DEFINING A COLLECTIVE MISSION AND VISION

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OBJECTIVES

• To Introduce a “pipeline” approach to Team Science
• To Explore “some” of the ways TS is working to inform scientific teaming
• To Highlight a resource-rich presentation

• All in 20 minutes…
The goals of the Accelerating Research through International Network-to-Network Collaborations (AccelNet) program are to accelerate the process of scientific discovery and prepare the next generation of U.S. researchers for multiteam international collaborations. “

- **The SCIENCE (of teams):** Transcends disciplinary perspectives and professions and enables development and application of new methodologic or conceptual frameworks.

- **The SCIENTISTS (of teams):** Change their identity and how they view themselves; that is, no longer tied to a particular disciplinary identity.

Stephen Fiore, University of Central Florida
THE TS INTER-DISCIPLINE

Management

Leadership

Learning Science

Sociology

Humanistic Studies

Anthropology

Research Policy Studies

Psychology

www.mendeley.com/groups/3556001

GW
DEFINING TEAM SCIENCE

• **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.

• **The Science-of-Team-Science**— provide cumulative empirical knowledge to assist scientists, administrators, funding agencies, and policy makers in improving the effectiveness of team science.

Future of Work

Convergence Research

Harnessing the Data Revolution

Mid-Scale Research Infrastructures

Navigating the New Arctic

Windows on the Universe

Understanding the Rules of Life

Quantum Leap

NSF Includes

NSF 2026

Revolutionary Shifts in Science
What are Knowledge Producing Teams (KPTs)?

Are **groups of scientific collaborators** with shared and/or aligning mental models (Cannon-Bowers, Salas & Converse 1993)

Contain unique aspects because of **expectations from the knowledge-generating environment** in which they operate (National Academy of Science 2015).

Primarily aim to **create knowledge** not ordinarily achieved outside of a collaborative environment

Have **task-oriented goals, share equipment and technologies, and develop professional and interpersonal relationships** within their unique context and content situations (Mohammed & Dumville 2001)

What are Knowledge Producing Teams (KPTs)?

Are embedded within the **teaming process** (DeChurch & Mesmer-Magnus 2010) that grounds their purpose.

Have members are typified as collections of **highly skilled, autonomous workers trained to use specific tools and theoretical concepts with goals that produce complex, intangible, and tangible results** (Bisch-Sijtsema et al. 2011)

Require **sustainability** of projects and the alliances of these knowledge workers depend upon the continued successful collaborative motivations of individual contributors (Andreas et al. 2006)

THE TEAM SCIENCE PIPELINE

Developmental Training

Mentoring Scientists to be Team Members

Professionalizing Teams

Sustaining Collaboration

Institutionalizing Team Science
OBJECTIVES

• Training New Scientists
• Engaging, Rewarding and Assessing Teams in the Learning Environment
• Team Development amidst Individual Development

CHALLENGES

• Designing measures of team engagement while using other individual measures of disciplinary competency
• Create objectives around teaming as set of core skills needed for scientific success.
• Integrating team based measurement along with individual measures of academic mastery.
*Comprehensive Assessment of Team Member Effectiveness (CATME)

Meta-Categories (p.626)

- Contributing to the Team’s Work
- Interacting With Team
- Keeping the Team on Track
- Expecting Quality
- Having Relevant Knowledge, Skills, and Abilities (KSAs)

PROJECTS TO FOLLOW:

• Center for Leading Innovation and Collaboration Domain Task Force Sub Committee for Translational Team Science Competencies

• Collaborations with SESYNC on developing Core Competencies for Team Science

• Team Science Education and Training Facebook

• Special Interest SIG (Team Science Training)
**OBJECTIVES**

- Establishing Professionals in Professions
- Creating reward systems that are in tune with science team values and individual needs
- Creating Pathways for Team Scientists

**CHALLENGES**

- Collaborations occur more in strategic disciplines that are application oriented than in basic disciplines, and they focus on practical problems.
- Lack of incentives in the reward system and pressure to build individual reputations result in minimizing or outright penalizing individuals’ contributions.

Creating a culture of reward is a comprehensive approach that spans the career life cycle, from hiring through pre-tenure and tenure review, and subsequent stages of promotion.

Recommendations
- Taking Preliminary Steps
- Revising Existing Practices and Policies
- Writing New Guidelines
- Preparing A Dossier for Promotion and Tenure
- Advancing Support in Professional Organizations

• InSciTS Special Interest Group (Fostering Team Science In Academia)


• Key Exemplars referenced in Klein and Falk-Krzesinski (2017)
  • **American Psychological Association**
    • Advocates for mentorship that BOTH encourages individual reputation along with teaming
  • **University of Kentucky’s College of Medicine**
    • Advocate Boyer’s multi-scholarship model
  • **George Washington University**
    • Clarifying and encouraging cross-stakeholder engagement
OBJECTIVES
• Team science as normative for conducting science.
• Funder and Funding priorities
• Rewarding Research Teaming
• Rewarding Translational Science

CHALLENGES
• Establishing funding streams that reward science conducted in teams.
• Developing metrics for evaluation leading to funding.
NEW NSF ERC PROGRAM MODEL

- 4 interconnected **foundational components**
  - Research
  - Workforce Development
  - Culture of Inclusion
  - Innovation Ecosystem
- Multi-layer **impact**
  - Engineering Community
  - Scientific Enterprise
  - Society

Institutionalizing Team Science
RESOURCES

- NSF (Convergence Research)

- **Research driven by a specific and compelling problem.** Research requiring a convergence paradigm 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 disciplines can form from sustained interactions across multiple communities.
OBJECTIVES

• Embrace Team Science Values
• Sensitize Team Readiness
• Measure Organizational Readiness

CHALLENGES

• Continual and Ongoing Encouragement for Teaming as a normative vehicle for advancing Science
• Measurement and Evidence that supports teaming knowledge, skills, and attitudes
• Utilizing TS Scholarly and Practical Materials
Team Science Toolkit

- **Toolkits** (Major Repository of information-Team Science)

- **Learning Tools**
  - COALESCE (CTSA Online Assistance for LEveraging the Science of Collaborative Effort)
    - http://teamscience.net/
  - http://toolbox-project.org/toolbox-team/ (Micheal O’Rourke et al.)

- **Measurement Tools**
  - **MATRICx.** Motivation Assessment for Team Readiness, Integration, and Collaboration (Lotrecchiano, GR, Mallinson, TR et al.) www.MATRICx.net

- **Field Guides**
  - **Collaboration and Team Science Field Guide** (Bennett, Gadlin, and Levine, 2018)
OBJECTIVES
• Feeding back into the system
• New Skills
• Understanding new skill requirements
• Leveraging Decision Making

CHALLENGE
• Understanding the mentor/mentee relationship and how it has changed
• Understanding Diverse Motivations for teaming
• Advancing skills that were not part of one’s (traditional) career development.

Developing Training Professionalizing Teams

Institutionalizing Team Science Sustaining Collaboration Mentoring Scientists to be Team Members


<table>
<thead>
<tr>
<th>Feature</th>
<th>Skill Development Foci</th>
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| Complex problem solving  | • A heightened focus on anticipated future states (Hirsch Hadorn G et al, 2007; Weisbord M, 2004)  
• Goal alignment with conditions of a changing world (Entin E et al., 1999)  
• Focus on dealing with interpersonal team challenges  
• Co-developed shared mental models within KPTs (Cannon-Bowers J et al., 1993)  
• Social learning as part of team engagement (Schwandt D, 2008)                                                                                                                                                                                                                                                                 |
| Stakeholder involvement  | • Translation of knowledge across disciplines (Colditz G et al., 2012)  
• Development and sustainability of scientific and non-scientific partnerships (Maasen S and Lieven O, 2006)  
• Establishing interdependence between knowledge partners (Lawrence P, Lorsch J., 1967)                                                                                                                                                                                                 |
| Methodological pluralism | • Boundary spanning over boundary forming (Klein J, 2004)  
• Shifting awareness of problems (Nicoleșcu B, 2005)  
• Pluralism as a normative reality (Lamont M and Swidler A, 2014)  
• Translation of knowledge (Larson E et al., 2001)                                                                                                                                                                                                                                                                 |
| Praxis                   | • Experience-based learning is necessary for impact-based solutions (Kolb, D, 1984)  
• Combining formal and informal knowledge (Horlick-Jones, Tet al., 2004)  
• Reintegrating co-created knowledge (Lang et al, 2012)                                                                                                                                                                                                                                                                 |

### INTERACTIVE SYSTEM COMPLEXITIES

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<thead>
<tr>
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<tr>
<td><strong>Open systems capacity</strong></td>
<td>• Reception to knowledge from outside of one’s system of knowledge (Tress et al., 2003)</td>
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<td>• Conflict and power struggles can breed innovative thought (Eldridge J and Crombie A, 1975)</td>
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<td>• Interdependent relationships between actors need to contribute to shared goals (Katz D and Kahn R, 1966)</td>
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<td><strong>Different (shifting) levels of reality</strong></td>
<td>• Navigation of multiple realities related to a single problem (McGregor S, 2011, Nicolescu, 2006)</td>
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<td></td>
<td>• Mastering the consideration of diversity over different timescales, landscapes, and experiential episodes (Cilliers P, 2013)</td>
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<td>• Adaptation through self-organization (Heylighen F, 2008)</td>
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<td><strong>Collaborative construction and reconstruction</strong></td>
<td>• Openness to rearranging collaborative and knowledge arrangements (Balsiger P, 2004)</td>
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<td>• Direct contact with those affected by the problem attempting to be solved (Klein, 2004)</td>
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