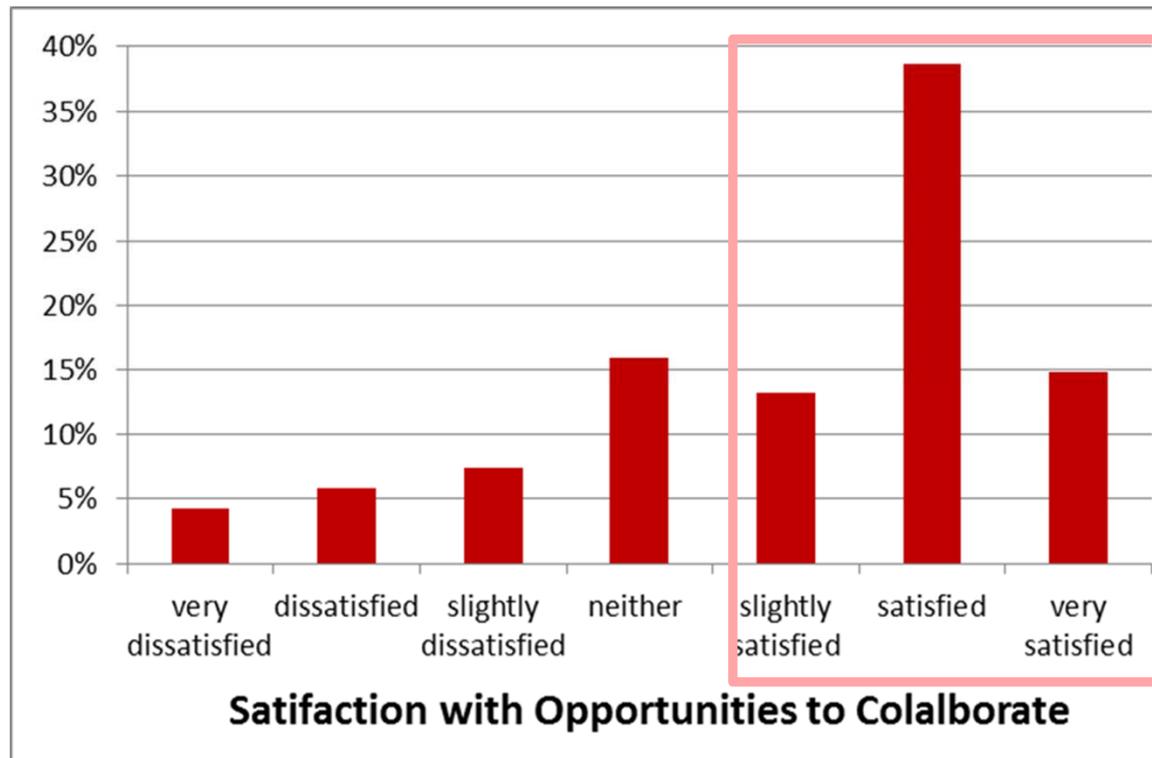
node size is proportional to the # of collaborators



	<i>mean</i>	<i>n</i>
Men	7.286	35
Women	5.833	6

- ***Who is most satisfied with their opportunities to collaborate?***

- *survey question:* How satisfied are you with opportunities to collaborate with faculty in your department?



over 75%



- ***gender differences: satisfaction with collaboration opportunities in your department***
  - scale range: very dissatisfied =1 to very satisfied = 7

	<i>Mean</i>	<i>n</i>
All Faculty	5.03	539
Men	5.11	408
Women	4.79	131

\*significant mean gender difference (F= 3.97, p<.05)

women are less satisfied than men with opportunities to collaborate



- ***Who is likely to collaborate with whom?***
  - shift in focus to a dyad level of analysis, there are a total of 2,016 collaboration dyads among UNL SoBSc and STEM faculty
    - tables below describe some dyad characteristics

<b>Dyad Characteristics</b>		
<b>Average difference:</b>	<i>n</i>	<i>mean</i>
age	2016	11.27
UNL years	2016	11.09
<b>Department</b>	<i>n</i>	<i>percent</i>
same department	1333	66.1%
different department	683	33.9%
<b>College</b>	<i>n</i>	<i>percent</i>
same college	1706	84.6%
different college	310	15.4%

<b>Dyad Characteristics</b>		
<b>Gender</b>	<i>n</i>	<i>percent</i>
men-men dyad	1347	66.8%
men-women dyads	539	26.7%
women-women dyads	130	6.4%
<b>Race</b>	<i>n</i>	<i>percent</i>
white-white dyads	1310	65.0%
white-nonwhite dyads	573	28.4%
nonwhite-nonwhite dyads	133	6.6%



# Explanations for Tie Formation

- **Physical Distance**

- the tendency to form connections to individuals who are near - geographic proximity and frequent contact
  - minimize effort by interacting with individuals close by

- **Social Distance**

- the tendency to form connections to individuals who share similar demographic characteristics (e.g., age, race and gender), attitudes, and/or behaviors
  - assumption of common interest and easy interactions

(Mouw and Entwisle 2006; Hipp and Perrin 2007; Mok, Wellman and Carrasco 2010; Freeman et al., 1988; Butts 2003 & 2011; McPherson et al. 2001; Blau, Ruan, and Ardel 1991; Roth 2004



# Exponential Random Graph Model (ERGM)

- new models developed explicitly to handle network data, that predict the probability of a tie existing between two actors based on:
  - selection processes for physical and social distance
    - e.g., are there more same-gender relationships in the network than we would expect due to chance?
  - social processes that generate the network structure
    - e.g., is the friend of my friend my friend?
  - individual level actor characteristics
    - e.g., do faculty with more years working at UNL have more ties?



# ERGM results

	Research Collaboration Tie		
	<i>Est.</i>	<i>SE</i>	<i>odds ratio</i>
<b>Social Distance</b>			
Same gender dyad <sup>a</sup>	.30	.05	1.36 ***
<b>Race</b>			
White-White dyad <sup>b</sup>	.02	.06	1.02
Nonwhite-Nonwhite dyad <sup>b</sup>	.40	.11	1.49 ***
Age (absolute difference)	-.01	.00	0.99 *

*note: analysis controls for more social and physical distance factors*

notes: <sup>a</sup> comparison group is mixed gender dyads

<sup>b</sup> comparison group is mixed race dyads

- the probability of a collaboration is:
  - *gender*: 36% higher when faculty share the same gender
  - *race*: 49% higher when both faculty are nonwhite compared to when the dyad is mixed race
  - *age*: for each year difference in age within the pair, the probability of collaboration decreases by 1%



## Part #1: Summary and Implications

- on average, UNL faculty have 6.7 collaborators at UNL (3.5 in their department)
- women have fewer collaborators and are less satisfied with collaboration opportunities than men
  - collaborators are often the same-gender, but women only make up 23% of SoBSc & STEM faculty at UNL
    - until more cross-gender collaboration ties form at UNL women will continue to have fewer collaboration opportunities than men



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## Two Different Types of Network Ties

- **Research Networks**

- collaborate with or received research support from
  - e.g., collaborate on papers or grants, review or discuss scholarship, provide resources

- **Friendship Networks**

- spent free time with - not a work function - and/or discuss personal/family matters
  - e.g., share meals or leisure activities, talk about social life, friends or family



# Background

- **Social Capital**

- *Social Closure*: actors benefit from belonging to tight-knit subgroups - a densely connected social circle
- *Structural Holes*: actors benefit from bridging subgroups - connecting distinct social circles

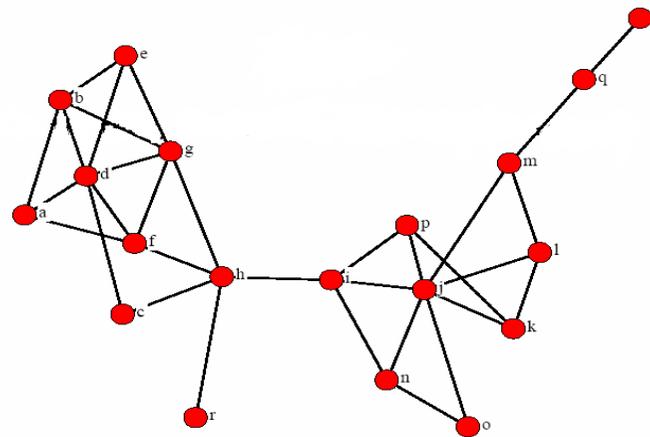
- **Social Perception**

- *Network Comparison Theory*: actors compare their position to others and develop perceptions of relative deprivation or satisfaction with workplace



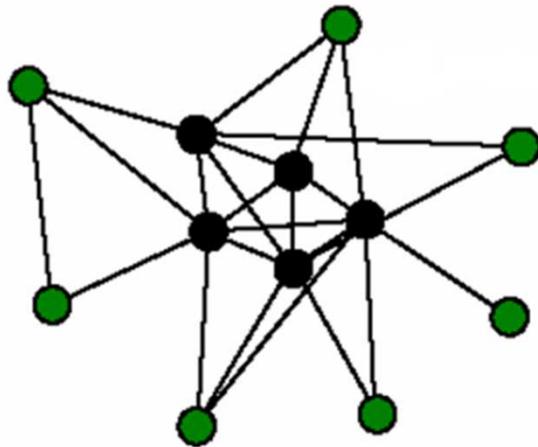
# Faculty Network Characteristics

- Alter-Density (*measures social closure*)
  - number of actual ties among direct faculty connections divided the number of possible ties (range 0 to 100%)
- Ego-Betweenness (*measures structural holes*)
  - # of times an actor lies on the *shortest* path between two actors whom do not have a direct connection (range 0 to 35)



# Faculty Network Characteristics

- Nestedness (*measures network integration*)
  - the deepest cutset an actor resides (range 0 to 8)
    - a cutset is a collection of actors that, if removed, would split the network into two unconnected groups



**Black dots** comprise the core of the network – well integrated faculty

**Green dots** are peripheral actors



## Department Climate Measures

- *Organizational Commitment*: spend the rest of career, take a lot to leave, considered leaving, want to leave
- *Research Valued*: contributions recognized, value my research, receive positive feedback
- *Promotion & Tenure Clarity*: about the body of work reviewed, performance expectations, steps in the evaluation process
- *Promotion & Tenure Fairness*: P & T decisions made on performance-based criteria (e.g., research) rather than non-performance (e.g., politics, relationships)

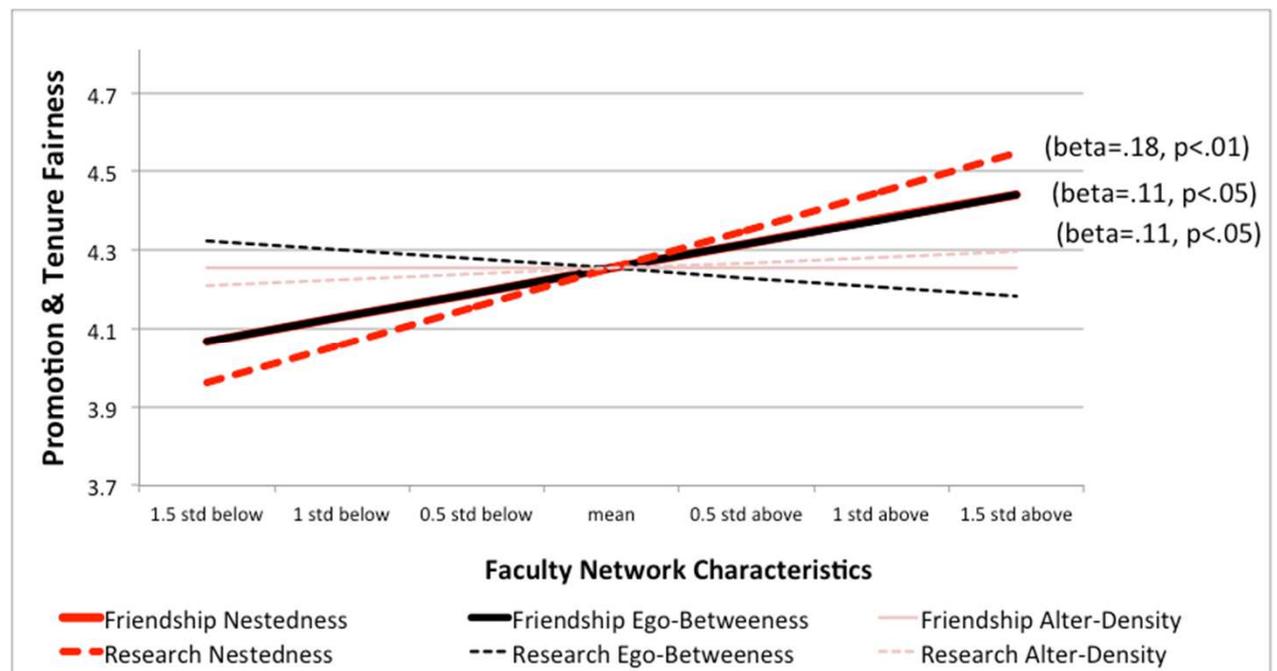
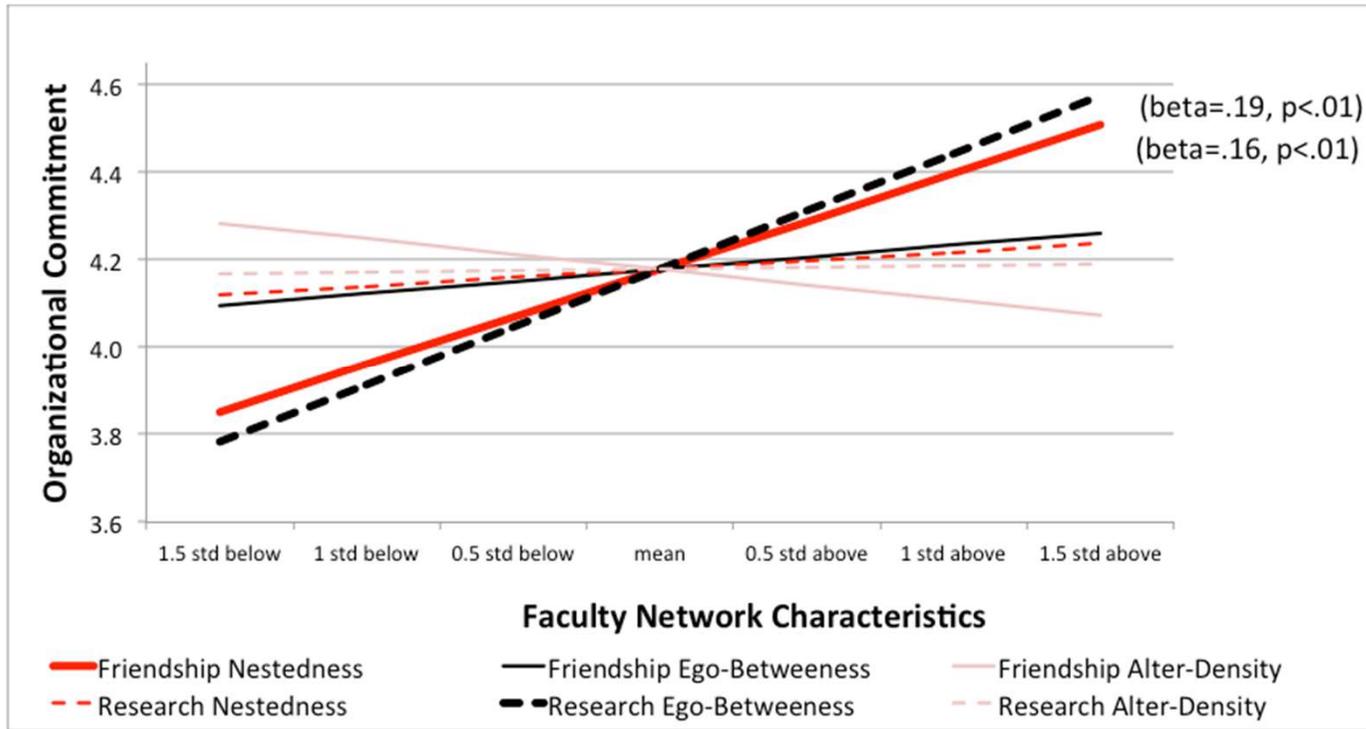


# OLS regression: Faculty Network Characteristics on Department Climate Perceptions

	Organization Commitment	Valued Research	P&T Clarity	P&T Fairness
<b>Friendship Network</b>	<i>beta</i>	<i>beta</i>	<i>beta</i>	<i>beta</i>
Alter-Density	-.05	-.07	-.04	.00
Ego-Betweenness	.04	.06	.10 *	.11 *
Nestedness	.16 **	.21 **	.07	.11 *
<i>R-squared</i>	<i>.053</i>	<i>.119</i>	<i>.063</i>	<i>.073</i>
<b>Research Network</b>	<i>beta</i>	<i>beta</i>	<i>beta</i>	<i>beta</i>
Alter-Density	.01	-.04	.06	.03
Ego-Betweenness	.19 **	.27 ***	-.02	-.04
Nestedness	.03	.07	.10 †	.18 **
<i>R-squared</i>	<i>.063</i>	<i>.148</i>	<i>.053</i>	<i>.056</i>

† p < .10, \* p < .05, \*\* p < .01, \*\*\* p < .001

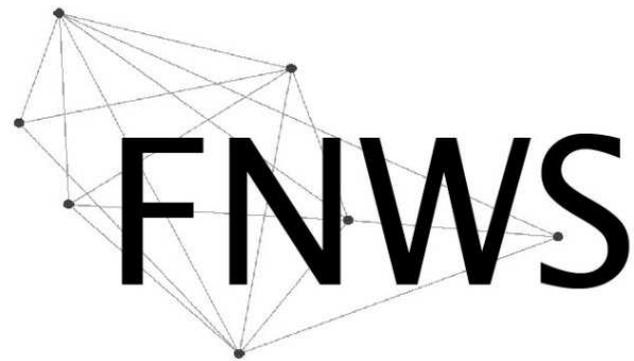
analysis control for gender, race and years since degree



## Part #2: Summary and Implications

- how faculty are embedded within their department networks matters for both research and friendship!
  - faculty on the periphery of department networks are likely to have less positive climate perceptions and may be at risk for leaving UNL
  - faculty who are integrated into different social circles within the department are likely to have the most positive climate perceptions





The second and final wave of data collection for the FNWS will take place in February 2013!

