NIH & Team Science

Sponsor Statement of Task Discussion

Research and Application in Team Science: Committee Meeting 1

Presenters:

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February 26, 2024
NASEM

Citation: Hall, K.L. & Spotts, E, (2024, February 26). NIH and Team Science. Presentation at the National Academies Research and Application in Team Science Committee Meeting 1, Washington, D.C.

NIH Sponsor Institutes, Centers, and Offices (ICO)

NIH Leads: Erica L. Spotts (OBSSR), Alyssa Dolge (OBSSR), & Kara L. Hall (NCI)

NIH sponsor ICOs	
Fogarty International Center	National Center for Advancing Translational Science
National Cancer Institute	National Institute on Aging
National Insitute of Arthritis and Musculoskeletal and Skin Diseases	National Institute of Biomedical Imaging and Bioengineering
National Institute of Environmental Health Sciences	National Institute of General Medical Sciences
National Institute of Mental Health	National Institute of Neurological Disorders and Stroke
NIH Brain Research Through Advancing Neurotechnologies (BRAIN) Initiative	National Institute of Nursing Research
NIH Chief Officer for Scientific Workforce Diversity (COSWD)	NIH Environmental Influences on Child Health Outcomes (ECHO)
NIH Office of Behavioral and Social Sciences Research	NIH Office of Disease Prevention
NIH Sexual and Gender Minority Research Office	

Committee Charge

Statement of Work

The role of diversity, equity, inclusion, and accessibility (DEIA) in current team science practices, including in-person, virtual, and hybrid environments. How does integration of DEIA impact team performance, processes, and outcomes? What principles and practices can be identified to best promote DEIA integration into team science throughout all stages of the research process and teams working across the translational continuum? What are the barriers for DEIA and how might they differ across disciplines, team sizes, and settings? ○ DEIA should be broadly defined to include but not limited to disciplinary diversity as well as race, ethnicity, sexual orientation, gender identify, socioeconomic position, ability status, educational status, and geography (e.g., rural versus urban).

The effectiveness, benefits, and potential pitfalls of virtual and hybrid approaches for team science. Are there models of collaboration outside of science that might inform best practices? What collaborative technologies are best suited for virtual and hybrid collaboration and how might these vary depending on the dimensions of team science, including the scale of the team, types of collaborators, degree of disciplinary integration, proximity of team members, permeability of team boundaries, disciplinary and form of research, and domains of research involved? What are best practices for working in the hybrid, virtual, and in-person work environment(s) and how might these vary depending on the dimensions of team science?

Evidence-based approaches and training that have been designed to enhance the effectiveness of team science and identify any gaps in resources and guidance. What methods have been employed and who was the target audience? What types of outcomes, methods, and measures are appropriate for evaluating team science training? What are best practices for training and/or optimizing teams that include various types of non-scientist team members?

Evidence of best practices in team science and how to enhance those efforts. What are the current team science best practices?

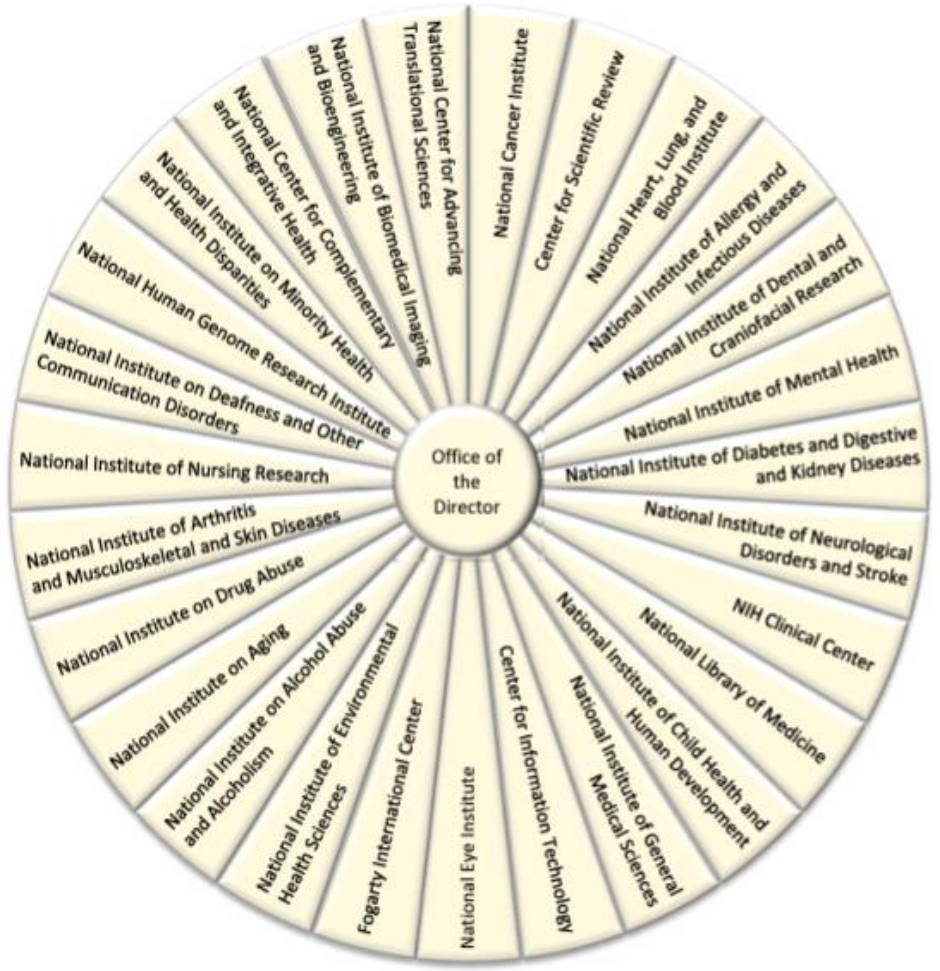
Informing Policies and Practices

Consensus Study Considerations

Key Take-Away

This consensus study is **important**.

- Informs policies and practices across the scientific enterprise
- Identifies research needed to further enhance policies and practices



Enhancing Policies and Practices with Evidence

Type of "Practices", Policies, and Interventions

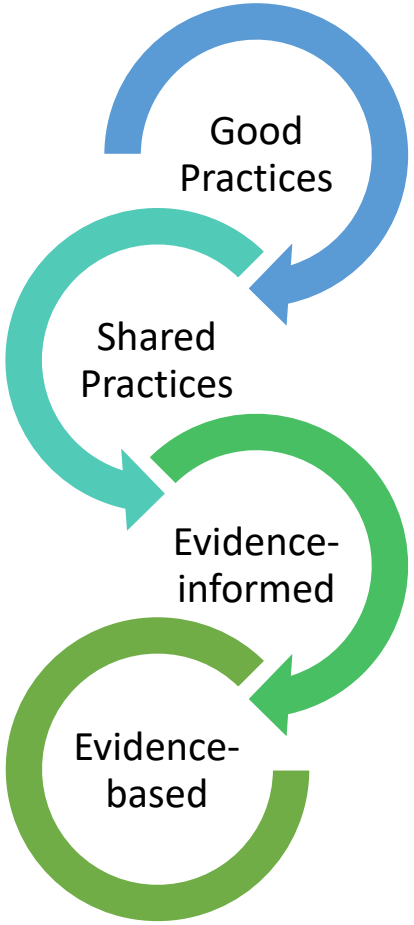
de novo solutions based primarily on tacit knowledge to address barriers, needs, and/or challenges

Practices that build on, adapt, and/or refine existing practices

Practices that draw on and incorporate insights from research evidence

Solutions based primarily on **research tested practices**

"Best" Practices



Level of "Evidence" Used

Local expert(s) **use tacit knowledge** to develop and implement new strategies

Local expert(s) look to the policies and practices and informal lessons learned of others to refine and adapt practices

Draw on empirical data, literature reviews, case studies, interviews, etc to build on/support tacit knowledge when developing practices

Practices tested via randomized trials, quasi-experimental designs, computational modeling, meta-analyses, etc. and adapted as needed,

Key Considerations for the Consensus Study

There is lot of ground to cover. Resources are dispersed across fields and organizations. And there are many unanswered questions.

- Leverage **existing definitions, concepts, and frameworks**
- Look to **diverse sources of knowledge**
- Use **creative strategies** to identify “best” available practices and evidence
- **Showcase “best” available** practices and evidence
- Develop **recommendations based on “best” available practices and evidence** in a particular area

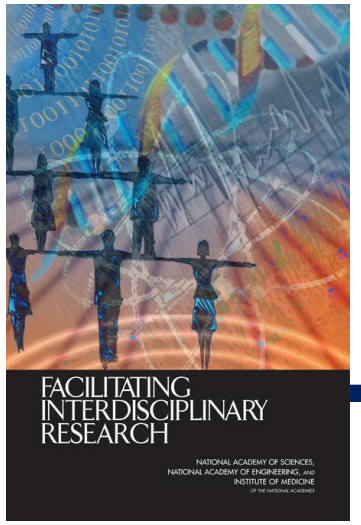
Terminology, Concepts, and Definitions

Draw on Existing Efforts and Look Towards Application

The National Academies of SCIENCES ENGINEERING MEDICINE

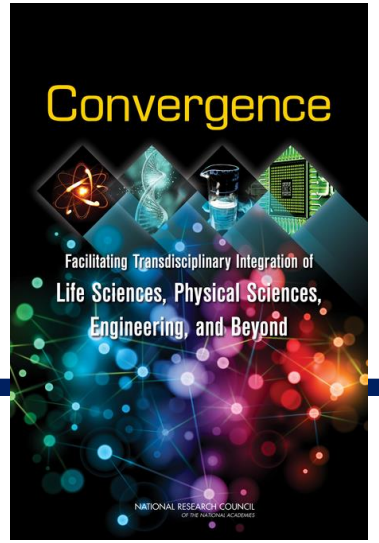
Build on Existing Efforts

2005



>17,000 downloads

2014



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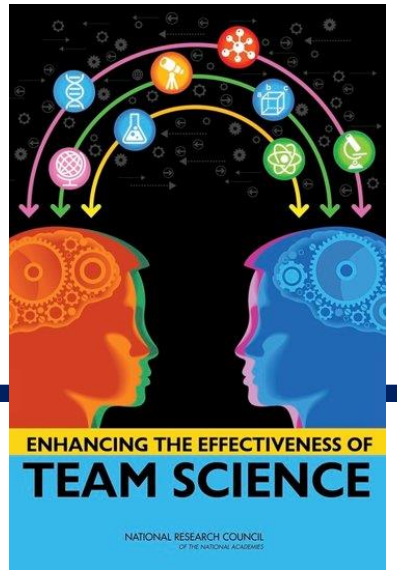
2015

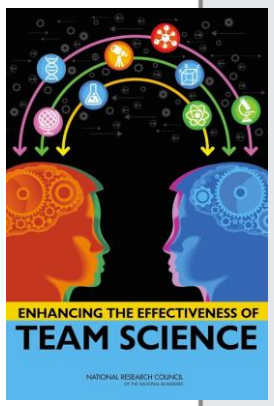


>30,000 downloads across 168 countries

New Consensus Study

Research & Application in Team Science

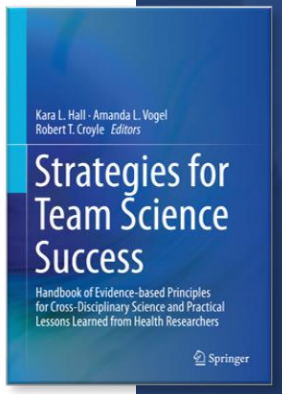
Team Science



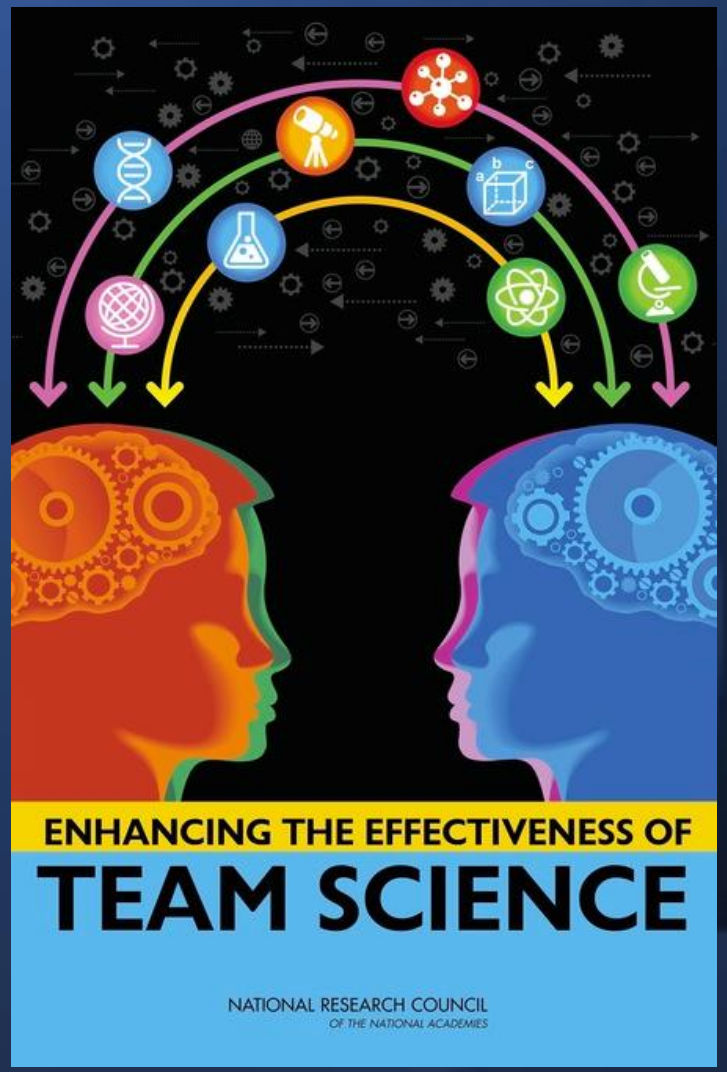
BOX 1-2
Definitions

- **Team science** – Scientific collaboration, i.e., research conducted by more than one individual in an interdependent fashion, including research conducted by small teams and larger groups.
- **Science teams** – Most team science is conducted by 2 to 10 individuals, and we refer to entities of this size as science teams.
- **Larger groups** – We refer to more than 10 individuals who conduct team science as larger groups.* These larger groups are often composed of many smaller science teams, and a few of them include hundreds or even thousands of scientists. Such very large groups typically possess a differentiated division of labor and an integrated structure to coordinate the smaller science teams; entities of this type are referred to as organizations in the social sciences.
- **Team effectiveness** (also referred to as **team performance**) – A team's capacity to achieve its goals and objectives. This capacity to achieve goals and objectives leads to improved outcomes for the team members (e.g., team member satisfaction and willingness to remain together), as well as outcomes produced or influenced by the team. In a science team or larger group, the outcomes include new research findings or methods and may also include translational applications of the research.

*Larger groups of scientists sometimes refer to themselves as "science teams."



"Team science" refers to both the ***approach*** of conducting research in , and the complex social, organizational, political, and technological ***milieus*** that heavily influence how that work occurs (Hall et al. 2018). The team science approach involves two or more individuals working interdependently toward a shared scientific goal. Team size spans from dyads to small teams, and from large groups to teams of teams. Teams also vary in their disciplinary composition and degree of disciplinary integration. (NRC 2015)



Team Science Diversity

TABLE 1-1 Dimensions of Team Science

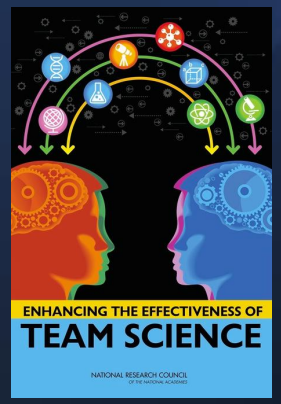
Dimension	Range	
Diversity of Team or Group Membership	Homogeneous	Heterogeneous
Disciplinary Integration	Unidisciplinary	Transdisciplinary
Team or Group Size	Small (2)	Mega (1000s)
Goal Alignment Across Teams	Aligned	Divergent or misaligned
Permeable Team and Organizational Boundaries	Stable	Fluid
Proximity of Team or Group Members	Co-located	Globally distributed
Task Interdependence	Low	High

Definitional Differences

Transdisciplinarity

- *"Disciplines" broadly defined*
- *Real World Actors*

Acknowledge vs Resolve



Disciplinary Integration

Across

Disciplines

Within

Transdisciplinary

Researchers from *different disciplines* work *jointly* to develop & use a shared conceptual framework that synthesizes & extends discipline-specific theories, concepts, & methods to create *new approaches* to address a common problem

Multidisciplinary

Researchers from *different disciplines work sequentially,* each from their own discipline-specific perspective, with a goal of eventually combining results to address a common problem

Interdisciplinary

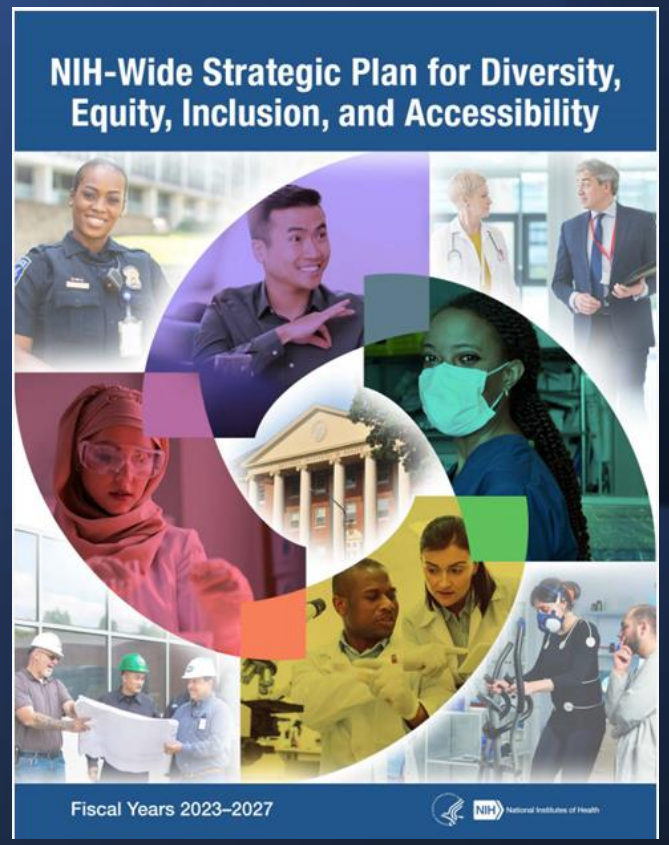
Researchers from *different disciplines work jointly* to address a common problem. Some integration of perspectives occurs, but contributions remain anchored in their own disciplines

Unidisciplinary

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

Hall, 2014 in National Research Council. 2015. *Enhancing the Effectiveness of Team Science*. Washington, DC: The National Academies Press.

Existing Definitions



DEIA

Diversity: The practice of including the many communities, identities, races, ethnicities, backgrounds, abilities, cultures, and beliefs of the American people, including underserved communities.

Equity: The consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment.

Inclusion: The recognition, appreciation, and use of the talents and skills of employees of all backgrounds.

Accessibility: The design, construction, development, and maintenance of facilities, information and communication technology, programs, and services so that all people, including people with disabilities, can fully and independently use them. Accessibility includes the provision of accommodations and modifications to ensure equal access to employment and participation in activities for people with disabilities, the reduction or elimination of physical and attitudinal barriers to equitable opportunities, a commitment to ensuring that people with disabilities can independently access every outward-facing and internal activity or electronic space, and the pursuit of best practices such as universal design.

Science of Team Science at NIH

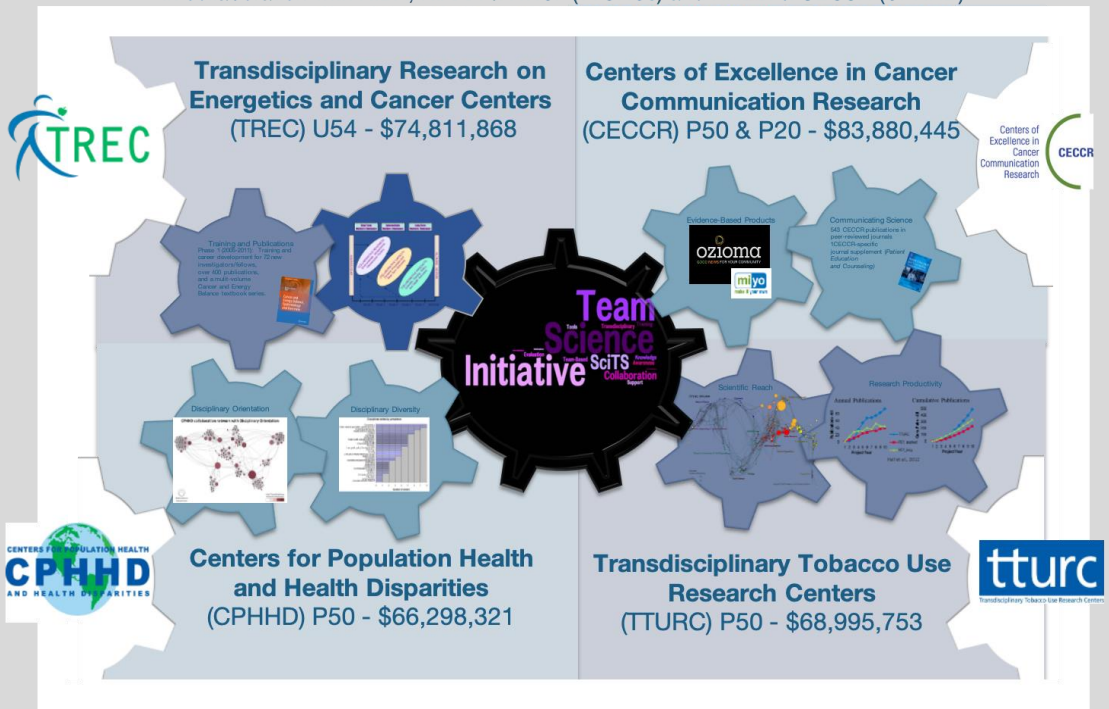
Context, Examples, and Team Science Challenges

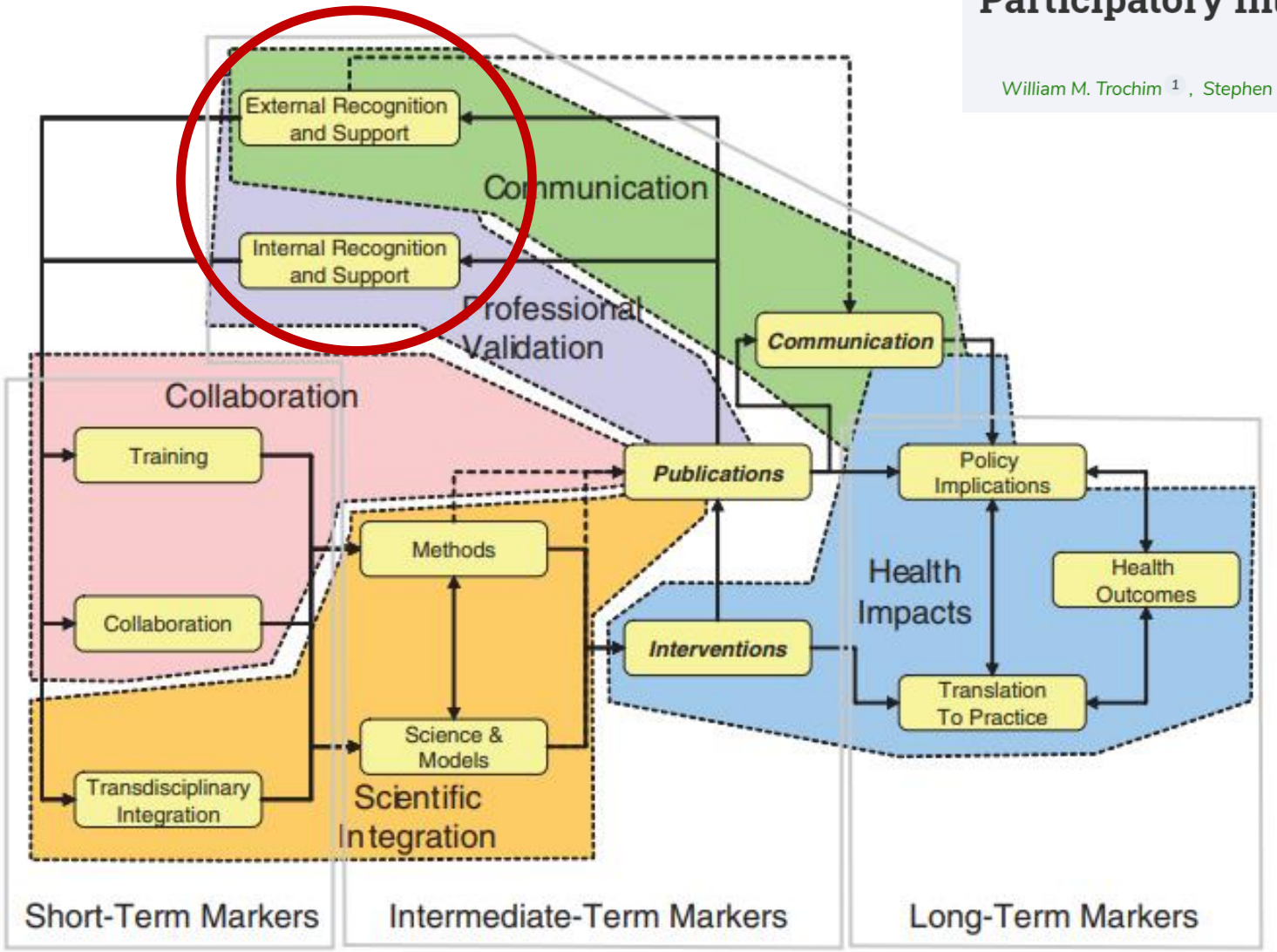
1995 2000 2005 2010 2015 2020 2025

Silos & Barriers

NCI **Transdisciplinary Center** Initiatives

*in collaboration with NIDA, NIAAA & RWJF (TTURCs) and NHLBI & OBSSR (CPHHD)





The Evaluation of Large Research Initiatives: A Participatory Integrative Mixed-Methods Approach

American Journal of Evaluation, 2008

William M. Trochim [1], Stephen E. Marcus [2], Louise C. Mâsse [3], Richard P. Moser [2], Patrick C. Weld [2]

Aims:

- Illuminate Challenges
- Justify Need for Investment
- Support Evidence-Informed Practices

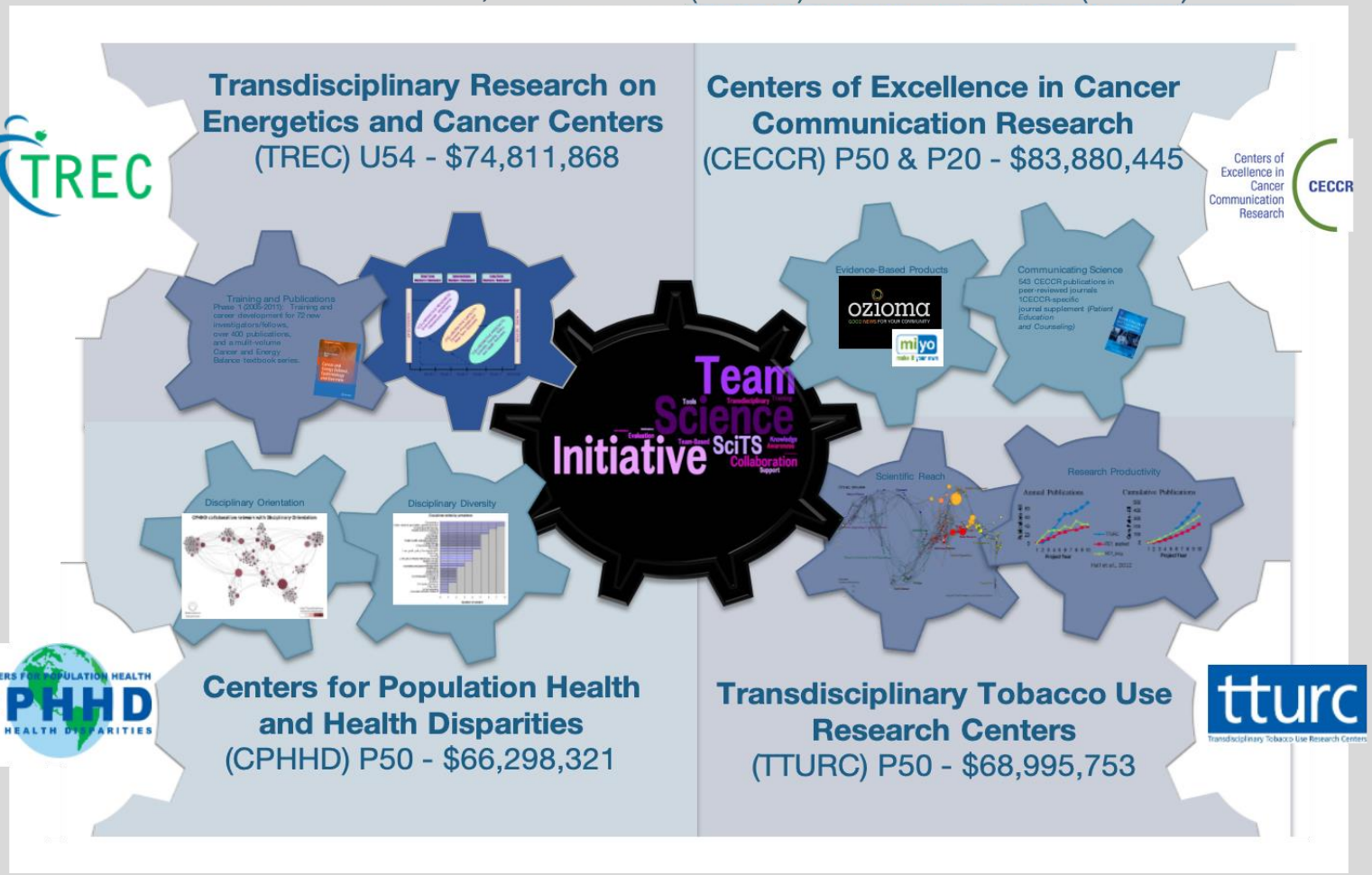
tturc

Transdisciplinary Tobacco Use Research Centers

1995 2000 2005 2010 2015 2020 2025

NCI **Transdisciplinary Center** Initiatives

*in collaboration with NIDA, NIAAA & RWJF (TTURCs) and NHLBI & OBSSR (CPHHD)



SciTS Studies:

Foci

- Integration
- Collaboration
- Productivity
- Impact
- Reach
- Research orientation
- Barriers/Facilitators
- P&T Policies
- Training

Methods

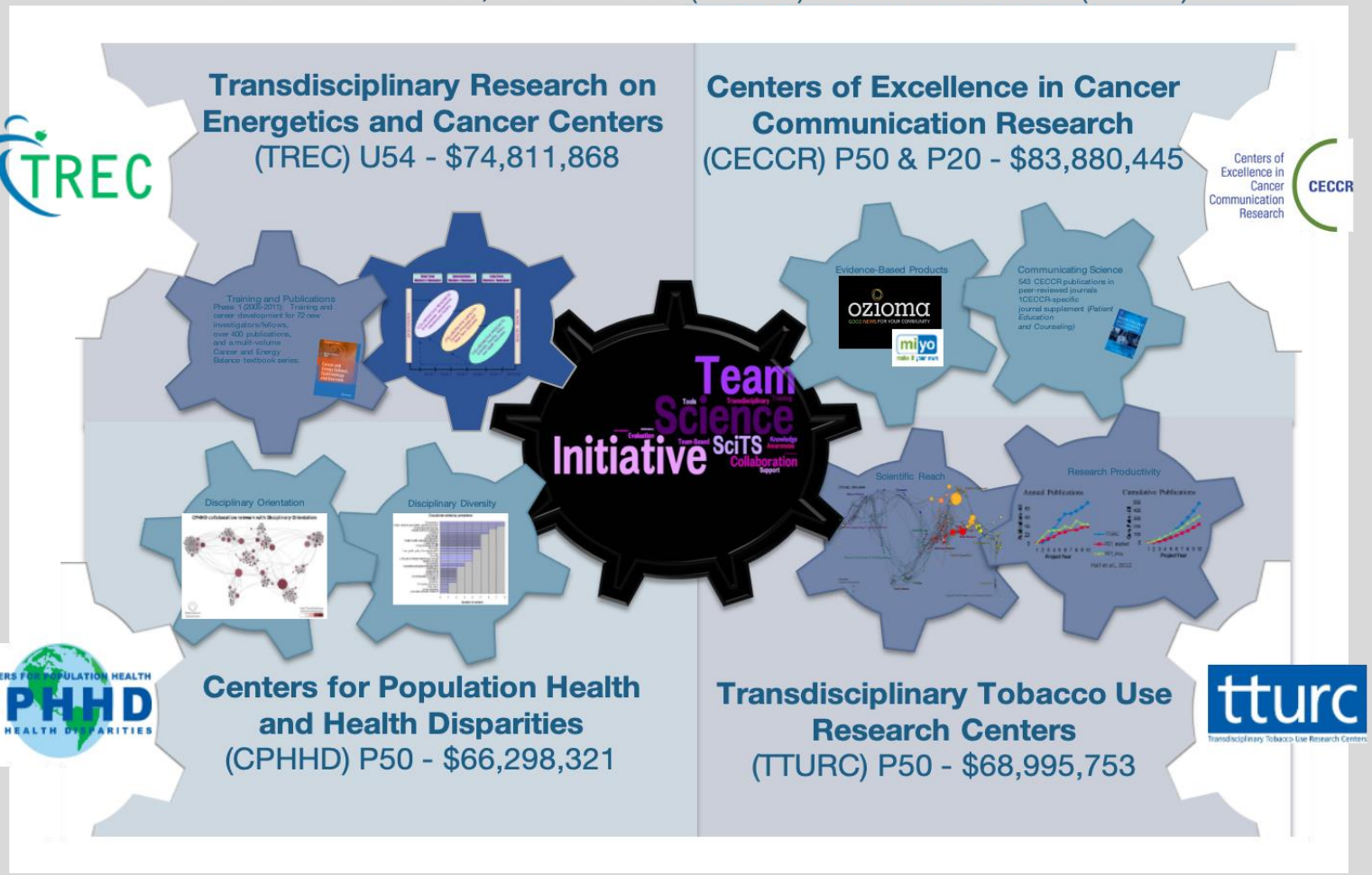
- Interview
- Survey
- Bibliometric
- Financial
- Science Mapping
- Written Products Protocol
- Social Network Analysis

1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025

Concepts – Measures – Models – Methods – Study Designs – Initiative Insights

NCI Transdisciplinary Center Initiatives

*in collaboration with NIDA, NIAAA & RWJF (TTURCs) and NHLBI & OBSSR (CPHHD)



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- Financial
- Science Mapping
- Written Products Protocol
- Social Network Analysis

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:

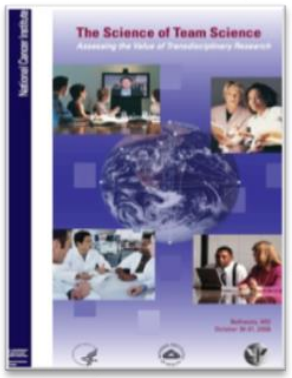
1. Generate an evidence-base
2. Develop translational applications

To help maximize the efficiency, effectiveness of team science.

Key SciTS Questions

- What is the added value of team science?
- What team processes (e.g., communication, coordination approaches) help maximize scientific innovation and productivity?
- What characteristics and skills of team leaders and team members facilitate successful team functioning?
- How can organizations (funding agencies, academia, industry) most effectively facilitate and support team science to advance discovery?
- What policies are needed?

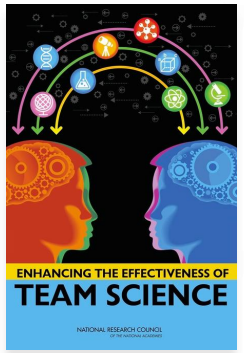
Building the SciTS Field



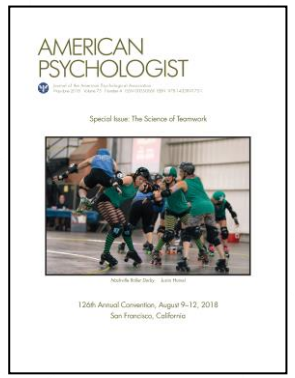
NCI SciTS/ Transdisciplinary Conference

Science of Teams Informing SciTS

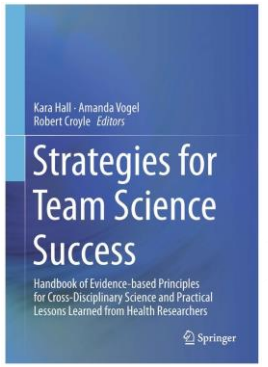
Team Approaches to Science, Practice, & Policy in Health



National Academies Consensus Study



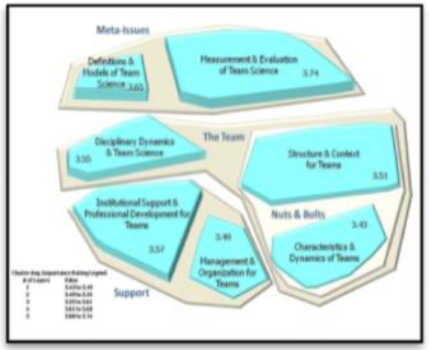
The Science of Team Science: A Review of the Empirical Evidence



2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

SciTS Journal Supplement

Mapping a Research Agenda for SciTS



Collaboration Science & Translational Medicine

Annual International SciTS Conference

INSciTS
New scientific society launched

ITD ALLIANCE

SciTS | Building the knowledge base for effective team science

1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025

Journal of Translational Medicine & Epidemiology
SciMedCentral

Research Article

Pioneering the Transdisciplinary Team Science Approach: Lessons Learned from National Cancer Institute Grantees

Amanda L Vogel[1]*, Brooke A Stipelman[2], Kara L Hall[2], Linda Nebeling[2], Daniel Stokols[3] and Donna Spruijt-Metz[4]

TREC

Conceptual and Scientific Challenges

- Lack of **clarity** about "what TD is" & "how you get there"
- TD science "**stretches**" investigators' intellectual "capacity" more than UD research
- TD research is **more complex** than UD research

Different Disciplinary Cultures Among Collaborators

- Differences in **values, language, traditions**
- Team members want to stay in their **"comfort zone"** (re: disciplinary culture)

Management Challenges

- TD research = ***more*** time, resources, planning, and management than UD research
- **Compromise**, change in routines (e.g., data management)
- Physical distance = communication challenges, slowed research process

Incentive and Recognition Systems and Academic Norms

- Academic incentives have **not yet "caught up"** to TD research (e.g., P&T criteria, limited funding opportunities, publishing venues)
- Colleagues may be **unfamiliar with TD research** (e.g., IRB, grant/manuscript review)

Organizations

Structures

People

Processes

Platforms

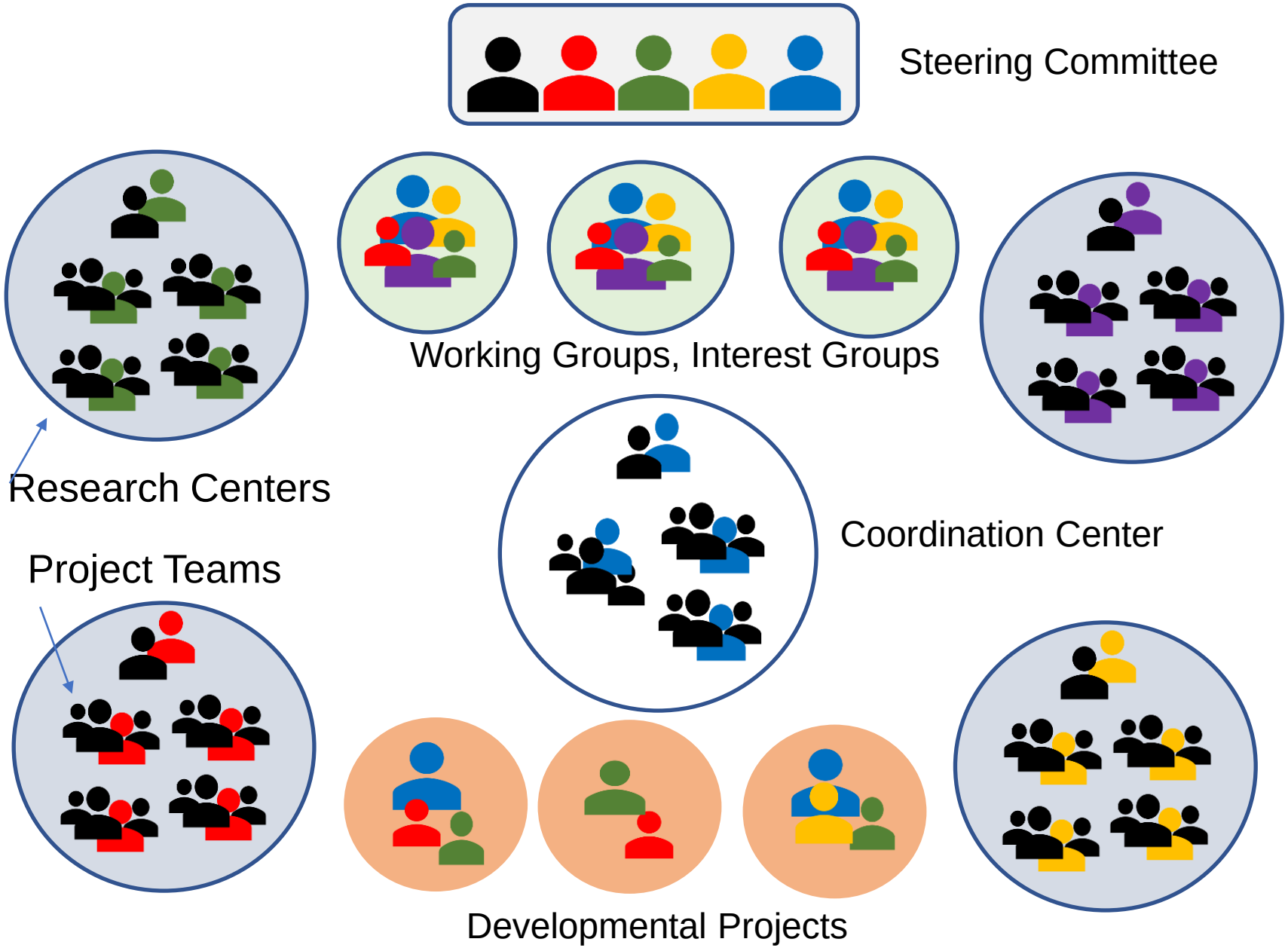
Products

Intentional & Evidence-Informed

Establish ***structures*** that enable ***people*** to work together in a **team and/or system.**

Develop ***processes & platforms*** designed to facilitate teams to produce ***products*** that align with the **team or system's vision and goals.**

Center Initiative - Multi-team System



MULTITEAM SYSTEM CHARACTERISTIC		Key Considerations for Effective MTSs
MTS Goal Hierarchy	Each MTS component team pursues **subordinate team goals**, while also pursuing **superordinate system goals**	• Understanding **goals of different teams**, and **how the different goals are related** to one another

Interteam Inter-dependence	Each component team is **mutually reliant** on at least one other team **to achieve higher-order goals**.	• Understanding the teams…
		  • …**on whom they are most reliant**?
		  • …**who are most reliant on them**?

Interteam Differentiation	The **boundaries of each component team** are identifiable	• Uniquely identifying each **component team** • Awareness of distinct team-level identities, goals, AND contributions to the system
Boundary Spanning Com-munication	Communication processes that **bridge a team to other teams** in the MTS, and to the external environment	• Component teams have **at least one** individual who serves as a **boundary spanner**, who continuously **works to maintain and develop relationships** with other teams' boundary spanners
Interteam Leadership	**Influences relationships** between teams that **motivate members to work together** toward the accomplishment of **MTS goals**	• Having a **subset of individuals** who provide **leadership** in support of **multiteam goals** • Leaders **facilitate connections** between teams and **motivating** the members of all component teams to pursue **team goals** as well as **MTS goals**

Adapted from Carter, D. et al (2019) in K.L. Hall et al - Strategies for Team Science Success

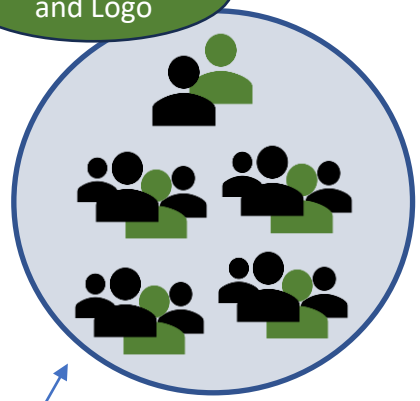
"Team" Name & Logo

Research Initiative

Multi-team System

Steering Committee

Team Name and Logo



Working Groups, Interest Groups

Research Centers

Project Teams

Coordination Center

Developmental Projects

MTS Goal Hierarchy
Interteam Leadership

Interteam Differentiation

Boundary Spanning
Communication

Interteam
Inter-dependence

Evidence- informed

"Team" Name & Logo

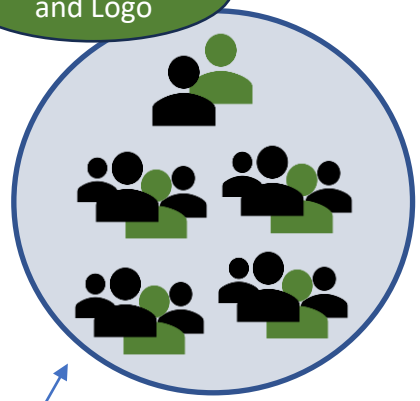
Research Initiative

Multi-team System

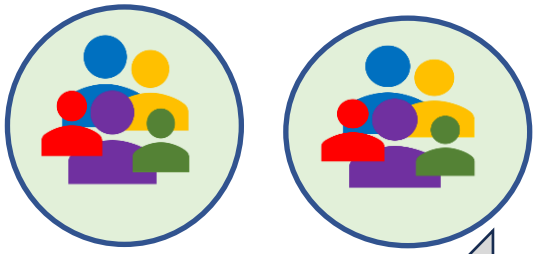
Steering Committee

MTS Goal Hierarchy
Interteam Leadership

Team Name and Logo



Research Centers



Working Groups

nterest

- How do we accelerate the integration of evidence into our practices?
- What do we know about **virtual and hybrid work** to enhance our current team science structures, supports, and practices?
- What changes are needed to **integrate diverse research members, such as patients and community members, throughout the research process**?

on

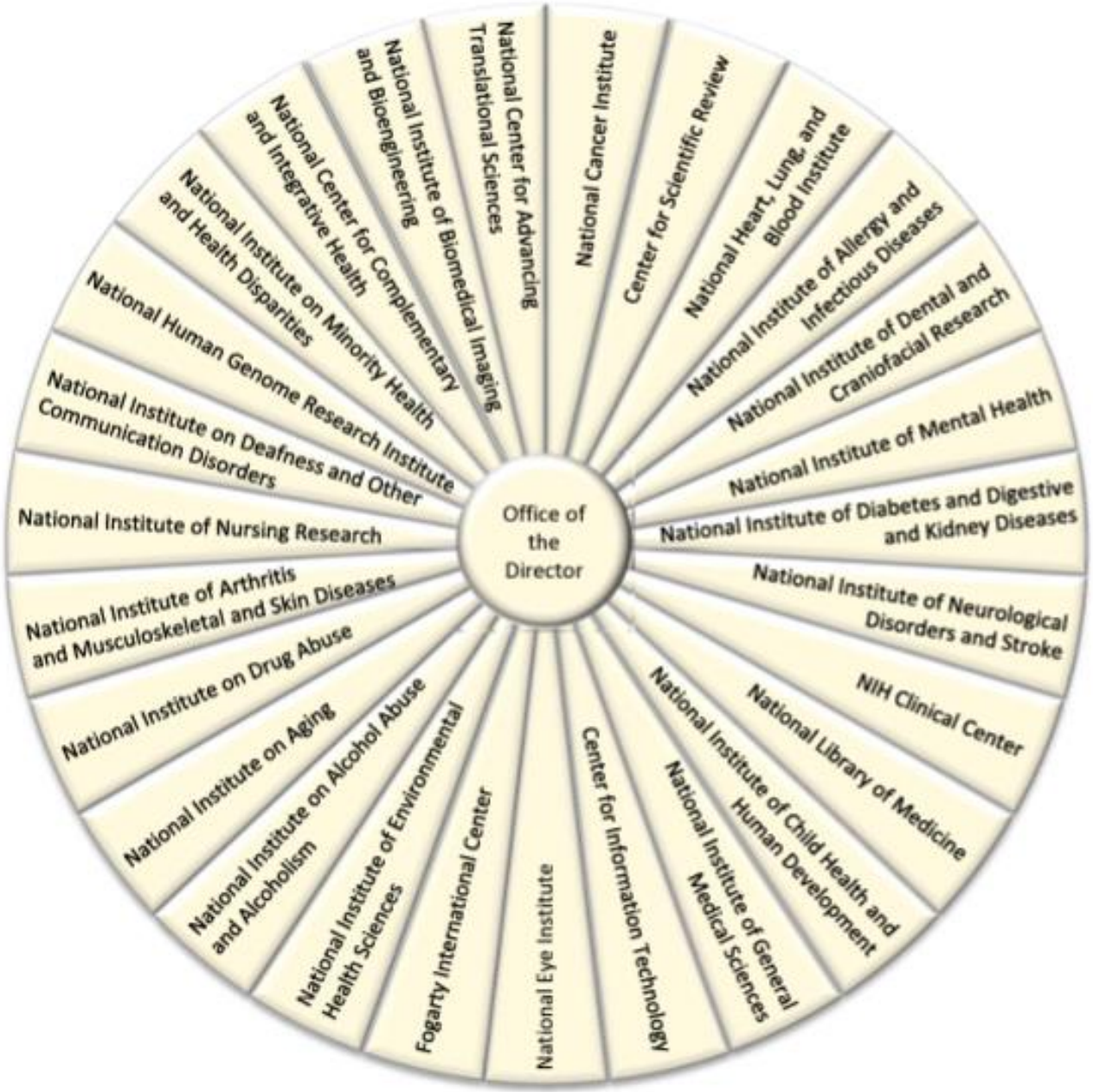
Project Teams

Developmental Projects

Evidence- informed

NIH Team Science

Examples and On-going Needs



1995 2000 2005 2010 2015 2020 2025

RFA Language:

In 2014, NIH aimed help address barriers and challenges to team science by adding new language to the regularly released CTSA funding opportunity announcement (FOA), which stated: "***CTSA hubs should advance team science and develop academic promotion criteria that help create a viable career path for translational scientists***."

NIH National Center for Advancing Translational Science (NCATS)
RFA-TR-14-009

Promotion & Tenure Policy Language:

"***Concordant with the position of the National Institutes of Health***, the ***Medical School values Co-Principal Investigators and interdisciplinary collaboration*** on ***major funding proposals*** as well."

U Minnesota, 2016; Hall et al. 2018

1995 2000 2005 2010 2015 2020 2025

CellPress

Neuron

NeuroView

NIH BRAIN Circuits Programs: An Experiment in Supporting Team Neuroscience

Karen K. David,[1] Hsiao Yu Fang,[1] Grace C.Y. Peng,[1] and James W. Gnadt[1,*]
[1]BRAIN Initiative, National Institutes of Health, Bethesda, MD, USA
*Correspondence: gnadtjw@nih.gov
https://doi.org/10.1016/j.neuron.2020.11.020

The NIH BRAIN Initiative is aimed at revolutionizing our understanding of the human brain. Here, we present discussion of support for team research in investigative neuroscience at different stages and on various scales.

The *Brain Research Through Advancing Innovative Neurotechnologies*® (BRAIN) Initiative

Revolutionizing our understanding of the human brain

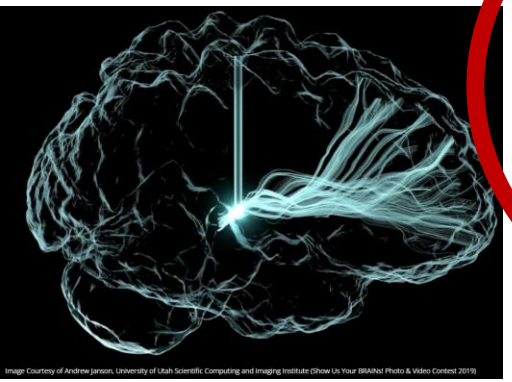


Image Courtesy of Andrew Janson, University of Utah Scientific Computing and Imaging Institute (Show Us Your BRAINs! Photo & Video Contest 2019)

Opportunities

- Comprehensive, multi-scale, multi-modal, rigorous science, generalizability
- Bridge fields, scales, species
- Multi-faceted trainees
- Big picture

Challenges

- **Credit Assignment, hiring, and promotion**
- Sense of ownership (particularly for early career stage scientists)
- **Incentives** remain individualistic (co-publication vs first/last authorship)
- **Program and data coordination across labs**
- **Diversity and inclusion**

The *Brain Research Through Advancing Innovative Neurotechnologies*® (BRAIN) Initiative

Revolutionizing our understanding of the human brain

LEARN MORE

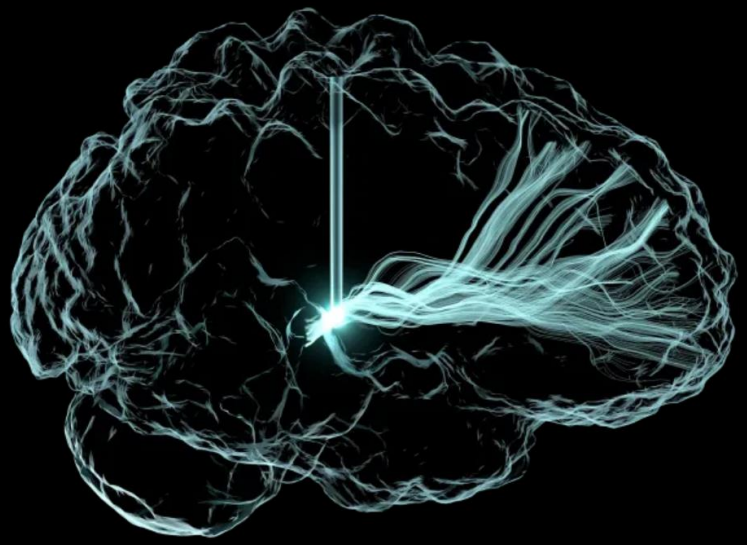


Image Courtesy of Andrew Janson, University of Utah Scientific Computing and Imaging Institute (Show Us Your BRAINs! Photo & Video Contest 2019)

Team Science (U01 & U19):

The NIH BRAIN Initiative is pleased to offer a program of funding opportunities that supports teams of scientists who seek to cross boundaries of interdisciplinary collaboration to advance brain science. A synergistic team-based approach allows researchers with diverse expertise, perspectives, and ideas to work together to set and tackle innovative and challenging goals. Together, the team has an opportunity to transform neuroscience and enable significant advances in the field.

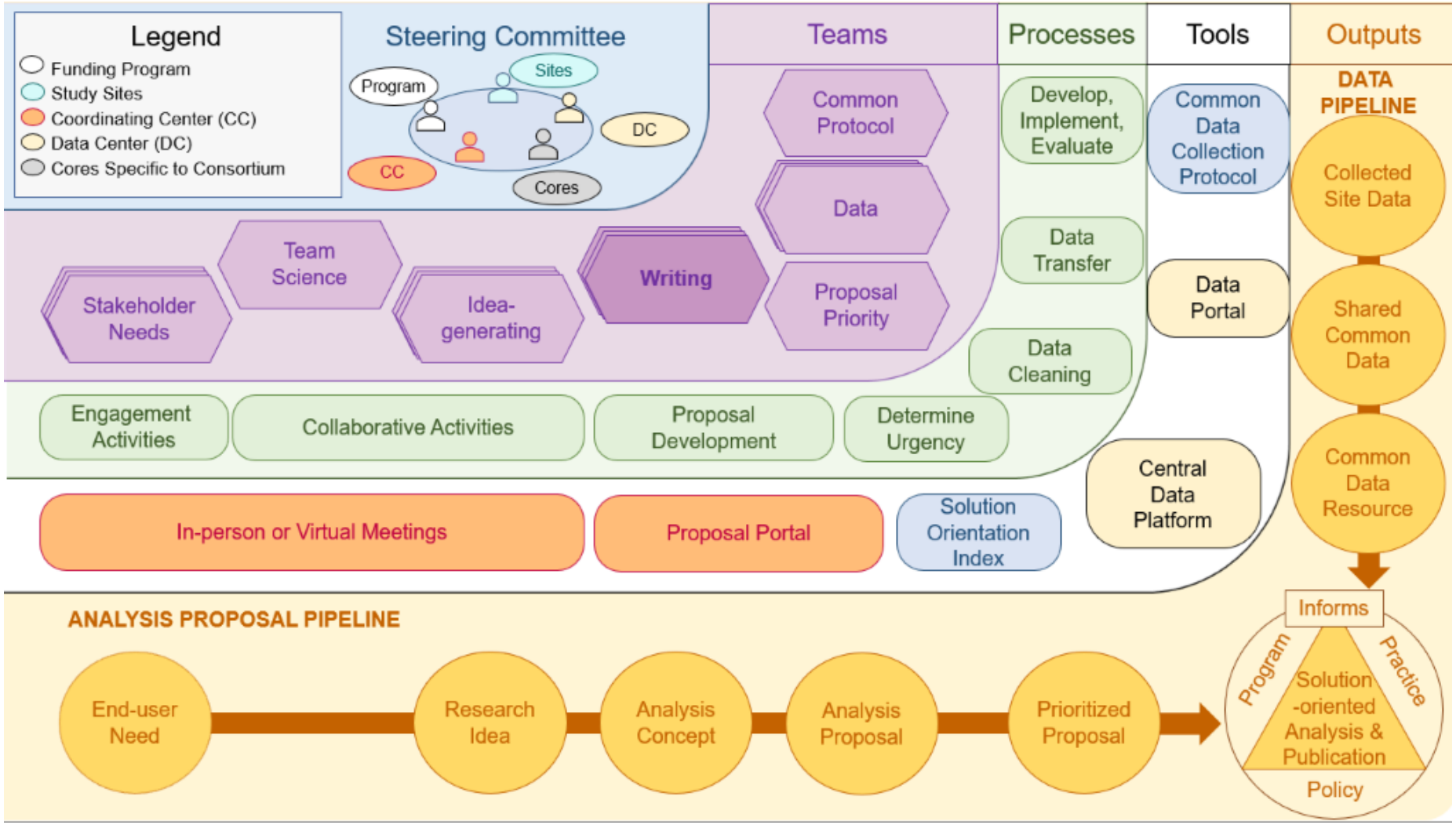
Additionally, by participating in team science, researchers will:

- Add distinct and diverse perspectives to improve the quality and value of the research
- Develop innovative conceptual frameworks, approaches, and technologies
- Build and strengthen a collaborative network of multidisciplinary researchers with similar scientific interests
- Build bridges for mentees

Needs and Challenges

- **Guidance to applicants and awardees** for engaging in more effective team science.
- **Develop and deploy team science funding opportunities that align with community best practices**.
- Need Inter/multi/trans-disciplinary science that is transformative, high-risk/high-reward and cutting-edge.
- Need **new pathways for careers rooted in team-based collaboration**
  - How is credit assigned?
  - What are the best ways to share data?
  - What are new ways to consider hiring and promoting?

Environmental influences on Child Health Outcomes (ECHO) Program



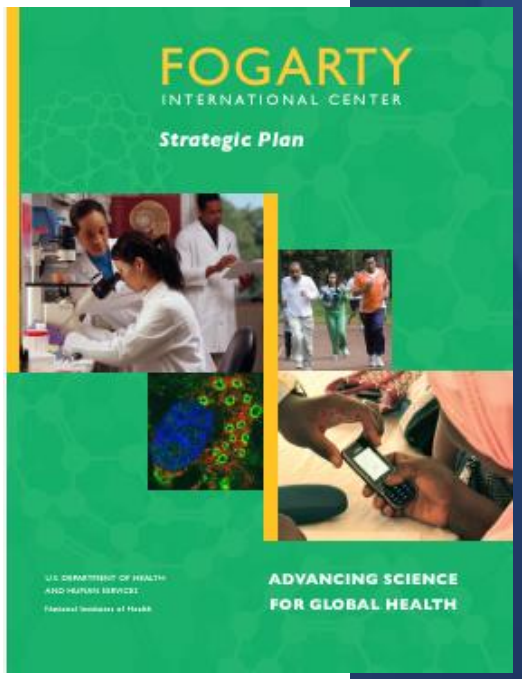
Needs and Challenges

- **Justification of resources for Team Science**
- Evaluation of Team Science
- Training, practices and improvement-focused evaluation for DEIA.
- Institutional and programmatic **policies for empowering team science practices and outcomes**

Thompson LC, Hall KL, Vogel AL, Park CH, Gillman MW. Conceptual models for implementing solution-oriented team science in large research consortia. J Clin Transl Sci. 2021 Jun 14;5(1):e139.

International Collaboration

The **Fogarty International Center** at the U.S. National Institutes of Health (NIH) is dedicated to advancing the NIH mission by supporting and facilitating global health research conducted by U.S. and international investigators, building partnerships between health research institutions in the U.S. and abroad, and training the next generation of scientists to address global health needs.



- Build research capacity through INDIVIDUALS, INSTITUTIONS, and NETWORKS to meet future and evolving global health challenges
- Stimulate innovation in the development and implementation of technologies and other **locally relevant solutions** to address global health problems
- Build and strengthen partnerships within **international** settings and **collaborations** to advance global health research and research capacity

Office of Behavioral and Social Science Research (OBSSR)

Application of BSSR - Science of Science

- Tasked by the **NIH Council of Councils bBSSR report to use behavioral science to address participation in science,** trust in science, research policy, science communication, and understanding the scientific process.

Integration of BSSR across the Biomedical Sciences

- Advancing the science of aggression across species and disciplines workshop (June 14-15, 2023)
  - Hub-and-spoke model that integrated research across disciplines and species.

How can we best support **"small" team science**?

What strategies exist for the **co-production of knowledge**?

What **guidance** can we offer?

Consensus Priories, Input, Evidence Synthesis

2011 **Trans-Agency Collaboration Subcommittee via the White House Office of Science and Technology Policy (OSTP), Networking and Information Technology Research and Development (NITRD) Program, Social, Economic and Workforce Implications of IT (SEW)**

2013 **Collaboration Plans Identified as a Cross-cutting Priority**

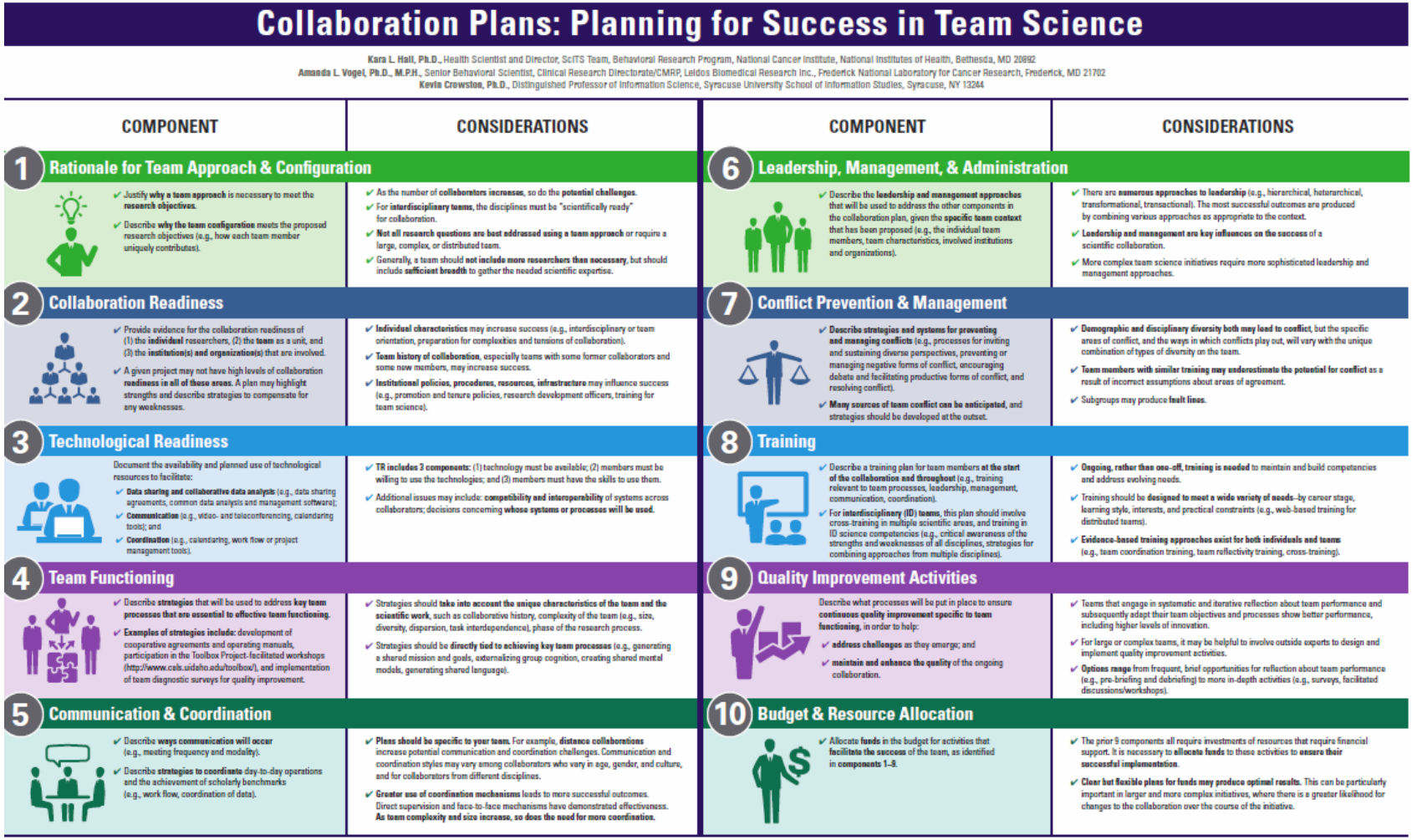
2014 **Collaboration Workshop Series**

2015 **Collaboration Plans Infographic Dissemination**

2016 **Collaboration Plans How to Guidance Document**

2019 **Expanded Collaboration Planning Guidance in *Strategies for Team Science Success*** (Open Access Chapter)

Changing Practice and Policies - Takes Time



Collaboration Plans: Planning for Success in Team Science

Kara L. Hall, Ph.D., Health Scientist and Director, SciTS Team, Behavioral Research Program, National Cancer Institute, National Institutes of Health, Bethesda, MD 20892
Amanda L. Vogel, Ph.D., M.P.H., Senior Behavioral Scientist, Clinical Research Directorate/CMRP, Leidos Biomedical Research Inc., Frederick National Laboratory for Cancer Research, Frederick, MD 21702
Kevin Crowston, Ph.D., Distinguished Professor of Information Science, Syracuse University School of Information Studies, Syracuse, NY 13244

COMPONENT	CONSIDERATIONS
1 Rationale for Team Approach & Configuration	
✔ Justify **why a team approach** is necessary to meet the **research objectives**. ✔ Describe **why the team configuration** meets the proposed research objectives (e.g., how each team member uniquely contributes).	✔ As the number of **collaborators increases**, so do the **potential challenges**. ✔ For **interdisciplinary teams**, the disciplines must be "scientifically ready" for collaboration. ✔ **Not all research questions are best addressed using a team approach** or require a large, complex, or distributed team. ✔ Generally, a team should **not include more researchers than necessary**, but should include **sufficient breadth** to gather the needed scientific expertise.
2 Collaboration Readiness	
✔ Provide evidence for the collaboration readiness of (1) the **individual** researchers, (2) the **team** as a unit, and (3) the **institution(s) and organization(s)** that are involved. ✔ A given project may not have high levels of collaboration **readiness in all of these areas**. A plan may highlight strengths and describe strategies to compensate for any weaknesses.	✔ **Individual characteristics** may increase success (e.g., interdisciplinary or team orientation, preparation for complexities and tensions of collaboration). ✔ **Team history of collaboration**, especially teams with some former collaborators and some new members, may increase success. ✔ **Institutional policies, procedures, resources, infrastructure** may influence success (e.g., promotion and tenure policies, research development officers, training for team science).
3 Technological Readiness	
Document the availability and planned use of technological resources to facilitate: ✔ **Data sharing and collaborative data analysis** (e.g., data sharing agreements, common data analysis and management software); ✔ **Communication** (e.g., video- and teleconferencing, calendaring tools); and ✔ **Coordination** (e.g., calendaring, work flow or project management tools).	✔ **TR includes 3 components:** (1) technology must be available; (2) members must be willing to use the technologies; and (3) members must have the skills to use them. ✔ Additional issues may include: **compatibility and interoperability** of systems across collaborators; decisions concerning **whose systems or processes will be used**.
4 Team Functioning	
✔ Describe **strategies** that will be used to address **key team processes that are essential to effective team functioning**. ✔ **Examples of strategies include:** development of cooperative agreements and operating manuals, participation in the Toolbox Project-facilitated workshops (http://www.cals.uidaho.edu/toolbox/), and implementation of team diagnostic surveys for quality improvement.	✔ Strategies should **take into account the unique characteristics of the team and the scientific work**, such as collaborative history, complexity of the team (e.g., size, diversity, dispersion, task interdependence), phase of the research process. ✔ Strategies should be **directly tied to achieving key team processes** (e.g., generating a shared mission and goals, externalizing group cognition, creating shared mental models, generating shared language).
5 Communication & Coordination	
✔ Describe **ways communication will occur** (e.g., meeting frequency and modality). ✔ Describe **strategies to coordinate** day-to-day operations and the achievement of scholarly benchmarks (e.g., work flow, coordination of data).	✔ **Plans should be specific to your team.** For example, **distance collaborations** increase potential communication and coordination challenges. Communication and coordination styles may vary among collaborators who vary in age, gender, and culture, and for collaborators from different disciplines. ✔ **Greater use of coordination mechanisms** leads to more successful outcomes. Direct supervision and face-to-face mechanisms have demonstrated effectiveness. **As team complexity and size increase, so does the need for more coordination.**
6 Leadership, Management, & Administration	
✔ Describe the **leadership and management approaches** that will be used to address the other components in the collaboration plan, given the **specific team context** that has been proposed (e.g., the individual team members, team characteristics, involved institutions and organizations).	✔ There are **numerous approaches to leadership** (e.g., hierarchical, heterarchical, transformational, transactional). The most successful outcomes are produced by combining various approaches as appropriate to the context. ✔ **Leadership and management are key influences on the success** of a scientific collaboration. ✔ More complex team science initiatives require more sophisticated leadership and management approaches.
7 Conflict Prevention & Management	
✔ **Describe strategies and systems for preventing and managing conflicts** (e.g., processes for inviting and sustaining diverse perspectives, preventing or managing negative forms of conflict, encouraging debate and facilitating productive forms of conflict, and resolving conflict). ✔ **Many sources of team conflict can be anticipated**, and strategies should be developed at the outset.	✔ **Demographic and disciplinary diversity both may lead to conflict**, but the specific areas of conflict, and the ways in which conflicts play out, will vary with the unique combination of types of diversity on the team. ✔ **Team members with similar training may underestimate the potential for conflict** as a result of incorrect assumptions about areas of agreement. ✔ Subgroups may produce **fault lines**.
8 Training	
✔ Describe a training plan for team members **at the start of the collaboration and throughout** (e.g., training relevant to team processes, leadership, management, communication, coordination). ✔ For **interdisciplinary (ID) teams**, this plan should involve cross-training in multiple scientific areas, and training in ID science competencies (e.g., critical awareness of the strengths and weaknesses of all disciplines, strategies for combining approaches from multiple disciplines).	✔ **Ongoing, rather than one-off, training is needed** to maintain and build competencies and address evolving needs. ✔ Training should be **designed to meet a wide variety of needs**—by career stage, learning style, interests, and practical constraints (e.g., web-based training for distributed teams). ✔ **Evidence-based training approaches exist for both individuals and teams** (e.g., team coordination training, team reflectivity training, cross-training).
9 Quality Improvement Activities	
Describe what processes will be put in place to ensure **continuous quality improvement specific to team functioning**, in order to help: ✔ **address challenges** as they emerge; and ✔ **maintain and enhance the quality** of the ongoing collaboration.	✔ Teams that engage in systematic and iterative reflection about team performance and subsequently adapt their team objectives and processes show better performance, including higher levels of innovation. ✔ For large or complex teams, it may be helpful to involve outside experts to design and implement quality improvement activities. ✔ **Options range** from frequent, brief opportunities for reflection about team performance (e.g., pre-briefing and debriefing) to more in-depth activities (e.g., surveys, facilitated discussions/workshops).
10 Budget & Resource Allocation	
✔ Allocate **funds** in the budget for activities that **facilitate the success** of the team, as identified in **components 1–9**.	✔ The prior 9 components all require investments of resources that require financial support. It is necessary to **allocate funds** to these activities to **ensure their successful implementation**. ✔ **Clear but flexible plans for funds may produce optimal results.** This can be particularly important in larger and more complex initiatives, where there is a greater likelihood for changes to the collaboration over the course of the initiative.

Application Structure different from typical NIH applications

Collaborative Opportunities for Multidisciplinary, Bold, and Innovative Neuroscience (COMBINE) (RM1, RFA-NS-23-027)

Transformative – Integrative - Innovative

- Address **"how will the project challenge existing paradigms, overcome long-standing roadblocks to progress, and/or develop new synergies between different scientific fields?"**
- Be intentional about **integrating efforts**: Highlight activities, planned outcomes, and/or frameworks that act as "glues", serving to integrate and **combine efforts across disciplines and team members**.
- Applications will assume some degree of risk and are in general more ambitious and innovative than traditional NIH applications. Because feasibility will be assessed, applicants should carefully manage any risk in the premise and/or approach.

Specific Aims and 15-page Research Strategy: structured differently (see Section IV).

- Specific Aims Page: *Multiple aims are inappropriate as the research plan must be focused on pursuing a single focused goal.*
- Research strategy (15-page max). Use subheadings: "Importance of the Research and Appropriateness for the NINDS COMBINE program" and "Approach and Experimental Design".

Three Other Attachments: The success of team science hinges on

1. **Well-managed team interactions** (**Team Management Plan** is complementary to MPI Leadership Plan).
2. **Clear Timelines and Benchmarks for Success**
3. **Evidence of commitment** to diversity, equity, and inclusion (**Plan for Enhancing Diverse Perspectives (PEDP)**)
   - ❑ Definition of "diverse perspectives" is broad
   - ❑ Unique and customized to the proposal; Summary of strategies+ timeline/milestones+approach to assess progress

NIH National Institute of Neurological Disorders and Stroke

Policies to Support Engagement
Plan for Enhancing Diverse Perspectives (PEDP)

The BRAIN Initiative® first implemented PEDP in 2021

What is a PEDP? A summary of strategies to advance the scientific and technical merit of the proposed project through inclusivity.

- To capitalize on innovative ideas, distinct perspectives, variety of experiences, training, backgrounds, and skillsets
- Definition of "diverse perspectives" is broad

What are **key practices for leveraging diverse science teams** specifically to advance translational progress?

What **guidance** can we offer?

WHO DOES the research

Investigators/trainees who are:

- historically underrepresented in the biomedical research workforce (NOT-OD-20-031)
- from different scientific disciplines
- at varying career stages
- with varied skills, experience, and expertise

WHO PARTICIPATES

- Recruit diverse participants for human studies.
- Use of specimens derived from varied ancestries.
- Any projects involving human participants or samples derived from humans should be collected in an ethically sound manner and consented appropriately

WHERE is it done

- Participation of researchers from diverse organizations and institutions (e.g., research intensive & active, undergraduate, minority-serving, community-based, etc.).

Resources to Engage the Community

NIH National Institutes of Health
Community Engagement Alliance

NIH CEAL
Community Engagement Alliance

Resources for Biomedical Citizen Science Research

NIH has many programs that support biomedical citizen science projects. Below you can find links to resources for researchers and the public to learn more about conducting or participating in citizen science activities. Learn more about programs at the NIH that support biomedical citizen science.

CitizenScience.gov

Citizenscience.gov is the official government website designed to accelerate the use of crowdsourcing and citizen science across the federal government. The site includes a catalog of federally supported citizen science projects as well as a toolkit to assist federal employees with project design and maintenance.

Crowdsourcing and Citizen Science Community

The Federal Community of Practice on Crowdsourcing and Citizen Science (FedCCS) works across the governr

The Community Engagement Alliance Consultative Resource

Topics:
Health Disparities in Chronic Conditions,
Community-Specific Health Disparities, Consultative Resource

The Community Engagement Alliance Consultative Resource (CEACR) serves as a channel for community-engaged best practices to NIH-funded research teams wanting to apply principles of community-engaged approaches to address health disparities and ensure inclusion in research programs. Through a partnership between the University of Pittsburgh and Community-Campus Partnerships for Health, CEACR has held more than 30 personalized consultations ranging in focus from equitable partner compensation to cultural appropriateness of public-facing study recruitment materials. Over 300 people across the country have joined CEACR webinars, which bring together experts from academic, clinical, and community-based settings to lead discussions focused on inclusive participation in research.

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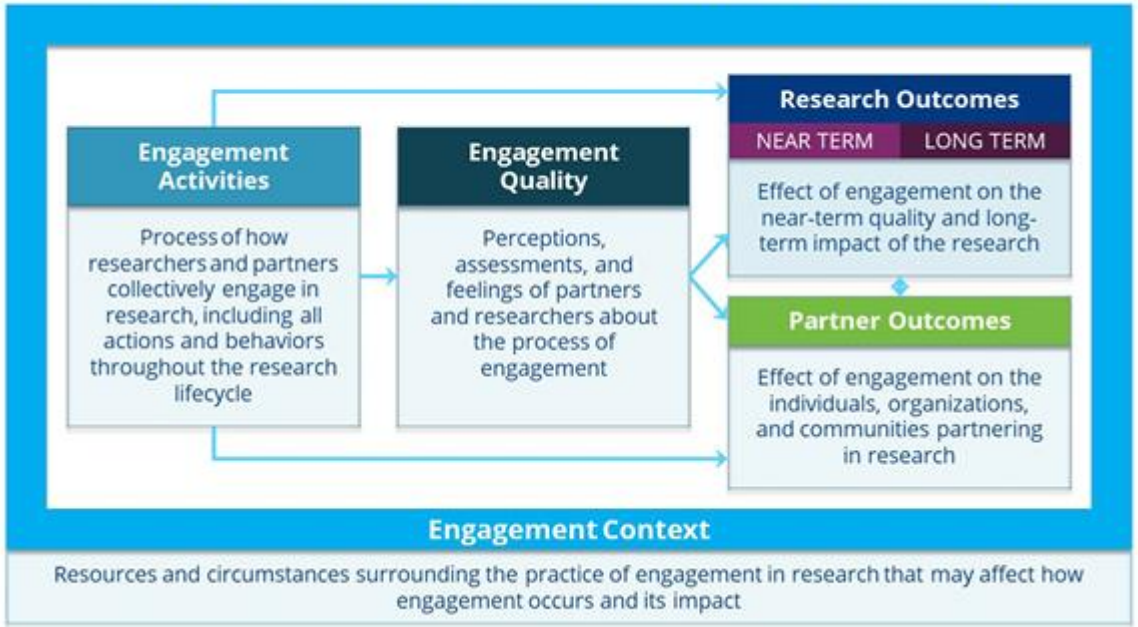
Measuring What Matters for Advancing the Science and Practice of Engagement

Table 1. Overview of Preliminary Measurement Concepts

Engagement Context	Engagement Activities	Engagement Quality	Partner Outcomes	Research Outcomes Near-Term
1. Partner diversity & representativeness	8. Planning & supporting engagement	12. Engagement experience	16. Post-engagement trust	22. Diverse & representative study participants
2. Pre-engagement capacity & readiness for engagement	9. Managing engagement	13. Partnership functioning & group dynamics	17. Sustainability of engagement	23. Research efficiency & successful study completion
3. Pre-engagement trust	10. Facilitating diverse participation & views	14. Equity & inclusiveness of engagement	18. Changes in personal health & health care	24. Patient-centeredness of studies
4. Research characteristics	11. Level of engagement	15. Trust between partners & researchers	19. Post-engagement capacity & readiness for engagement	25. Importance of study findings
5. Resources for engagement			20. Other partner effects	26. Release of findings
6. Socio-historical context			21. Resource use	Research Outcomes Long-Term
7. Barriers & facilitators to engagement				27. Uptake & use of findings
				28. Health/clinical outcomes at project and/or community level

Engagement in Research: Theory of Action



Box 3. What We Can Learn from Measuring Concepts within the Domains

Engagement Context	Measuring engagement context may help identify the circumstances in which engagement activities are more or less successful in achieving certain outcomes.
Engagement Activities	Measuring engagement activities may help identify best practices that lead to achieving desired outcomes
Engagement Quality	Measuring engagement quality may help describe how partners and researchers feel about engagement and identify opportunities to improve engagement practice for the partner and researcher partners in ongoing or future projects.
Partner Outcomes	Measuring outcomes for individuals and institutions may help describe the range of effects of being engaged in health research and, when linked with engagement activities, may suggest best practices for improving outcomes for research partners.
Research Outcomes	Measuring the outcomes of engagement on research may help demonstrate the value of engagement for the production and use of health information and, when linked with engagement activities, may suggest best practices for improving research outcomes.

Team Science Training

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Building Effective Multi-Stakeholder Research Teams

Building Effective Multi-Stakeholder Research Teams offers resources created to support all members of multi-stakeholder research teams in working together.

The website is organized into two sections, each of which addresses a key area for success as an effective multi-stakeholder team: **Engaging Stakeholders** and **Working as a Team**. Each section includes evidence-based information and resources for team members to learn new concepts and skills.

Browse Building Effective Multi-Stakeholder Research Teams

NIH National Center for Advancing Translational Sciences

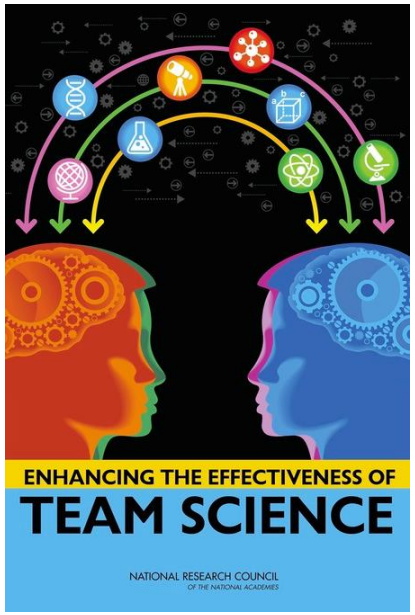
Translational Science Training and Education Resources

We provide leadership to advance the **field of translational science** by offering courses in translational science, webinars and educational and training resources.

Developing New Science Policies & Funding Strategies

Justification

- Priorities
- Community Input
- Authoritative Support/Synthesis



National Institute of General Medicine (NIGMS)

Collaborative Program Grant for Multidisciplinary Teams

PAR-20-103 (first released: September 22, 2017)

….to conduct research to **address complex and challenging biomedical problems,** important for the mission of NIGMS, through deeply integrated, multidisciplinary research teams. The Collaborative Program Grant is designed to support research in which funding a **team of interdependent investigators** offers significant advantages over support of individual research project grants….

Background

Recent reports (e.g., enhancing the effectiveness of team science) have evaluated the benefits of a team science approach to scientific inquiry, and the need to create flexible funding opportunities that enable interdisciplinary research teams to accomplish goals that could not be achieved individually. **The Collaborative Program Grant draws on our past experience and is designed to improve support for interdisciplinary collaborative research across different** scientific domains. We also anticipate that these grants will enhance the diversity and interdisciplinarity of participating investigators, and provide opportunities to encourage early stage investigators (ESIs) to engage in team science projects.

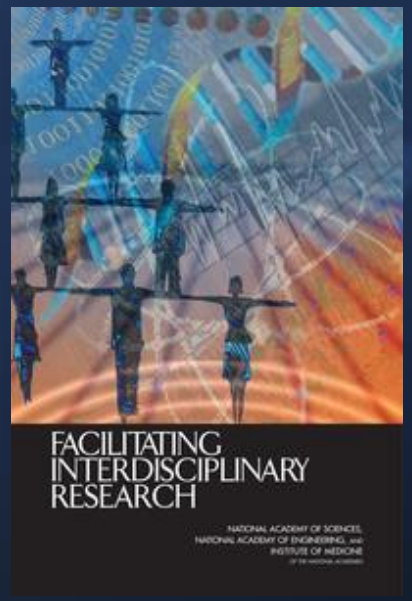
New Consensus Study
Exciting Opportunity to Accelerate Change

Considerations For Data Gathering

Convocation Quote

The most interesting observation is that the students are the integrating glue. Graduate students, undergraduates, and postdocs are the ones that go between the laboratories that make things happen.

Harvey Cohen, professor of pediatrics, Stanford School of Medicine and chair, Interdisciplinary Initiatives Program



Example strategies to highlight current "best" practices, opportunities, and future research to advance policies and practices

CASE studies:

"…case studies describing how interdisciplinary research is performed in industry and national laboratories…an understanding of the drivers for IDR in those settings can provide helpful insights in the examination of IDR in academic settings."

CONVOCATION – Experiences and Opinions

"At the convocation, the committee heard the experiences and opinions of representatives from private, federal, international, and state funding organizations who have had leading roles in facilitating IDR; leading senior and junior researchers involved in IDR; interdisciplinary research-center directors; experts in interdisciplinary education and training; and more than 200 participants."

POSTER Session – "Good Practice" SHOWCASE

".. the convocation included a poster session that featured some 30 model interdisciplinary programs…"

SURVEYs

"…committee's surveys of students, postdoctoral scholars, faculty members, funders, policy makers, and disciplinary societies involved in interdisciplinary research and education….The surveys asked questions about the impediments, programs, and evaluation criteria related to IDR."

Facilitating Interdisciplinary Research (2005)

Closing
NIH Perspectives - Input from NIH ICO Representatives

What key issues do you hope the report will address?

- How funding agencies can encourage/require awardee institutions to invest in team science infrastructure and account for the challenges of team science in promotion and tenure criteria
- How institutional and programmatic policies can work to empower team science practices and outcomes
- How awards like cooperative agreements enhance team science in consortia contexts and even on science teams operating within consortia
- Identification of evidence-based approaches and training designed to enhance the effectiveness of team science and any gaps in resources and guidance.
- The relationship between team science and advancing translational progress from discovery to health solutions (i.e., uptake of new treatments, drugs, and devices, as well as new population health interventions).
- Key practices for leveraging diverse science teams specifically to advance translational progress.
- How to address challenges such as credit assignment, data sharing, and hiring/promotion
- Make sure the DEIA definition and efforts are inclusive to include, but not limited, to disciplinary diversity, race, ethnicity, sexual orientation, gender identify, socioeconomic position, ability status, educational status, and geography (e.g., rural versus urban).
- A focus on measurement and methods to accurately capture and understand the impact of the diversity of teams has on team science.
- Are there evidence gaps that need to be addressed?

What types of team science collaborations or initiatives might benefit the most in terms of DEIA, team science approaches (in general and/or virtual/hybrid approaches), training, or evaluation, etc.

- DEIA itself is known to enhance team science outcomes, while also raising challenges in team science practice for newly DEIA-focused science teams. Collaborative efforts can benefit from better DEIA and team science training, practices, and improvement-focused evaluation.
- From our experience, initiatives that require complex problem solving and solution development benefit the most from DEIA.
- Translational research (focus on training on interdisciplinary collaboration) and rare disease (collaborations between researchers and clinicians, and patients) research requires team-based collaboration among researchers, clinicians, patients, and patient advocates. How can collaborators engage patients earlier in the pipeline?
- Who counts as a collaborator and in what context? How do you bring in appropriate collaborators meaningfully and from the onset of the project?
- There is a need diversity of expertise—in experience, where in the pipeline they're working.

What do you see as the value of this consensus study for your ICO?

- Studying or evaluating how to enhance team science planning, practices, and outcomes
- Providing useful guidance and best practices that could help our researchers, but also inform our program officers as we develop and manage complex programs.
- Making outcomes of the study generalizable to international research settings
- Producing a clear set of evidence-based approaches and trainings and generating practical tools that help implement effective approaches in team science. Recommendations around trainings will be of great value.

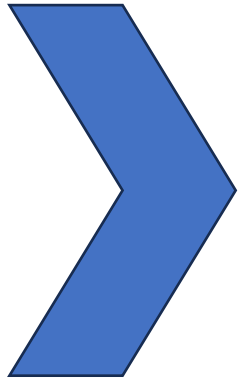
How might you see your ICO using this report?

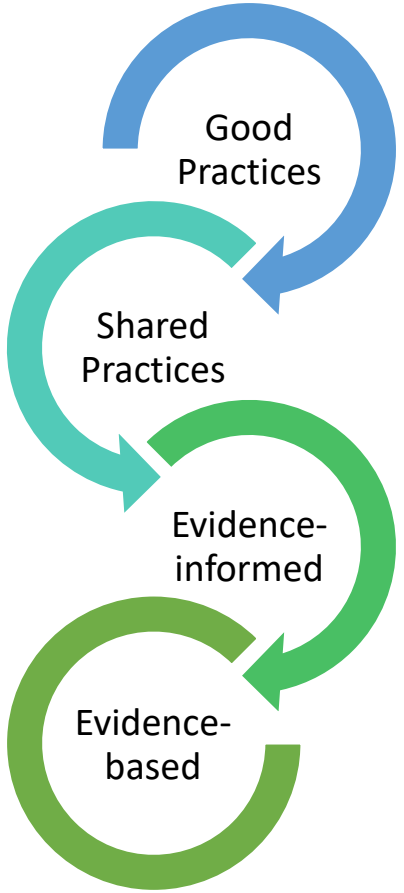
- Informing cost-efficient planning, implementation, and evaluation of team science in the context of large consortia
- Sharing it with our grantees and across the ICOs. Depending on the generalizability of the content, we may encourage certain programs to adopt recommendations or best practices from the study.
- Enhancing our approaches to team science in both intramural and extramural activities.
- Advancing DEIA in team science, both with respect to DEIA in team composition and DEIA in research objectives and outcomes.
- Raising collective awareness that broadening our understanding of team science and its potential value to advance translation – from discovery to changes in practice.
- Educating individuals about what team science is, its benefits for advancing scientific progress, and the fact that there are evidence-based approaches for leading, managing, facilitating, and supporting effective team science.
- Development and deployment of team science funding opportunities that align with community best practices.

1995 2000 2005 2010 2015 2020 2025 2030

New Consensus Study Helping to Advance Best Practices and Policies

Research & Application in Team Science





Key Considerations for the Consensus Study

- Leverage **existing concepts and frameworks**
- Look to **diverse sources of knowledge**
- Use **creative strategies** to identify “best” available practices and evidence
- **Showcase “best” available** practices and evidence
- Develop **recommendations based on “best” available practices and evidence** in a particular area

Up-coming NIH Events

NIH Chief Officer for Scientific Workforce Diversity (COSWD)

How Does Diversity Impact Innovation in Team Science?

Scientific Workforce Diversity Seminar: Evidence from team science research finds that having diverse perspectives in science benefits individual scientists and the scientific enterprise. Outcomes from team science-related research offers insights on approaches to foster diversity, equity, inclusion, and accessibility in team-led research. This seminar, in collaboration with UK Research and Innovation (UKRI), will offer perspectives on diversity in team science-related data findings from the United States and United Kingdom.

Wednesday, 3/13/24

10:30 a.m. – 12:00 p.m.

Office of Behavioral and Social Sciences Research & NIH-wide Planning Committee

Future of Scientific Conferencing

This virtual workshop will bring together diverse perspectives from multiple disciplines to explore advantages, barriers, gaps, and opportunities in the future of scientific conferencing for the behavioral and social sciences. Areas of particular focus will include technological innovations that enable virtual and hybrid approaches, and the impact of these approaches on diversity, equity, inclusion, accessibility, and belonging (DEIAB) of participants and attendees as well as environmental sustainability.

June 6, 2024, 12:00pm – 5:00pm

June 7, 2024, 12:00pm – 3:00pm

June 11, 2024, 12:00pm – 5:00pm

Thank you

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