

Scientific Collaboration in Interdisciplinary and International Settings

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INSTITUTE FOR RESEARCH
IN THE SOCIAL SCIENCES
COLORADO STATE UNIVERSITY

Introductions



Jeni Cross, PhD



Anne Mook, PhD



Trends in the Science of Team Science



The Impact of Team Science



Interdisciplinary and international communication

Objectives

Poll: Where in the World are You?

- US South
- US Northeast
- US Midwest
- US West
- Canada
- Latin America
- Scandinavia
- Western Europe
- Mediterranean
- Eastern Europe
- Africa
- Elsewhere in the world





**TRENDS IN THE
SCIENCE OF
TEAM SCIENCE**



POTENTIAL

**GLOBAL
IMPERATIVES**

**UNIQUENESS
PEOPLE, PLACE
& TIME**

Climate Change

Feeding the Globe

Human Health

Ending Homelessness

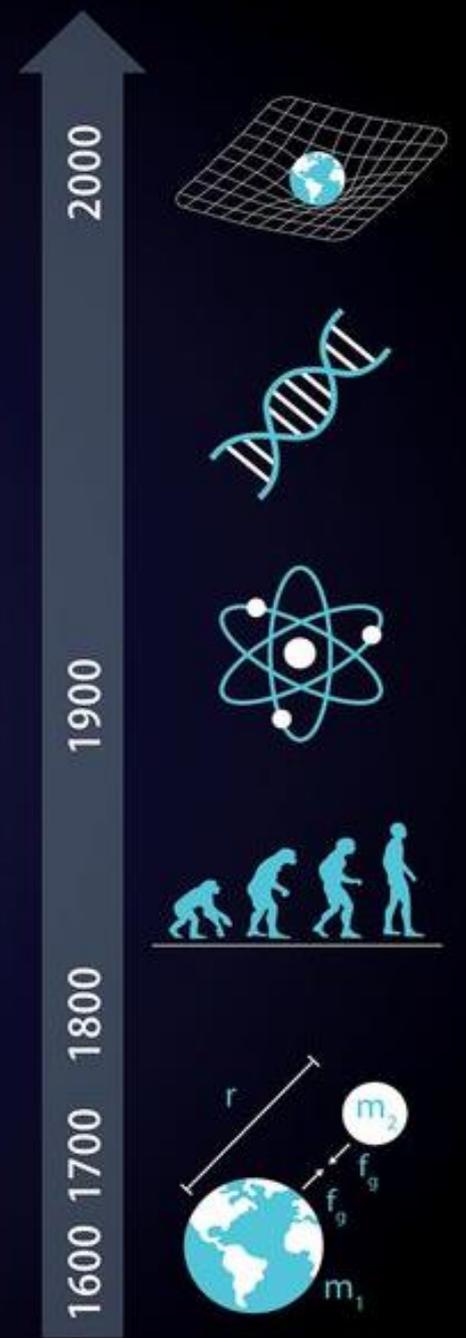
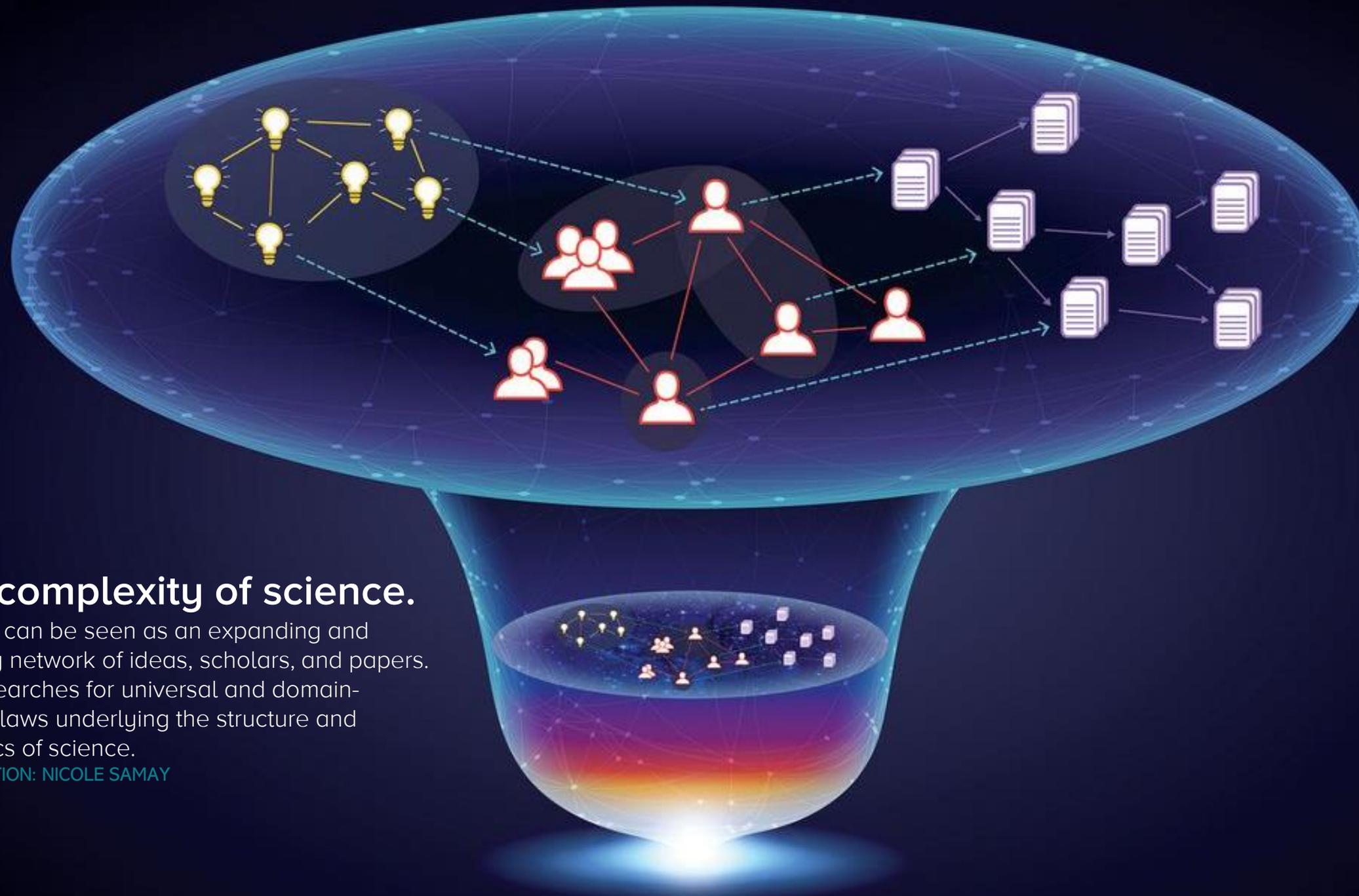
Exploring Universe



The grand challenges of today will not be solved by one discipline alone. They require convergence: the merging of ideas, approaches and technologies from widely diverse fields of knowledge to stimulate innovation and discovery.

A digital globe of the Earth is centered in the image, rendered in a golden-brown, textured style. It is surrounded by a complex network of white and blue lines and dots, suggesting a global network or data flow. A bright, glowing light source is positioned behind the globe, creating a lens flare effect. The background is a dark blue space filled with faint, distant stars and a large, semi-transparent circular arc. A dark horizontal bar is overlaid across the middle of the image, containing the text.

Current Shifts in Science



The complexity of science.

Science can be seen as an expanding and evolving network of ideas, scholars, and papers. SciSci searches for universal and domain-specific laws underlying the structure and dynamics of science.

ILLUSTRATION: NICOLE SAMAY

Science of Science (Fortunato et al. 2018)



Open Science

VERY Big Team Science

New Analytic Power

Data Intensive Science

Complexity Science

Science is Growing in Complexity

Growing Convergence Research at NSF

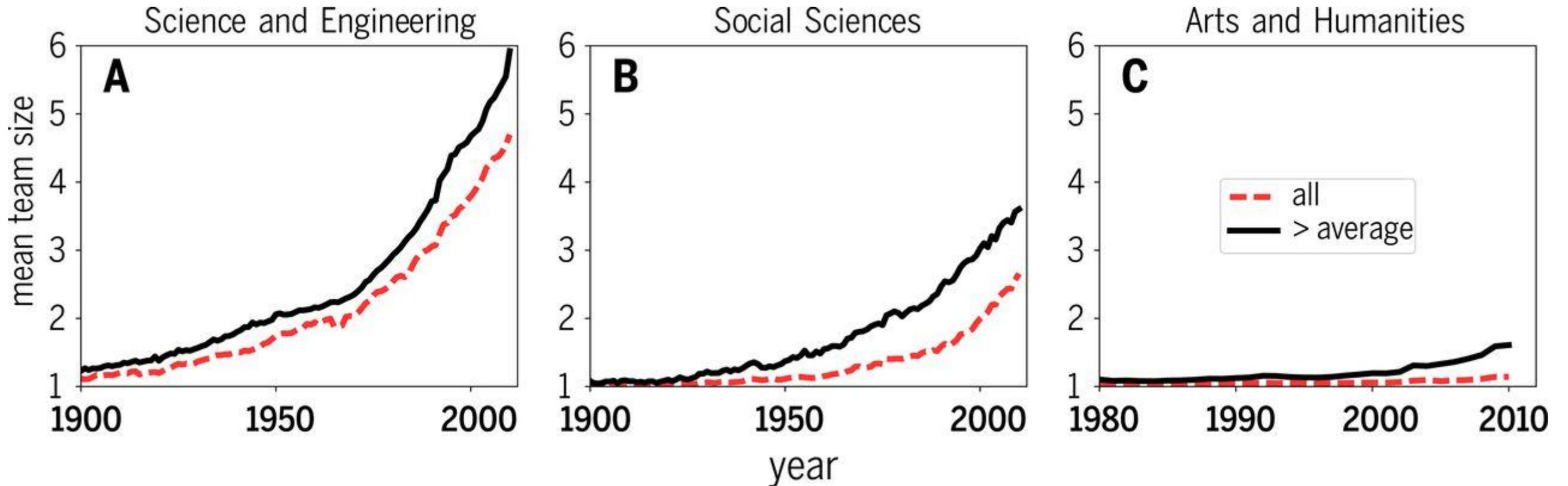
Supports transitioning teams from research that is multidisciplinary to research that transcends disciplinary boundaries with novel conceptual frameworks, theories and methods.

Research driven by a specific and compelling problem. Convergence Research is generally inspired by the need to address a specific challenge or opportunity, whether it arises from deep scientific questions or pressing societal needs.

Deep integration across disciplines. As experts from different disciplines pursue common research challenges, their knowledge, theories, methods, data, research communities and languages become increasingly intermingled or integrated. New frameworks, paradigms or even disciplines can form sustained interactions across multiple communities.

Teams are Growing in Size

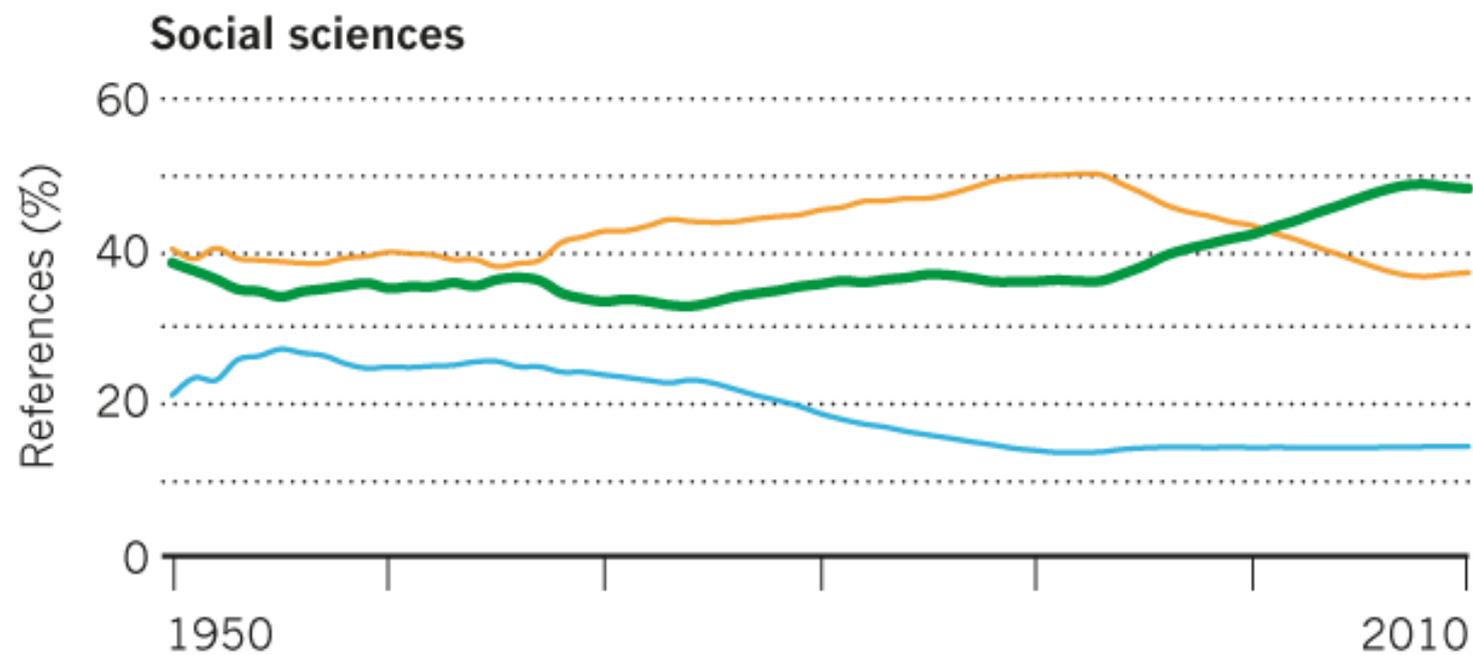
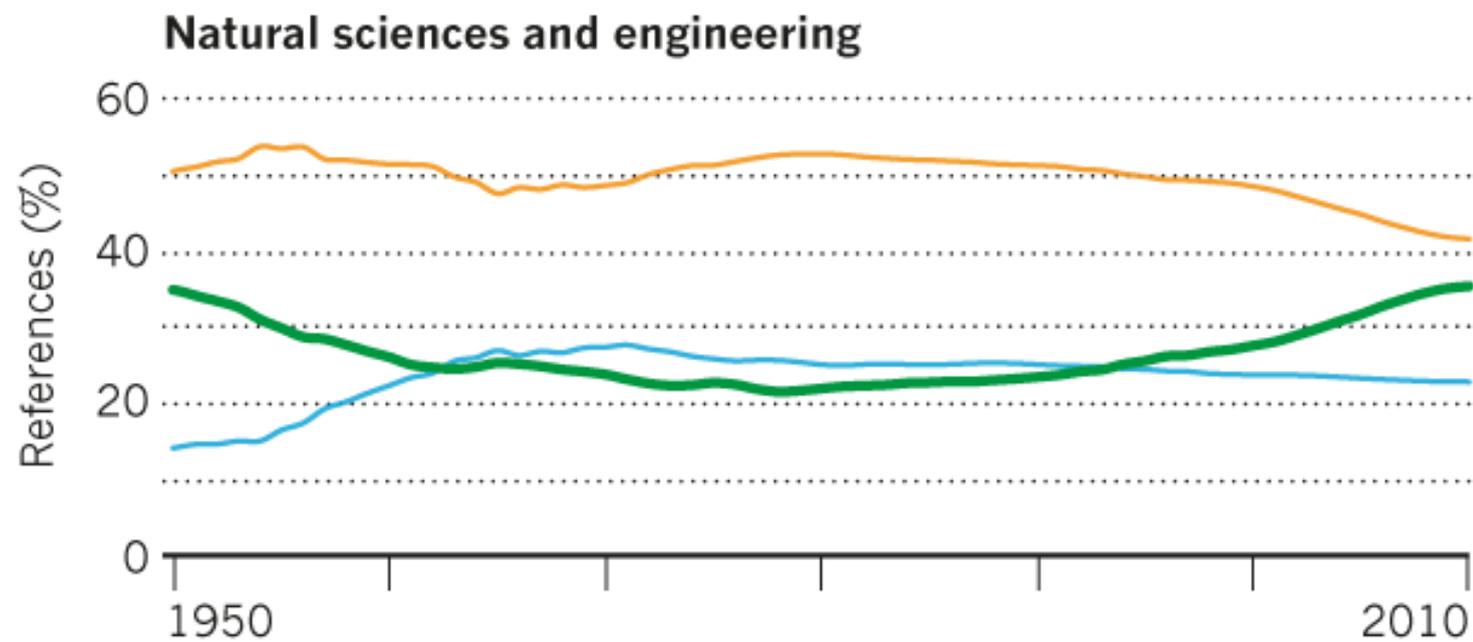
(Fortunato et al. 2018)



a **team-authored paper** in science and engineering is **6.3 times more likely to receive 1000 citations** or more than a solo-authored paper

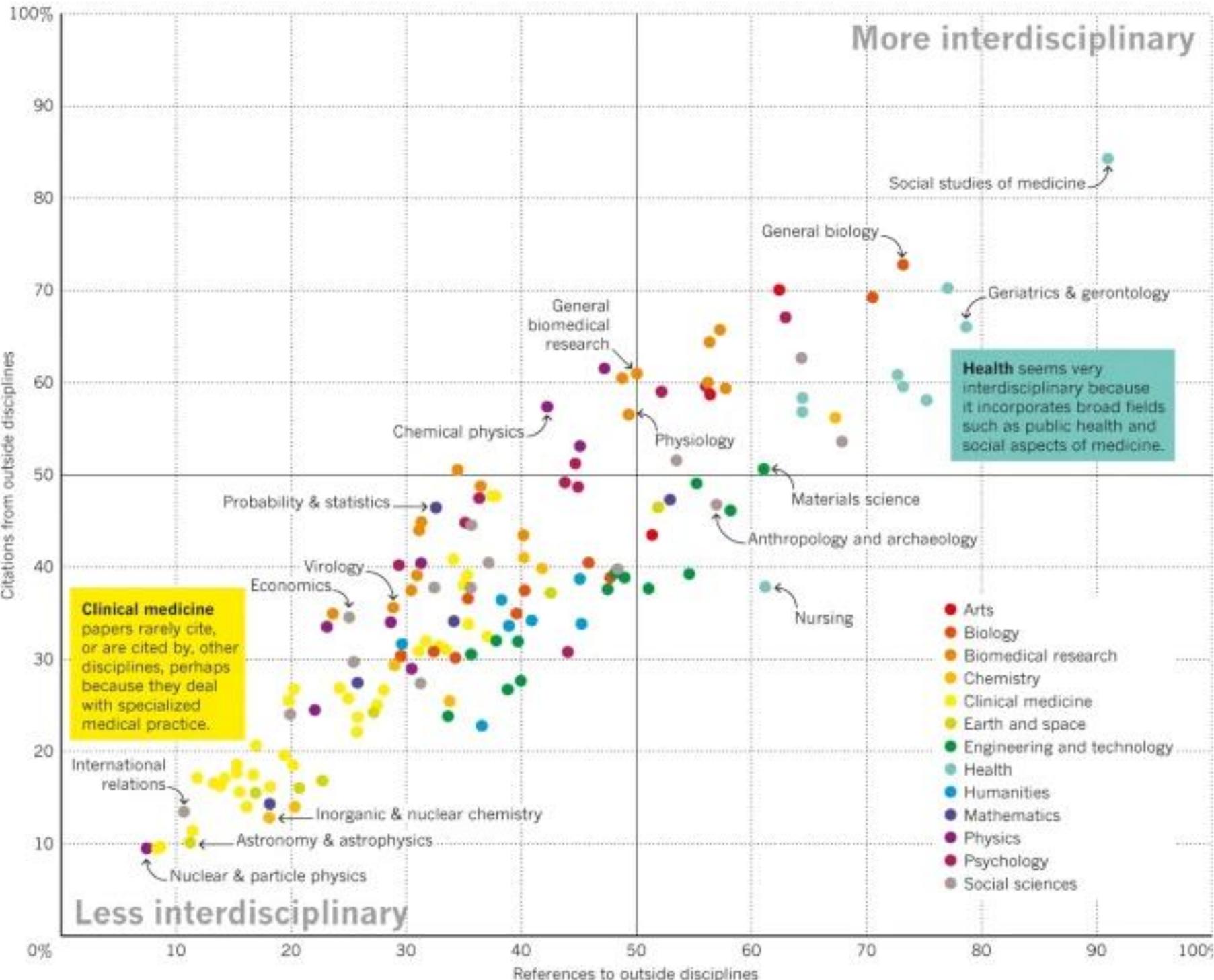
Interdisciplinarity in Published Articles 1950-2010

(Van Noorden 2015)



- References within same speciality
- References to other specialties in same discipline
- References to other disciplines



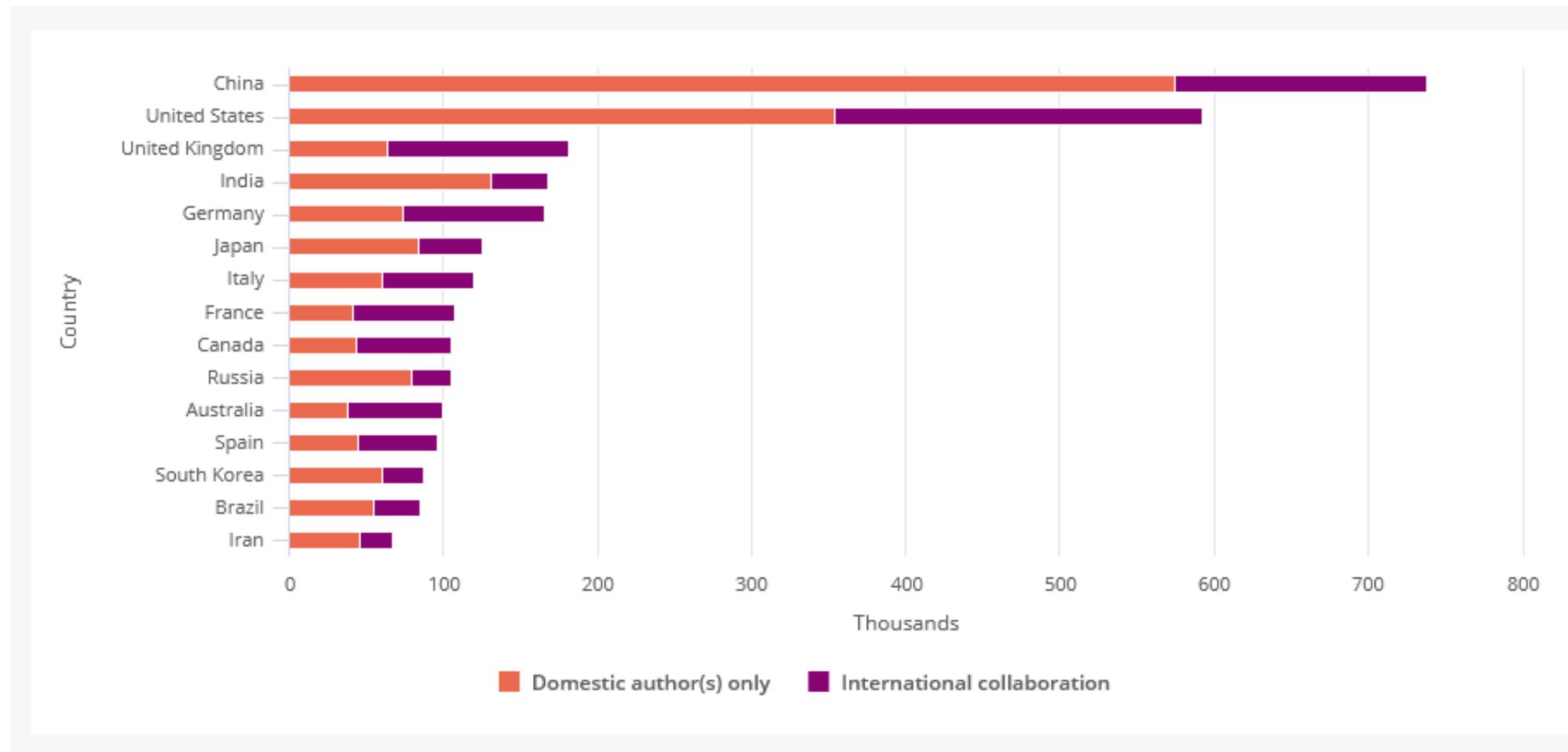


Some Fields are More Interdisciplinary

(Van Noorden 2015)



International Collaboration Science & Engineering Articles 2020



<https://nces.nsf.gov/pubs/nsb20221>

The background features a complex network of nodes and edges. The nodes are represented by small spheres in white, blue, and red. The edges are thin lines connecting these nodes, with some appearing in blue and others in red. The overall aesthetic is futuristic and scientific, set against a dark blue background with a bokeh effect of light spots.

Impacts of Team Science



Bigger Teams, Bigger Questions (Sharma et al. 2015)

New Ecological Science is Possible

(Cheruvilil & Soranno 2018)

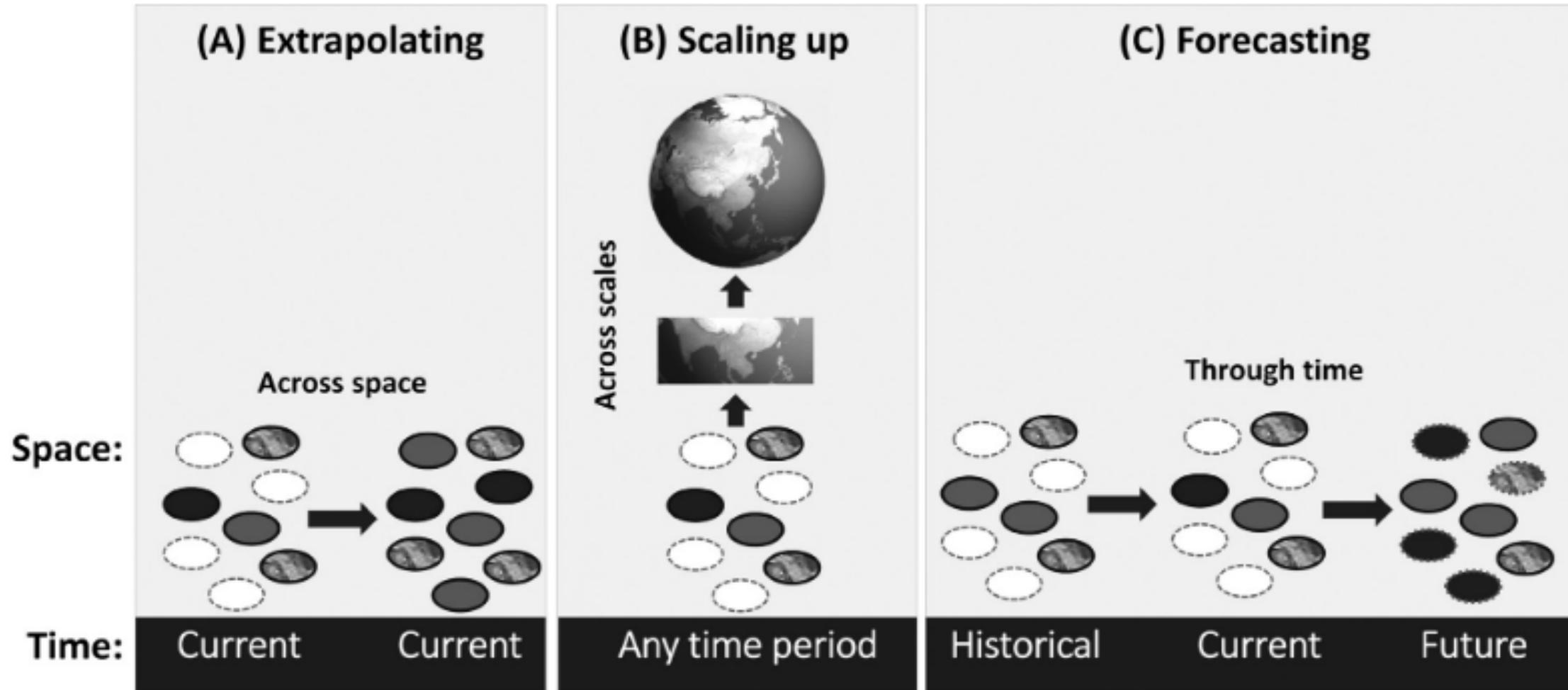
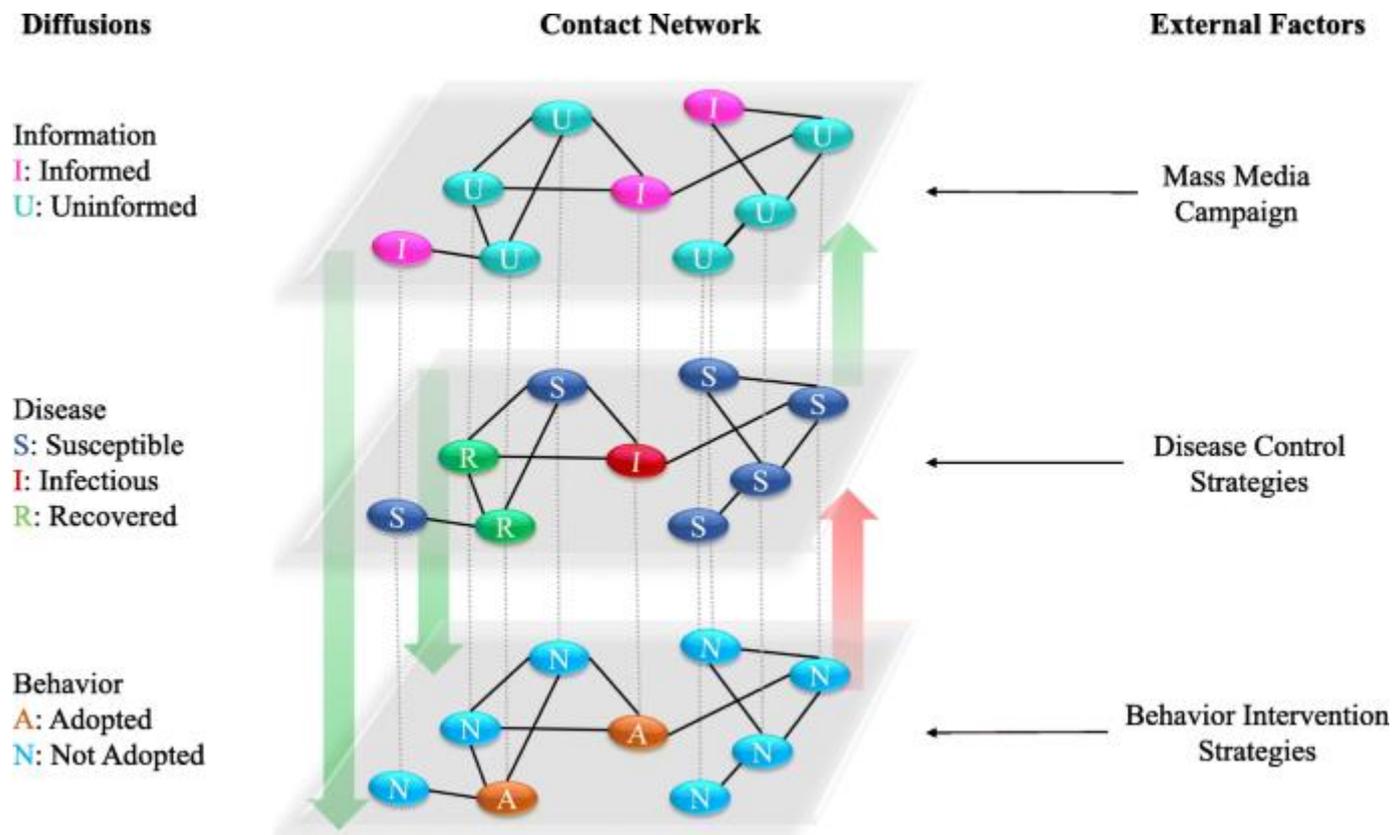
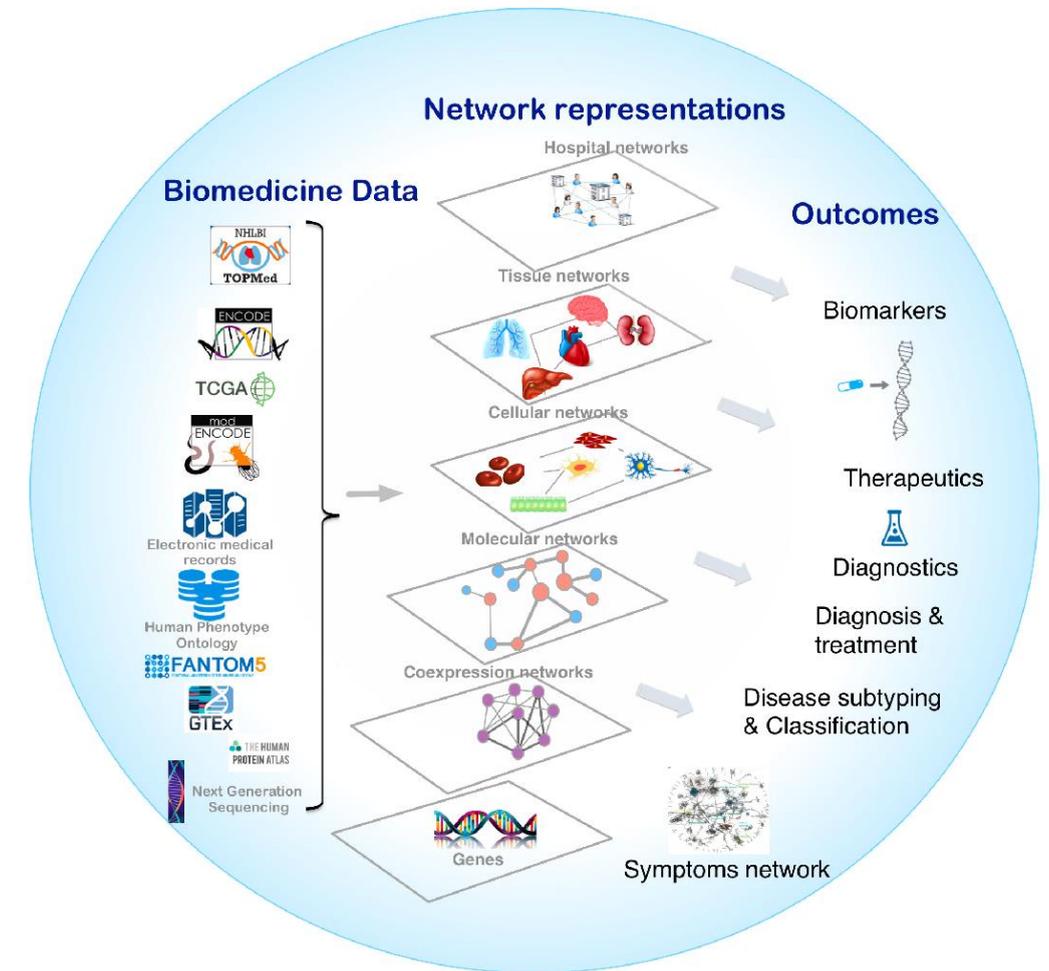


Image of globe and continent from: Globe Master 3D [CC BY 3.0 (<http://creativecommons.org/licenses/by/3.0>)]

Multi-Layer Network Studies



(Hammoud and Kramer 2020)



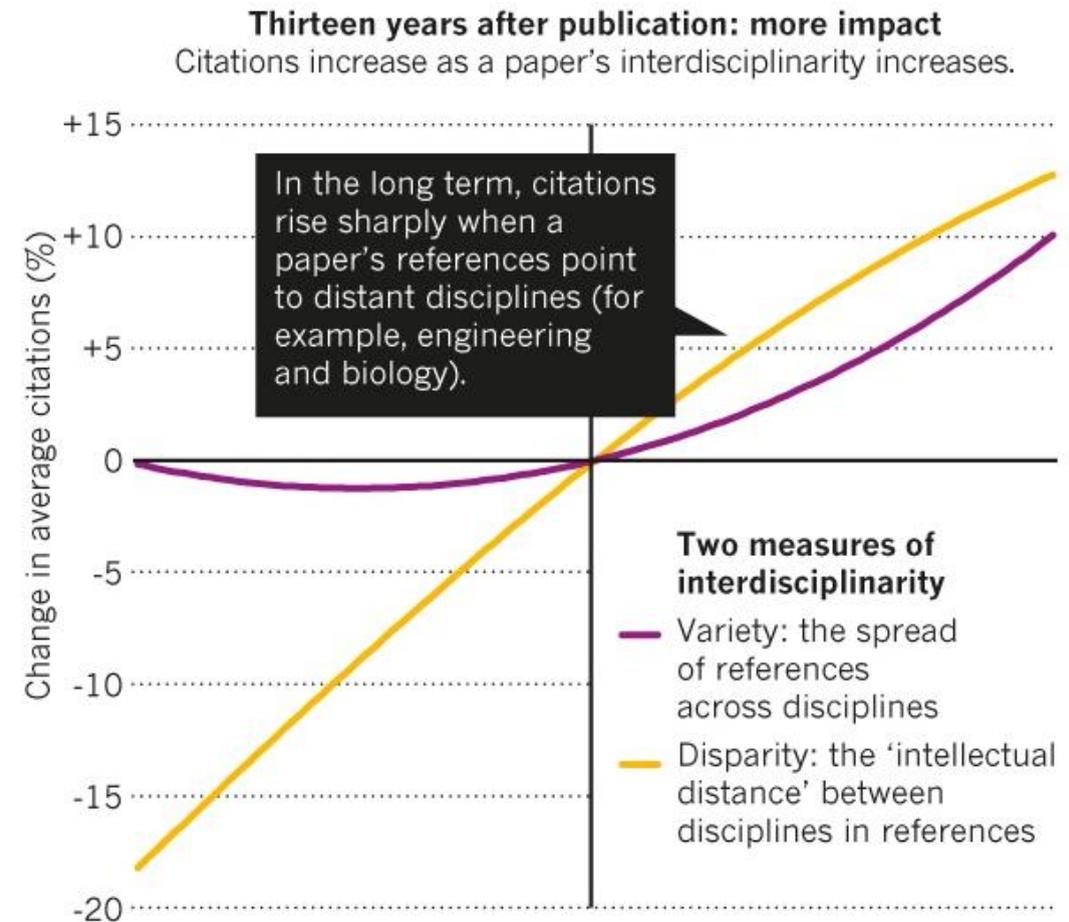
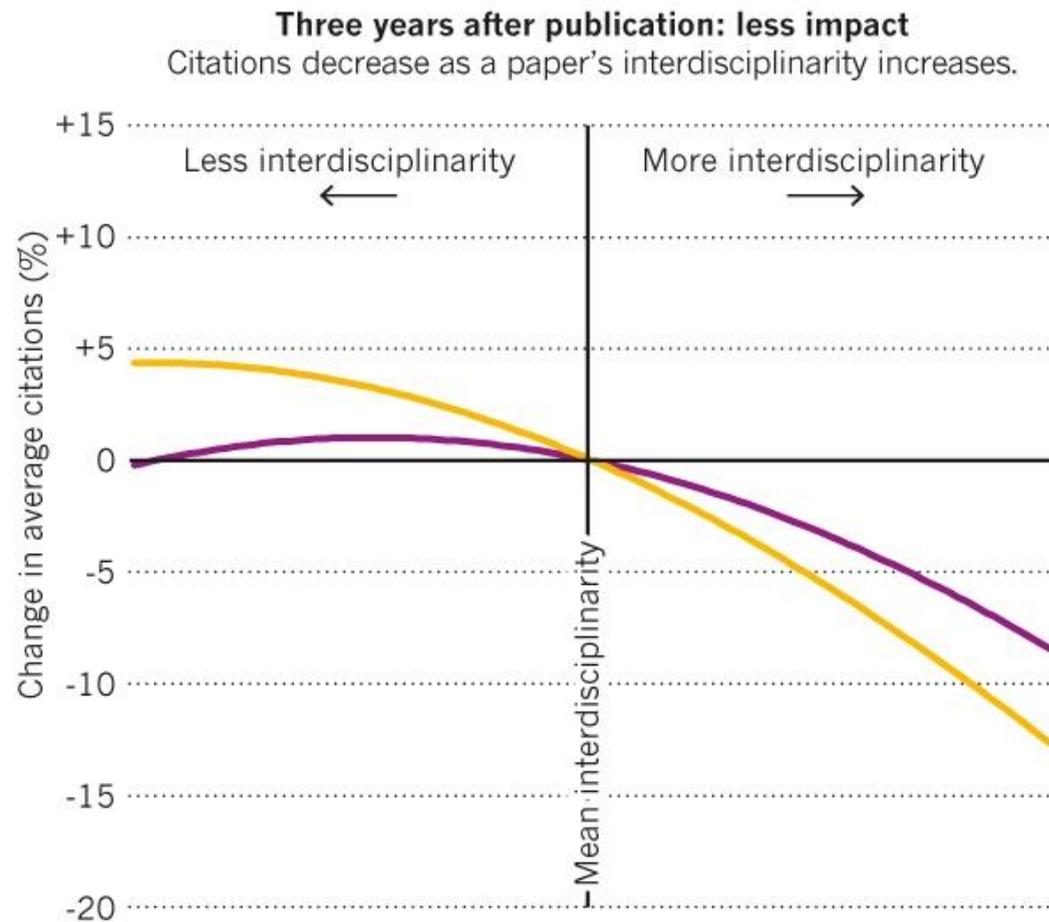
https://kishankc.com.np/post/network_properties/

New Discoveries for Treatment



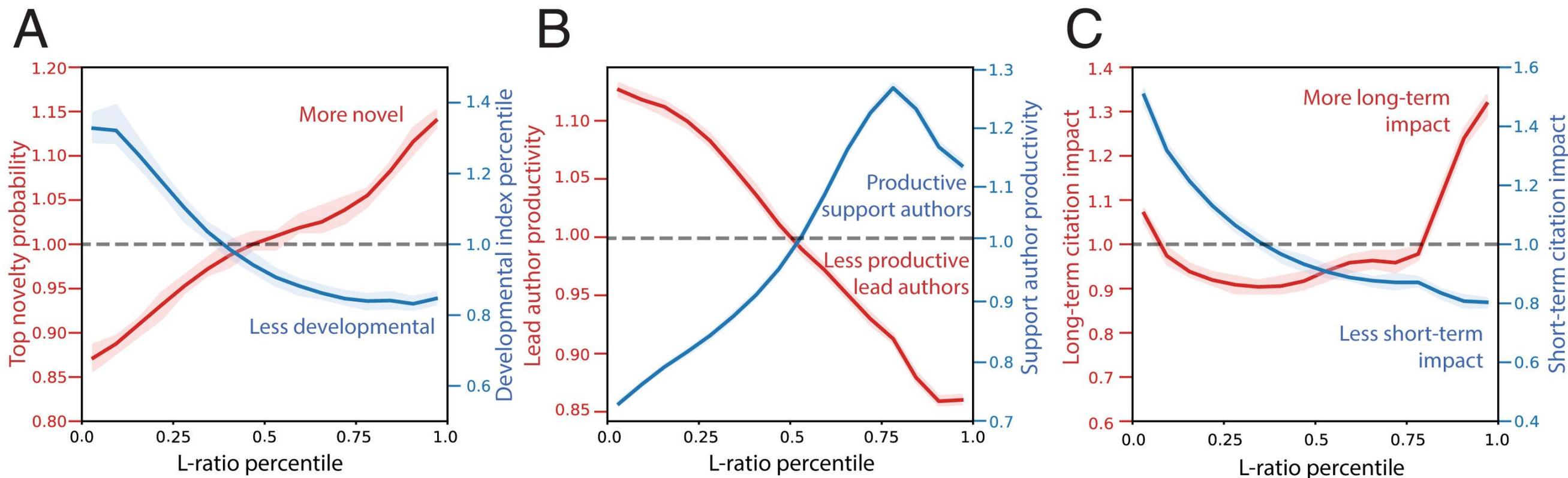
(Kimbrel et al. 2022)

Long-term Impacts (Van Noorden 2015)



Flatter Teams = Greater Impact

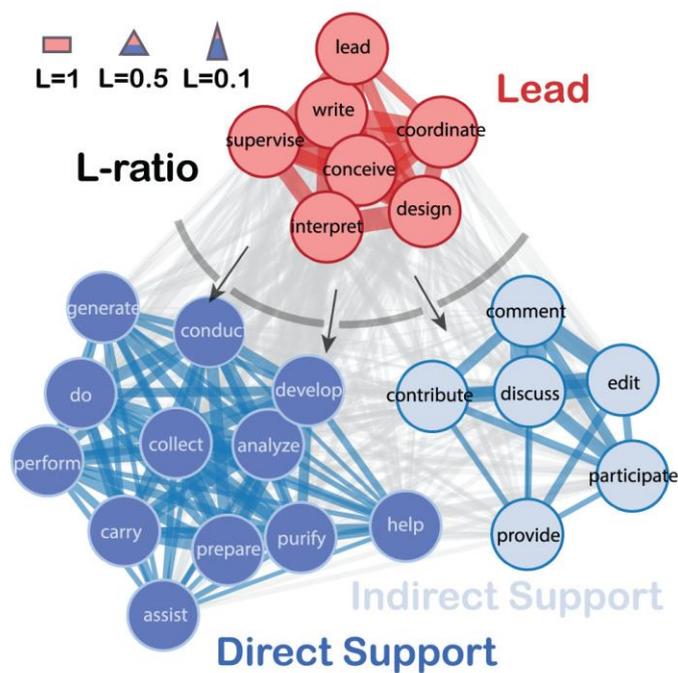
(Xu, Wu and Evans 2022)



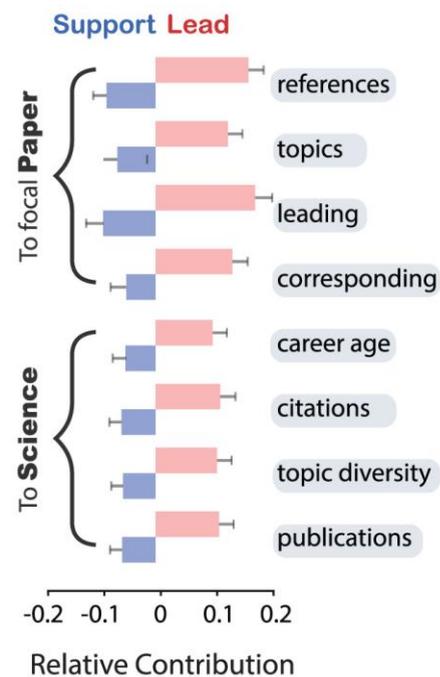
Flatter Teams = Greater Impact

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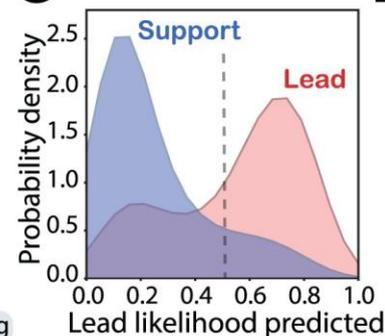
A Team Roles & Hierarchy



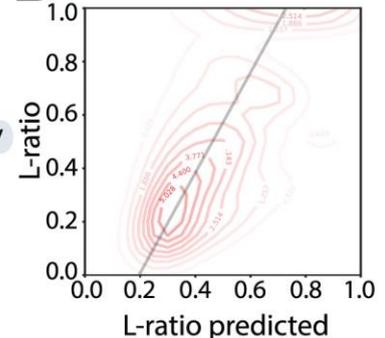
B Team Roles & Contribution



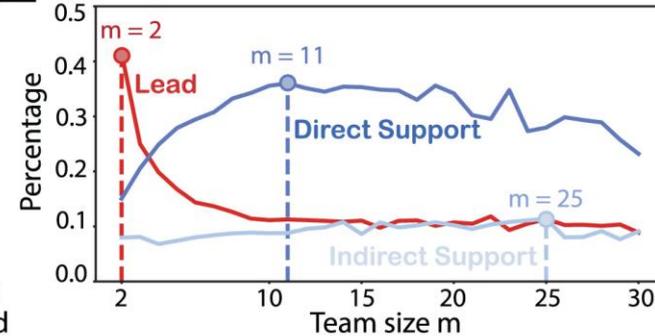
C



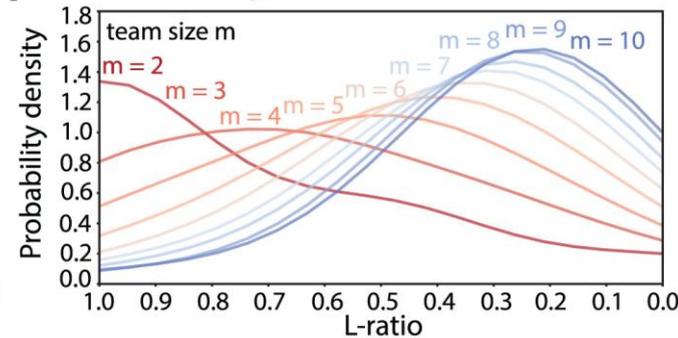
D



E Team Roles Across Sizes



F Team Hierarchy Across Sizes



when more members of the team are integrated into leading roles, the character of research changes and comes to influence unfolding scientific advance in strikingly different ways



Interdisciplinary and International Communication



What is your home discipline?

Share in the chat!



Barriers to Effective Communication

Language	Intonation, colloquialism, accents, non-verbal
Power and status	Order and rules, who comes to, maintains, and loses power
Physical preferences, intimacy	Personal space, use of time, expectations of coworker relationships, relationships between sexes
Rewards and punishment	Agreement on good and bad behavior, what should be rewarded and disciplined
Ideology	Giving meaning to unexplainable events
Emotional	Expression of emotions, stress, uncertainty
Cultural	Attitudes, values, believes

International miscommunication

American saying	American meaning	Dutch interpretation
Do you want more tea? “I am good”	No, thanks	Yes
Break a leg	Good luck	F*** you
How are you?	Hi	I want to know exactly how you are feeling
Compliments	Appreciation/friendliness	What do you want from me?
Avoidance of negative emotions/criticism	Professional	Fake

Interdisciplinary miscommunication

Biology	Biology meaning	Sociology interpretation
Population	Group of organism	Group of people
Protein	Macromolecular polypeptides	Chicken, beef, or scrimp?
Concentration	The amount of a substance that is in a certain amount of tissue or liquid	Focus
Carbonate	Any member of two classes of chemical compounds derived from carbonic acid or carbon dioxide	Drink with bubbles
Colony	Two or more conspecific individuals living in close association	Territory subject to a form of foreign rule

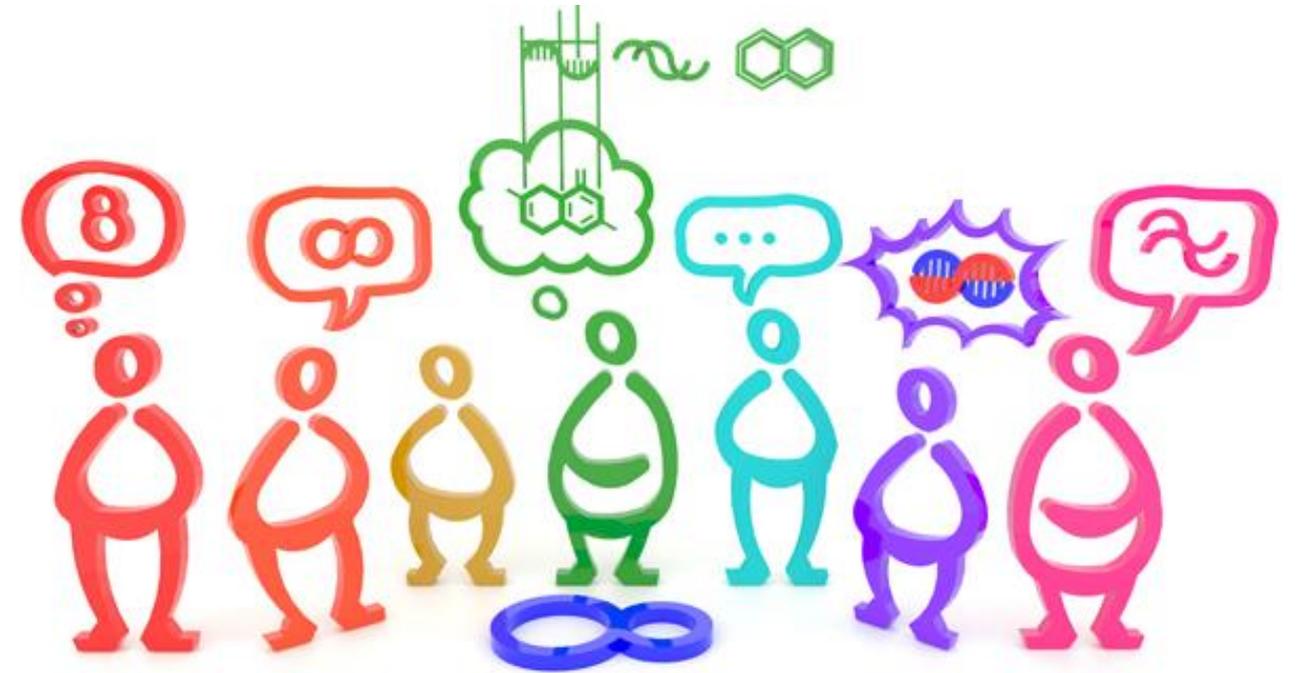
Problem of Unacknowledged Differences

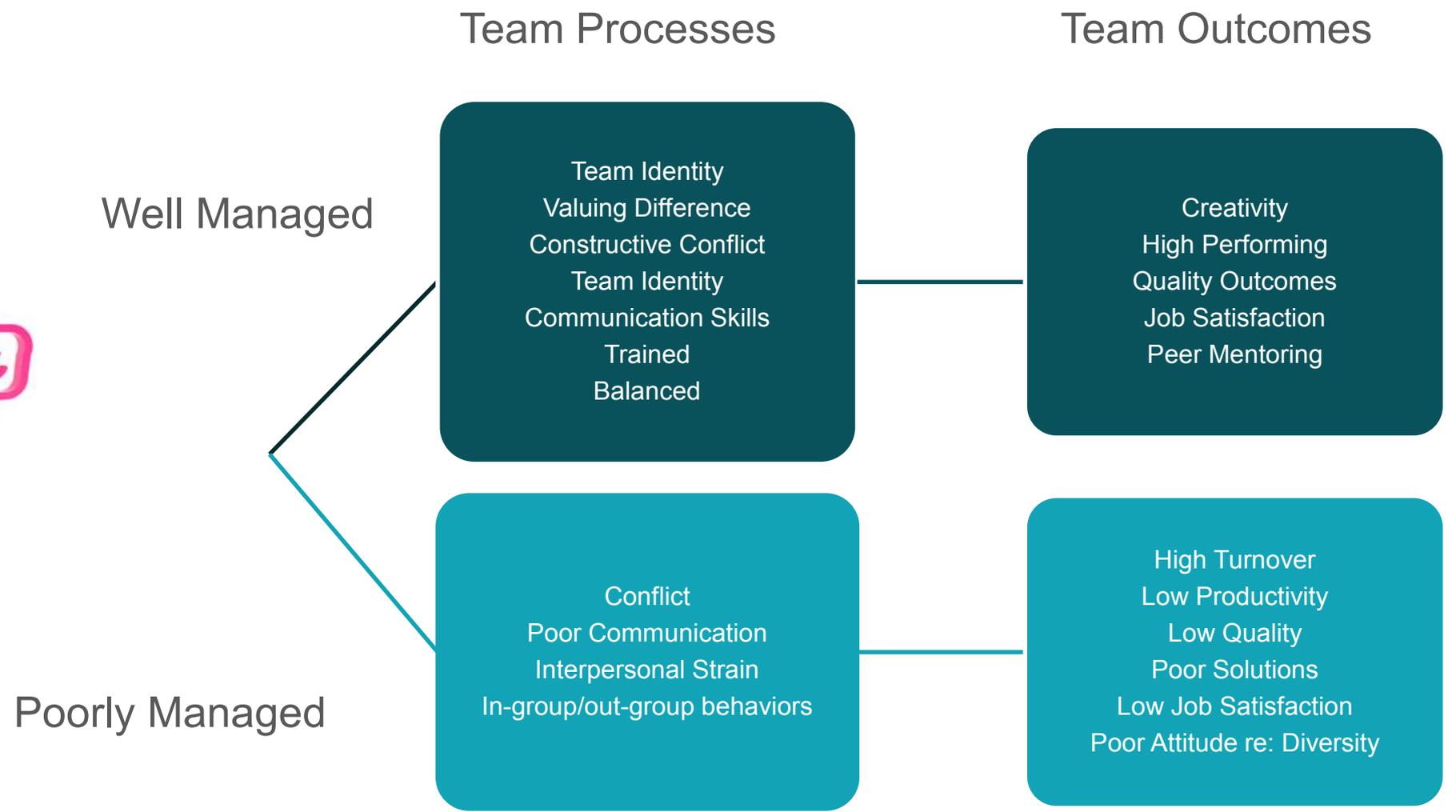
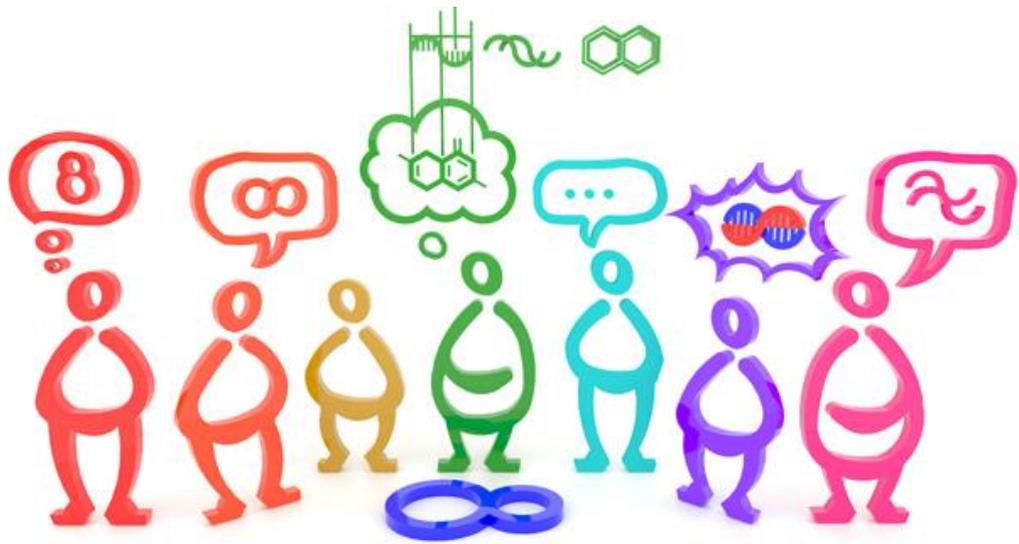
We are different from one another...

But we don't necessarily know how...

We tend to assume that we are more alike than we are.

(Eigenbrode et al. 2007)



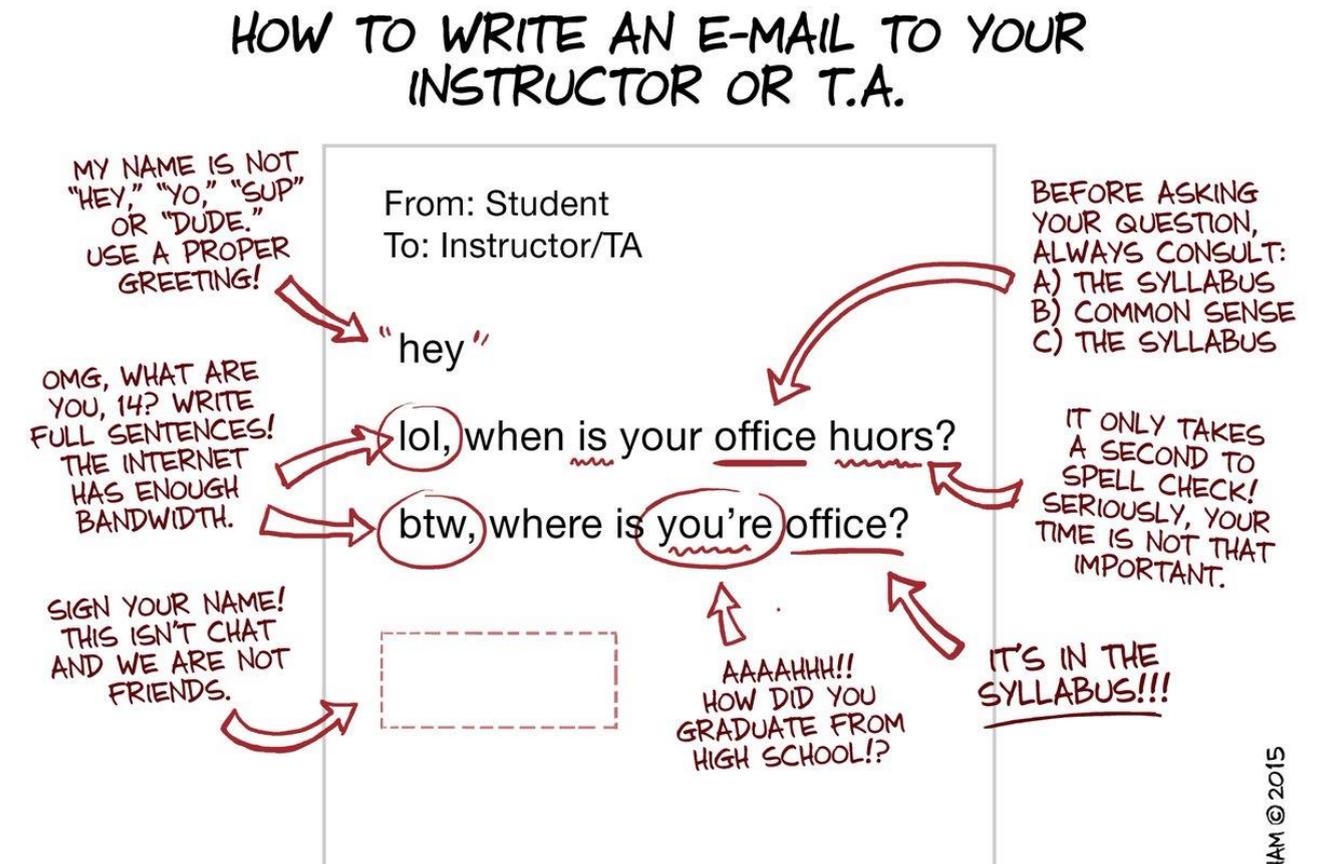


Difference is not the problem!

Solution: Guidelines for Communication

Set up norms and expectations regarding interpersonal communication in your team

- Language (e.g., use of slang, acronyms, jargon)
- Norms what should and should not be discussed
- Formality (e.g., use of titles)
- Platform (e.g., text, email, Basecamp)
- Frequency, duration, and timing
- Turn taking, participation, silence
- Cameras & microphones online



Solution: Address issues early

For other individuals they may not be aware that their message is not received the way they intended

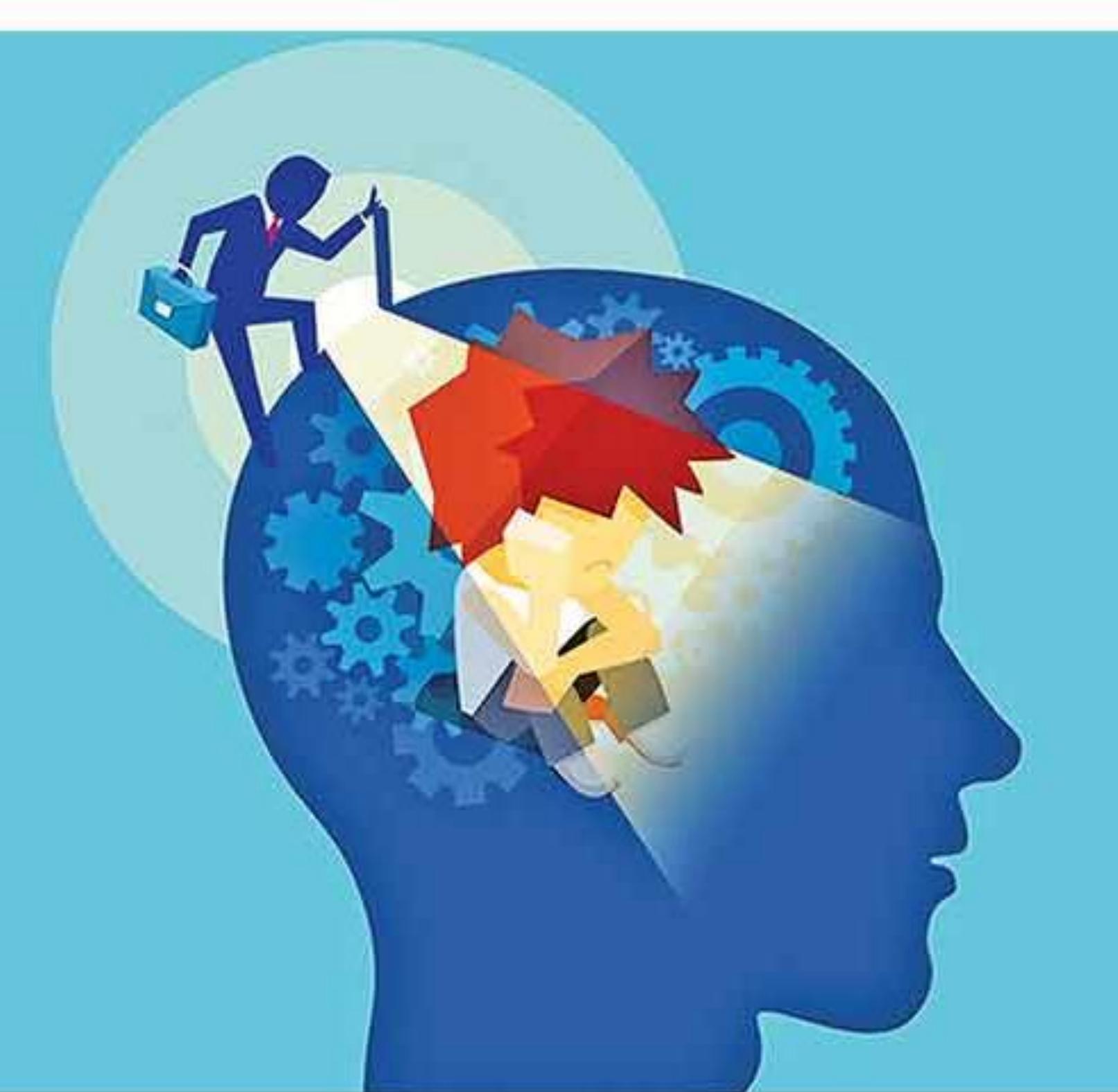
- Observe non-verbal cues
- Seek clarification (e.g., what do you mean by that)
- Repeat your interpretation
- Offer resources to overcome intercultural/interpersonal barriers
 - Information on cultural differences
 - Guidelines to specific organizations
 - Counseling



Solution: Be aware of self and others

Everyone is different. No guide or strategies can overcome all individual nuances. With some people a certain communication style works, while others may need a different approach.

- Be genuine and share who you are and why
- Be curious and get to know others and their styles





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Thank you



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