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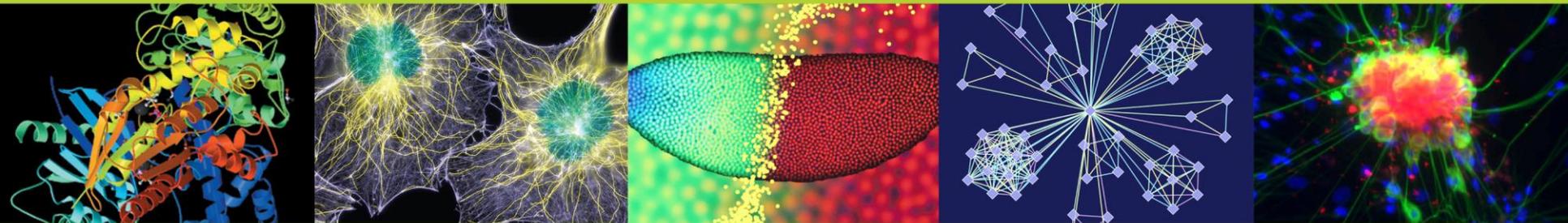


# Career Development of Biomedical PhDs: Cross-cutting Trends & Demographic Differences

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# References and Acknowledgements

**Gibbs KD, Jr., Basson J, Xierali IM, Broniatowski DA. “Decoupling of the minority PhD talent pool and assistant professor hiring in medical school basic science departments in the US.” *eLife* 2016 Nov 17;5. pii: e21393**

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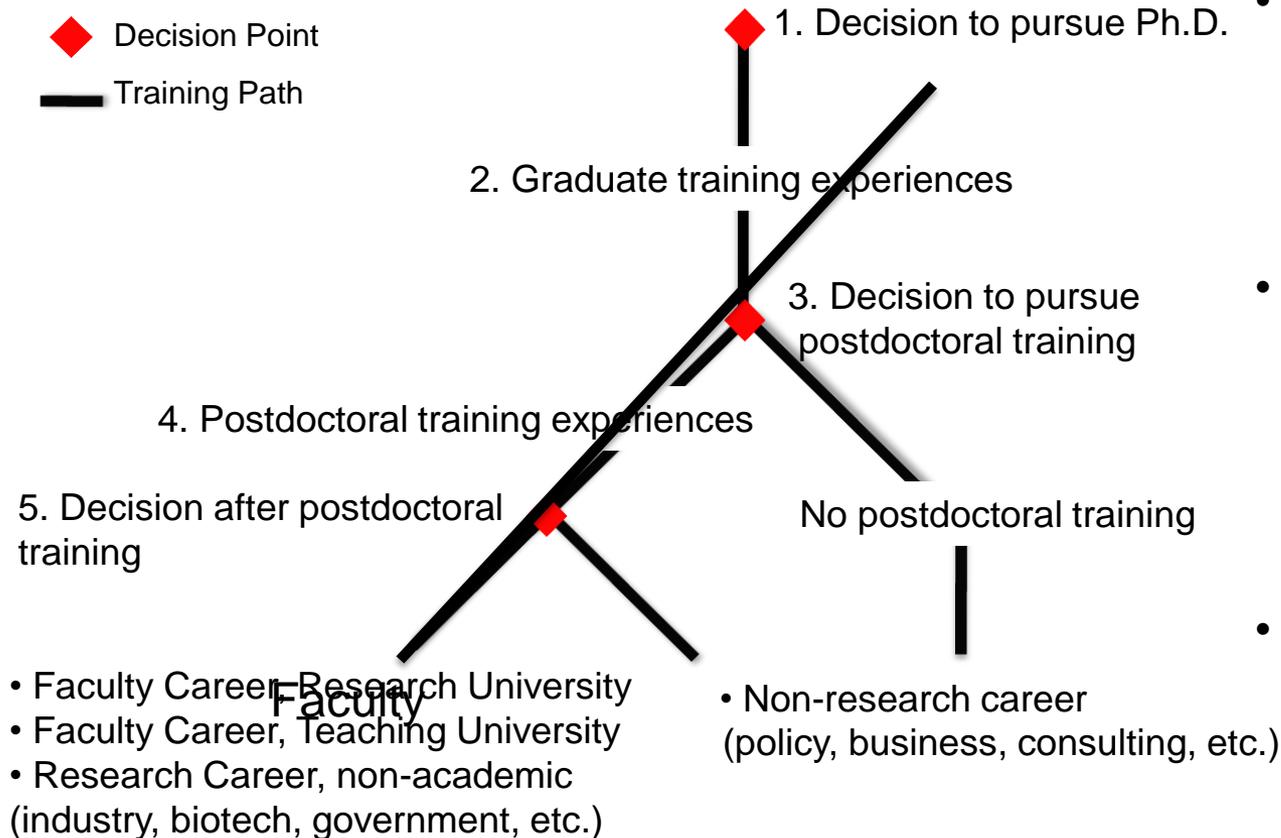


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# Framework: Career Pathway For Ph.D. Scientists



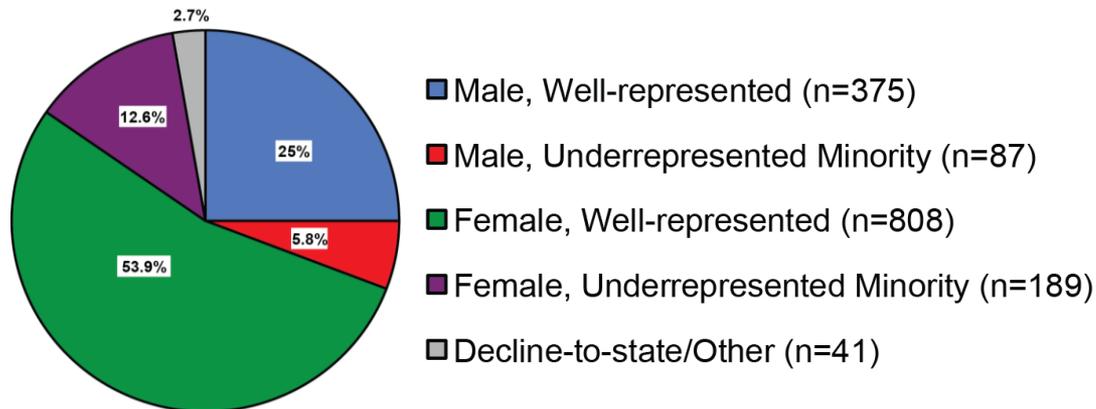
## Research Questions

- What's the process of career interest formation for recent biomedical Ph.D. graduates?
- To what extent does this process differ across demographics (i.e. race/ethnicity, gender, and their intersection)?
- How do career outcomes compare across demographics (e.g. faculty appointments in medical school basic science departments)?

# Mixed Methods Approach

## Quantitative

- Survey of 1500 US citizen and permanent resident biomedical Ph.D. graduates (2007-2012)



URM = African American/Black, Hispanic/Latin@, American Indian, or Alaska Native

Well-Represented (WR) = everyone else (i.e. White, Asian, Other)

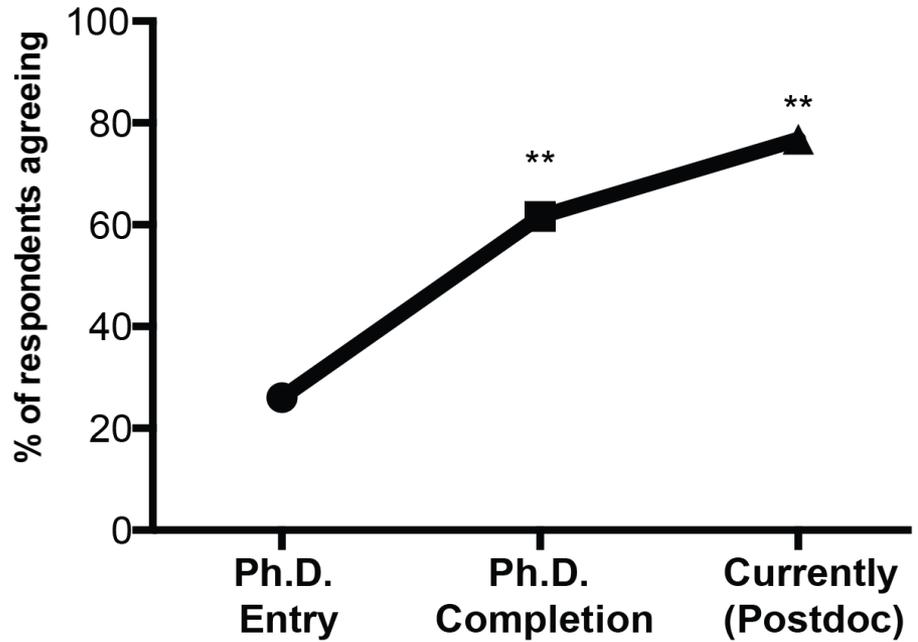
- System-level data from NSF Survey of Earned Doctorates and AAMC Faculty Roster

## Qualitative

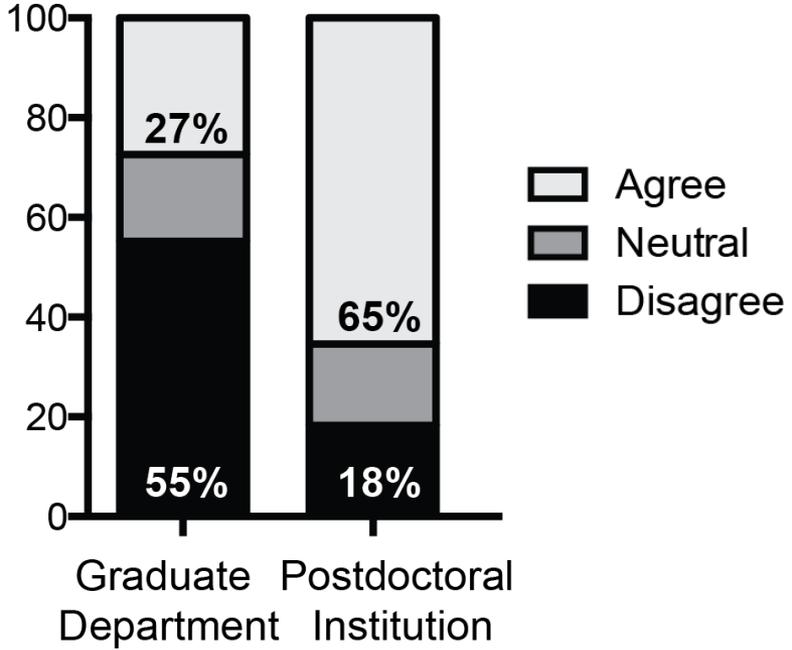
- Focus groups (n=38) and in-depth interviews (n=70)

# Cross-cutting Career Development Challenges

**(B) I was/am knowledgeable about the various career options available to a person with a Ph.D. in my discipline**



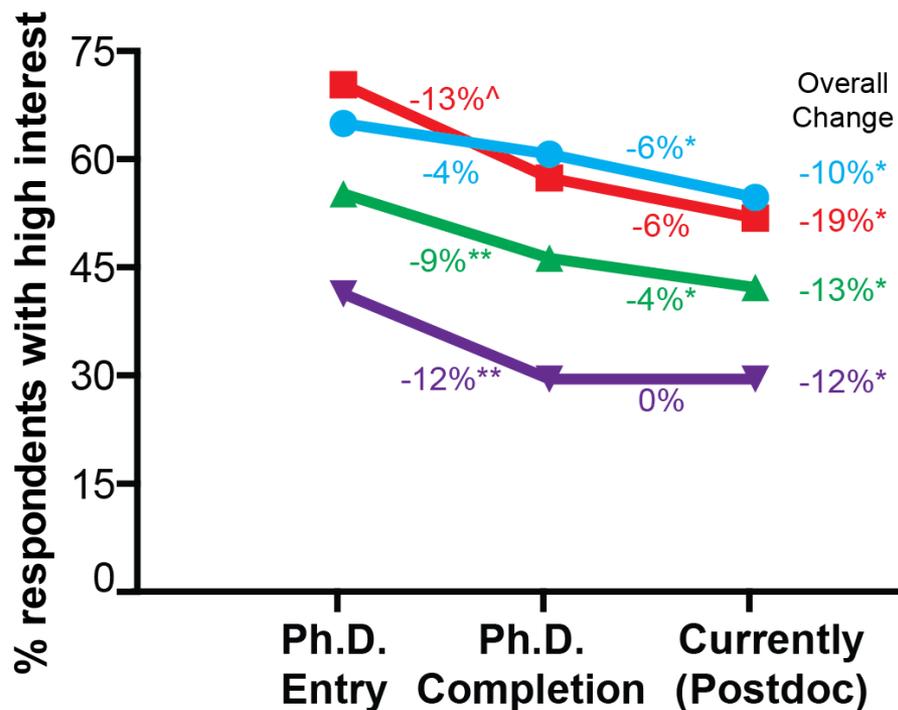
**Offered structured opportunities to explore a variety of career pathways (academic & non-academic)**



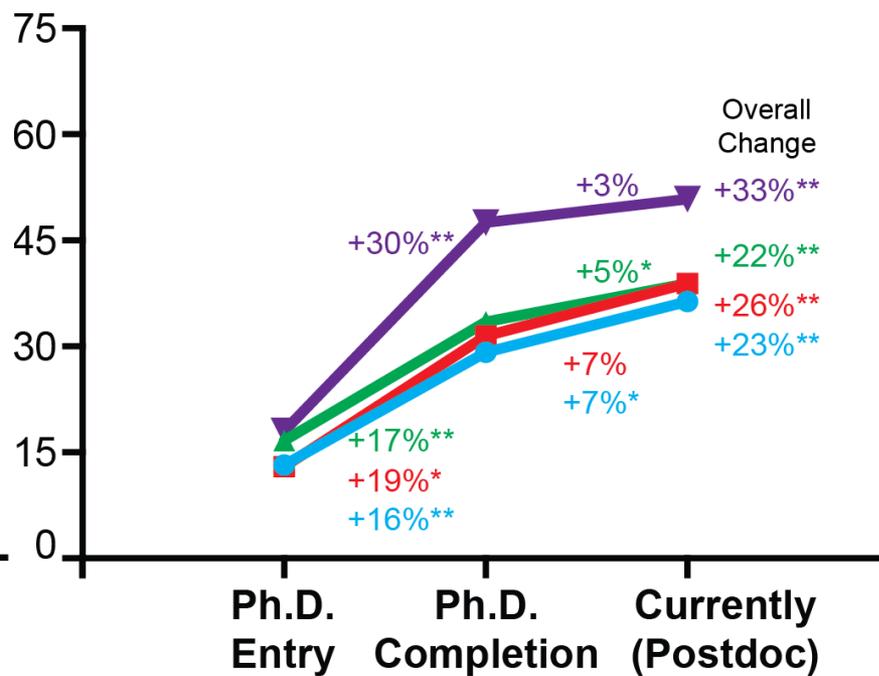
*Poor early career knowledge, career development occurs late in training*

# Cross Cutting & Demographic Differences in Career Interest Changes

## Faculty Career, Research-Intensive University



## Non-Research Career (e.g. policy, business, law)



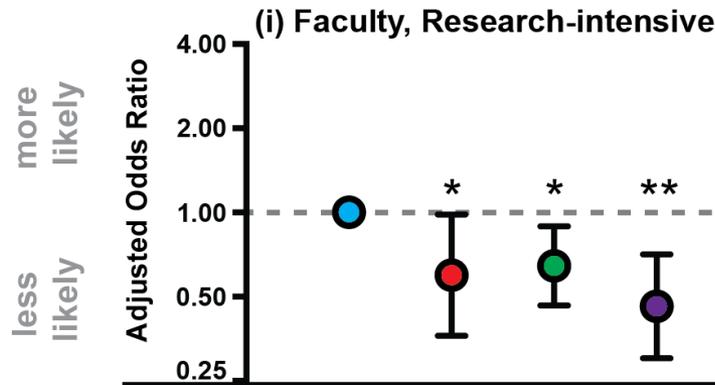
Men, Well-Represented (n=257)  
 Women, Well-Represented (n=547)

Men, URM (n=54)  
 Women, URM (n=122)

Level of significance (time period):  
 \*\*p<0.001 \*p<0.05 ^p<0.10

# Disparate Career Interest Profiles at Ph.D. Completion by Social Identity

(A) Likelihood of high interest in career path at Ph.D. completion



## Positive Predictors:

- High interest & intentions at Ph.D. entry
- Advisor investment in career
- Publication record
- Research self-efficacy
- Departmental support for all careers

## Negative Predictor:

- Ph.D. at “Top 50” university

■ Well-represented, Male (WRM)

■ Underrepresented Minority, Male (URMM)

■ Well-represented, Female (WRF)

■ Underrepresented Minority, Female (URMF)

\* p < 0.05, cf. WRM

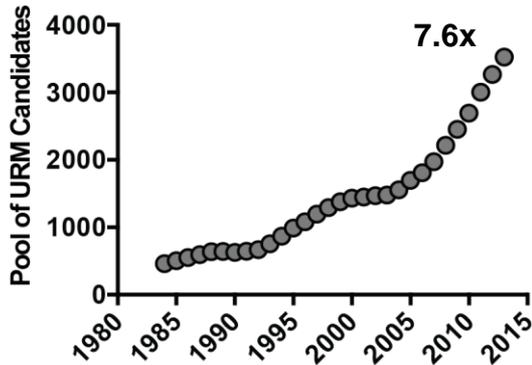
\*\* p < 0.001, cf. WRM

Gibbs et al, PLOS ONE (2014)

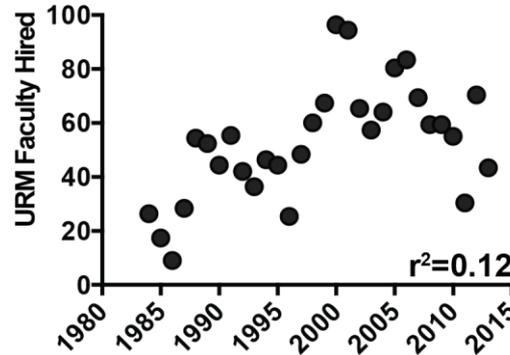
# Distinct Asst. Prof Hiring Dynamics for URM & WR

## (A) URM Faculty Hiring Dynamics

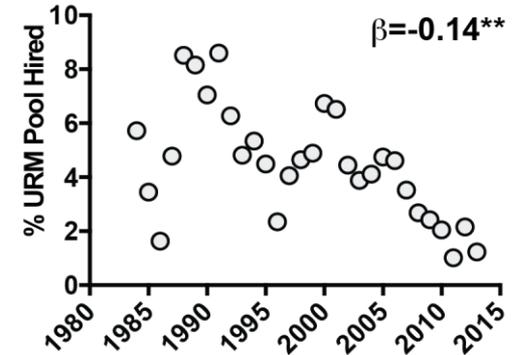
(i) Pool of Potential Candidates



(ii) Number of Faculty Hired

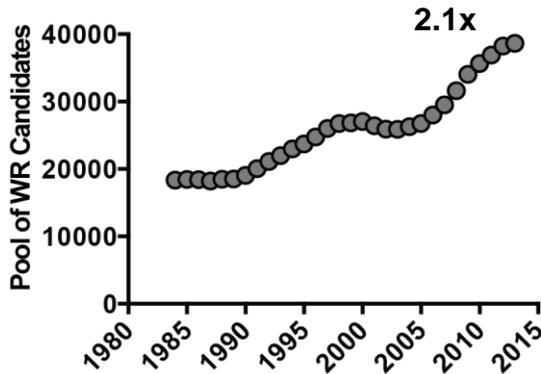


(iii) Percent of Candidate Pool Hired

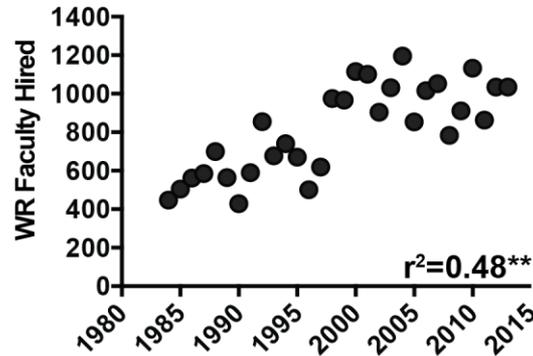


## (B) WR Faculty Hiring Dynamics

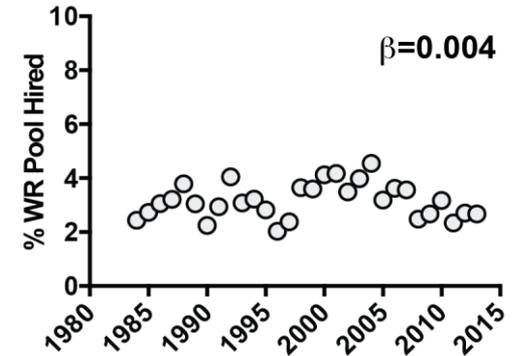
(i) Pool of Potential Candidates



(ii) Number of Faculty Hired



(iii) Percent of Candidate Pool Hired



● Pool of Potential Candidates

● New Faculty Hires (Imputed)

○ Percent of Candidate Pool Hired

\*\*  $p < 10^{-4}$

# Distinct Asst. Prof Hiring Dynamics for URM & WR

## (A) URM Faculty Hiring Dynamics

- Built a system dynamics model to simulate assistant professor hiring trends
- Given current structure of the workforce, model predicted fewer than 9% URM faculty **in 2080** (even if unlimited supply of URM Ph.Ds. or assistant professor positions)
- Faculty diversity increased by focusing on postdoctoral transitions and hiring
- ~100 URM Ph.D. hires per year gives parity with Ph.D. pool (currently graduate ~900 per year)

\*\*  $p < 10^{-4}$

# Vicarious Learning Shapes Outcome Expectations Regarding Academia

## ***Academic Job Market***

“I had a postdoc in my lab who had three *Nature* publications. Three! It took him two-and-a-half years to find a job. He is a very smart person, very good with mentoring...But I am like, if that type of person, [who] did this well cannot find a position...He ended up going to [an institution] and it is obvious that he didn't want to live there, but he had been a postdoc for six years. He just had to move on. He had no control whatsoever in that...” *Will, Low Interest, Male, URM*

## ***Faculty Workload & Lifestyle***

...There's a professor at [graduate university] who's like an amazing mentor to his students, amazing teacher, does all this time on his committees, sits on all of the review panels, publishes in *Science*, has a very full lab, and he's exponentially smarter than I am. And he sleeps three hours a night...If I was gonna be a professor, I wanted to be all of that, you know? And if it, if someone as smart of him, who is exponentially smarter than I am, if he was only getting three hours of sleep a night, I bet my life would be destroyed. You know? And that wasn't worth it to me.

*Frank, Low Interest, WR, Male*

# Structural Dynamics of Academic Workforce

## Also Influenced Career Decisions

- **Men: Academic job market, grant funding, postdoc pay**

“The seeming lack of control you have over your career options as an academic scientist. In terms of, whether not you get grants, or whether or not you publish, especially in this climate where the science funding has stalled or gone down in most cases over the last ten years ...You have no control...and that really turns me off.”

*Will, Low Interest, Male, URM*

“I would have thought twice or even three times about leaving academia had the prospect for [postdoc salary] been something like \$50,000-55,000.”  
*Steve, Low Interest, Male, URM*

- **Women: Life balance, climate**

“I want to have a family and to be able to see my children grow up, not just get home when they are in bed.”

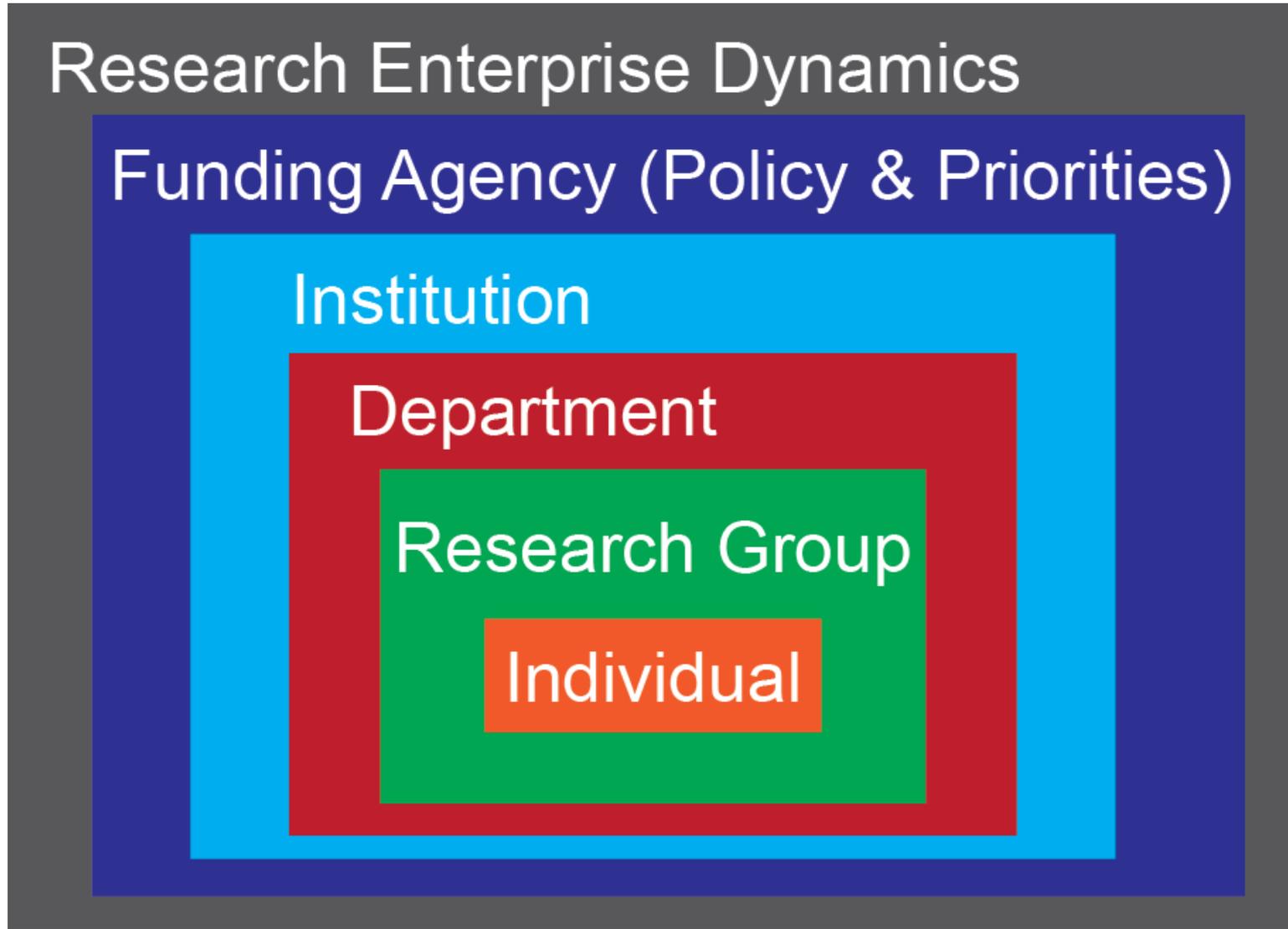
*Mandy, Low Interest, Female, Well-Represented*

“My interaction with [graduate school colleagues] is the thing that deterred me from...seeking a career in an academic environment. I felt that I could hold my own with them...but if I stepped back from it, I was like, there's no reason for me to work really hard to have these people be my peers. That's not what I am excited to do.” *Deborah, Low Interest, Female, URM*

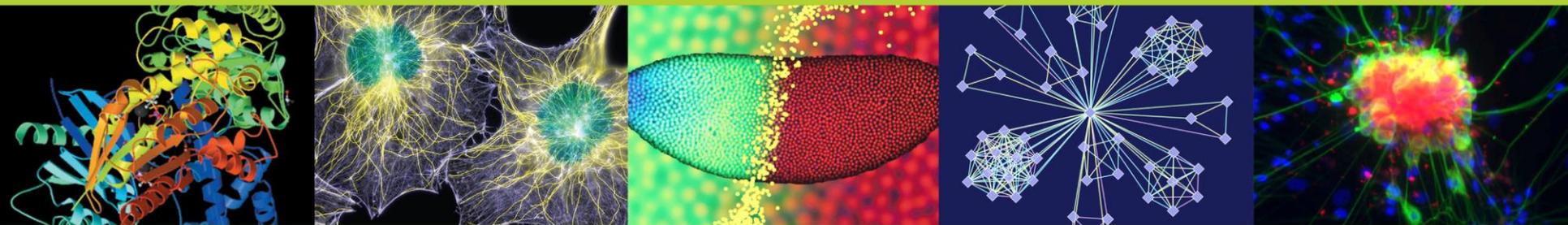
# Takeaways

- **Cross-cutting**
  - Ph.D. students enter with poor knowledge about career options
  - Formalized career development occurs late in training
  - Less interest in faculty careers at research-intensive universities, more interest in careers outside of academia
- **Demographic Differences**
  - Magnitude and kinetics of career interest changes
  - Disparate career interests at Ph.D. completion (not explained by starting interest, advisor relationship, productivity, self-efficacy, etc.)
  - Distinct patterns across URM status in progression from Ph.D. to assistant professor in AAMC basic science departments (size of candidate pool not linked to the number of URMs hired annually)
- **Systemic issues in research enterprise (e.g. grant funding, time to independence, climate, postdoc salary) shape career interests**

# Levels of Influence for Next Gen Researchers



**Thanks for listening!**  
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# STEM Ph.D. Careers Survey

- October 2012- January 2013: Recruited through LinkedIn, Twitter, listservs of Ph.D.-level science policy professionals, academic and government postdocs, direct contact at national scientific conferences, graduate school and postdoctoral administrators, professional societies (e.g. National Postdoctoral Association), snowball sampling
- N=1500, US citizens & permanent residents, completed Ph.D. between 2007-2012

## % Disciplinary Background

Biochemistry & Cell/Molecular Biology	30.00
Neuroscience	13.20
Microbiology & Immunology	12.73
Pharmacology/Toxicology	7.40
Psychology	7.40
Biological Sciences	7.20
Genetics	5.33
Biostat/Epi/Public Health/Clinical Sciences	4.87
Bioengineering	4.73
Biomedical Sciences	3.87
Pathology	1.67
Bioinformatics	1.60

## % Current Position

Postdoc	66.8
Non-Research Career (i.e. science policy, science communication, business, consulting, patent law, technology transfer)	9.2
Research Scientist/Engineer	5.67
Tenure-track Professor	4.13
Academic Position, other than tenure-track professor	4.13
Other	7.53
Unknown/Unemployed	2.47

# Survey Assessed Career Pathway Interests, Knowledge, and Training Experiences

- Career goals and knowledge
- Career pathway interest
  - Faculty, research-intensive university
  - Faculty, teaching-intensive university
  - Research career, non-academic (e.g. industry, pharmaceutical, biotech, government, start up, etc.)
  - Non-research career (e.g. consulting, policy, science writing, patent law, business, etc.)
- Graduate and postdoctoral training experiences and career development
- 5-point Likert scales (1= lowest, 5= highest; interest or agreement)
- Time points: Ph.D. entry, Ph.D. completion, currently
  - Cross-sectional, retrospective

# What Explains Career Pathway Interest at Ph.D. Completion?

- Multiple Logistic Regression
  - Outcome: high career pathway interest at Ph.D. completion (i.e. 4 or 5 on the interest scale)
- Covariates:
  - Personal: Interest & intentions at Ph.D. entry, confidence in research ability
  - Objective: first-author publication rate, time-to-degree, h-index, institution type (Top50 yes/no)
  - Graduate training: sense of belonging (intellectually or socially), advisor interactions, and career development measures