Toward Strategic Team Science: Reducing Opportunity Costs While Enabling Innovation

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Presented in Panel 2, *A Perspective on Challenges Related to the Science of Team Science,* at the Northwestern University First Annual International Conference on the Science of Team Science,
Chicago, Illinois, April 22-24, 2010

Acknowledgments

I want to acknowledge and thank my colleagues at the National Cancer Institute's Division of Cancer Control and Population Sciences, especially Drs. Kara Hall, Richard Moser, Annie Feng, Brooke Stipelman, Amanda Vogel, Robert Croyle, Linda Nebeling, Brad Hesse, Glen Morgan, Stephen Marcus, David Berrigan, Shobha Srinivasan, and Bill Klein, with whom I've had the opportunity to collaborate closely over the past several years as a member of the NCI Science of Team Science Team. My thinking about and involvement in the science of team science have been significantly influenced and enhanced through my collaboration with them. I also thank colleagues at the National Academy of Sciences, Anne Heberger Marino, Kimberly Suda-Blake, and Ken Fulton at NAS, and Shalini Misra in the School of Social Ecology at UC Irvine, for the opportunity to participate with them in the National Academies Keck Foundation Futures Initiative (NAKFI) to promote interdisciplinarity.

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

Strategic Team Science

An approach to planning and managing team science projects that:

(1) mobilizes particular arrangements or infrastructures for conducting collaborative research,

(2) within one or more domains of inquiry,

(3) in a manner that optimizes the prospects for achieving intended scientific and societal innovations,

(4) while minimizing potential opportunity costs associated with the collaboration.

Different Vantage Points on Defining and Achieving Strategic Team Science

- *Individual Scientists*
- *Research Institutions*
- *Funding Agencies and Foundations*
- *Elected Officials and Policy Makers*
- *Community Partners and Stakeholders*

Some Strategic Decisions Faced by Individual Scientists

- *Whether to work individually or to collaborate with others as part of a scientific team or network*
- *Whether to engage in specialized unidisciplinary projects or to conduct broader cross-disciplinary research*

Examples of Alternative Infrastructures for Conducting Team Science

- *NIH Transdisciplinary Research and Training Centers*
- *National Academy of Sciences Keck Foundation Futures Initiative (NAKFI) Conferences, Seed Grants*
- *MacArthur Research Networks*
- *Robert Wood Johnson Foundation Active Living Research Grants*
- *Multi-site Virtual Collaboratories and Networks*

(these vary according to their *place-based* or *virtual qualities*, *size and duration of research grants*, *numbers of scientists participating*, *cross-disciplinary scope of the research undertaken*)

Identifying Intended Scientific and Societal Innovations at the Outset and Subsequent Phases of a Team Science Project

- *The Science of Team Science has given considerable attention to measuring collaborative processes but is just beginning to elucidate the links between teamwork and the achievement of intended (or serendipitous) innovations (e.g., potential value of mixed-methods studies that combine quantitative bibliometric indices of scientific impact with qualitative peer appraisals of the magnitude of scientific and societal innovations)*

- *Benefits of developing more explicit typologies of scientific and societal outcomes of team research*

Some Dimensions of Scientific Innovations

- *Temporal scope – proximal, discrete vs. distal, cumulative*
- *Within domain vs.* cross-domain *advances in scientific thinking and research methods, metrics and measures (Gretchen Jordan's 2006 dimension of small vs. large scale scientific innovations)*
- *Paradigm elaboration vs. paradigm shifting and paradigm creating innovations (Jerald Hage's 1980 dimension of incremental vs. radical innovations)*
- *Translational value of scientific innovations for developing new and more effective public policies and targeted interventions to alleviate community problems*

The Emergence of Big Science

(See Wuchty, S., B. F. Jones, et al. (2007, *Science*). "The increasing dominance of teams in production of knowledge.")

Qualities of Large Scale Cross-Disciplinary Collaborations

- Labor intensive, conflict prone *(Fiore, 2008; Levine & Moreland, 2004; Paletz & Schunn, 2010)*
- Require preparation, practice, trust, and extensive coordination, often among co-investigators working at geographically dispersed sites *(Olson et al., 2008)*
- Impact of contextual factors on collaborative processes (e.g., institutional constraints, connectivity)
- Scientific outcomes are often uncertain, as are the metrics and timeframes for measuring them
- Not all researchers are well-suited to cross-disciplinary collaboration – need to match investigators, research infrastructures, and intended innovations more effectively in order to do “smarter science”

Some Opportunity Costs Arising from Mis-Matches Between Research Infrastructures, Substantive Domains, and Intended Innovations

- *Behavioral – fragmentation of scientists' research activities*
- *Cognitive – information overload arising from participation in complex collaborative transactions and multiple "collaborative spheres" (Gonzalez & Mark, 2005)*
- *Social – interpersonal conflict and strains arising from divergent scientific world views and disciplinary biases (Eigenbrode et al., 2007; Klein, 2008)*
- *Organizational/Institutional – "sunk costs" invested in complex research infrastructures whose duration and sustainability are unclear*
- *Scientific/Community/Societal –investments of scarce resources for scientific research in large yet "low-yield" initiatives; "missed" disciplinary or cross-disciplinary discoveries*

Summary

1. *From the outset and over the course of a collaborative project, give extensive consideration to the kinds of scientific innovations that the team aspires to achieve during a specified time interval.*

2. *Consider carefully the distinctive features and trade-offs among alternative infrastructures for implementing team science and create an infrastructure that's best suited for achieving the team's highest priority innovations.*

3. *Anticipate potential opportunity costs associated with particular research infrastructures and take steps to avoid or reduce them.*

4. *Periodically refine the infrastructure for conducting team science to optimize the achievement of intended or serendipitous innovations.*