Creating Diverse and Inclusive Science Teams
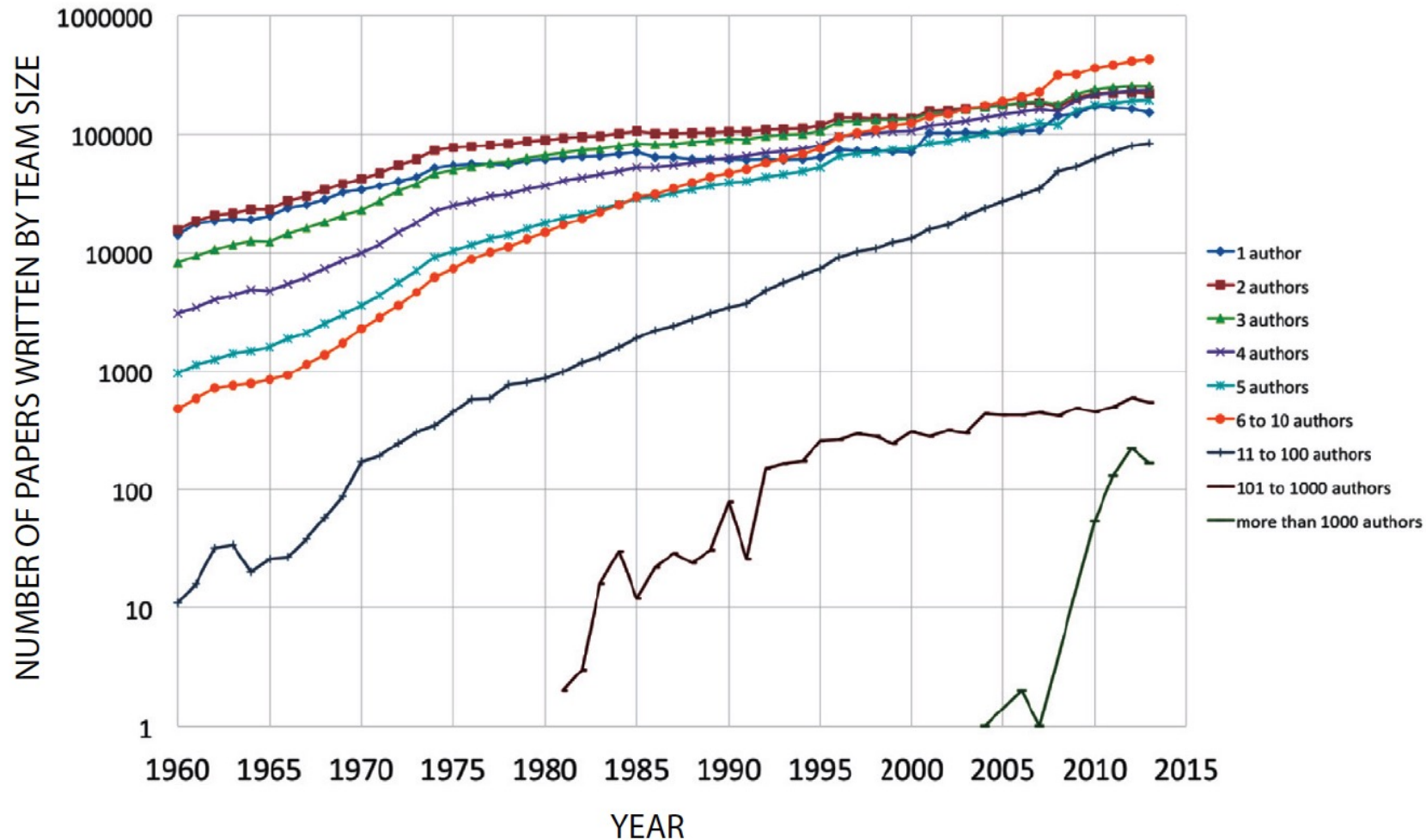
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PI Launchpad

July 27, 2023

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The Rise of Team Science

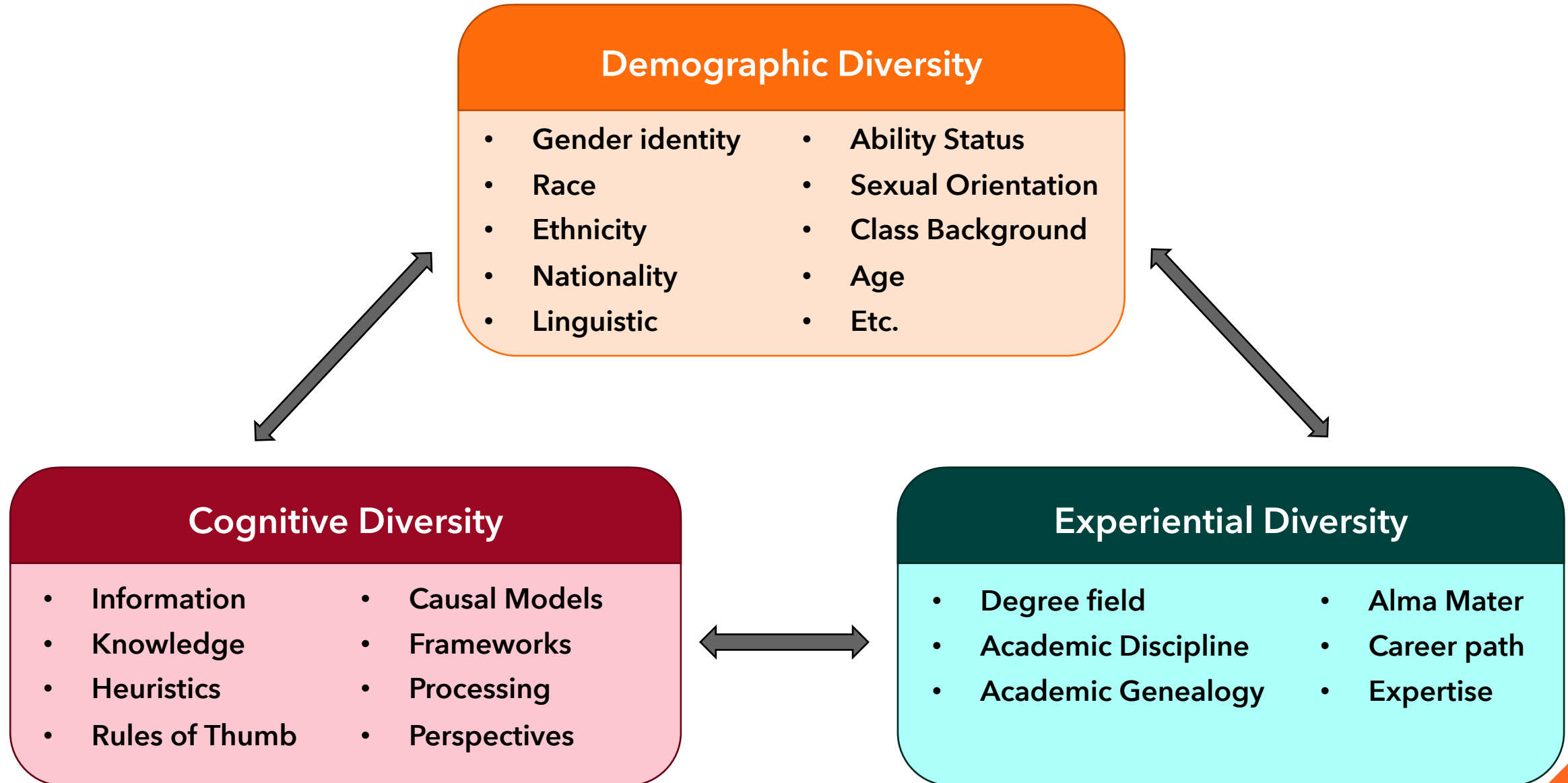**Frequency of author team sizes in S&E, 1960-2013**

- The prevalence of **scientific collaboration** (i.e., team science) has risen over the past several decades.

- Teams are getting **larger**, more **interdisciplinary**, and increasingly **diverse**.

- The process and outcomes of team science have been empirically investigated to identify the **benefits** and **challenges**.

Source: National Academies of Sciences, Engineering, and Medicine. (2015). *Enhancing the effectiveness of team science.*

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The Benefits and Challenges of Team Science

Benefits	Challenges
Increased expertise	Knowledge integration
Greater access to resources via multi-institutional collaboration	More time spent communicating and coordinating
Increased productivity	Potential conflict over misaligned goals or working styles
Ability to onboard additional expertise as needed	Difficult to maintain team cohesion
Diversity of the team enhances creativity and innovation	Realizing the benefits of diversity requires intentional, inclusive approaches

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What is Diversity?

Demographic Diversity

- Gender identity
- Race
- Ethnicity
- Nationality
- Linguistic

- Ability Status
- Sexual Orientation
- Class Background
- Age
- Etc.

Cognitive Diversity

- Information
- Knowledge
- Heuristics
- Rules of Thumb

- Causal Models
- Frameworks
- Processing
- Perspectives

Experiential Diversity

- Degree field
- Academic Discipline
- Academic Genealogy

- Alma Mater
- Career path
- Expertise

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The Diversity Effect

Diversity Interrupts Group Think

- Group Think: Overly cohesive teams ignore information or ideas that challenge group norms or flow.

- Diversity leads to generative "friction that enhances deliberation and upends conformity."[1]

- Diversity results in a wider range of information exchange, more discussion, and fewer errors. [2]

Diversity Leads to Innovative Solutions

- Diversity encourages us to anticipate differences.[3,4]

- Diverse perspectives lead groups to consider alternatives.

- Resolving dissent requires novel, integrative, complex solutions.

Sources:
[1] S. S. Levine et al. (2014). Ethnic diversity deflates price bubbles. *PNAS, 111*(52).
[2] S. R. Sommers. (2016). On racial diversity and group decision-making: Identifying multiple effects of racial composition on jury deliberations. *Journal of Personality and Social Psychology, 90*(4), 597.
[3] S. E. Page (2007). *The difference: How the power of diversity creates better groups, firms, schools, and societies.* Princeton University Press.
[4] S. E. Page (2017). *The diversity bonus.* Princeton University Press and Andrew W. Mellon Foundation.

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The Benefits of Diversity in Team Science

- **From a pool of agents of similar ability, diverse groups outperform homogenous groups because…**

…Diverse groups draw from a larger space of:

- **Perspectives (i.e., internal representations of problems)**

- **Heuristics (i.e., algorithms used to locate solutions)**

"When trying to solve complex problems, progress often results from diverse perspectives. That is, the ability to see the problem differently, not simply "being smart," often is the key to a breakthrough. As a result, when groups of intelligent individuals are working to solve hard problems, the diversity of the problem solvers matters more than their individual ability. Thus, diversity is not distinct from enhancing overall quality–it is integral to achieving it."

-- *The Difference*, S. E. Page (2008)

Source: L. Hong & S.E. Page (2004). Groups of diverse problem solvers can outperform groups of high-ability problem solvers. PNAS, 101(46). https://doi.org/10.1073/pnas.0403723101

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The Benefits of Diversity in Team Science

- In a review of 2.57 million scientific papers published between 1985-2008 across 11 scientific fields…

…Papers written by ethnically diverse groups:

- Were more highly cited

- Were published in journals with higher impact factors.

After controlling for the number of authors and population density of author locations.

- Similar findings for gender diversity (Campbell et al., 2013).
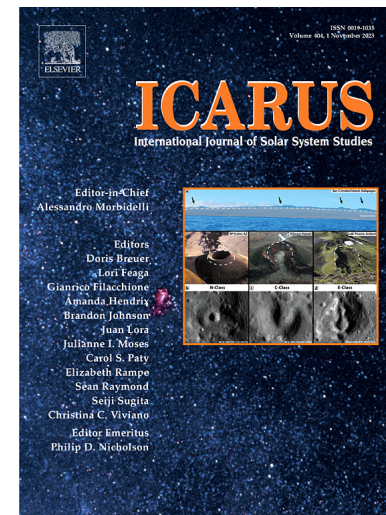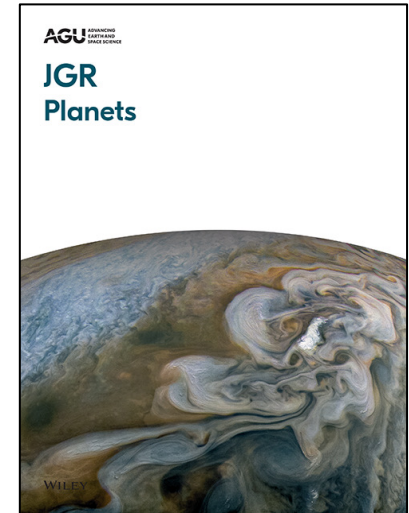
Sources: R. B. Freeman & W. Huang (2014). *NBER Working Paper No. 19905.*
L.G. Campbell, S. Mehtani, M. E. Dozier, J. Rinehart (2013). *PLoS ONE 8*(10).

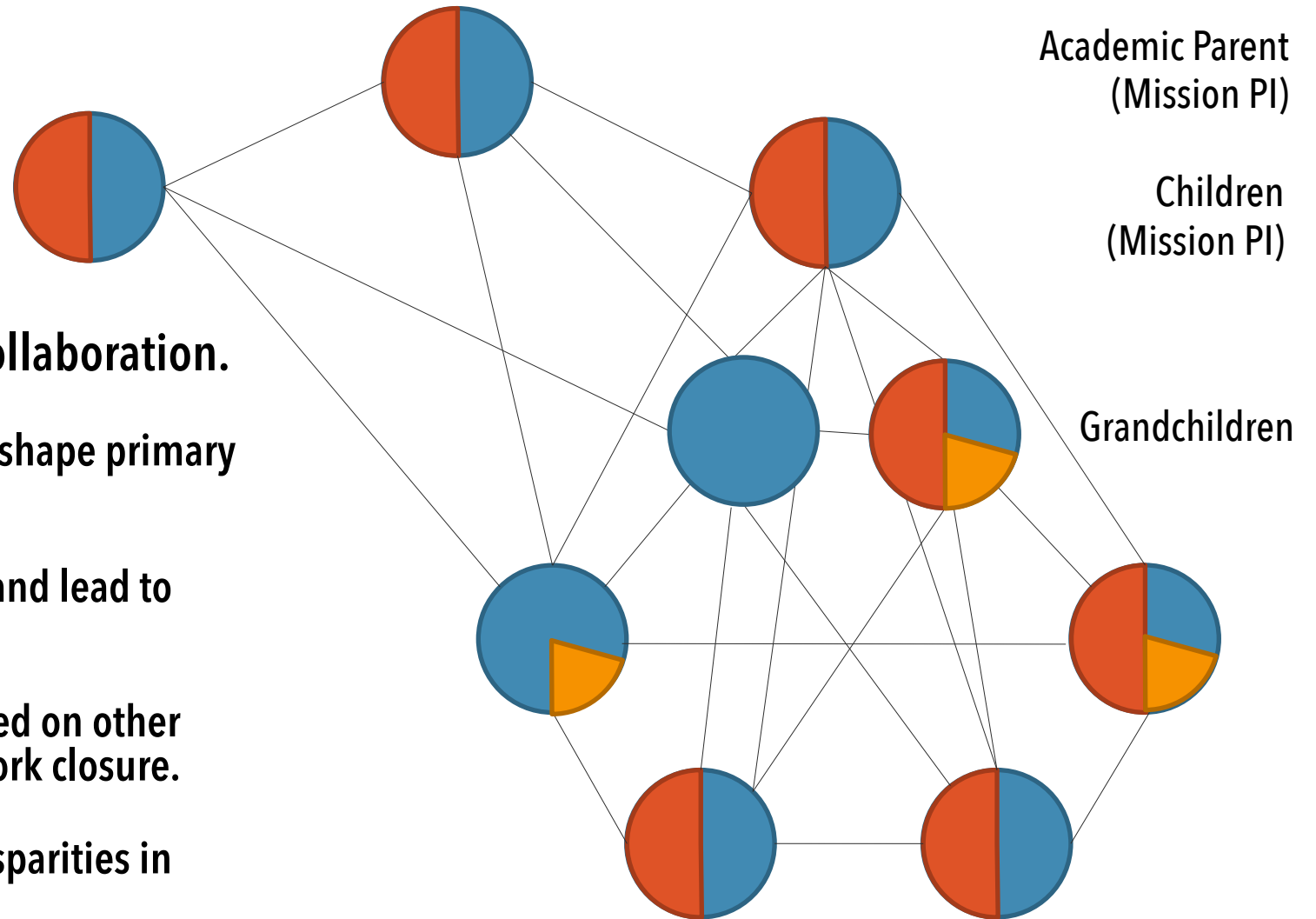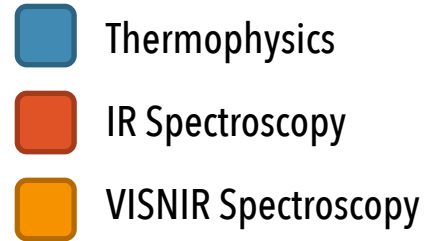# Creating the Conditions to Realize the Benefits of Diversity
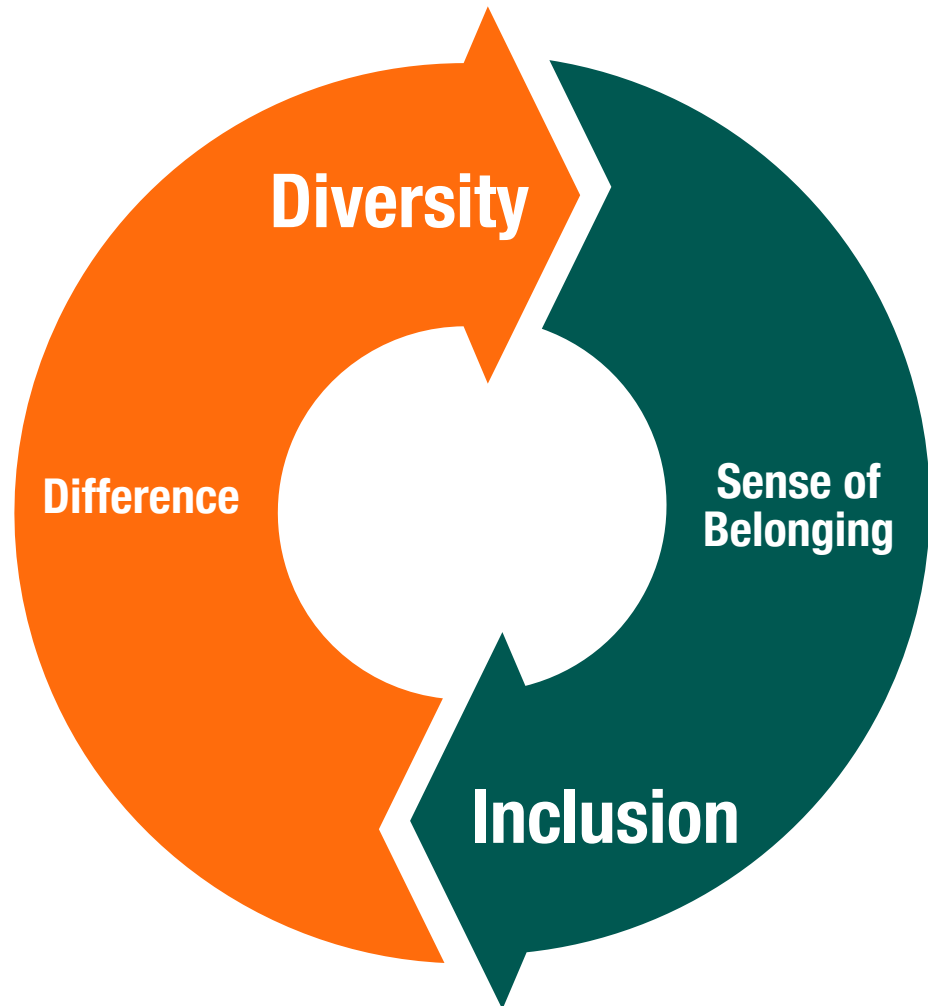
- Establish inclusive systems to increase and retain the diversity of the research team (e.g., admissions, hiring, evaluation).

- Build capacity for inclusive interactions and behaviors among team members.

- Plan for the collaborative and interpersonal aspects of the research as well as the scientific and technical aspects:
  - Decision-making
  - Conflict resolution
  - Providing and receiving feedback
  - Team development and cohesion

Sources: NASEM. (2015). *Enhancing the effectiveness of team science.*
R. Tulshyan (2022). *Inclusion on purpose.*
F. Dobbins & A. Kalev (2022). *Getting to diversity: What works and what doesn't.*

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Barriers to Diverse and Inclusive Systems: Homophily

Legend:
- Thermophysics
- IR Spectroscopy
- VISNIR Spectroscopy

Academic Parent (Mission PI)

Children (Mission PI)

Grandchildren

Homophily is common in research collaboration.

- **Academic pedigree and genealogy shape primary collaborative units.**

- **Areas of expertise structure teams and lead to bridging ties.**

- **Familiarity, particularly when formed on other funded projects, can increase network closure.**

- **There is also evidence of gender disparities in access to research networks.**

Sources: Li, W., Zhang, S., Zheng, Z. et al. Untangling the network effects of productivity and prominence among scientists. Nat Commun 13, 4907 (2022). https://doi.org/10.1038/s41467-022-32604-6

Schwartz LP, Liénard JF, David SV. (2022). Impact of gender on the formation and outcome of formal mentoring relationships in the life sciences. PLoS Biol 20(9): e3001771. https://doi.org/10.1371/journal.pbio.3001771

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Barriers to Diverse and Inclusive Systems: Biases

Team formation requires that we make judgments about people, their competence and abilities. These judgments can be influenced by implicit and explicit biases.

Affinity Bias

Halo/Horn Effects

Anchor Bias

Confirmation Bias

Contrast Effect

Attribution Bias

Stereotyping

Conformity Bias

Barriers to Diverse and Inclusive Systems: Biases

Team formation requires that we make judgments about people, their competence and abilities. These judgments can be influenced by implicit and explicit biases.

Affinity Bias

Tendency to prefer people who share similar interests, backgrounds, and experiences.

Halo/Horn Effects

Judgment of a person's character is generalized from a positive (halo) or negative (horn) impression in one specific area.

Anchor Bias

Tendency to hold onto an initial, singular piece of information to make decisions.

Confirmation Bias

Tendency to (consciously or unconsciously) seek out information that conforms to your pre-existing viewpoint, while ignoring information that goes against your pre-existing view.

Contrast Effect

Comparison of two or more things that you have been in contact with simultaneously or one right after the other, causing you to exaggerate the performance of one in contrast to the other.

Attribution Bias

Judgment of a person's behaviors based on prior observations and interactions you have had with that individual.

Stereotyping

Expecting a group or person to have certain qualities without having real information about the person; generalizing while ignoring individual difference.

Conformity Bias

Increased likelihood to adopt a belief as more people hold that belief; groupthink.

Biases Can Affect Our Assessments of High-Ability STEM Talent

In an experimental study, biology and physics faculty were asked to evaluate postdoc candidates based on otherwise identical CVs with gendered/racialized names.

	Gender Bias	**Racial Bias**
Biology	**Hireability and Competence:** Male = Female	**Hireability and Competence:** Asian > Black **Hireability:** Asian > Latinx
Physics	**Hireability and Competence:** Male > Female	**Hireability and Competence:** Asian and White > Black and Latinx

Source: Eaton, A. A., Saunders, J. F., Jacobson, R. K., & West, K. (2020). How gender and race stereotypes impact the advancement of scholars in STEM: Professors' biased evaluation of physics and biology post-doctoral candidates. *Sex Roles*, *82*, 127-141.
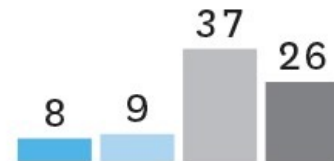
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Biases Can Contribute to Inequitable Experiences
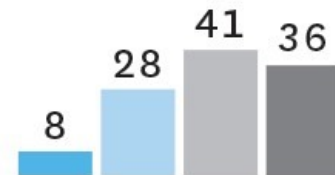

PERCENT OF U.S. WOMEN IN STEM WHO REPORT…

having to provide more evidence of competence than others to prove themselves.
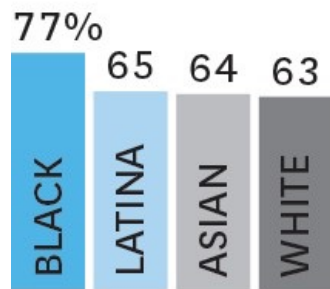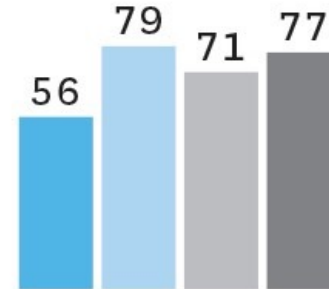
that colleagues have suggested they should work fewer hours after having children.
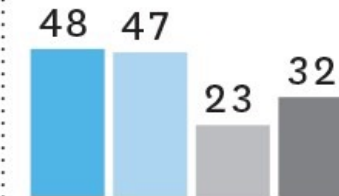
that at work, they find themselves pressured to play a stereotypically feminine role.*

that women in their work environments support one another.

they've been mistaken for either administrative or custodial staff.

77% BLACK | 65 LATINA | 64 ASIAN | 63 WHITE

8 | 9 | 37 | 26

8 | 28 | 41 | 36

56 | 79 | 71 | 77

48 | 47 | 23 | 32

*SUCH AS "OFFICE MOTHER" OR "DUTIFUL DAUGHTER."
SOURCE JOAN C. WILLIAMS, KATHERINE W. PHILLIPS, AND ERIKA V. HALL

HBR.ORG

Sources: Williams, J. C., Phillips, K. W., & Hall, E. V. (2014). Double jeopardy? Gender bias against women in science. UC Hastings College of Law, San Francisco, CA.

Williams, J. C. (2015). The 5 biases pushing women out of STEM. Harvard Business Review.

Strategies to Mitigate the Influence of Bias

Practice De-biasing Techniques
- Stereotype Replacement
- Counter-Stereotypic Imaging
- Increase opportunities for contact.

Avoid Your Triggers for "Biased" Decision-making
- Doubt your own objectivity
- Improve conditions of decision-making (maximize time, minimize stress)
- Rely on data, not perceptions of "fit"

Use Tools to Optimize Decision-Making
- Seek clarity in criteria and how to evaluate performance before evaluation begins.
- Be consistent and apply criteria to all candidates.
- Articulate the reasoning for every decision.
- Look for other/outside perspectives.

Source: J. Moody (2010). *Rising above cognitive errors: Guidelines to improve faculty searches, evaluations, and decision-marking.*

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Constructing a Diverse Science Team

Be Intentional

- Include personnel from historically underrepresented populations

- Seek out those who have done training in a range of geographical locations, institutions

- Represent a range of career stages

- Look to different types of institutions and organizations (e.g., MSIs: HBCUs, HSIs; research active and/or master's level institutions (e.g., R2s); Non-IHEs)

- Consider individuals from varying scientific fields to contribute to transdisciplinary aspects of the proposed work
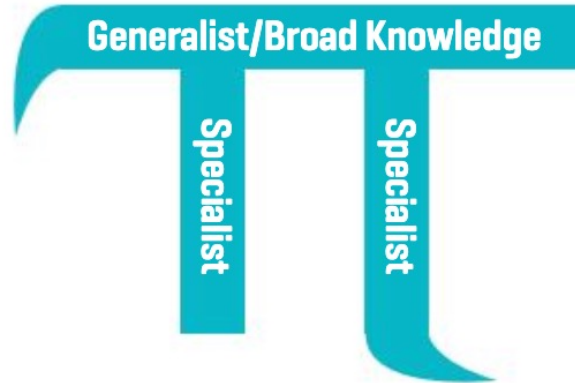
Be Strategic

- Think about diversity early, and play the long game

- Seek out ways to build in training and mentorship opportunities for diverse student- and postdoctoral researchers

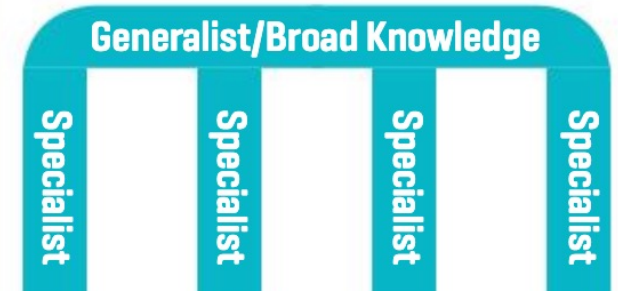- Cultivate reciprocal relationships and partnerships

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Constructing a Diverse Science Team
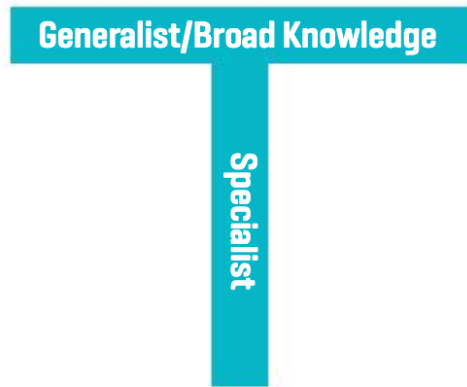
T-shaped model

Pi-shaped model

Comb-shaped model

Consider multiple profiles of knowledge, deep expertise, and skill sets
- Increases pool of potential collaborators/team members
- Broadens possibilities for reaching outside of your network
- Counterforce against network closure

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Build Capacity for Inclusive Interactions and Behaviors

Psychological Safety

- Shared perception among team members that they will not be embarrassed, rejected, or punished for speaking up with ideas, questions, concerns, or mistakes.

Inclusive Behaviors

- Develop the ability to think with others.

- Value the diverse ways people frame questions, process new information, and innovate new ideas.

Sense of Belonging

Mutual Respect

Interpersonal Trust

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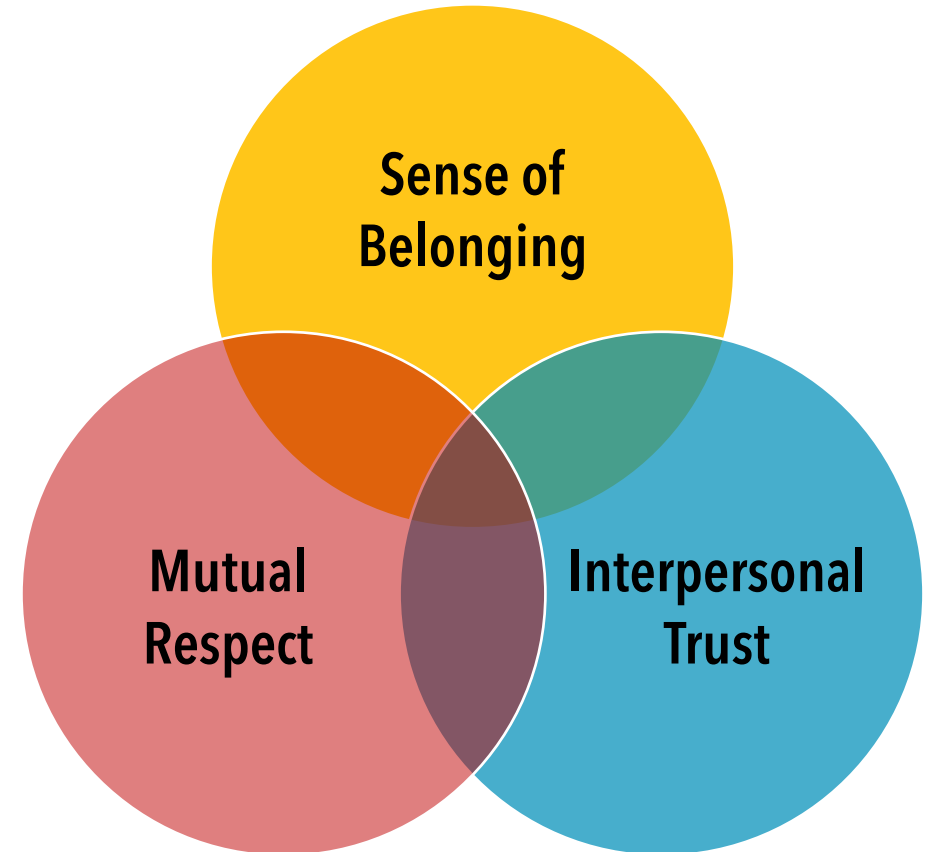
Recognize Subtle Acts of Exclusion

VERBAL

"You're so articulate."

NONVERBAL

Avoiding Eye Contact or Interaction

ENVIRONMENTAL

Only pictures of white male physicists in the hallways

Sue, D. W., Capodilupo, C. M., Torino, G. C., Bucceri, J. M., Holder, A. M. B., Nadal, K. L., & Esquilin, M. (2007). Racial microaggressions in everyday life: Implications for clinical practice. *American Psychologist*, 62(4), 271–286. https://doi.org/10.1037/0003-066X.62.4.271

Solorzano, E., Perez Huber, L., & Huber-Verjan, L. (2020). Theorizing racial microaffirmations as a response to racial microaggressions: Counterstories across three generations of critical race scholars. *Seattle Journal for Social Justice. 18*(2).

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Strategies For Addressing Subtle Acts of Exclusion:

1. Assume good intent, explain impact
   - I know what you meant….but the impact of it….

2. Ask a question about it
   - What do you mean by that?

3. Interrupt the sentence/behavior and redirect the conversation
   - Let's talk about _____

4. Broaden it back out to a universal human behavior
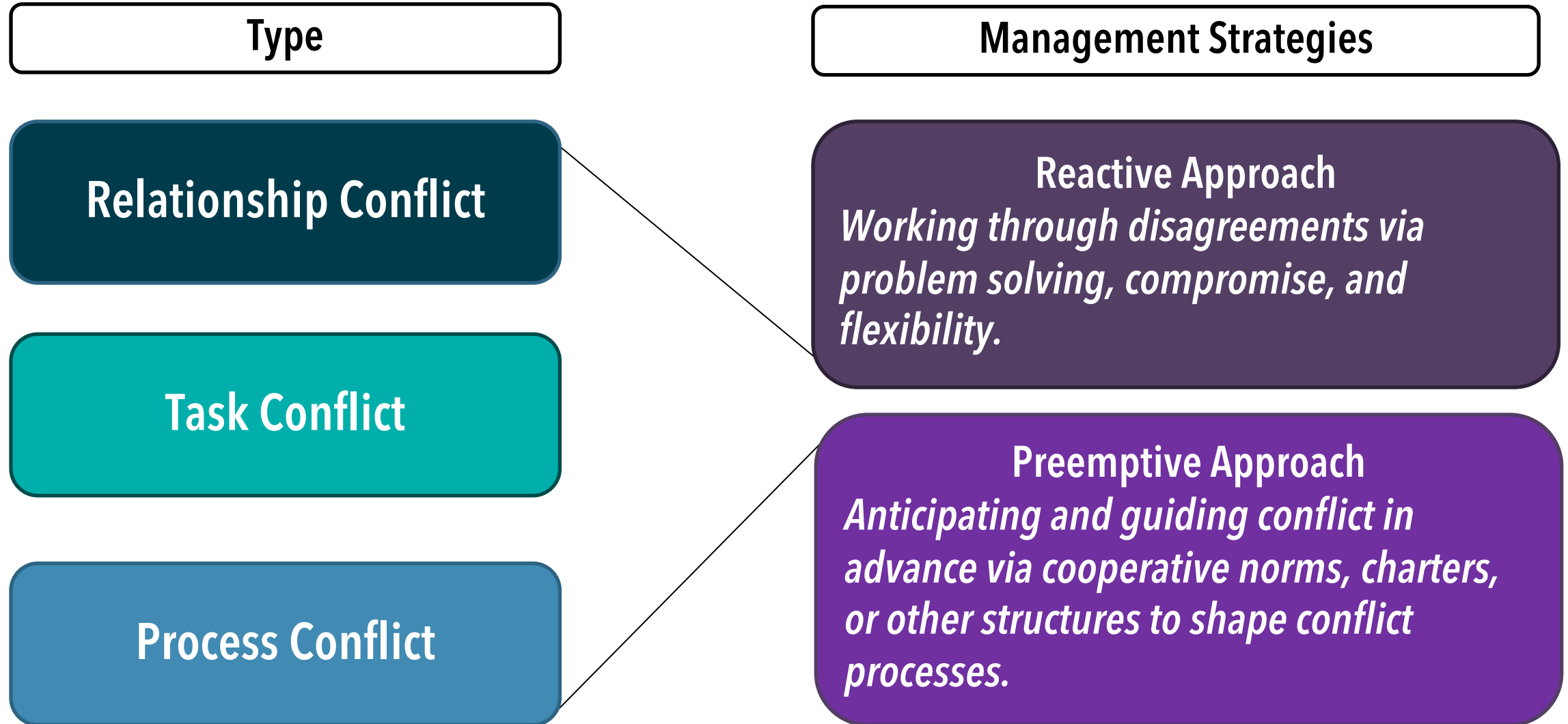   - I think that applies to just about anyone….

5. Help individualize it
   - Is there someone in particular you're talking about?

6. OUCH
   - ouch, that hurts

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Establish Team Processes: Conflict Resolution

Type	Management Strategies
Relationship Conflict	**Reactive Approach** *Working through disagreements via problem solving, compromise, and flexibility.*
Task Conflict	
Process Conflict	**Preemptive Approach** *Anticipating and guiding conflict in advance via cooperative norms, charters, or other structures to shape conflict processes.*

Source: NASEM. (2015). *Enhancing the effectiveness of team science.*

Establish Team Processes: Reporting and Addressing Harassment and/or Bias

RE-FRAME	Research integrity and ethical behavior includes maintaining a research environment free from harassment, bias, and discrimination.
PREVENT	Develop a shared understanding of what is meant by harassment and engage in regular training to prevent it.
SET STANDARDS	Maintain clear, unambiguous standards of professional behavior and policies.
FACILITATE REPORTING	Provide accessible and effective means for reporting in all research environments, and ensure process is well-known by all team members.
LEVERAGE RESOURCES	Partner with the Title IX or similar office to ensure the safety of all parties, investigate the allegations, and determine the appropriate sanctions in the event of findings.

Sources: NASEM. (2022). *Action collaborative on preventing sexual harassment in higher education: Year three annual report of activities.*
NSF. (2023). Stop harassment: Promising practices.

Establish Team Processes: Giving and Receiving Feedback

Ensure feedback is timely, specific, actionable, candid
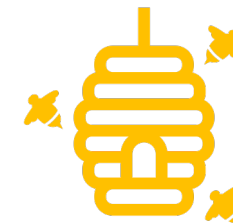
Reflect on your intention for giving feedback

Examine how biased norms can lead to biased feedback

Focus on substance, not style

Deliver feedback with the Situation-Behavior-Impact framework

Get comfortable feeling uncomfortable

Sources: NASEM. (2015). *Enhancing the effectiveness of team science;* R. Tulshyan (2022). *Inclusion on purpose.*

Case Study Activity

Use the QR Code to download the case study.

Take the time you need to read the case study.

Work in small groups to complete the worksheet in the PI Launchpad workbook.

https://tinyurl.com/LMPLaunchpad

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Questions and Discussion

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