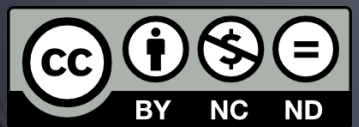
Team Science: The Why and How of Scientific Collaboration

Stephen M. Fiore, Ph.D.
University of Central Florida
Cognitive Sciences
Department of Philosophy and
Institute for Simulation & Training

Fiore, S. M. (2012). Team Science: The Why and How of Scientific Collaboration. *Presentation at the Office of Research and Commercialization, UCF Grants Day - Strategies for Team-Based Research.* University of Central Florida, April 9, Orlando, FL.



Why and How of Team Science
Overview

UCF Cognitive Sciences

- Part 1. Why Team Science?
  - Science and Society
  - Developing the Field
  - Relation to Interdisciplinary Research
- Part 2. How do you do Team Science?
  - What is Difficult about Team Science
  - Applying Science of Teams to Team Science
  - Training Teams for Team Science

Why Team Science?
Science and Society

UCF Cognitive Sciences

- Science and Society
  - Science must better address the complex problems facing our planet, whether they be health, environmental, or social
  - Must to bring together researchers from differing disciplines so as to address the multi-faceted nature of such problems
- Dealing with Aristotle's Legacy
  - What is critical to realize is that "the way in which our universities have divided up the sciences does not reflect the way in which nature has divided up its problems" (Salzinger, 2003, p. 3)

- ***So what's a scientist to do…?***

Why Team Science?
Science and Society

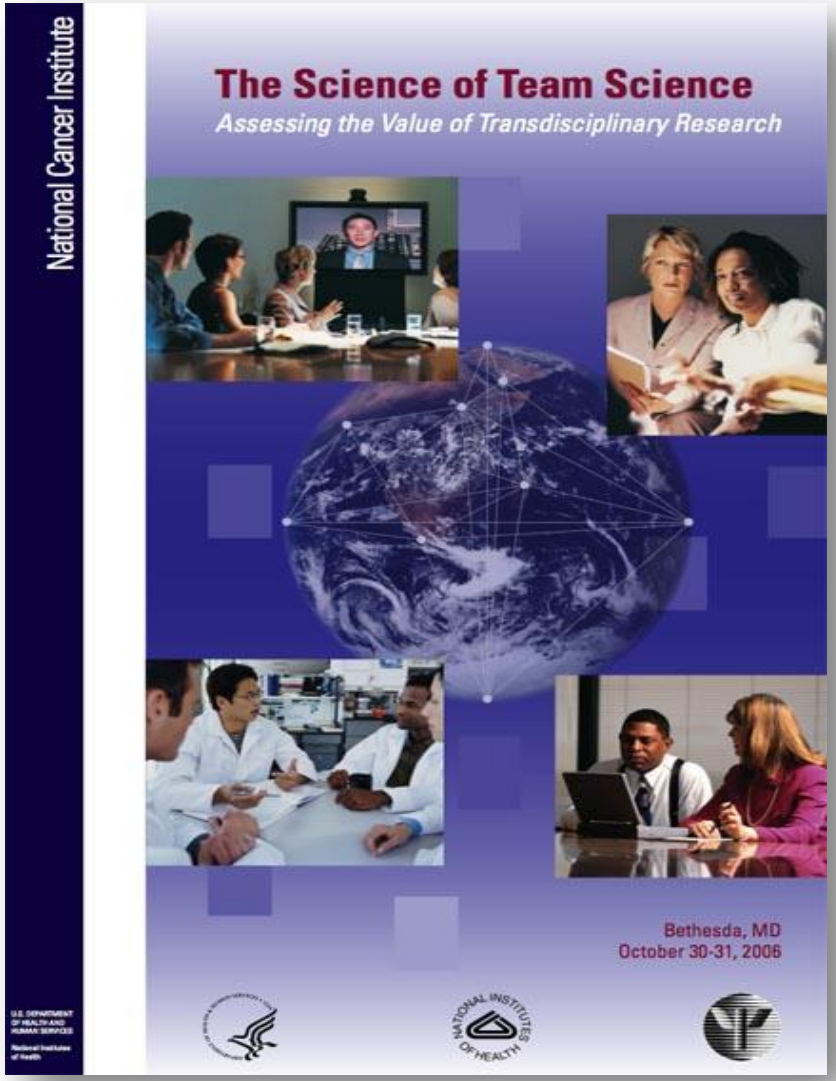
- **Science, Society, and the Science of Team Science**
  - Greater investment in research across scientific disciplines and knowledge
  - Increasing commitment to understand how to enhance the scientific capacity to address complex societal problems

  - "***the inherent complexity of contemporary public health, environmental, political, and policy challenges… [leads to] realization that an integration of multiple disciplinary perspectives is required to better understand and ameliorate these problems***" (Stokols et al., 2008).

- ***So what has been happening…?***

Why Team Science?

2006 - Developing the Field



2006 NCI Conference on the Science of Team Science: Assessing the Value of Transdisciplinary Research

Examine:

- State of the art knowledge concerning transdisciplinary team science and training
- Methods and metrics available for evaluating transdisciplinary collaboration
- Priorities for transdisciplinary research

Why Team Science?

2008 - Developing the Field

UCF Cognitive Sciences

Small Group Research
Volume 39 Number 3
June 2008 251-277
© 2008 Sage Publications
10.1177/1046496408317797
http://sgr.sagepub.com
hosted at
http://online.sagepub.com

Interdisciplinarity as Teamwork

How the Science of Teams Can Inform Team Science

Stephen M. Fiore
University of Central Florida

This essay discusses interdisciplinary research in the context of science policy and the practice of science. Comparisons between interdisciplinary research and other forms of cross-disciplinary research are made, and a brief discussion of the development of the concept of interdisciplinarity is provided. The overarching thesis of this essay is that interdisciplinary research is *team* research, that is, research conducted by a team. This notion is developed via recent policy discussions of *team science* and the need to understand interdisciplinary research in action. The author shows how it may be possible to consider the implementation of principles from teamwork and team training to improve interdisciplinary research and the practice of team science.

Keywords: *team science; interdisciplinary; teamwork; team training; graduate education*

Interdisciplinarity in research continues to influence both the practice of science and the production of knowledge. Yet, despite this influence, much remains unknown with regard to interdisciplinary research. Part of the problem stems from the difficulty in defining *what* is meant by interdisciplinarity. But perhaps the larger problem comes from understanding *how* to do interdisciplinary research. To illustrate, consider what was published on this issue in one of our more influential scientific journals, *Science*:

Author's Note: Development of this article was supported by Grant N000140610118 from the

Why Team Science?

2008 - Developing the Field

UCF Cognitive Sciences

nature International weekly journal of science

comments on this story

Stories by subject
- Lab life
- Mathematics

Stories by keywords
- Citations
- Authors
- Team work
- Collaboration
- Network analysis
- Co-authors
- Network
- Visualization
- Interdisciplinary

This article elsewhere

Blogs linking to this article

Add to Connotea

Add to Digg

Published online 8 October 2008 | *Nature* **455**, 720-723 (2008) | doi:10.1038/455720a

News Feature

Collaboration: Group theory

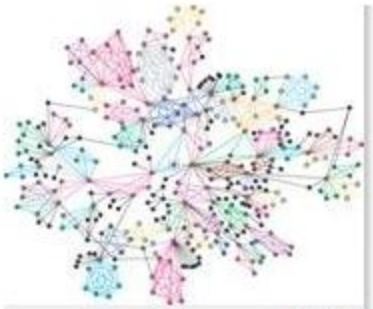
What makes a successful team? John Whitfield looks at research that uses massive online databases and network analysis to come up with some rules of thumb for productive collaborations.

John Whitfield

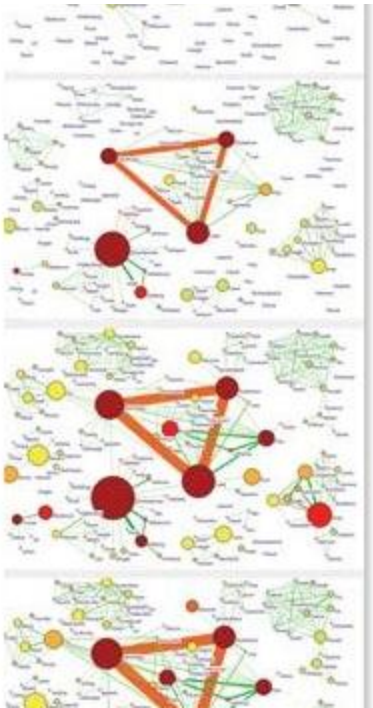
J. H. VAN DIERENDONCK

Flip through any recent issue of *Nature*, including this one, and the story is there in black and white: almost all original research papers have multiple authors. So far this year, in fact, *Nature* has published only six single-author papers, out of a total of some 700 reports. And the proportions would be much the same in any other leading research journal.

Of course, there is nothing new about this: the scholars who study the folkways of science have been tracking the decline of the single-author paper for decades now. And they have followed the parallel growth of 'invisible colleges' of researchers who are separated by geography yet united in interest. But what is new is how their studies have been turbo-charged by the availability of online databases



REF. 3



Why Team Science?

2010 - Developing the Field

UCF Cognitive Sciences

UCF Cognitive Sciences | NC State University Department of Communication | NSF

FINAL REPORT

NSF Workshop

Applying the Science of Teams to Inform Policy and Research on Team Science

Stephen M. Fiore
University of Central Florida

Joann Keyton
North Carolina State University

Report: May 2011
Workshop: March 4-5 2010

SCIENCE OF TEAM SCIENCE

Please join us for the First Annual International
SCIENCE OF TEAM SCIENCE CONFERENCE

LAMBERT FAMILY COMMUNICATION CONFERENCE in collaboration with Research Team Support (RTS) within the Northwestern University Clinical and Translational Sciences (NUCATS) Institute on the Science of Team Science

THURSDAY AND FRIDAY, APRIL 22-23, 2010
Wyndham Chicago

Why Team Science?

2010-2011 - Developing the Field

UCF Cognitive Sciences

Advancing the Science of Team Science

Holly J. Falk-Krzesinski, Ph.D.[1], Katy Börner, Ph.D.[2], Noshir Contractor, Ph.D.[3], Stephen M. Fiore, Ph.D.[4], Kara L. Hall, Ph.D.[5], Joann Keyton, Ph.D.[6], Bonnie Spring, Ph.D.[7], Daniel Stokols, Ph.D.[8], William Trochim, Ph.D.[9], and Brian Uzzi, Ph.D.[10]

Abstract
The First Annual International Science of Team Science (SciTS) Conference was held in Chicago, IL April 22–24, 2010. This article presents a summary of the Conference proceedings. Clin Trans Sci 2010; Volume 3: 263–266

Keywords: editorial, editorials, translational research

The public health, social, technological, and environmental problems that impact our world are complex, but increasingly we are able to address them through scientific pursuit.[1] The sophistication of these challenges necessitates cross-disciplinary engagement and collaboration, and the longer-term interaction of groups of investigators—what is termed *team science*.[2–9] Such team-based research collaborations are also an essential feature of a robust translational research enterprise.[10,11]

The emerging field of the *Science of Team Science* (SciTS) encompasses both conceptual and methodological strategies aimed at understanding and enhancing the processes and outcomes of collaborative, team-based research.[12,13,28] SciTS is concerned with understanding and managing circumstances that facilitate or hinder the effectiveness of collaborative cross-disciplinary science,[14–18,28] and the evaluation of collaborative science outcomes.[20–27] Its principal units of analysis are the research, training, and community-based translational initiatives implemented by both public and private sector organizations. SciTS focuses on understanding and enhancing the antecedent conditions, collaborative processes, and outcomes associated with initiatives rooted in team science, including scientific discoveries, educational outcomes, and translations of research findings into new practices, patents, products, technical advances, and policies.[18,21]

In an effort to enhance the understanding of how best to engage in team science to promote collaborative translational research and meet society's needs, the First Annual International SciTS Conference was convened on April 22–24, 2010 in Chicago, Illinois. The event was produced by Research Team Support (RTS) of the Northwestern University Clinical and Translational Sciences (NUCATS) Institute, in partnership with the NIH National Cancer Institute, Division of Cancer Control and Population Sciences and the Lambert Family Communication Conference of the School of Communication at Northwestern University. A Program Conference Committee of twelve renowned investigators in SciTS served as advisors.

The 3-day conference marked the first international, multi-agency forum dedicated to the emerging empirical field of SciTS, bringing together thought leaders from a broad range of disciplines, including: translational research, evaluation, communications, social and behavioral sciences, complex systems, technology, and management. The goals of the conference were to serve as a point of convergence for team science practitioners and investigators studying science teams, to engage funding ag
on developing and n
afford data providers
tracking and analysis
the conference serve
empirical findings a
effective practices fo
science—a bridge be
science of team scien

More than 200 te
development officers,
and funding agency p
included a keynote ad
poster session. In add
social network analys
followed by a lively q
2 days of the confere
the topics and ideas p

**Setting the Stage: S
Mapping Project**

In a keynote presentat
presented the result
preparation for the
other interested part
based concept map
comprehensive taxon
guide both the confe
term. The conceptual
study, incorporating
by integrating an onli
analysis, provided a pr
in this field. A visual
include: Definitions a
and Evaluation of Te
Team Science; Struct
Support and Professio
and Organization for
of Teams (*Figure 1*).

[1]Research Team Support, Northwestern University Clinical and Translational Sciences (NUCATS) Institute, Northwestern Network Science Center, SLIS, Indiana University, Bloomington, Illinois, USA; [2]Department of Industrial Engineering & M Illinois, USA; [4]Department of Philosophy and Institute for Simulation and Training, University of Central Florida, Orlando, Flo ances, National Cancer Institute, Bethesda, Maryland, USA; [6]Department of Communication, North Carolina State University Medicine, Northwestern University, Chicago, Illinois, USA; [8]Department of Planning, Policy and Design and Department o Irvine, Irvine, California, USA; [9]Department of Policy Analysis and Management, Cornell University, Ithaca, New York, USA School of Management, Northwestern University, Evanston, Illinois, USA
Correspondence: Holly Falk-Krzesinski (h-falk@northwestern.edu)

Research Evaluation, 20(2), June 2011, pages 145–158
DOI: 10.3152/095820211X12941371876580; http://www.ingentaconnect.com/content/beech/rev

Mapping a research agenda for the science of team science

Holly J Falk-Krzesinski, Noshir Contractor, Stephen M Fiore, Kara L Hall, Cathleen Kane, Joann Keyton, Julie Thompson Klein, Bonnie Spring, Daniel Stokols and William Trochim

Published 15 September 2010; Volume 2 Issue 49 49cm24

This Commentary describes recent research progress and professional developments in the study of scientific teamwork, an area of inquiry termed the "science of team science" (SciTS, pronounced "sahyts"). It proposes a systems perspective that incorporates a mixed-methods approach to SciTS that is commensurate with the conceptual, methodological, and translational complexities addressed within the SciTS field. The theoretically grounded and practically useful framework is intended to integrate existing and future lines of SciTS research to facilitate the field's evolution as it addresses key challenges spanning macro, meso, and micro levels of analysis.

COMMENTARY

TEAM SCIENCE

A Multi-Level Systems Perspective for the Science of Team Science

Katy Börner,[1]* Noshir Contractor,[2] Holly J. Falk-Krzesinski,[3] Stephen M. Fiore,[4] Kara L. Hall,[5] Joann Keyton,[6] Bonnie Spring,[7] Daniel Stokols,[8] William Trochim,[9] Brian Uzzi[10]

RESEARCH PROGRESS IN THE SCIENCE OF TEAM SCIENCE

At its most general, the production of knowledge can involve either an incremental change in understanding or a more radical, discrete change. Recently, a change of the second sort occurred that altered our perception of the workings of science itself. A study of more than 21 million papers published worldwide from 1945 to the present reveals a fundamental and nearly universal shift in all branches of science: Teams increasingly dominate solo scientists in the production of high-impact, highly cited science; teams are growing in size; and teams are increasingly located across university boundaries rather than within them (*1*). Similar patterns were found for all the patents published worldwide (*2*). Speculation as to why this shift occurred centers on the nature of the problems increasingly studied: complex problems that cut across disciplinary areas and require multiple divergent perspectives. Cross-disciplinary teams, whether utilizing approaches that are multidisciplinary (in which experts from different scientific fields collaborate yet reside in their topic areas), interdisciplinary (results and expertise from two or more scientific fields are combined), or transdisciplinary (disciplinary boundaries are crossed to create a holistic approach) (*3*) are expected to hold the key to success. More specifically, "team science" is expected to combine specialized expertise, theoretical approaches, and research methods across disciplinary boundaries, solving these complex problems and producing high-impact science.

In order to realize the unprecedented opportunities posed by team science, we need to develop new means to recruit, retain

[1]CyberInfrastructure for Network Science Center, School of Library and Information Science (SLIS), Indiana University, Bloomington, IN 47401, USA. [2]Department

have as a major goal "… to develop teams of investigators from various fields of research who can take scientific discoveries in the laboratory and turn them into treatments and strategies for patients in the clinic" (*5*). The National Science Foundation invites projects on Cyber-Enabled Discovery and Innovation that place an "emphasis on bold multidisciplinary activities that, through computational thinking, promise radical, paradigm-changing research findings." The MacArthur, Robert Wood Johnson, and W.T. Grant Foundations all support interdisciplinary research networks. The National Academies' KECK Futures Initiative promotes interdisciplinary research related to science, engineering, and medicine. At the same time, according to a White House memorandum, funding agencies, academic leadership, and industry must manage their portfolios in an objective, evidence-based manner to address science and technology priorities of our nation and increase the productivity of our research institutions (*6*). The confluence of these developments is the critical need to understand, support, and measure the investment, return, and effect of team science projects.

PROFESSIONAL DEVELOPMENT IN THE SCIENCE OF TEAM SCIENCE

The "science of team science" (SciTS, pronounced "sahyts") is an emerging area of research centered on examination of the processes by which scientific teams organize, communicate, and conduct research (*7–9*). The field is concerned with understanding and managing circumstances that facilitate or hinder a range of collaborative research efforts—from determining the effectiveness of large-scale collaborative research, training, and translational initiatives to understanding how teams connect and collaborate to achieve scientific break-

iplinary, collaborative team science initiatives over the last few decades has le stakeholder groups in empirical research on scientific teams, giving rise to ed to as the science of team science (SciTS). This study employed a e concept-mapping evaluation methodology to develop a comprehensive ciTS field. Its integrative mixed-methods approach combined group process derive a conceptual framework that identifies research areas of team science nce to the emerging SciTS field. The findings from this concept-mapping for moving SciTS forward at theoretical, empirical, and translational levels.

ADES, expanding
e have resulted in
h across scientific
is to address com-
health problems.
propelled by re-
nt and scientific
al problems (Disis
l, 2007). Science

emporary public
al, and policy
zation that an
ary perspectives
and ameliorate
08b).

elihood that scien-
ivergent perspec-
new insights and
The problems they
of disciplines, but
llaborate in such a

ments see page 155.

way that their efforts are coordinated and integrated (Fiore, 2008; NAS, 2004). Although it is possible for team science to be unidisciplinary, team science most often connotes cross-disciplinarity (multi-, inter-, and trans-disciplinarity), a composite term for team science programs and projects that differ in the degree to which they interact and integrate across disciplinary, professional, and institutional boundaries (Crowley *et al*, 2010; Fiore, 2008; Klein, 2010; Rosenfield, 1992; Stokols *et al*, 2008a; Wagner *et al*, 2011).

Despite this growth in collaborative research, the scientific community continually struggles with overcoming the challenges arising from this complex form of teamwork (Cummings and Kiesler, 2005, 2007, 2008; Olson and Olson, 2000). As such, science policy must be developed to help address the theoretical and practical challenges emerging from this form of collaborative endeavor. Further, scientific, social scientific, philosophical, and humanistic research is needed to help understand the team processes that drive knowledge production in such teams; that is, help examine how new knowledge is generated in collaborating teams of scientists. This need has given rise to an empirical area of inquiry referred to as the *science of team science — SciTS*, pronounced 'sights' (Annual International Science

0958-2029/11/02145-14 US$12.00 © Beech Tree Publishing 2011

Why Team Science?

2012 - Developing the Field

UCF Cognitive Sciences

National Science Foundation Steps Up Its Push for Interdisciplinary Research
From Chronicle of Education, February 13, 2012

- The push for more interdisciplinary research has been a priority of the NSF's director, Subra Suresh, since his arrival at the foundation in October 2010.
  - NSF leadership - rapid advances in a variety of fields are making clear the **value of applying discoveries and approaches as widely as possible**.
- For universities worried about securing federal research money at a time of tightening budgets, NSF has a simple message: ***Collaborate!***
  - Grants will be increasingly **won by those researchers who find partners in other university departments**.
- Efforts to promote interdisciplinary research have been slow
  - Universities still too often **align tenure and job-promotion policies along established departmental divisions**

- ***But just what exactly is interdisciplinary research…?***

Why Team Science?
Relation to Interdisciplinary Research

UCF Cognitive Sciences

Defining Disciplinary Approaches

- **Cross-disciplinary Research**
  - Research simply involves investigators drawn from different disciplines
  - *Does not necessarily qualify nature of interaction between the investigators*

- **Multidisciplinary Research**
  - Coordinated efforts of several disciplines to achieve a common goal
  - Contributions drawn from different disciplines are complementary not integrative
  - *In service of objective, adopts but not necessarily integrate*

National Academies, Committee on Facilitating Interdisciplinary Research (2004). *Facilitating interdisciplinary research.* Washington, DC: National Academies Press.

Why Team Science?
Relation to Interdisciplinary Research

UCF Cognitive Sciences

So what is interdisciplinary research?

- Overarching goal is the systematic *integration* of ideas
  - Interdisciplinarity demands more than just complementarity
- National Academies of Science ("Facilitating interdisciplinary research," 2004)
  - Integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge

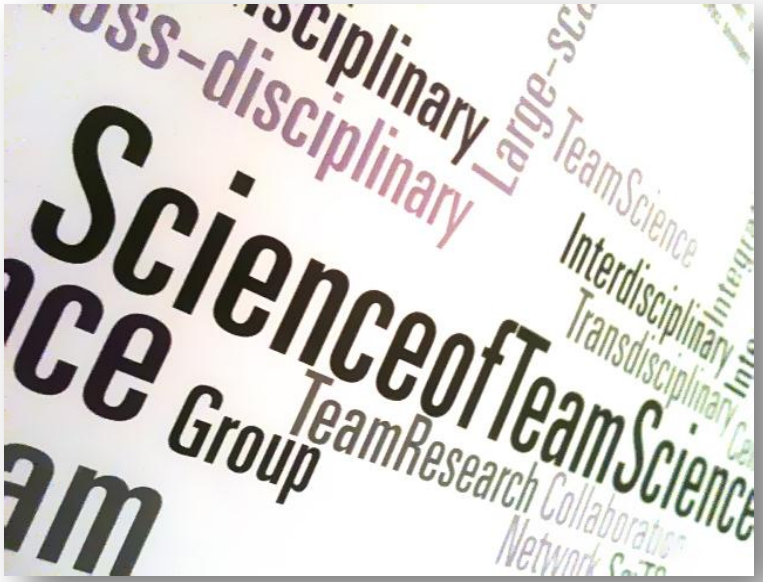
- **Goal is to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or field of research practice.**

National Academies, Committee on Facilitating Interdisciplinary Research (2004). *Facilitating interdisciplinary research.* Washington, DC: National Academies Press.

Why Team Science?
Relation to Interdisciplinary Research

UCF Cognitive Sciences

- **But interdisciplinarity is a team *activity* -- it is a process engaged by members of a coordinated scientific team**
  - Just like other forms of teamwork occurring outside of science
  - Teams brought together to achieve some end an individual could not achieve while only maintaining partially overlapping knowledge
- **So we need to reframe interdisciplinarity as a process of teamwork**
  - ***As an understanding of the teamwork activities necessary for success***
- Understand and improve how they interact and integrate across disciplinary, professional, and institutional boundaries (e.g., Börner et al., 2010; Falk-Krzesinski et al., 2010; Fiore, 2008).



How do you do Team Science?

Part 2

How do you do Team Science?
What is Difficult about Team Science

UCF Cognitive Sciences

- **Consider what was published on this issue in the journal *Science*:**
  - "The interdisciplinary approach is becoming one of the prominent characteristics of [science] and represents a synthesizing trend which focuses the specialized research techniques on problems common to a number of separate disciplines. Such cooperative research has to overcome serious obstacles when operating within the existing departmentalized framework of the universities. It appears that real progress in this direction will be made in institutions which are organized on a permanent and frankly cooperative basis. Psychologically, interdisciplinary research requires not only abstract, theoretical intelligence (and, frequently, manipulative skill) but also 'social intelligence.' Cooperative work is a social art and has to be practiced with patience."

How do you do Team Science?
What is Difficult about Team Science

UCF Cognitive Sciences

What is informative here?

- First, we see acknowledged the increasing influence and importance of interdisciplinarity as a method of inquiry.
- Second, we see the challenge of interdisciplinarity distinguished along two inter-related lines.
  - On the one hand there is the problem of infrastructure, both tangible and tacit
    - The inherent challenge associated with the current structure of the modern university - the discipline bound department - and the tacit norms which prevent or stifle interaction amongst them.
  - On the other hand there is the problem of interaction
    - The difficulty inherent in communicating and collaborating across disciplines and how patience and a particular form of social intelligence are necessary precursors to effective collaboration in such environments.

How do you do Team Science?
What is Difficult about Team Science

UCF Cognitive Sciences

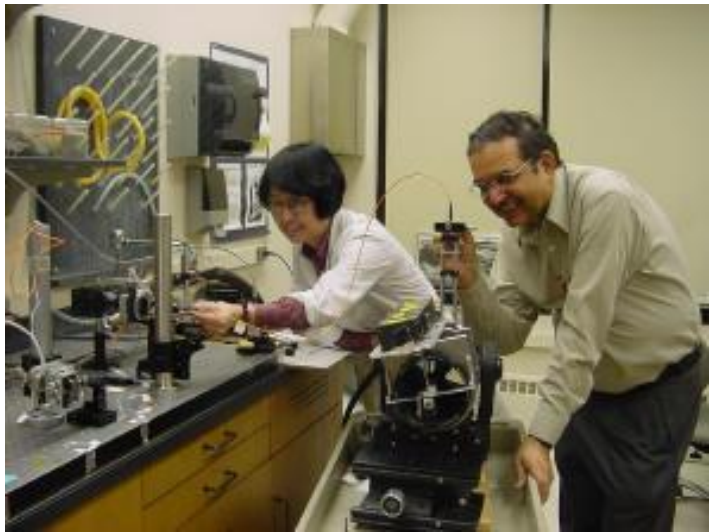
- Anyone familiar with some manner of cross-disciplinary collaborative effort will likely have experienced some or all of these factors
  - ***So one might wonder why this quote is particularly informative?***
- What is informative is not ***what*** was said, it is ***when*** it was said.
  - ***It was written well over a half century ago in one of the first articles specifically addressing interdisciplinary research (Brozek & Keys, 1944).***
- If science has long recognized the challenges associated with interdisciplinary research why do we still struggle?
  - Why should we think that anything will change?
  - ***Should we be so bold as to think that we have a better chance at overcoming these challenges than those from generations before us?***

How do you do Team Science?
What is Difficult about Team Science

UCF Cognitive Sciences

- **YES - for three main reasons:**
  1. Evidence that interdisciplinarity is on the rise and educational and policy institutions are making more of a concerted effort to examine this process
  2. Science is paying attention to teams - *Team Science* discussions in policy circles illustrates increased focus on collaborative research projects that create a team of scientists to address some complex phenomenon
  3. Most critical, is fact that what has truly changed in the last generation is growth in the study and understanding of groups and teams

- **It is the science of teams (Salas, Fiore, & Letsky, 2012) that could be the true catalyst for change**
  - **Has matured into its own area of inquiry producing a rich base of knowledge**
  - **Helps us better understand the complex coordinative processes engaged by teams**



How do you do Team Science?
What is Difficult about Team Science

UCF Cognitive Sciences

In Sum

- Scientific community continually struggles with challenges arising from this complex form of teamwork (Cummings and Kiesler, 2008).
  - Definitions of core terminology remain parochial
  - Methods of practice remain disconnected
  - Departmental silos prevalent
- **Applying Science of Teams to Team Science**
  - Scholarly community needs to work to strategically understand and improve collaboration in science (Falk-Krzesinski et al., 2011; Fiore, 2008)

How do you do Team Science?
Applying Science of Teams to Team Science

UCF Cognitive Sciences

What is needed is a multi-level approach

- ***Leverages theory and practice from the study of teams***
- ***Serve as framework to link research on individual scientists, teams, and teams of teams.***
- Macro-level research
  - Examines collaboration at higher levels
    - Leads to insights about broad patterns of collaboration and growth/impact of knowledge
- Meso-level research
  - Increases our understanding at the team level
    - Examines how interaction patterns and communication alter process
- Micro-level research
  - Studies the individuals within the team
    - Consider their training and education and what they need to know

How do you do Team Science?
Applying Science of Teams to Team Science

UCF Cognitive Sciences

Macro-level Issues in Team Science

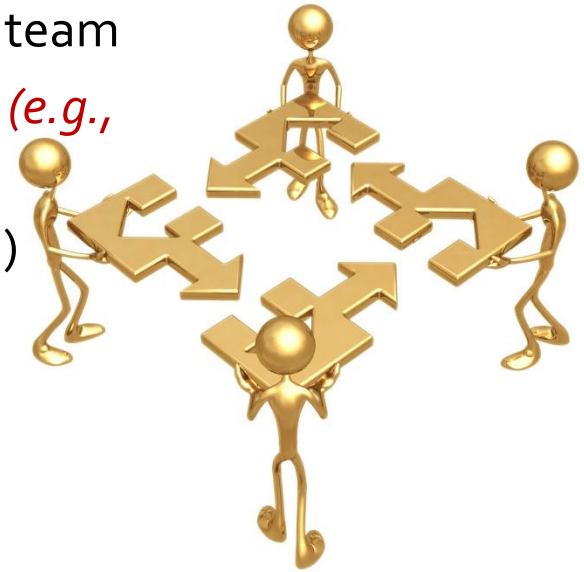
- **Examines structures of successful collaboration networks (centers, universities)**
  - Consider affiliations within and across disciplines
- Address broader philosophical issues concerning the ways of pursuing (and encouraging) differing forms of scientific progress.
  - Organizational change needs at the university level where researchers practicing interdisciplinarity get rewarded and not (tacitly) punished.
- **At macro-level, what you need to attend to and manage are the following issues:**
  - Professional culture and identity
    - *Affiliations within and across disciplines*
  - Organizational leadership - at the "center" and the "department" levels
    - *Challenges with leading individuals versus teams*
  - Organizational culture, including both departmental and institutional culture
    - *Affiliations with departments and/or centers*

How do you do Team Science?
Applying Science of Teams to Team Science

UCF Cognitive Sciences

Meso-level Issues in Team Science

- ***Considers how understanding group process influences scientific collaborations***
  - Involves examining the group dynamics emerging in team science
  - Considers how to coordinate teamwork in science teams
- **At meso-level, what you need to attend to and manage are the following issues:**
  - Identification of nature of interdependencies within team
    - *Determine who relies on whom for task completion (e.g., sequential versus reciprocal)*
  - Form of Interpersonal Skills Needed (Marlowe, 1986)
    - *Ability to understand behaviors, cognitions, and attitudes of individuals (including oneself)*
    - *Skill to translate understanding into appropriate behavior in social situations*



How do you do Team Science?
Applying Science of Teams to Team Science

UCF Cognitive Sciences

Micro-level Issues in Team Science

- Understand how the individual scholar gets trained
  - In the scientific aspects of his/her work
  - In the process of collaboration in pursuit of innovation and discovery
- **At micro-level, what you need to attend to and manage are the following issues:**
  - Determine requisite knowledge
    - *What do team members need to know (disciplinary breadth versus depth)*
  - Determine requisite skills
    - *What do team members need to know how to do (methodologies, procedures, technologies)*
  - Determine requisite attitudes
    - *What is level of interpersonal trust?*
    - *What is their view of collaboration?*

How do you do Team Science?
Training Teams for Team Science

UCF Cognitive Sciences

Team and Task Competencies and Team Science

- **Training Issue**
  - The interdisciplinary nature of science teams necessitates a better understanding of the competencies required for effective teamwork
- **Training Goal**
  - Articulating the team and task competencies for sciences teams to inform training and pedagogy
  - Better prepare the next generation of team scientists

How do you do Team Science?
Training Teams for Team Science

UCF Cognitive Sciences

Identifying Team and Task Competencies and Team Science

- Competencies as knowledge, skills, and attitudes necessary in all teams versus specific to certain teams (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995)

You Need to Identify the TEAM Competencies

- ❑ TEAM GENERIC competencies are those necessary regardless of the context or the organizational setting (e.g., communication skills)
- ❑ TEAM SPECIFIC competencies are more directly related to particular teams and include knowledge of roles within the team and the abilities held by team members (e.g., roles within a team)

You Need to Identify the TASK Competencies

- ❑ TASK GENERIC competencies are those necessary across task situations (e.g., subject recruitment)
- ❑ TASK SPECIFC competencies include understanding objectives or using appropriate procedures (e.g., procedures/methods)

How do you do Team Science?
Training Teams for Team Science

UCF Cognitive Sciences

Identifying your Team and Task Competencies and Team Science

		Relation to Task	
		Specific	Generic
Relation to Team	Specific	*CONTEXT DRIVEN* • Knowledge – *Team objectives and resources* • Skills – *Goal analysis* • Attitudes - *Collective efficacy*	*TEAM CONTINGENT* • Knowledge – *Teammate characteristics* • Skills – *Conflict resolution* • Attitudes – *Team cohesion*
	Generic	*TASK CONTINGENT* • Knowledge – *Procedures for task accomplishment* • Skills – *Problem analysis* • Attitudes – *Trust in competence*	*TRANSPORTABLE* • Knowledge – *Understanding group dynamics* • Skills – *Assertiveness* • Attitudes – *Collective orientation*

How do you do Team Science?
Interdisciplinary DOs and DON'Ts

UCF Cognitive Sciences

- Increasing complexity/quantity of knowledge in individual disciplines requires collaboration in science
  - Utilize to understand complex problems
  - No one person is capable of maintaining such broad understanding
- Must be sure to monitor and adapt one's attitude, behavior, and cognition when engaged in team science.
  - *Be patient , be a good listener, and be a good collaborator*

https://ccrod.cancer.gov/confluence/display/NIHOMBUD/Home

Thank You

Questions or Comments?

UCF Cognitive Sciences

Funding and Collaborators

Fiore, S. M. & Keyton, J. (2009). Applying the Science of Teams to Inform Policy and Research on Team Science. *National Science Foundation*.

NIH and NCI sponsored "Science of Team Science" conference at Northwestern University. Organizing Program Committee (http://www.scienceofteamscience.org/)

Papers

Börner, K., Contractor, N., Falk-Krzesinski, H, J., Fiore, S. M., Hall, K. L., Keyton, J., Spring, B., Stokols, D., Trochim, W., Uzzi, B. (2010). A multi-level systems perspective for the science of team science. *Science Translational Medicine, 2(49),* 1-5.

Falk-Krzesinski, H. J., Börner, K., Contractor, N. S., Cummings, J., Fiore, S. M., Hall, K. L., Keyton, J., Spring, B., Stokols, D., Trochim, W., Uzzi, B. (2010). Advancing the science of team science. *Clinical and Translational Science 3,* 5-8.

Falk-Krzesinski, H.J., Contractor, N., Fiore, S.M., Hall, K.L., Kane, C., Keyton, J., Klein, J.T., Spring, B., Stokols, D., and Trochim, W. (2011). Mapping a Research Agenda for the Science of Team Science. *Research Evaluation 20,* 143-156.

Fiore, S. M. (2008). Interdisciplinarity as teamwork: How the science of teams can inform team science. *Small Group Research, 39,* 251-277.

NC STATE UNIVERSITY Department of Communication

INGROUP interdisciplinary network for group research