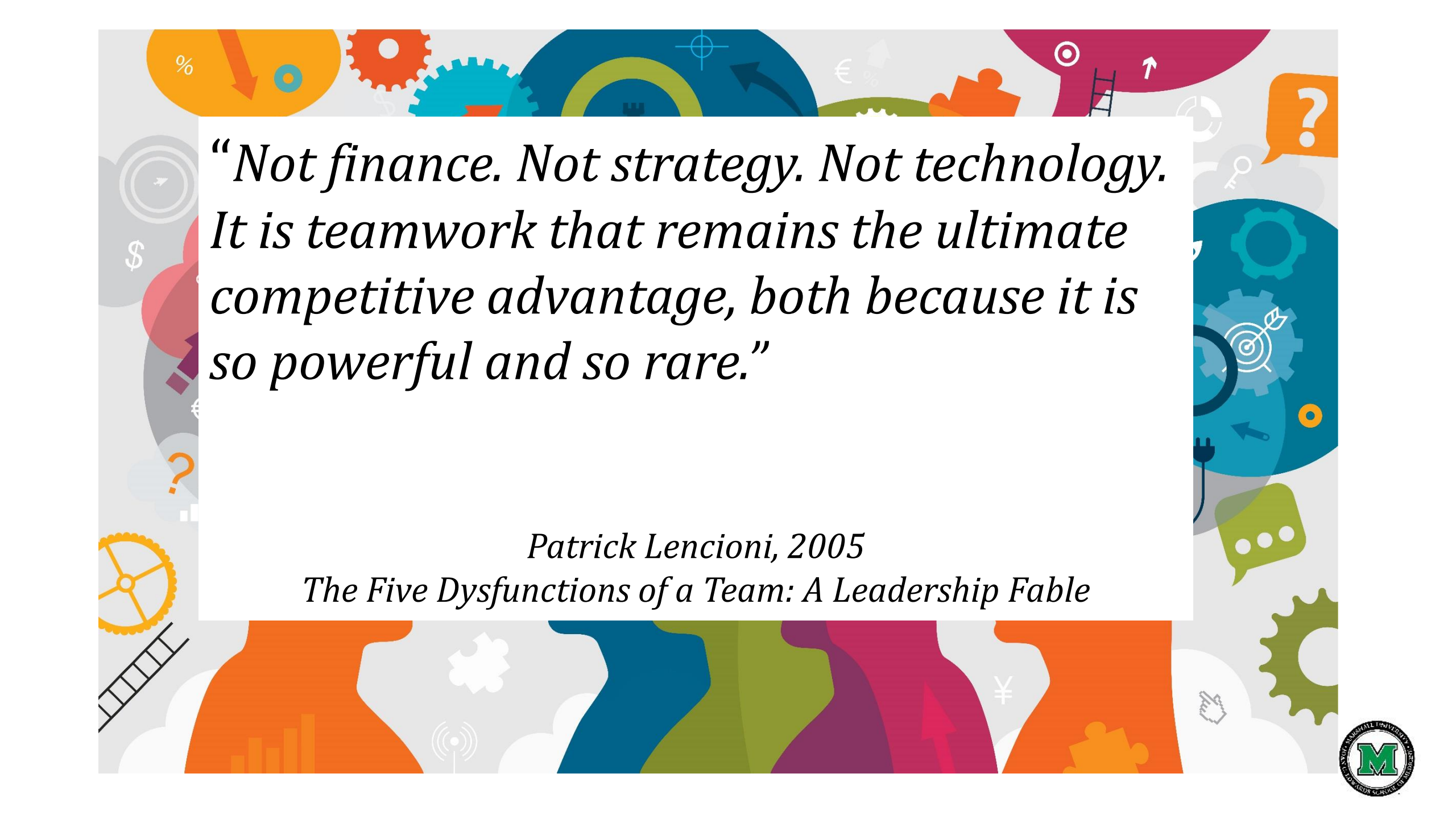


Fundamentals of Team Science

Darshana Shah, PhD
Professor & Associate Dean
Office of Faculty Advancement
Editor-in-Chief, [Marshall Journal of Medicine](#)
Marshall University Joan C. Edwards School of Medicine
5-21-2020





*“Not finance. Not strategy. Not technology.
It is teamwork that remains the ultimate
competitive advantage, both because it is
so powerful and so rare.”*

Patrick Lencioni, 2005

The Five Dysfunctions of a Team: A Leadership Fable





Outline

- Overview: The “what” and “why” of Team Science
- What Team Science tells us about working together in research teams
- Identify key Team Science concepts you can use today
- Resources

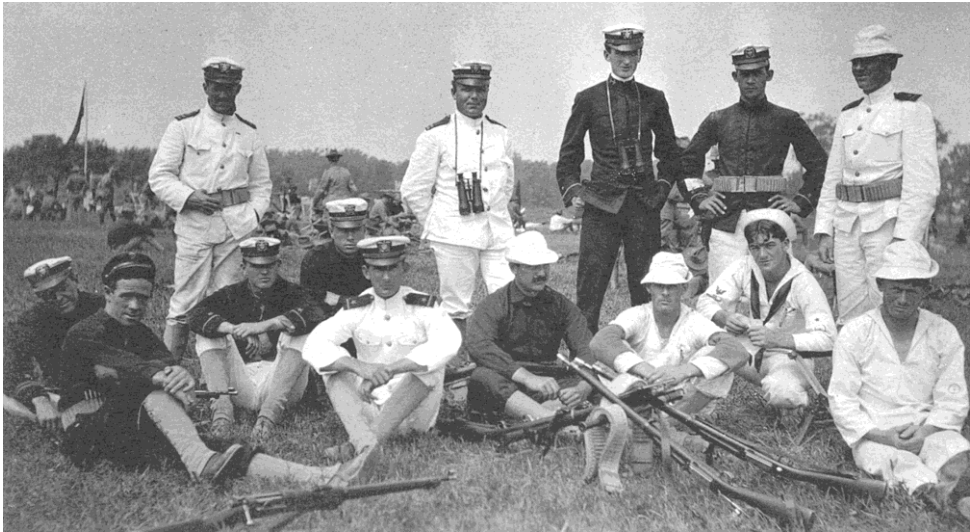


TEAM examples

- What examples come to mind when you hear the word "team"?



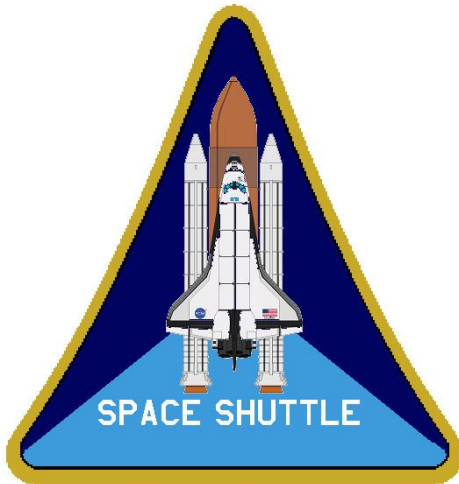
TEAMS & TEAM EFFCETIVENESS



Dalenberg et al. 2009



Hughes et al., 2016



Salas et al., 2015



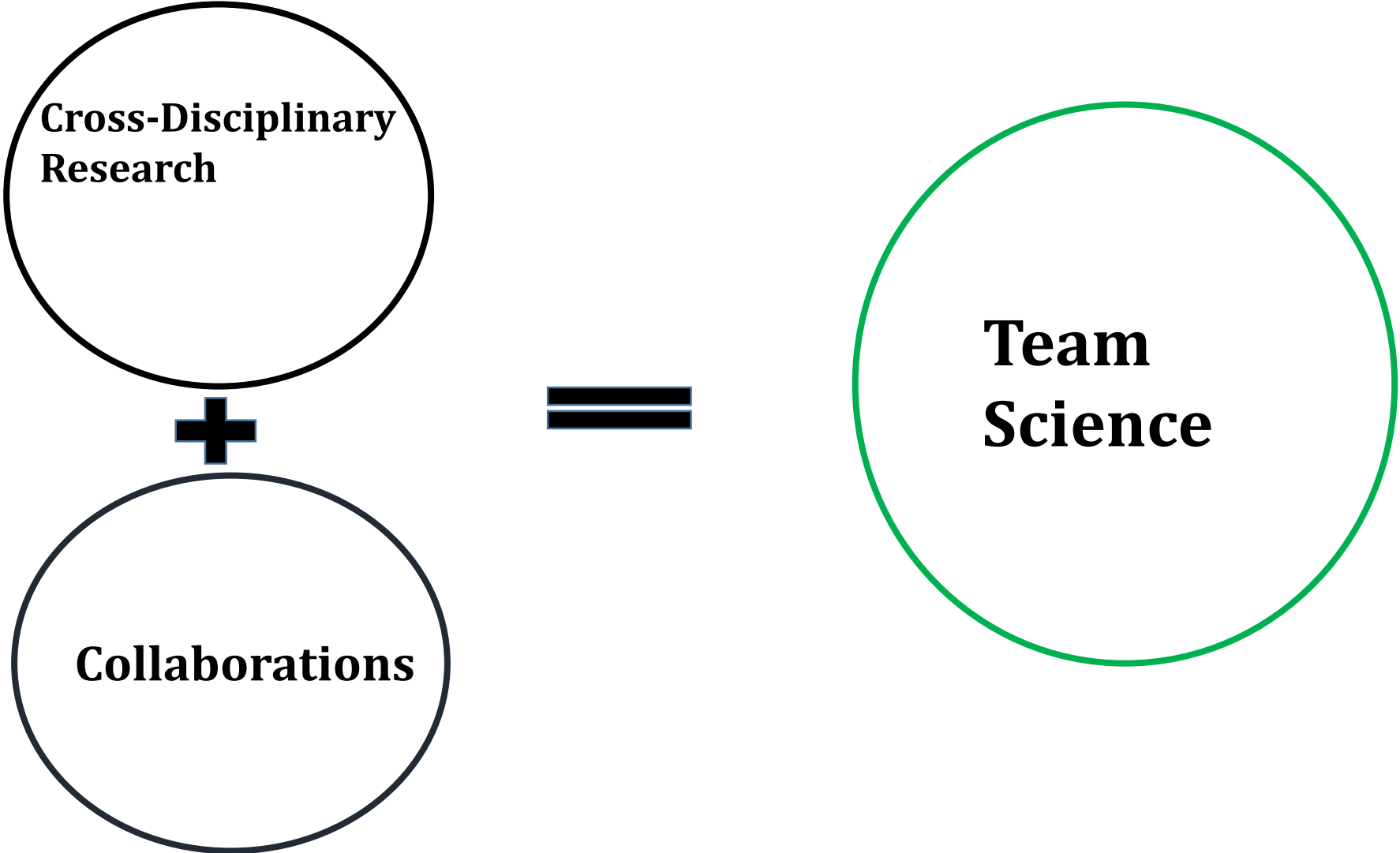
McEwan & Beauchamp, 2014



Littlepage et al., 2016



What is Team Science?



“ Most of the work still to be done in science and the useful arts is precisely that which needs knowledge and cooperation of many scientists and disciplines. That is why it is necessary for scientists and technologists in different disciplines to meet and work together, even those in branches of knowledge which seem to have least relation and connection with one another”

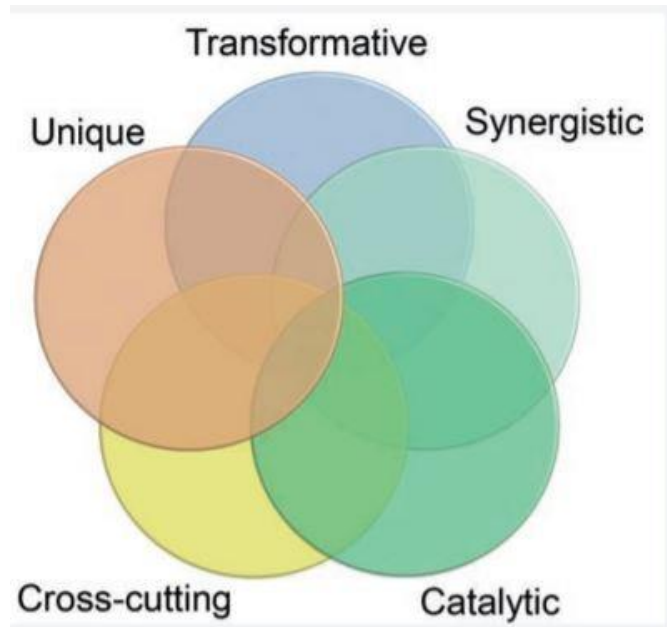
Antoine Lavoisier

1793



NIH Roadmap Initiative

What novel approaches can be developed that have the potential to be truly transformative for human health?



NIH Roadmap: <https://commonfund.nih.gov/sites/default/files/ADecadeofDiscoveryNIHRoadmapCF.pdf>



Scientific Research Team

Transdisciplinary

Combines or integrates from more than one field: concepts, methods, and theories

Multidisciplinary

An **independent, sequential** process where team members contribute individually, representing the tradition of their own discipline, and staying well within their own areas of expertise

Interdisciplinary

A **joint, interactive** process where each member draws from his or her own discipline and specific perspective to address a common research problem

Unidisciplinary

Researchers from a **single discipline** work together to address a common research problem.

High

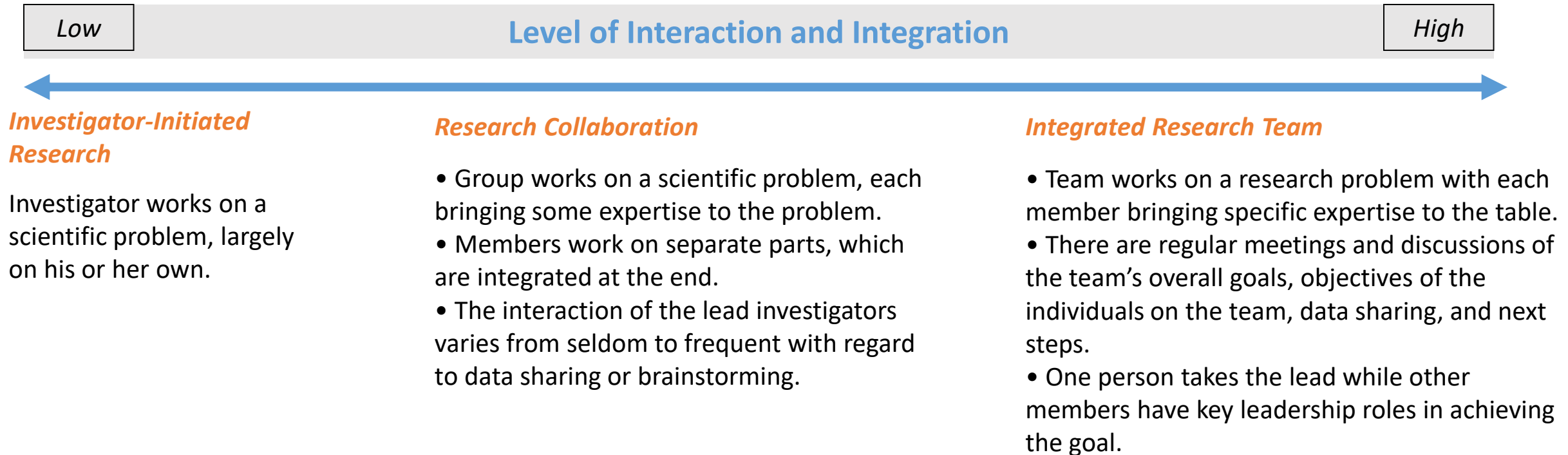
Level of Interaction
and Integration

low



What is a Scientific Research Team?

.....think of it as a continuum.....



Scientific Research Team

.....think of it as a continuum.....

Low

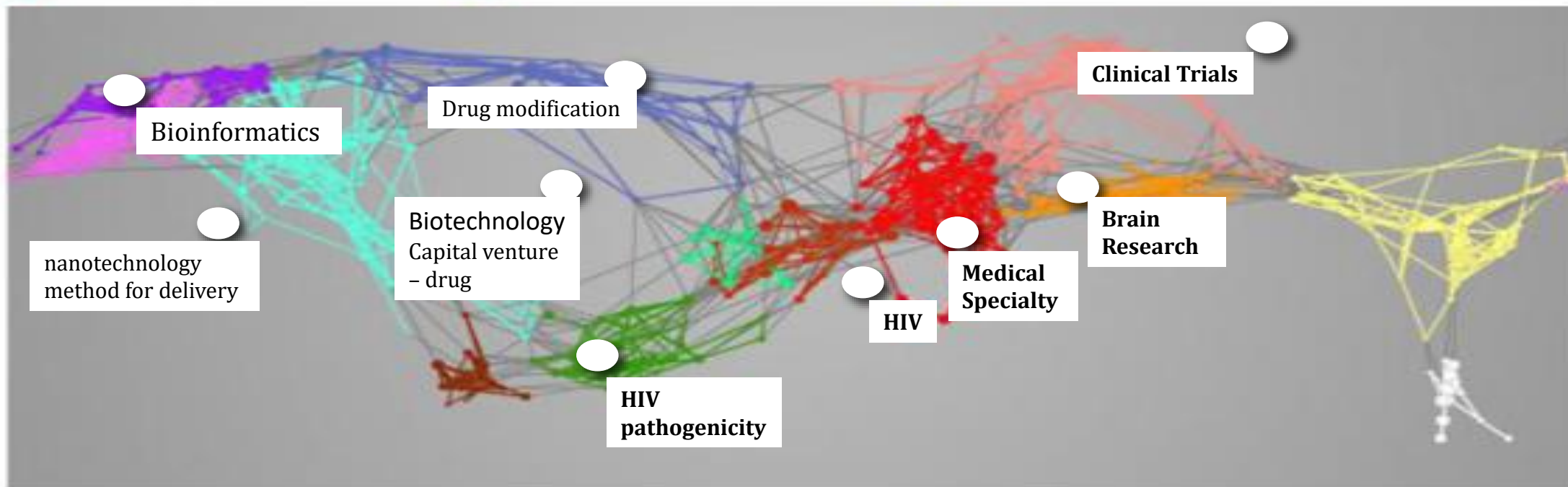
High

Investigator-Initiated Research

Collaboration

Integrated Research Team

The following color coding is used for the disciplinary map:



What is Team Science?

Definition: **integration** of two or more scientific approaches to solve a **complex, multifaceted** problem

It is a **collaborative effort to** address a scientific challenge that leverages the strengths and expertise of professionals trained in different fields.

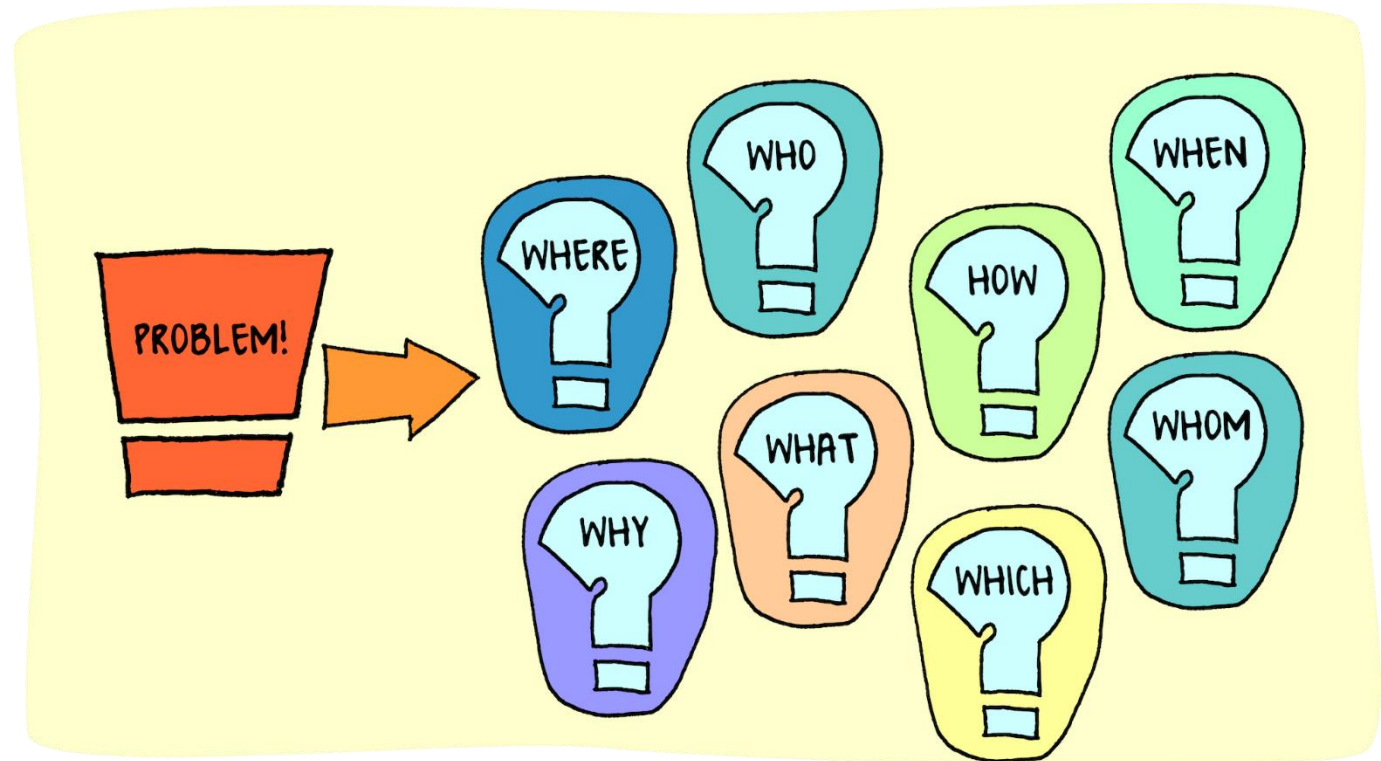


- Team Science is a collaborative effort to address a scientific challenge that leverages the strengths and expertise of professionals trained in different fields.

National Research Council (2015) *Enhancing
Effectiveness of Team Science*



Why Team Science ?

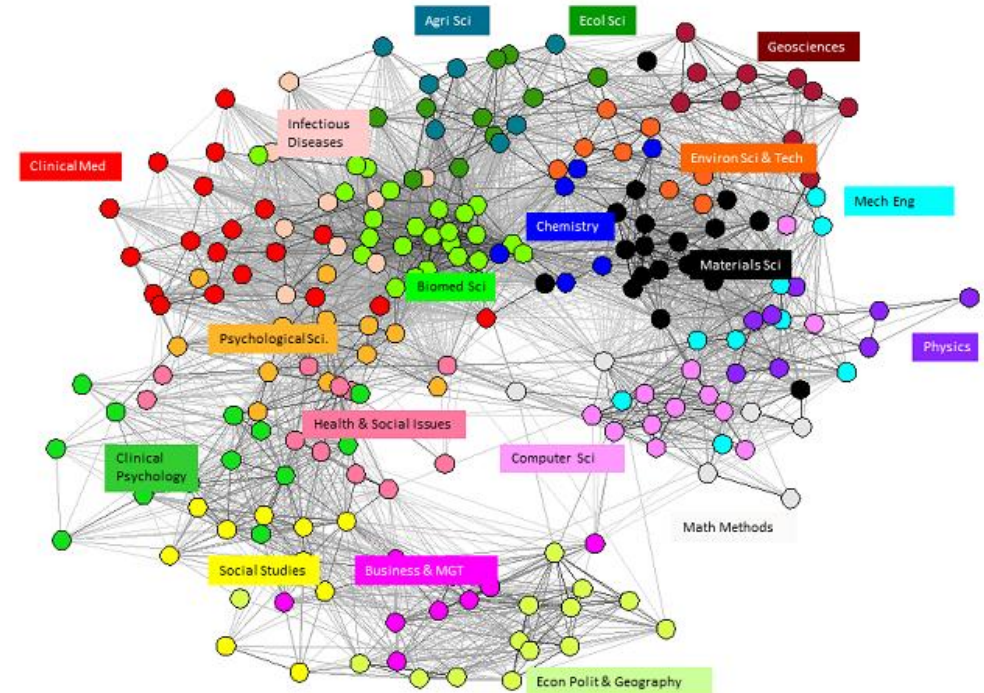
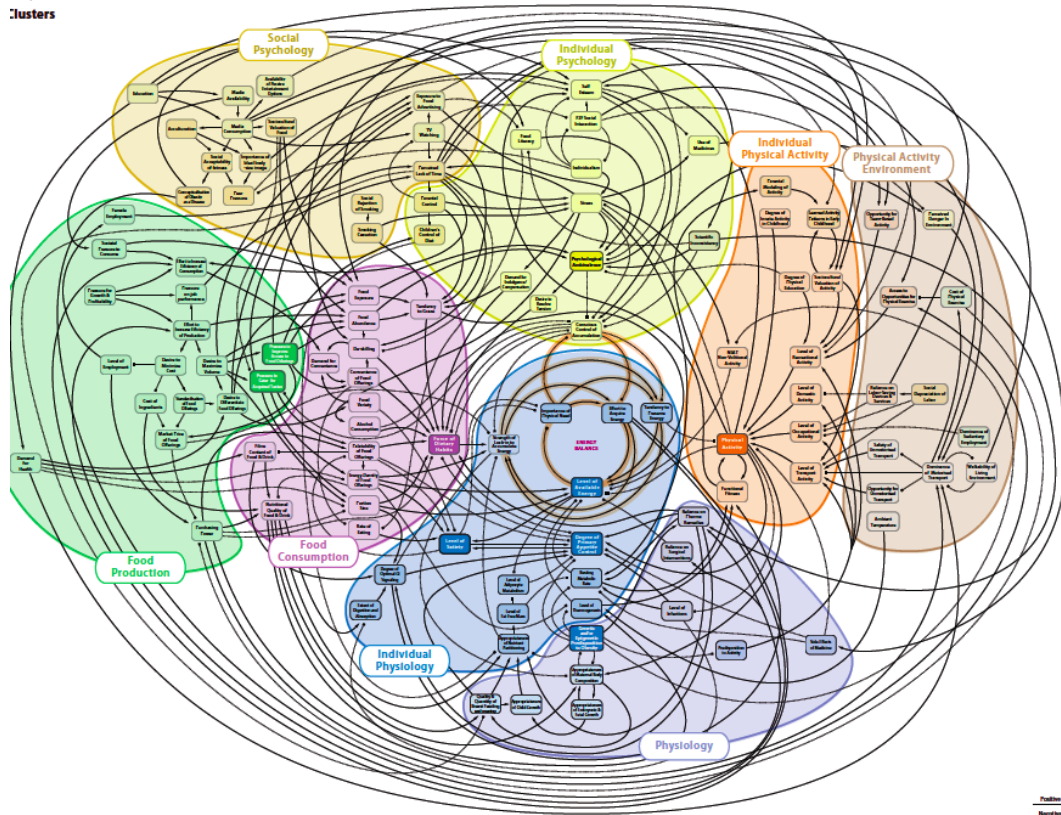


Why TEAM Science?

- **Complex** 21st-century societal (health, social, environmental, energy, and technological) problems require cross-disciplinary solutions
- Advances in technologies
- Vast data sets
- Enormously increased range of questions
- Research is increasingly conducted in teams across virtually all fields
- ~90% of all work in science & engineering disciplines is done in teams



Why Team Science ?



researchers; endocrinologists; pediatricians; internists; surgeons;
exercise physiologists; nutritionists; behavioral researchers;
psychologists economists—to name just a few types of specialists

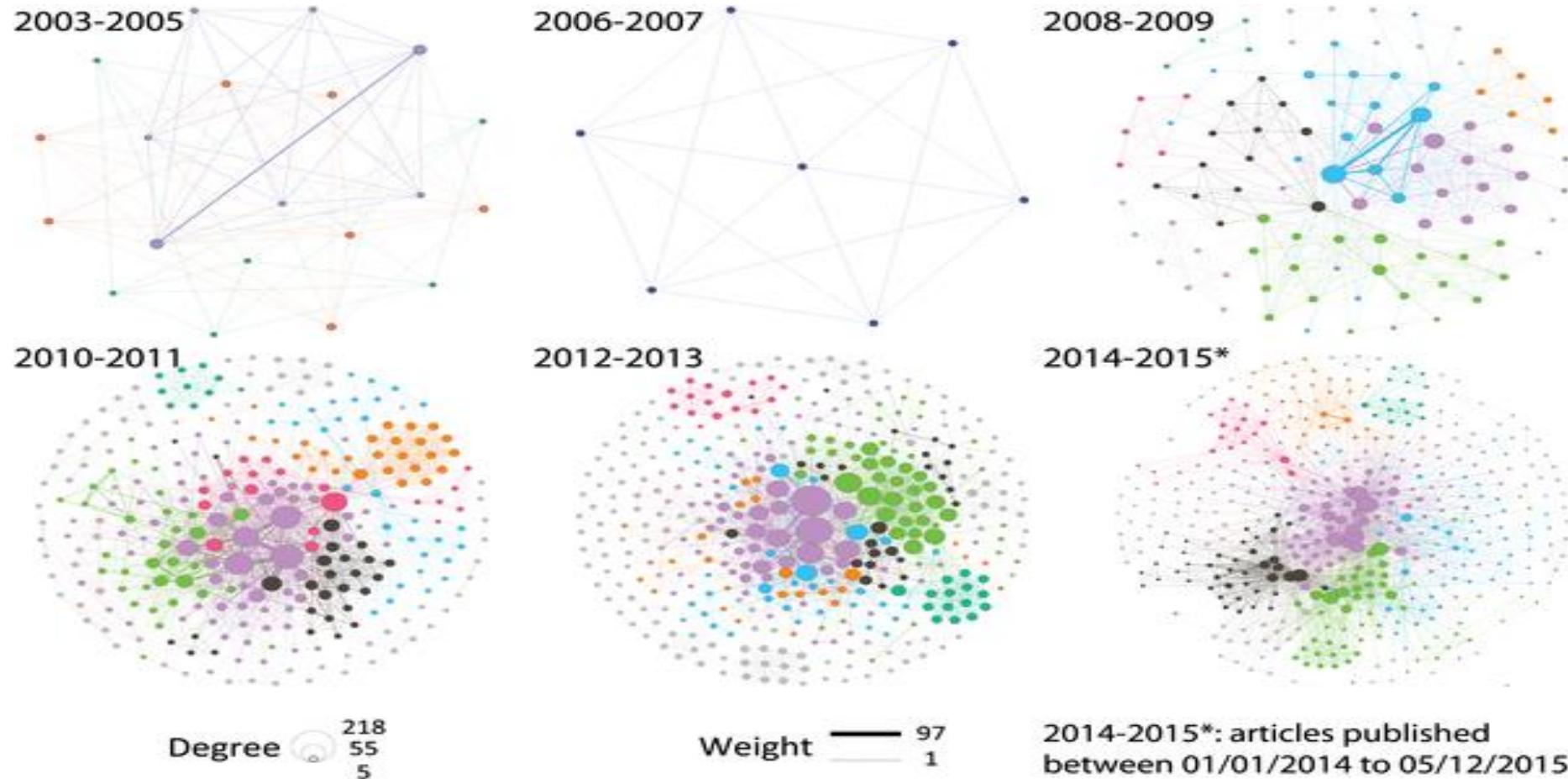
www.ScienceTranslationalMedicine.org 10 March 2010 Vol 2 Issue 22 22cm9
<https://www.teamsciencetoolkit.cancer.gov/public/expertBlog.aspx?tid=4&rid=1570>
NIH Roadmap is available at: <http://nihroadmap.nih.gov/>.

Know your Network !!!!



Teams produce more highly cited research & patents than individuals.

Mapping longitudinal scientific progress, collaboration, and impact of the Alzheimer's disease neuroimaging initiative growth of co-publication networks over time.



Why Team Science?

- The **synergy** of Team Science fosters unique insights into problems that may not be readily available from the perspective of a solitary discipline
- Speed up the **rate** of discovery
- Apply **novel methods** to solve old problems
- Apply **specialized** knowledge to new problems
- Promote **breadth** of knowledge



How Do We Turn a TEAM of Experts into an EXPERT Team?



“We like to bring together people from radically different fields and wait for the friction to produce heat, light and magic. Sometimes it takes a while.”



What factors are required to form a successful research team?

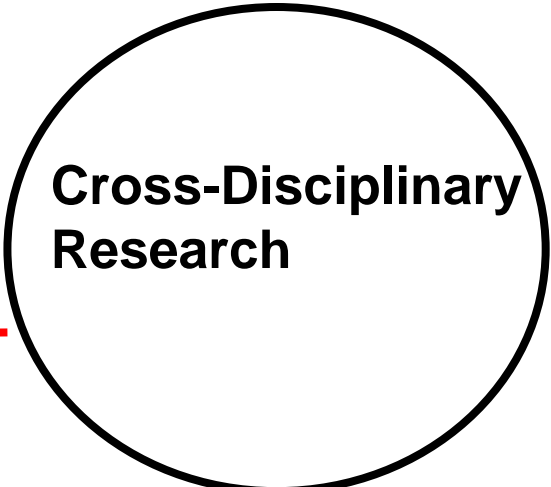


What is the Science of Team Science?

What makes them work?

The study of collaborative processes grounded in scientific collaborations

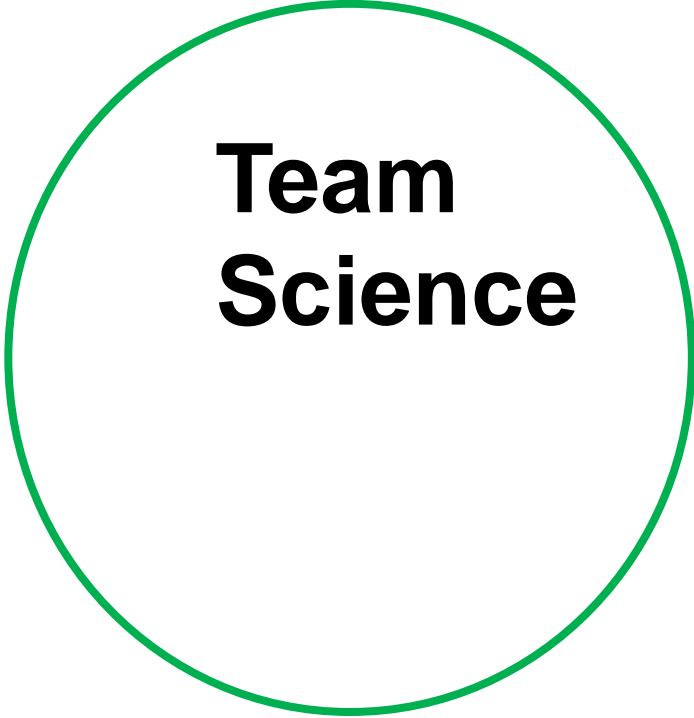
The Science-of-Team-Science



+



=





SciTS

Building the knowledge base
for effective team science

- The **Science of Team Science** (SciTS) is a cross disciplinary field of study that aims to...
- ***(1) Build an evidence base***
- ***(2) Develop translational applications***
.....to help maximize the efficiency & effectiveness of team-based research



**Trust (identity-based trust, competence-based
Trust, calculus-based trust)**

SELF-AWARENESS

EMOTIONAL INTELLIGENCE

COMMUNICATION

MENTORING

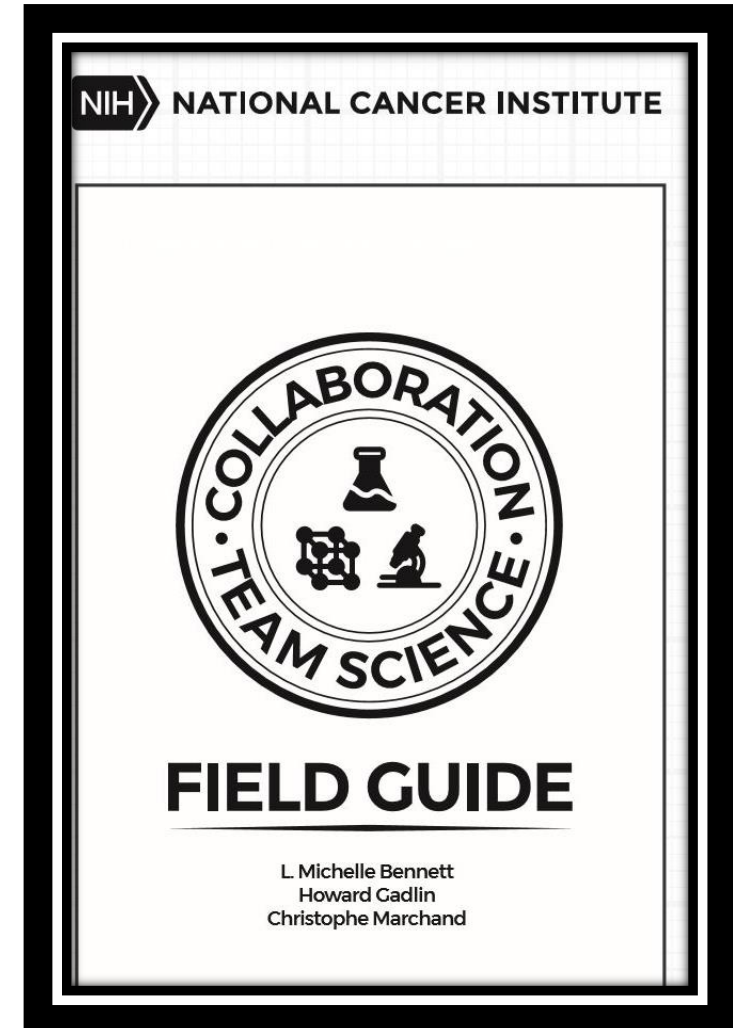
TEAM EVOLUTION AND DYNAMICS

EFFECTIVE LEADERSHIP

RECOGNITION AND SHARING SUCCESS

CONFLICT AND DISAGREEMENT

NAVIGATING AND LEVERAGING NETWORKS AND SYSTEMS



*National Cancer Institute
Collaboration and Team Science: A Guide
L. Michelle Bennett. Et. Al. 2018*



Key Team Science Concepts You Can Use Today

- Bring together diverse backgrounds and experiences
- **Clarify** roles, responsibilities, and contributions
- Define milestones and success
- Develop an **environment of openness**
- Establish a schedule of meetings
- **Discuss** processes for sharing data and managing authorship
- **Prepare** for disagreements
- Have a policy for bringing on new members



Developing Grant Proposals - Key Team Science Concepts

- Create a shared vision
- Present the proposal in a unified voice
- Demonstrate commitment to leveraging available expertise and resources toward problem solving
- Consider coordination, interrelationships, cohesiveness, and synergy among the research projects and cores as they relate to the common theme
- Define appropriate leadership/management/administrative structures
- Define roles and responsibilities; include logistics, operations, and administration
- Develop mechanisms for regular communication, dispute resolution, and recognition and credit assignment
- Discuss day-to-day operations of the program



Resources:

Websites, articles, and online documents about Team Science:

- [Team Science Toolkit](#): This is “an interactive website to help you support, conduct, and study team-based research.” The website is open-access and allows individuals to add resources to the site’s searchable database.
- [Science of Team Science](#): Website for the Northwestern University Clinical and Translational Sciences Institute (NUCATS). This institute holds an annual “Science of Team Science” conference, and provides online resources for individuals interested in becoming involved in team-based research.
- [Team Science](#): This website (created by NUCATS) offers excellent video training modules that provide guidance on collaboration processes inherent to team-based research. The training modules also include interactive components intended to answer researchers’ specific questions about team-based research.
- [Collaboration & Team Science: A field guide](#) (PDF, 2.23MB). National Institutes of Health, Office of the Ombudsman. This guide provides a great deal of information on getting started with team science.
- [Team Science: Heaving Walls & Melding Silos](#) (PDF, 2.06MB). A White Paper produced by Sigma Xi (The Scientific Research Society). This paper provides an excellent description of Team Science, its history, and benefits.
- [Profiles in Team Science](#). This website was developed with support from the National Science Foundation (NSF) Discovery Corps Program, and provides excellent examples of Team Science “in action.”
- Team Science Toolkit. An online repository of over 3000 resources, applications, and instruments. Includes models, methods, and materials for evaluation, with bibliography. <http://www.teamsciencetoolkit.cancer.gov/public/home.aspx?>
- Science of Team Science Mendeley Group. A forum for cross-disciplinary and inter-professional information exchange and other resources
- <http://www.mendeley.com/groups/3556001/science-of-team-science-scits/>
- Coalesce [Teamscience.net]. Learning modules, including an introduction to Team Science,
- Dialogue and shared decision making, evidence-based practices, and community engagement with emphasis on healthcare and research. <https://www.teamscience.net>



Team Science Toolkit

An interactive website to help you support, conduct and study team-based research.

- Home
- About Team Science
- About the Toolkit
- Discover**
- Contribute
- Connect
- News & Events
- About Us

Interdisciplinary Research and Team Science

In this blog entry, Julie Thompson Klein, PhD, Professor of Humanities and Faculty Fellow for Interdisciplinary Development at Wayne State University, discusses the relationship between team science and disciplinary integration. She describes the history of interdisciplinarity into the U.S. and identifies key online and print resources about collaboration and disciplinary integration.

[> Learn More](#)



> **Discover** what resources are available.

Search for a keyword [Search](#)

OR

Browse by type of resource or goal [Browse](#)

> **Contribute** new resources to the Toolkit.

Share your knowledge by uploading tools and information about the practice or study of team science.

> **Connect** to colleagues across disciplines.

Join expert discussions on the blog, add your name to the directory, or stay up-to-date on News and Events.



[What Users Are Saving >](#)

Recently Added Resources

- [Collaboration Science and Translational Medic...](#)
 - [Improving virtual science team performance: W...](#)
 - [National Science Foundation's...](#)
- The Toolkit currently includes 2325 resources.

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- [Bibliography](#)
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- [Communication Materials](#)

www.teamsciencetoolkit.cancer.gov

The Team Science Toolkit is an interactive website that provides resources to help users support, engage in, and study team-based research.



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Any ??????

Thank you!

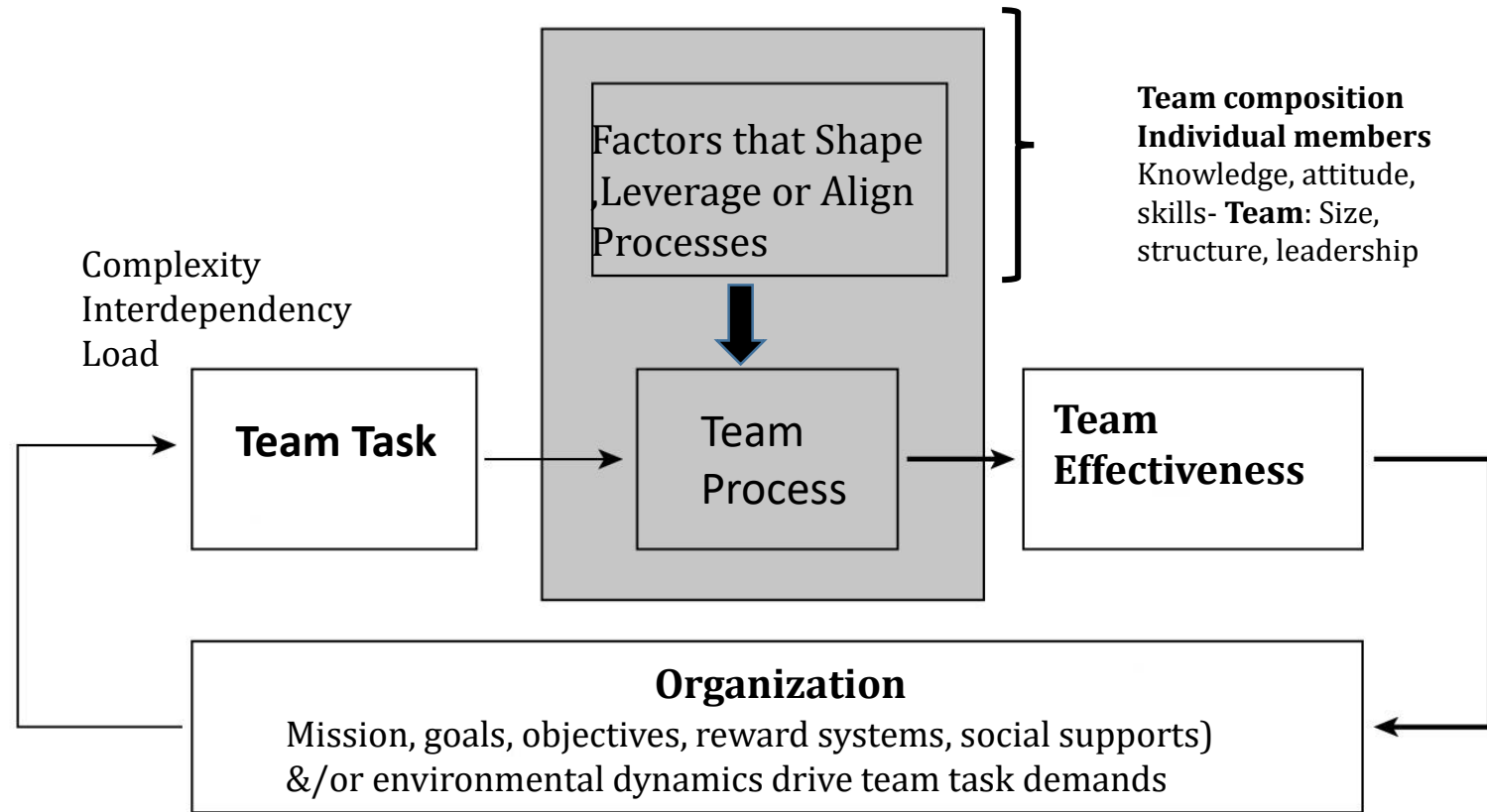
shah@marshall.edu



Dimension	Skills/Processes	Type of training
Diversity	Communication and interpersonal interactions	ID educational seminars, interpersonal skills training
Integration	Coordination and communication, shared mental models	Cross-training, knowledge-sharing training, coordination training
Size	Compositional, taskwork, and teamwork transactive memory	Positional clarification, communication, coordination training
Proximity	Compilational, compositional transactive memory, team cohesion/self-efficacy	Team reflexivity training, positional clarification training
Boundaries	Team-specific knowledge/goals	Cross-training, knowledge development
Task interdependence	Taskwork transactive memory	Team reflexivity training



National Research Council (2015) *Enhancing Effectiveness of Team Science* Conceptual Framework of Team Effectiveness



Enhancing the Effectiveness of Team Science. The National Academy Press:2015
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