Converging on Convergence

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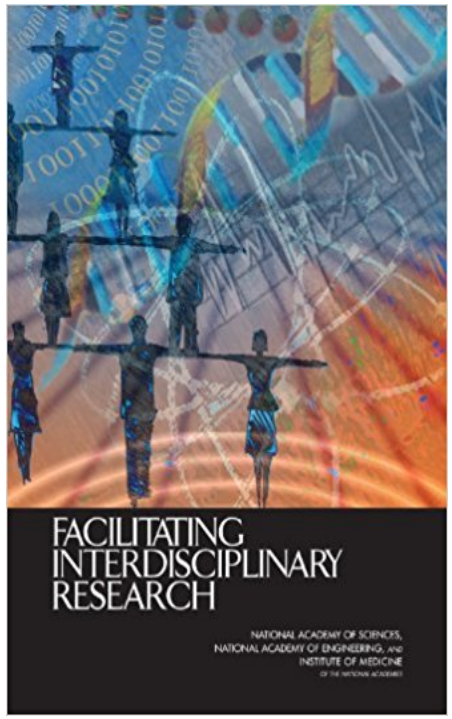
Workshop on Transdisciplinary Research on the Changing Arctic and Its Global Impacts:
Enhancing Capacity for Convergence Science
Beckman Center of the National Academies of
Sciences, Engineering and Medicine
University of California, Irvine
October 31, 2019

Convergent Team Science

A National Need



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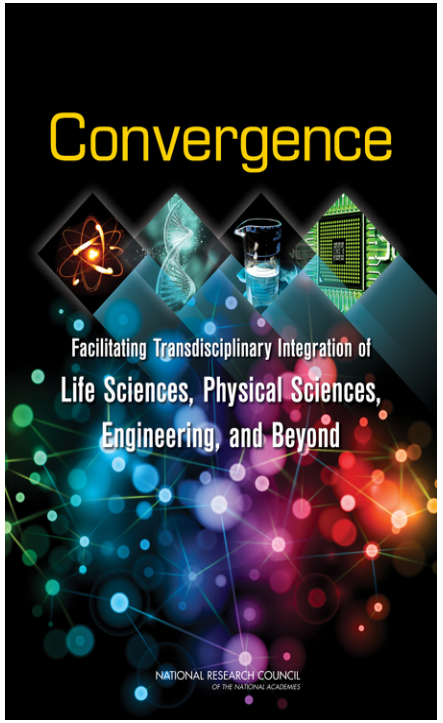

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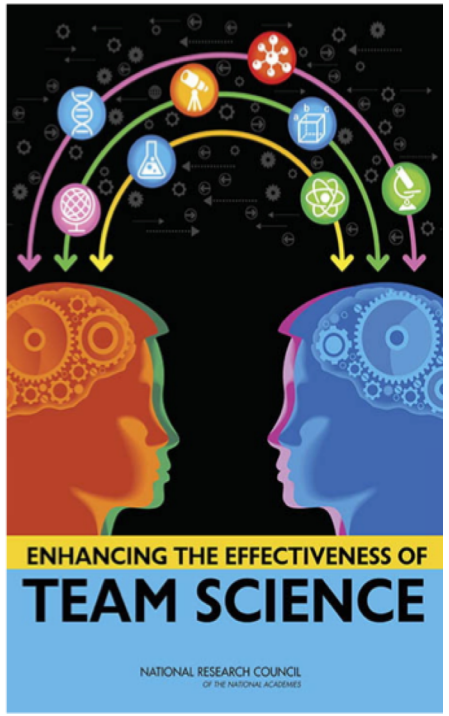

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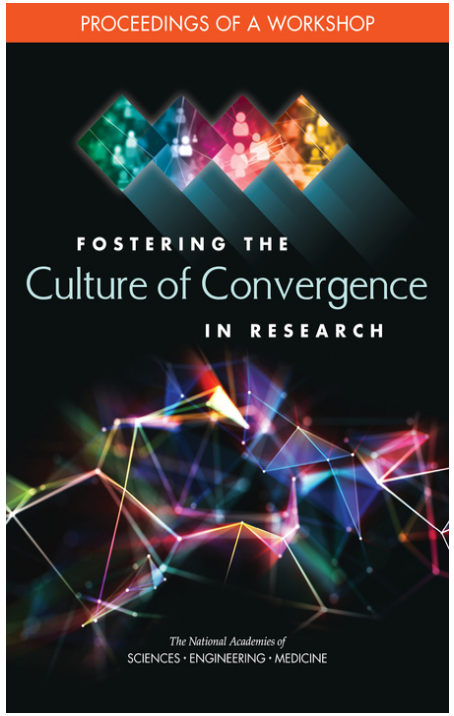


(2019)

Hallmarks of Convergent Science

- *Involves deep integration across disciplines*
- *Driven by a specific and compelling problem*
- *Often leads to co-production of knowledge by researchers and community stakeholders*

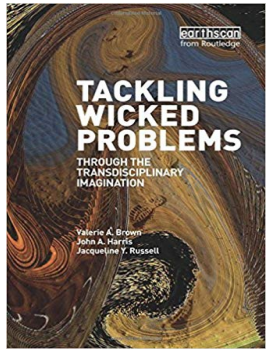
(https://www.nsf.gov/od/oia/convergence/index.jsp)

Grand Challenges of the 21st Century

- Environmental

- Sociopolitical

- Technological



Wicked and Super-Wicked Problems

- Wicked

  Multiple, highly interdependent causes and outcomes at multiple scales, no clearly designated entities responsible for solving the problem

- Super-Wicked

  All of the above, plus extreme time urgency for solving the problem

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences, 4*(2), 155-169.

Levin, K., Cashore, B., Bernstein, S., & Auld, G. (2012). Overcoming the tragedy of super wicked problems: Constraining our future selves to ameliorate global climate change. *Policy Sciences, 45*(2), 123-152.

Global Climate Change and Its Impacts

- *rising levels of greenhouse gases and earth temperatures*
- *melting of polar ice caps, sea rise, flooding*
- *mass migrations of climate refugees*
- *disruption of ocean currents, extreme weather events*
- *acidification and deoxygenation of the oceans*
- *biodiversity loss*
- *food insecurity*
- *disease pandemics*
- *poverty and income inequality*
- *regional and international conflicts over scarce resources*

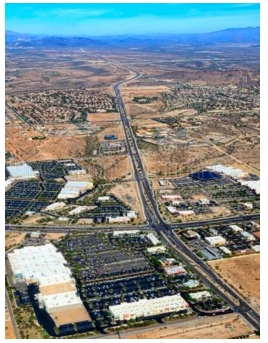
Population Groups Disproportionately Exposed to Climate Hazards

Island residents and those living in coastal regions, flood zones, arid and polar regions

The Marshall Islands Are Disappearing

Flooding in Bangladesh

Arizona Desert Area



Polar Ice Sheets Melting

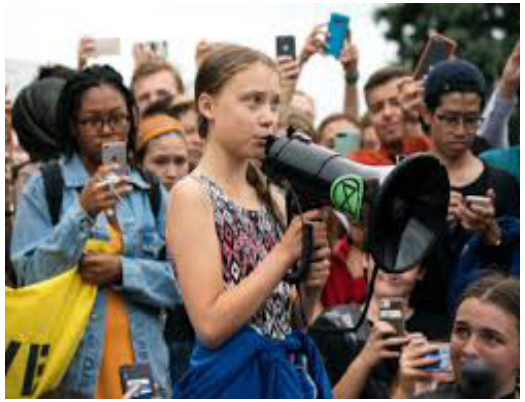
Impoverished women, children, elderly and the infirm

Zaatari Camp on the Jordanian-Syrian Border

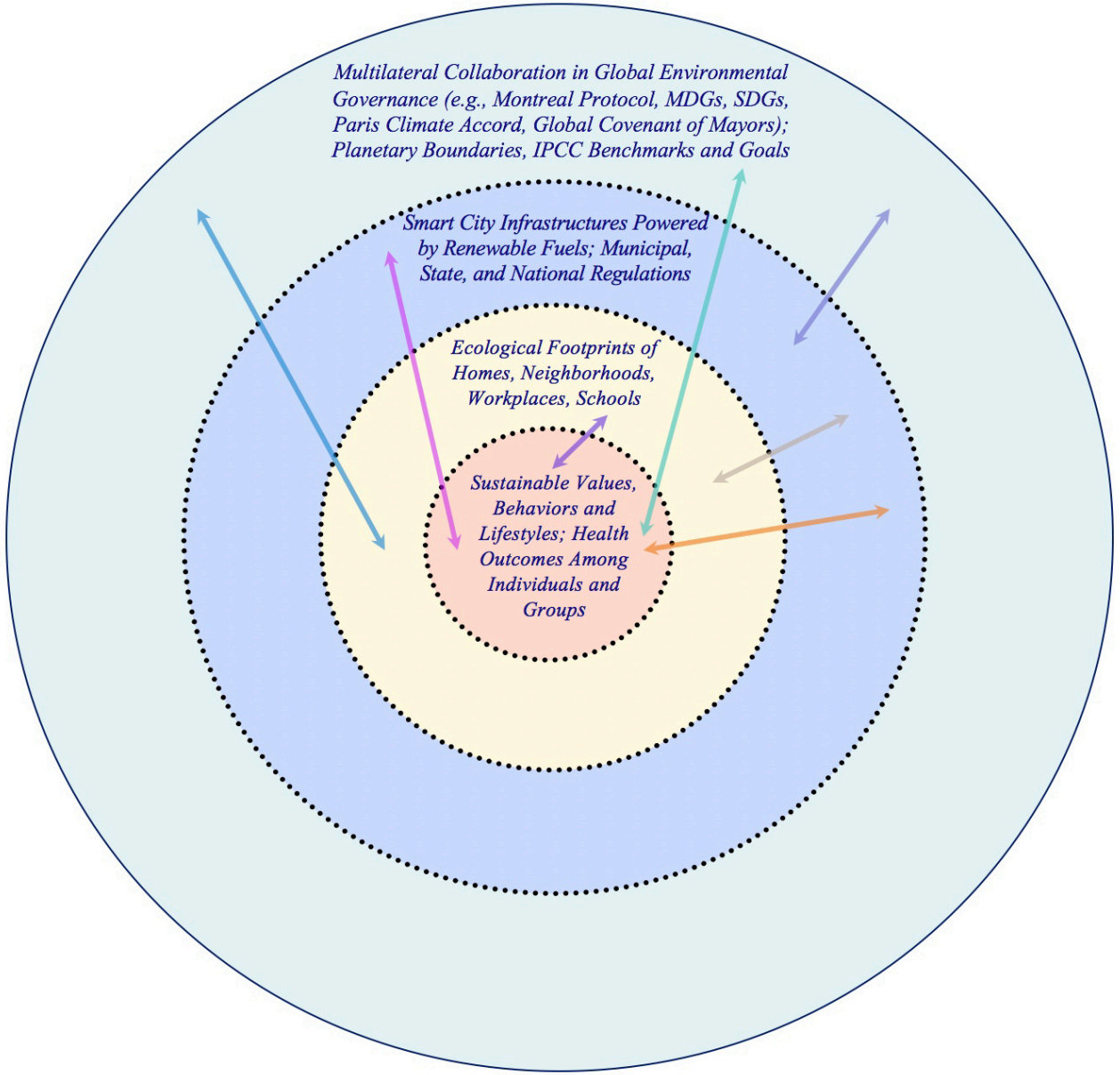
Migrant Mother in the U.S.

Elderly and Homeless in the U.K.

Greta Thunberg Leading a Climate Strike



Linking Multi-Scale Influences on Sustainability and Health



(Stokols, 2018)

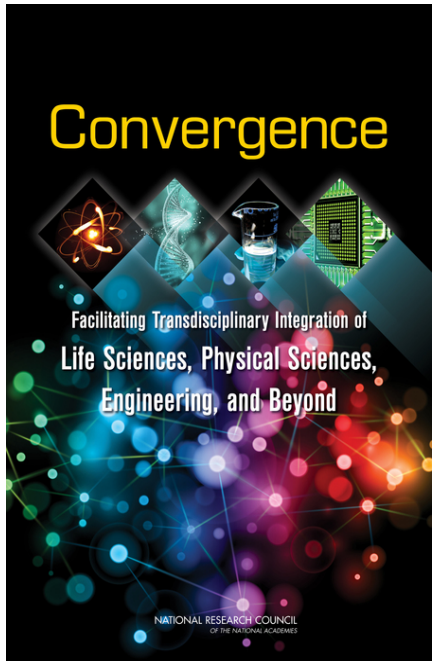
Urban Sprawl, Air Pollution, and Alzheimer's Disease

Los Angeles

Mexico City

Cumulative exposure to combustion-derived nanoparticles (CPM2.5) were linked to pre-clinical AD (NFTV, amyloid phases 1-2, Htau) in Mexico City residents ranging in age from 11 months to 40 years. APOE4 carriers had 23.6 times higher odds of NFTV than non-carriers with similar CPM2.5 exposure and age (Calderon-Garciduenas et al., 2018).

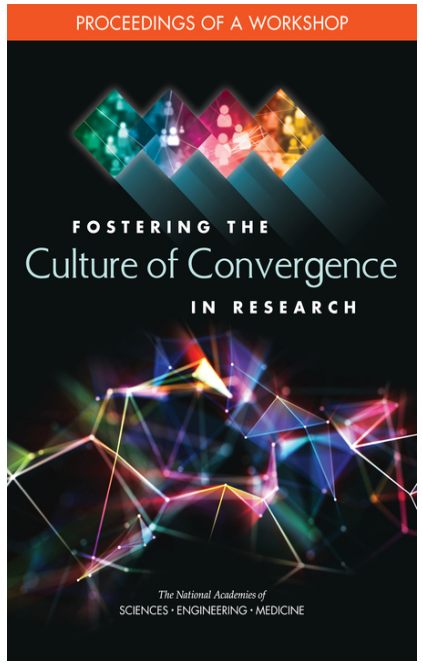
(Cacciottolo et al., 2017; Calderon-Garciduenas et al., 2018; Jung et al., 2015)



(2014)

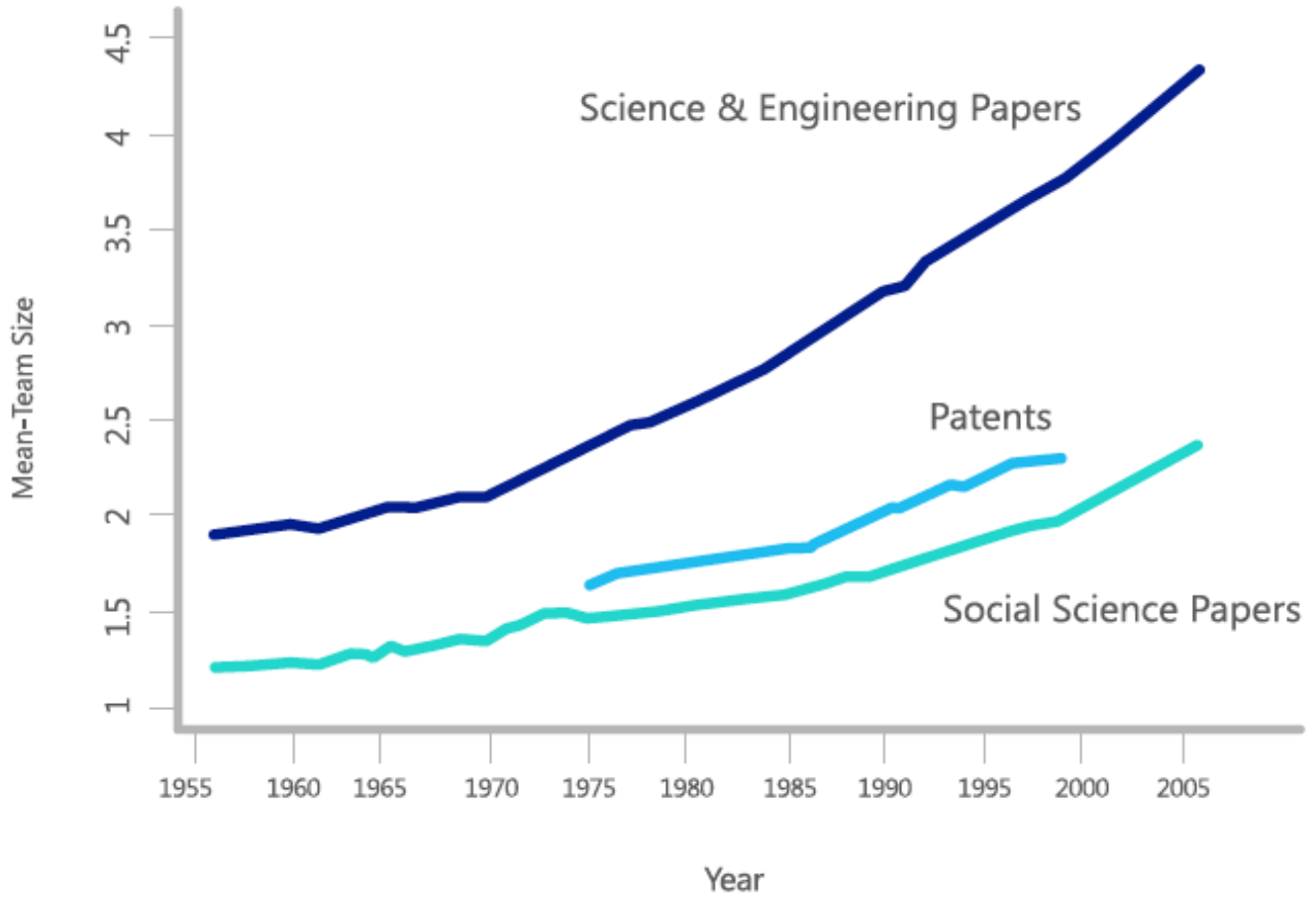
Changing Conceptions of Convergence

- *Broader cross-disciplinary scope*
- *Greater emphasis on linking team science research and convergence*
- *Explicit consideration of strategies for creating a culture of convergence in research organizations*
- *Closer look at the interplay between divergent and convergent thinking in research teams*



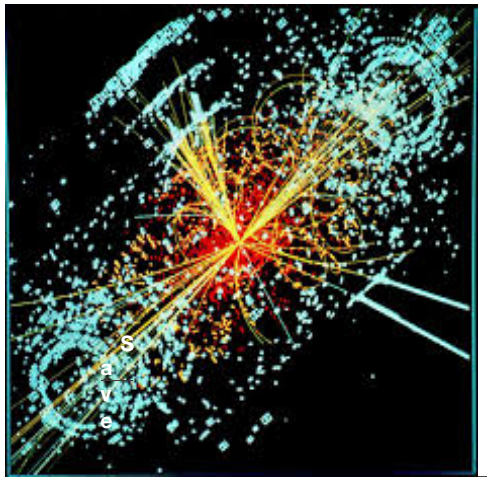
(2019)

Sustained Rise in Teamwork Over Five Decades and Across Multiple Fields

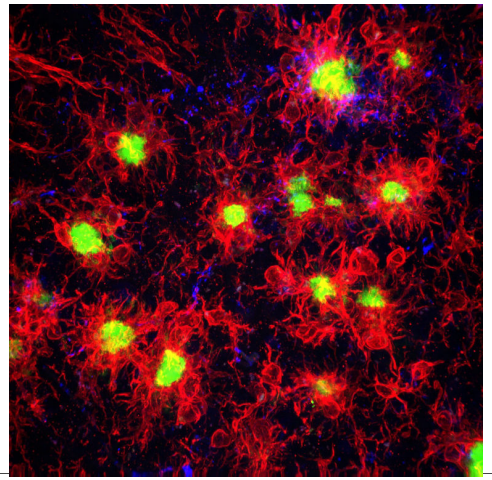


(Data drawn from Web of Science and all U.S. Patents. From Wuchty, S., B. F. Jones, et al. (2007, Science)
"The increasing dominance of teams in production of knowledge."

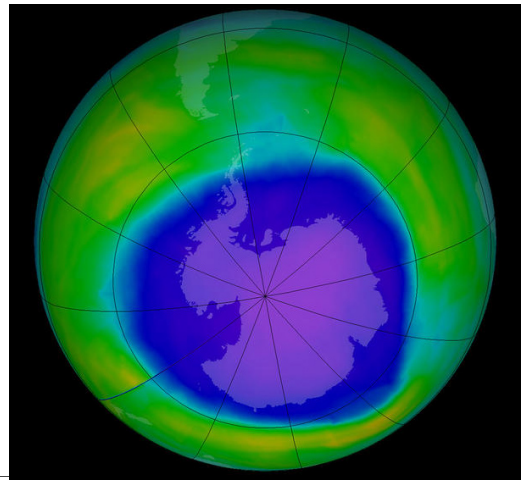
Cross-Disciplinary Teamwork Can Propel Innovation



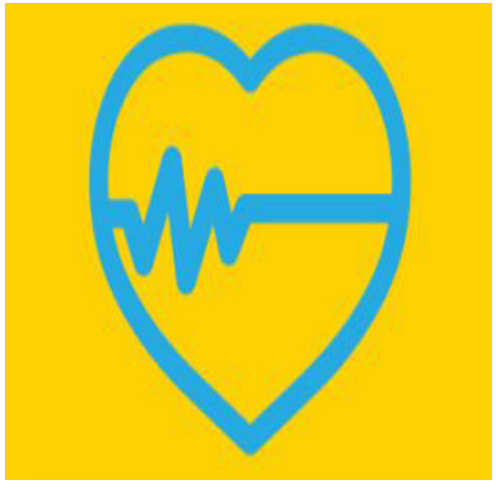
Particle Detection: Physics and Machine Learning



Alzheimer's Disease and Neuroscience



Earth System Science



Medical Humanities

But cross-disciplinary teamwork is quite challenging…

It's Labor Intensive

- coordination
- communication
- training

Administratively Complex

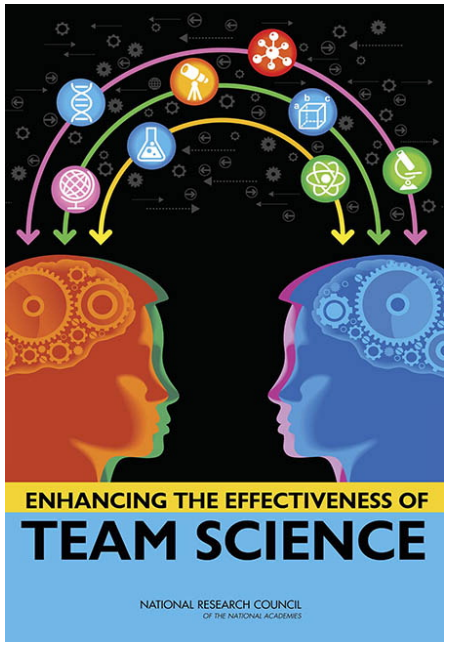
- disagreements and conflict
- formalized collaborative plans

Poses Opportunity Costs

- reduced individual credit
- career jeopardy

The Science of Team Science

…an interdisciplinary field concerned with understanding and managing circumstances that facilitate or hinder the effectiveness of collaborative (and often cross-disciplinary) research, training, and translational initiatives



https://www.inscits.org/

Types of Teams

- *Military Teams*
- *Factory Teams*
- *Corporate Teams*
- *Surgical Teams*
- *Emergency Response Teams*
- *Science Teams*

A Continuum of Disciplinary Integration

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

Across

Disciplines

Within

Interdisciplinary

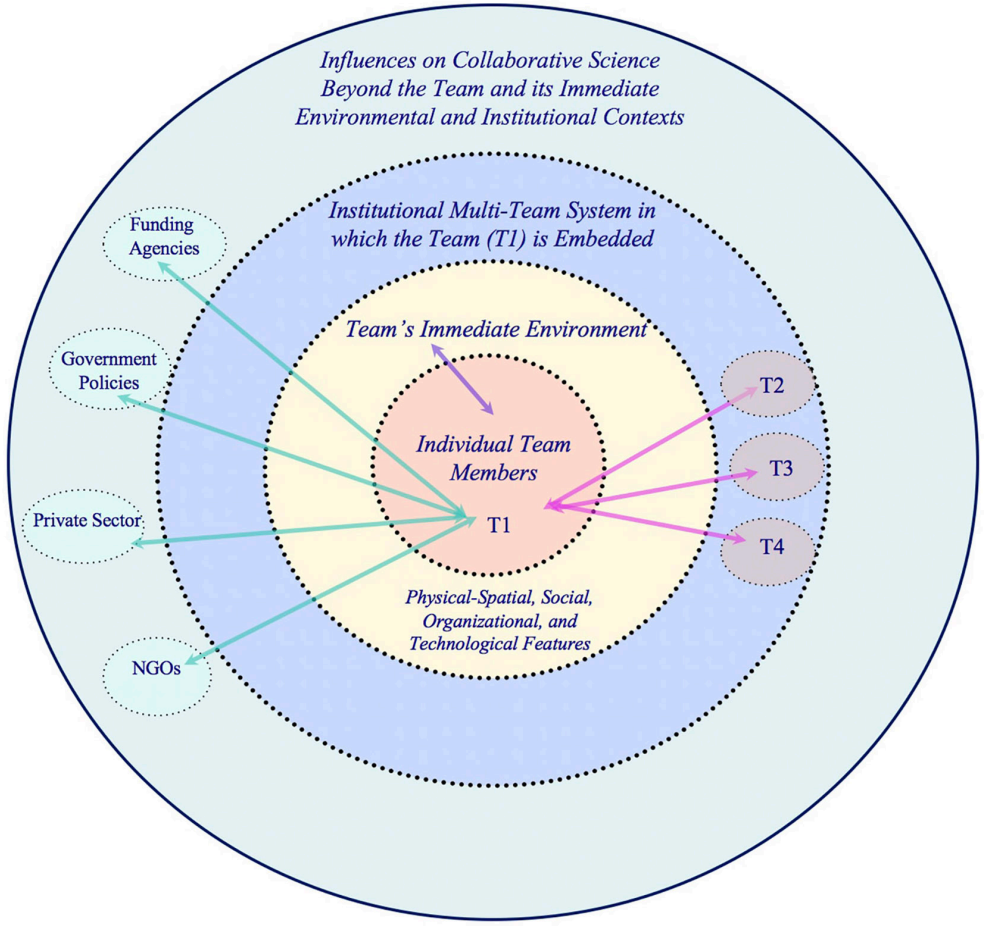
Researchers from *different disciplines work jointly* to address a common problem. Some integration of perspectives occurs, but contributions remain anchored in their own disciplines

Unidisciplinary

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

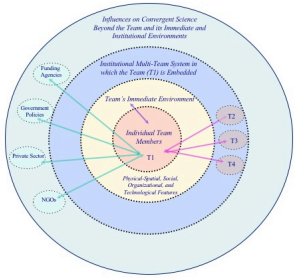
Adapted from: Rosenfeld, 1992; Hall et al., 2008, 2018; Falk-Krezsinski, 2012; Austin et al., 2008; Nissani, 1995

Key Facets of the Convergence Ecosystem



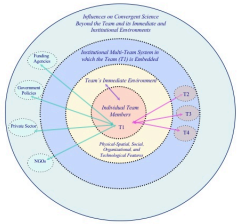
- *Funding agency and foundational support for team science initiatives*
- *Institutional incentives for cross-disciplinary partnerships*
- *Team-level supports*
- *Cultivating individual core competencies*

Institutional Leverage Points for Promoting Convergence



- *Campus mission statements*
- *Tenure and promotion criteria*
- *Credit and resource sharing*
- *Seed grants and collaborative support*
- *Shared space and facilities*
- *Education and mentorship*

Tools to Assist Faculty in Identifying Their Contributions to Collaborative Scholarship in Promotion and Tenure Reviews



UCI Office of Academic Personnel

Google Custom Search

POLICIES & PROCEDURES ▾ COMPENSATION & BENEFITS ▾ LISTS & FORMS ▾ AP SYSTEMS ▾ PROGRAMS & INITIATIVES ▾ RESOURCES ▾

> Resources for Faculty > Guidance for Faculty on Preparing Files > Identifying Faculty Contributions to Collaborative Scholarship

Identifying Faculty Contributions to Collaborative Scholarship

(https://ap.uci.edu/faculty/guidance/)

Collaborative Contributions List

Type of Contributions	Examples

Contribute the key idea behind the work

Help obtain grant funding

Bring statistical expertise

Provide overall project administration, leadership

Be a liaison to a key community or organization

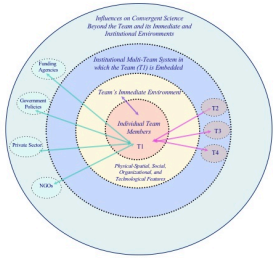
Take leadership in creating research papers

Create theoretical ideas or frameworks

Do significant work in editing papers

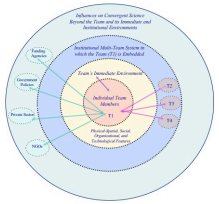
(https://ap.uci.edu/faculty/guidance/collablist/)

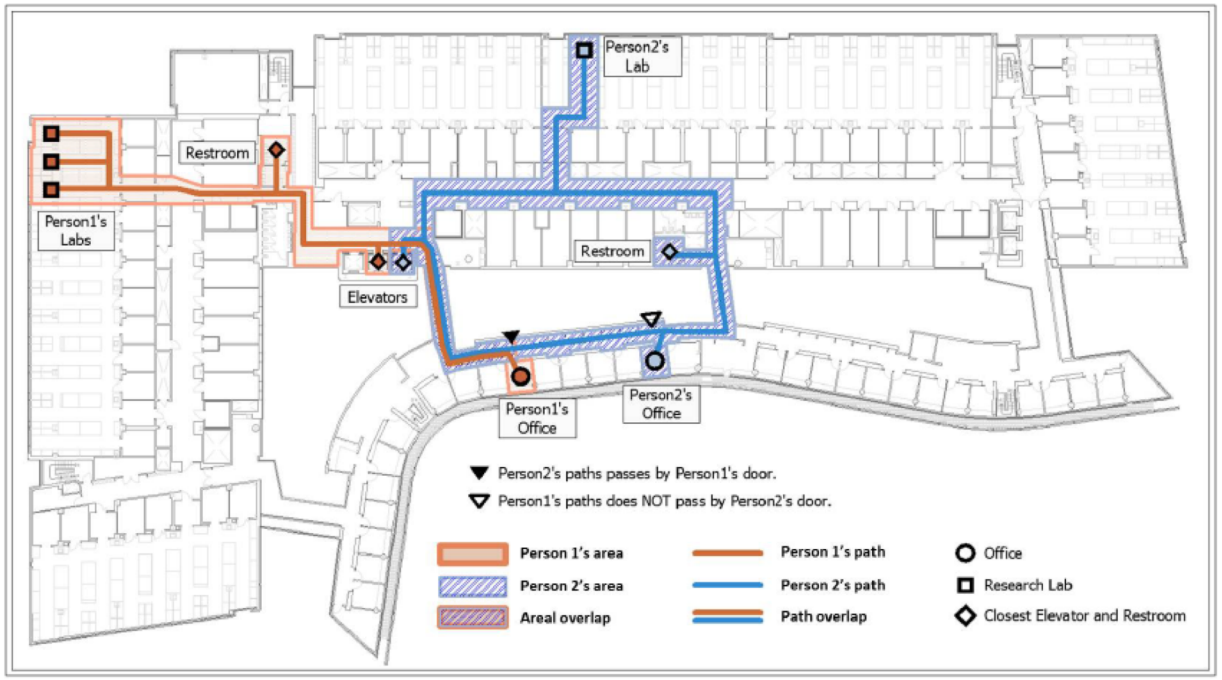
Credit and Resource Sharing



- Implement more effective credit sharing strategies for inter-school grants
- Improve policies for distributing indirect costs

Shared Space and Facilities





Environment and Behavior
Volume 41 Number 3
May 2009 427-442
© 2009 SAGE Publications
10.1177/0013916508314854
http://eab.sagepub.com
hosted at
http://online.sagepub.com

Spatial and Social Networks in Organizational Innovation

Jean D. Wineman
Felichism W. Kabo
Gerald F. Davis
University of Michigan

Research on the enabling factors of innovation has focused on either the social component of organizations or on the spatial dimensions involved in the innovation process. But no one has examined the aggregate consequences of the link from spatial layout, to social networks, to innovation. This project enriches our understanding of how innovation works especially in highly innovative organizations by exploring the social dimensions of innovation as they are embedded in a specific spatial milieu. Workspace layout generates spatial boundaries that divide and reunite built space. These boundaries create relations of accessibility and visibility that integrate or segregate behaviors, activities, and people. As built space structures patterns of circulation, copresence, coawareness, and encounter in an organization, these interrelationships become fundamental to the development of social networks, especially those networks critical to the innovation process. This article presents a review of the knowledge bases of social network and spatial layout theories, and reports on a preliminary study of the effects of spatial layout on the formation and maintenance of social network structure and the support of innovation.

Keywords: *office design; network analysis; space syntax; productivity*

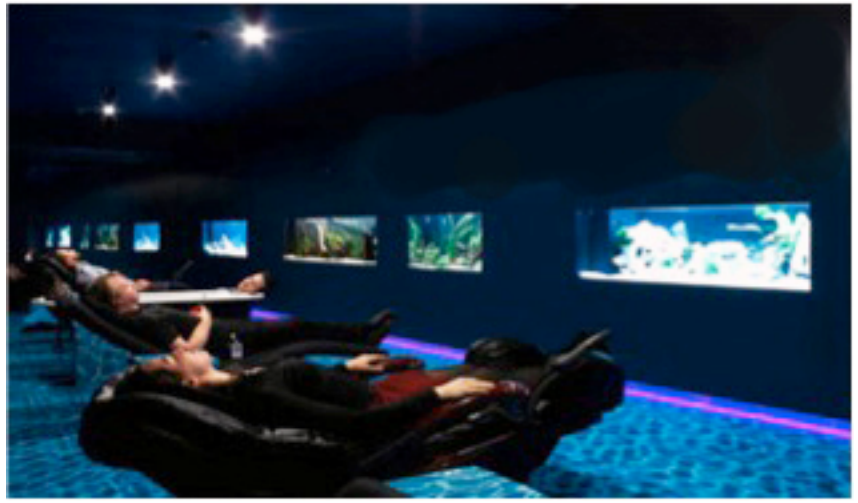
Same building	*33% more likely to collaborate*
Same floor	*24% more likely to collaborate*
Overlapping activity zones	*more likely to receive joint grants*

(Kabo, Hwang, Levenstein, & Owen-Smith, "Shared paths to the lab", *Environment and Behavior*, 2013)

Externalizing Shared Values and Team Identity Through the Physical Environment

Pacificare, Cypress, CA

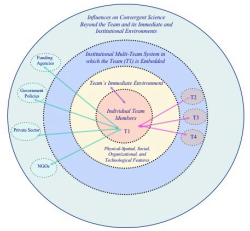
LSA Associates, Irvine, CA



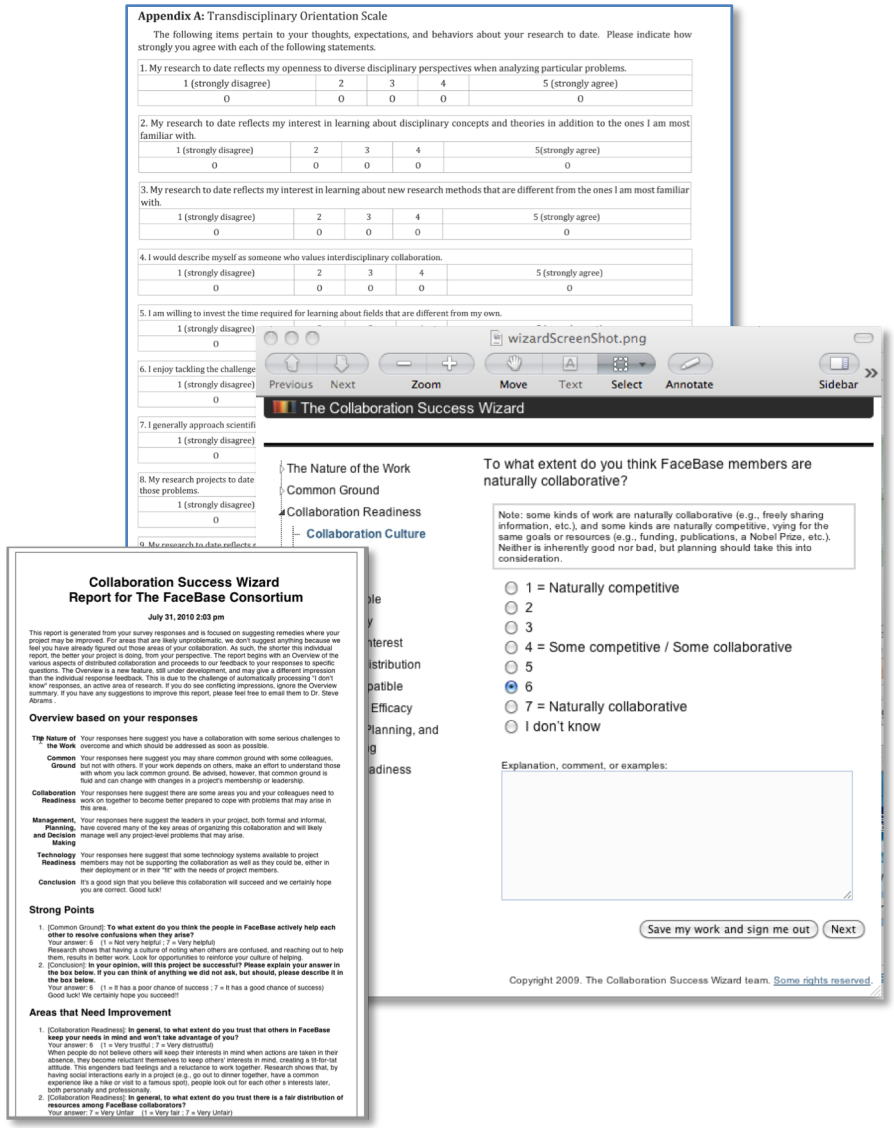
Google-Zurich

LSA Associates, Irvine, CA

Strengthening Team-Level Capacities for Transdisciplinary Collaboration



- *Measure and strengthen transdisciplinary orientation and integrative capacity*
- *Measure additional assets and constraints known to influence team effectiveness*
- *Suggest strategies for remedying weaknesses and bolstering success*



Appendix A: Transdisciplinary Orientation Scale

The following items pertain to your thoughts, expectations, and behaviors about your research to date. Please indicate how strongly you agree with each of the following statements.

1. My research to date reflects my openness to diverse disciplinary perspectives when analyzing particular problems.					
1 (strongly disagree)	2	3	4	5 (strongly agree)	
0	0	0	0	0	
2. My research to date reflects my interest in learning about disciplinary concepts and theories in addition to the ones I am most familiar with.					
1 (strongly disagree)	2	3	4	5(strongly agree)	
0	0	0	0	0	
3. My research to date reflects my interest in learning about new research methods that are different from the ones I am most familiar with.					
1 (strongly disagree)	2	3	4	5 (strongly agree)	
0	0	0	0	0	
4. I would describe myself as someone who values interdisciplinary collaboration.					
1 (strongly disagree)	2	3	4	5 (strongly agree)	
0	0	0	0	0	
5. I am willing to invest the time required for learning about fields that are different from my own.					
1 (strongly disagree)					
0					
6. I enjoy tackling the challenge					
1 (strongly disagree)					
0					
7. I generally approach scientifi					
1 (strongly disagree)					
0					
8. My research projects to date those problems.					
1 (strongly disagree)					
0					
9. My research to date reflects					

wizardScreenShot.png

Previous Next Zoom Move Text Select Annotate Sidebar

The Collaboration Success Wizard

- The Nature of the Work
- Common Ground
- Collaboration Readiness
  - Collaboration Culture

To what extent do you think FaceBase members are naturally collaborative?

Note: some kinds of work are naturally collaborative (e.g., freely sharing information, etc.), and some kinds are naturally competitive, vying for the same goals or resources (e.g., funding, publications, a Nobel Prize, etc.). Neither is inherently good nor bad, but planning should take this into consideration.

- 1 = Naturally competitive
- 2
- 3
- 4 = Some competitive / Some collaborative
- 5
- 6
- 7 = Naturally collaborative
- I don't know

Explanation, comment, or examples:

Save my work and sign me out | Next

Copyright 2009. The Collaboration Success Wizard team. Some rights reserved.

Collaboration Success Wizard
Report for The FaceBase Consortium

July 31, 2010 2:03 pm

This report is generated from your survey responses and is focused on suggesting remedies where your project may be improved. For areas that are likely unproblematic, we don't suggest anything because we feel you have already figured out those areas of your collaboration. As such, the shorter this individual report, the better your project is doing, from your perspective. The report begins with an Overview of the various aspects of distributed collaboration and proceeds to our feedback to your responses to specific questions. The Overview is a new feature, still under development, and may give a different impression than the individual response feedback. This is due to the challenge of automatically processing "I don't know" responses, an active area of research. If you do see conflicting impressions, ignore the Overview summary. If you have any suggestions to improve this report, please feel free to email them to Dr. Steve Abrams .

Overview based on your responses

The Nature of the Work Your responses here suggest you have a collaboration with some serious challenges to overcome and which should be addressed as soon as possible.

Common Ground Your responses here suggest you may share common ground with some colleagues, but not with others. If your work depends on others, make an effort to understand those with whom you lack common ground. Be advised, however, that common ground is fluid and can change with changes in a project's membership or leadership.

Collaboration Readiness Your responses here suggest there are some areas you and your colleagues need to work on together to become better prepared to cope with problems that may arise in this area.

Management, Planning, and Decision Making Your responses here suggest the leaders in your project, both formal and informal, have covered many of the key areas of organizing this collaboration and will likely manage well any project-level problems that may arise.

Technology Readiness Your responses here suggest that some technology systems available to project members may not be supporting the collaboration as well as they could be, either in their deployment or in their "fit" with the needs of project members.

Conclusion It's a good sign that you believe this collaboration will succeed and we certainly hope you are correct. Good luck!

Strong Points

1. [Common Ground]: **To what extent do you think the people in FaceBase actively help each other to resolve confusions when they arise?**
   Your answer: 6 (1 = Not very helpful ; 7 = Very helpful)
   Research shows that having a culture of noting when others are confused, and reaching out to help them, results in better work. Look for opportunities to reinforce your culture of helping.
2. [Conclusion]: **In your opinion, will this project be successful? Please explain your answer in the box below. If you can think of anything we did not ask, but should, please describe it in the box below.**
   Your answer: 6 (1 = It has a poor chance of success ; 7 = It has a good chance of success)
   Good luck! We certainly hope you succeed!!

Areas that Need Improvement

1. [Collaboration Readiness]: **In general, to what extent do you trust that others in FaceBase keep your needs in mind and won't take advantage of you?**
   Your answer: 6 (1 = Very trustful ; 7 = Very distrustful)
   When people do not believe others will keep their interests in mind when actions are taken in their absence, they become reluctant themselves to keep others' interests in mind, creating a tit-for-tat attitude. This engenders bad feelings and a reluctance to work together. Research shows that, by having social interactions early in a project (e.g., go out to dinner together, have a common experience like a hike or visit to a famous spot), people look out for each other's interests later, both personally and professionally.
2. [Collaboration Readiness]: **In general, to what extent do you trust there is a fair distribution of resources among FaceBase collaborators?**
   Your answer: 7 = Very Unfair (1 = Very fair ; 7 = Very Unfair)

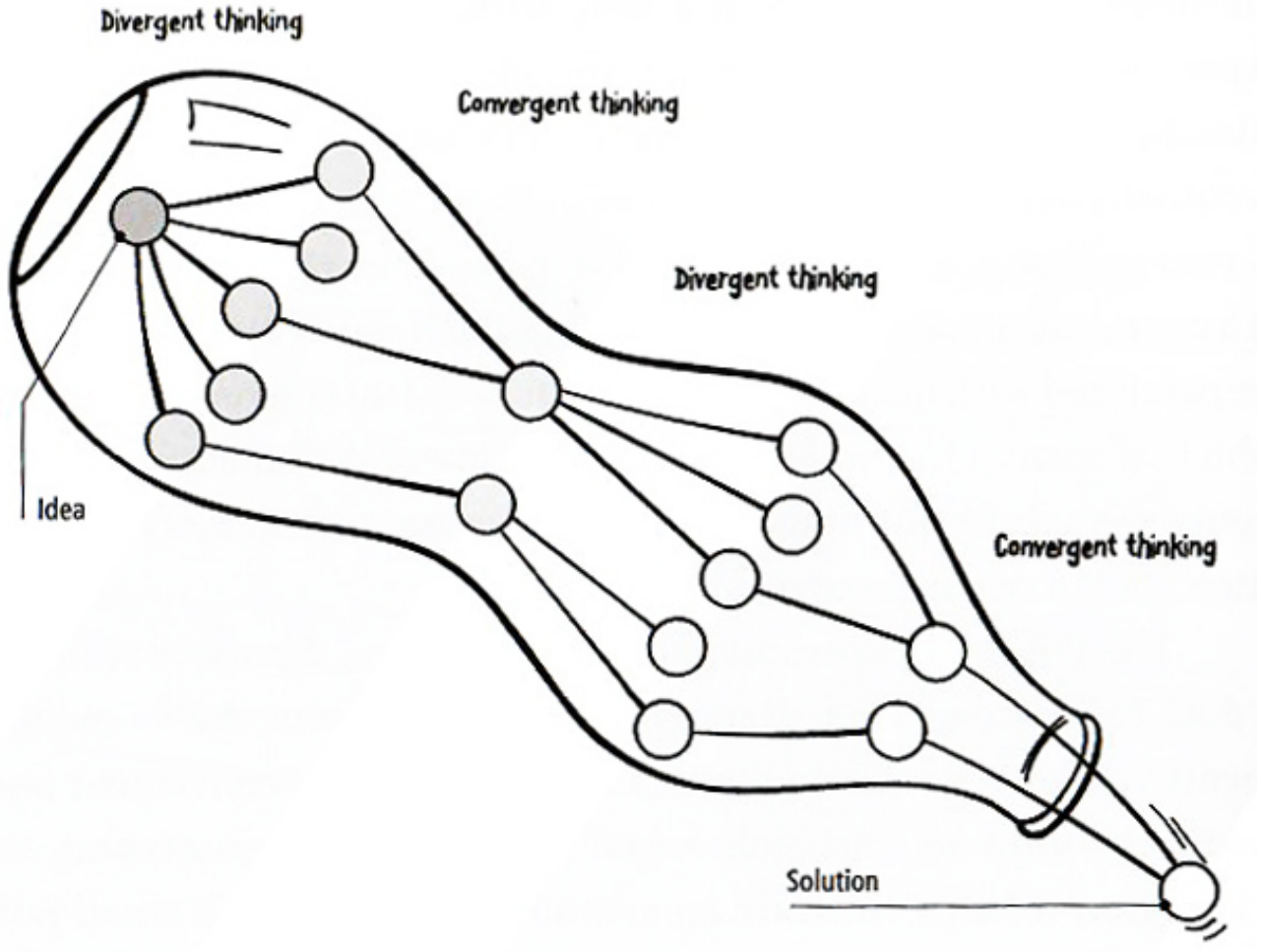
Key Facets of Team-Based Scholarship

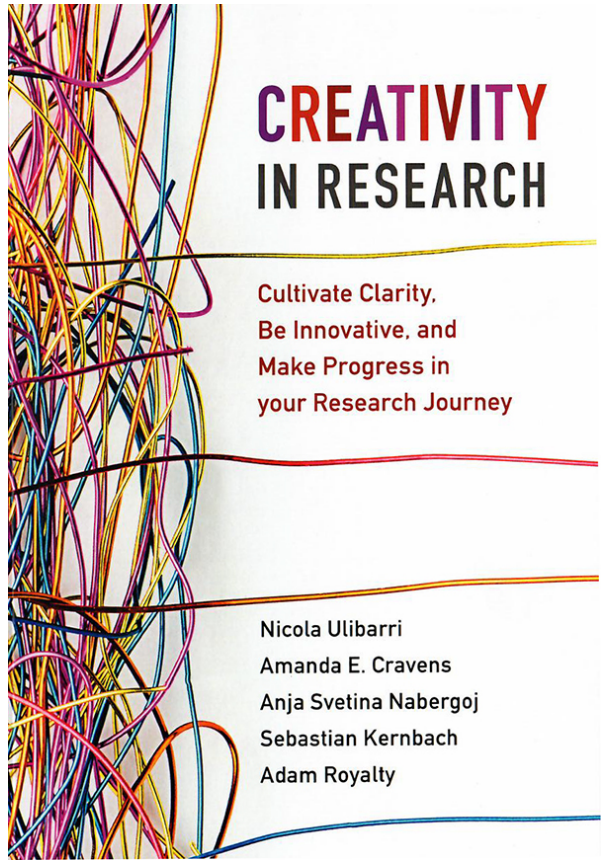
- Promoting Social Integration
- Fostering Intellectual Synergy

Using the Idea Tree Exercise to incubate and integrate novel ideas

https://i2insights.org/2019/03/12/idea-tree-brainstorming-tool/

Integrating Divergent and Convergent Ideation in Research Teams





(Ulibarri et al., 2019)

Educating Convergent Cross-Disciplinary Scholars

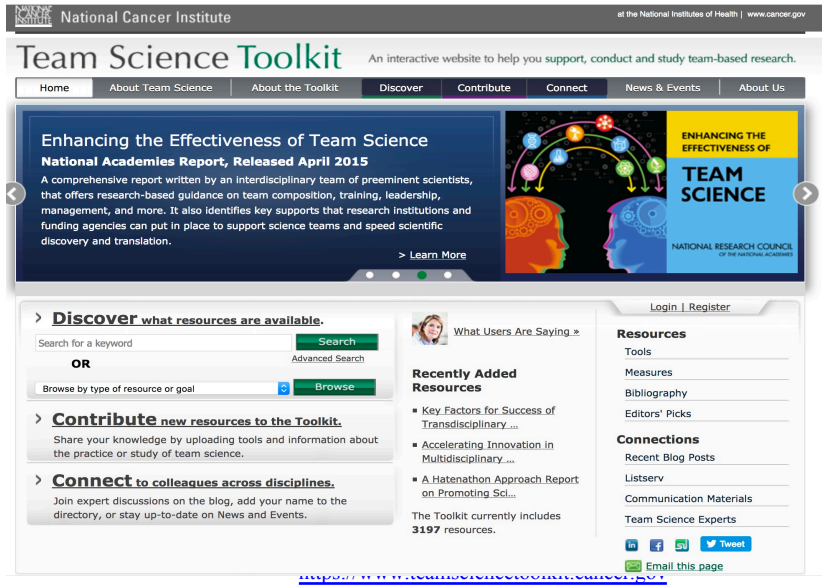
Cultivating Core Competencies for Convergent Team Science

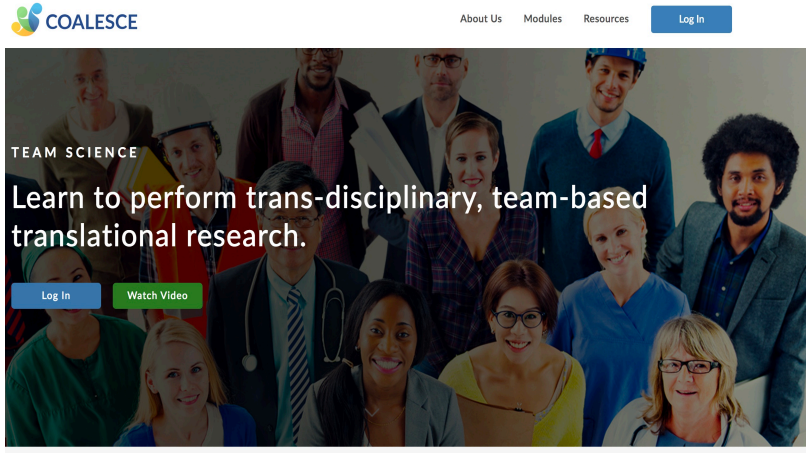
The Four T's of Research Training in the 21st Century

- ***Transdisciplinary***
- ***Team-based***
- ***Translational***
- ***Transcultural***

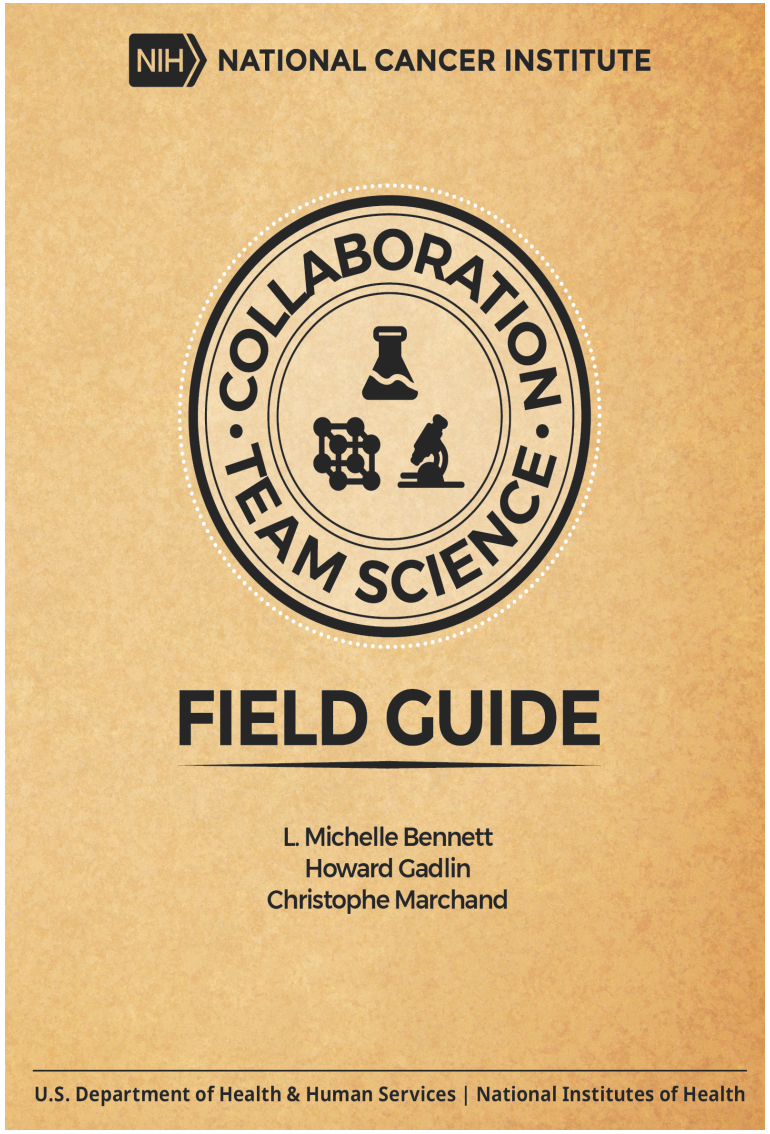
Members of the ALICE Collaboration, A Large Ion Collider Experiment

Training Resources for Team Science





http://www.teamscience.net



https://www.cancer.gov/about-nci/organization/crs/research-initiatives/team-science-field-guide

http://www.scienceofteamscience.org/scits-a-team-science-resources

http://tdi.msu.edu/

http://tdi.msu.edu/workshops/