Interdisciplinary Team Science:
Annotated Bibliography and Coaching and Training Module

This combination of an Annotated Bibliography and a Coaching and Training Module highlights key resources and offers suggestions on how to use them for self-tutorials, coaching and mentoring others, and presentations and support materials in workshops, colloquia, and short courses.

Additional related modules on this website focus in greater detail on Education and Training and on Evaluation.

In order to be successful, Team Science requires understanding antecedents, processes, and outcomes of collaboration among experts from different disciplines, professions, and fields. The Science of Team Science (SciTS) is an emergent field that studies barriers, facilitators, and best practices. This combined bibliography and training module identifies key resources from the literature

It covers five areas:

(1) introductions and overviews, including definitions and rationale for teamwork

(2) resources for successful collaboration, including team building and management

(3) evaluation, including tools and strategies for multiple stages

(4) training, including best practices and core competencies

(5) strategies for finding more resources and staying up to date.

Note. Access to article links requires a Wayne State University access ID and password.
All URLs were accessed 11 June 2014.

FAQ #1: Where can I find introductions and overviews?

Stokols, D., Hall, K. L., Taylor, B. K., & Moser, R. P., & Syme, S. L. (2008). The science of team science. *American Journal of Preventive Medicine*, *35*(2), S77-S252.
http://www.sciencedirect.com.proxy.lib.wayne.edu/science/article/pii/S074937970800408X

Provides a comprehensive overview of team science in a special issue on the nature of the field, theoretical perspectives, methodological contributions, and future directions.

- Individuals and groups may read and discuss introductions to the field, especially "The Science of Team Science"(S77-89) and "The Ecology of Team Science" (S96-115).
- Leaders and teams can frame discussion and planning around specific articles on the topics of leadership, training, evaluation, collaboration readiness, and systems thinking.
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Promoting Team Science at the University of Colorado Denver: Leadership for Innovation in Team Science (LITeS).
http://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CDIQFjAB&url=http%3A%2F%2Fcctsi.ucdenver.edu%2Ftraining-and-education%2FDocuments%2FLITeSTeamScienceReport2013.pdf&ei=fjAVU9XuE6bp0gH_vYD4Cg&usg=AFQjCNFZAE-oCFNnoq3AaoAPkgUmPT2ppQ&sig2=xGjC8iC_4blVi9Eb0rSFZw&bvm=bv.62286460,d.dmQ

Covers topics emanating from interviews with collaborative teams at the University of Colorado Denver's Anschutz Medical Campus.

- Planners can read the entire report for a preliminary overview of how to foster team science locally, informed by national trends.
- Planners, team leaders, and groups can use individual chapters to frame discussion of specific areas including education and training, funding, space and the physical environment, and toolkits for improved practice.

For shorter syntheses in single articles, see:

Stokols, D., Hall, K. L., Taylor, B. K., & Moser, R. P., Feng, S., Misra, S., and Taylor, B. (2010). Cross-disciplinary teams science initiatives: research training, and translation. In R. Frodeman, J. T. Klein, and C. Mitcham (Eds.). *The Oxford Handbook of Interdisciplinarity*. (pp. 471-93) New York: Oxford University Press.
https://webfiles.uci.edu/dstokols/Pubs/Stokols%20et%20al.%20HOI%20Chapter%2032.pdf

Covers key terms, characteristics, models and frameworks, methodologies, training, evaluation, and collaboration readiness. Includes graphics depicting logic models, a schematic of antecedents-processes-outcomes, and a typology of contextual factors influencing effectiveness of collaboration.

Stokols, D., Hall, K., and Vogel, A. (2013). Defining transdisciplinary research and education. In D. Haire-Joshu and T. McBridge (Eds.). *Transdisciplinary Public Health: Research, Education, and Practice* (pp. 1-30). San Francisco: Jossey Bass.
https://webfiles.uci.edu/dstokols/Pubs/Stokols,%20Hall,%20%26%20Vogel%20(2013)%20%20TD%20Public%20Health.pdf

Defines the nature of team-based transdisciplinary (TD) approaches in public health research and education, illustrates a four-phase model of a TD initiative with support table, and presents guidelines for success evaluation and outcomes. Textbook-style learning objectives, review questions, and glossaries also make it useful for self-directed learning and teaching.

Sellers, T. A., Caporaso, N., Lapidus, S., Petersen, G. M., & Trent, J. (2006). Opportunities and barriers in the age of team science: Strategies for success. *Cancer Causes & Control*, *17*(3), 229-237.
http://link.springer.com.proxy.lib.wayne.edu/article/10.1007/s10552-005-0546-5#page-1

Outlines justification of team science efforts based on expert interviews, with discussions of funding and grant strategies, partnerships, technology, and academic incentives, as well as bridging of gaps across academic cultures and recognition and budgeting in university-community and industry alliances and

See Also For Background Reading

Falk-Krzesinski, H.J., Contractor, N., Fiore, S. M., Hall, K. L., Kane, C., Keyton, J., & Trochim, W. (2011). Mapping a research agenda for the science of team science. *Research Evaluation*, *20*(2), 145-158.
http://rev.oxfordjournals.org.proxy.lib.wayne.edu/content/20/2/145.short

Presents findings from a concept mapping exercise to define the field of team science. Synthesizes inputs from key informants and stakeholders in seven meta-areas of research central to refining and developing the field.

Fiore, S. M. (2008). Interdisciplinarity as teamwork—How the science of teams can inform team science. *Small Group Research, 39,* 251–277.
http://sgr.sagepub.com.proxy.lib.wayne.edu/content/39/3/251.short

Defines best practices and policies for team science. Includes comparisons between multiple levels of research, ways of translating theory into practice, and ways of improving interdisciplinary research and theory in team science.

FAQ # 2: Where can I learn about strategies for successful collaborations?

Bennett, L. M., Gadlin, H., & Levine-Finley, S. (2010). Collaboration and team science: A field guide (pp. 1-79). *National Institutes of Health.*
Downloadable free at http://ombudsman.nih.gov/collaborationTS.html

Presents an introductory overview of characteristics, processes, and dynamics of successful collaboration.

- Leaders and teams can use for common background reading.
- They can focus at an early stage on sections devoted to starting to think about and preparing for team science, building a team, fostering trust, and developing a shared vision, along with practical guidelines such as "The Collaborators' Pre-Nup."
- They can use other sections to focus on handling conflict and common challenges, strengthening team dynamics, and navigating and leveraging networks and systems.
- They can use case studies and scenarios to demonstrate dynamics of collaboration, and return to checklists of review questions on an iterative basis to assess progress.

Falk-Krzesinski, H. J. (2013). Tools you can use: Guidance for team science leaders. Retrieved from *Team Science, Vol. 2*(2) [PowerPoint slides].
http://academicexecutives.elsevier.com/articles/guidance-team-science-leaders-tools-you-can-use

Discusses two aspects of effective collaborations: ways to effectively construct and manage collaborative teams and ways to promote trust. Includes evidence-based guidance for managers and links to specific tools for conducting and evaluating team science.

- Leaders and teams can use for both presentations and internal review guidelines. Includes the Collaboration Wizard, Toolbox workshop for examining dimensions of collaboration and communication, Questions for Scientific Collaborators, and the Team Science Toolkit.

Schultz, A. J., Israel, B. A., & Lantz, P. (2003). Instrument for evaluating dimensions of group dynamics within community-based participatory research partnerships. *Evaluation and Program Planning, 26, 249*-262.
http://www.sciencedirect.com.proxy.lib.wayne.edu/science/article/pii/S0149718903000296

Describes an evaluation tool for assessing dynamics of a collaborative group process and community-based partnerships. Based on literature review and three case studies

- Leaders and teams can adopt or adapt the tool for local use.
- They can use case studies as scenarios for discussion of team dynamics.
- They can focus on passages dealing with specific factors for collaborative success such as shared leadership, two-way communications, conflict resolution, a shared vision, participatory decision-making, problem-solving procedures, shared resources, mutual trust, and efficient management.

Cummings, J. N., & Keisler, S. (2005). Collaborative research across disciplinary and organizational boundaries. *Social Studies of Science 35,* 703-722.
http://sss.sagepub.com.proxy.lib.wayne.edu/content/35/5/703.short

Presents findings of a study of 62 collaborative multidisciplinary science projects.

- Leaders and teams can use to frame discussion of favorable conditions for specific aspects of team science, including coordination, management, and physical space and infrastructure for bringing collaborators together on a regular basis.

Note: Cross-check articles in the special issue of "The Science of Team Science in the *American Journal of Preventive Medicine*, in FAQ #1.

See also:

Weiss, E. S., Anerson, R. M., Lasker, R. D. (2002). Making the most of collaboration: Exploring the relationship between partner synergy and partnership functioning. *Health Education & Behavior, 29*(6), 683-698.
http://heb.sagepub.com.proxy.lib.wayne.edu/content/29/6/683.short

Describes an evaluation tool for assessing the synergy of partnerships in six dimensions of functioning.

- Leaders and teams can use at an early stage of planning to foster common understanding of the six dimensions of leadership, administration and management, efficiency, non-financial resources, and challenges of partnership and of community involvement.
- They can follow specific recommendations for longitudinal designs, large partnerships, and collaborative process.

Ansari, W. (2003). Educational partnerships for public health: Do stakeholders perceive similar outcomes? *Journal of Public Health Management and Practice, 9*(2), 136-156.
http://journals.lww.com.proxy.lib.wayne.edu/jphmp/Abstract/2003/03000/Educational_Partnerships_for_Public_Health__Do.6.aspx

Considers collaboration from perspectives of public health partnerships, including academic institutions, health service centers, and community agencies. Explains how stakeholder perspectives lead to differing views of implementation and success in both general categories and subgroups.

- Leaders and teams can use to frame understanding of five sets of anticipated outcomes: impact of health professions education, curricula and services, students, community and policy, and sustainability and structural change outcomes.

FAQ #3: Where can I find resources for evaluating team science?
For further resources see also the Evaluation module on this website.

Wagner, C. S., Roessner, J. D., Bobb, K., Klein, J. T., Boyack, K. W., Keyton, J., & Börner, K. (2011). Approaches to understanding and measuring interdisciplinary scientific research (IDR): A review of the literature. ***Journal of Informetrics*****, *5*(1), 14-26.** Reviews literature on definitions, assessment tools, evaluation processes, and measures of interdisciplinary research with focus on knowledge integration, single vs. multi-team integration, and quantitative metrics.
http://www.sciencedirect.com.proxy.lib.wayne.edu/science/article/pii/S1751157710000581

- Leaders and teams can use to define appropriate criteria for evaluating interdisciplinary collaboration based on authoritative literature review.
- They can structure combinations of suggested quantitative and qualitative approaches while emphasizing the importance of integrative and holistic framework for evaluation.

Wooten, K. C., Rose, R. M., Ostir, G. V., Calhoun, W. J., Ameredes, B. T., & Brasier, A. R. (2013). Assessing and Evaluating Multidisciplinary Translational Teams: A Mixed Methods Approach. ***Evaluation & The Health Professions*****, 1-17.**
http://www.sciencedirect.com.proxy.lib.wayne.edu/science/article/pii/S1751157710000581

Illustrates a multi-method assessment and evaluation of translational teams in a case report.

- Leaders and teams can use to guide discussion of multiple types of evaluation including unobtrusive measures, surveys, interviews, and focus groups across outcomes, process, and developmental evaluation.
- They can adopt or adapt logic models and classifications of team projects into the categories of early development, traditional, process-focused, and exemplary.

Stokols, D., Fuqua, J., Gress, J., Harvey, R., Phillips, K., Baezconde-Garbanati, L., & Trochim, W. (2003). Evaluating transdisciplinary science. ***Nicotine & Tobacco Research*****, *5*(Suppl 1), S21-S39.**
http://ntr.oxfordjournals.org.proxy.lib.wayne.edu/content/5/Suppl_1/S21.short

Presents a comprehensive framework for conceptualizing and evaluating innovative large-scale research programs based on use tobacco initiatives (TTURCs).

- Leaders and teams can use specific methods and measures for focusing on collaborative activities, personal attitudes, values, collaborative readiness, and common challenges.

Evaluating Transdisciplinary Research. Special issue of *PANORAMA*, 1 (1999). Swiss Priority Program Environment, Swiss National Science Foundation Newsletter.
http://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCcQFjAA&url=http%3A%2F%2Fwww.ikaoe.unibe.ch%2Fforschung%2Fip%2FSpecialissue.Pano.1.99.pdf&ei=PzYVU5PrI8bz0gGykYDgBw&usg=AFQjCNHfsrtZN1u-CfnJiWBTanSGIqd7_g&sig2=IIfOqP74gccG-EnADAKrGg&bvm=bv.62286460,d.dmQ

Presents a report and comprehensive instrument for evaluating inter- and trans-disciplinary research, adaptable to specific contexts and features of research programs.

- Leaders and teams can use the Catalogue of Criteria as both a coaching model and an evaluation instrument, with flexible sequencing and combining of questions from a pool of options.
- They can zero in at different times on stages of ex ante, intermediary, ex post, and impact evaluation.

Spaapen, J., Dijstelbloem, H., and Wamelink, F. (2007). Evaluating Research in Context [ERIC]: A Method for Comprehensive Assessment. 2nd Edition. The Hague, Netherlands: Consultative Committee of Sector Councils for Research and Development (COS). Materials from the ERIC project are available from the Rathenau Instituut at
http://www.rathenau.nl/en/themes/theme/project/eric-evaluating-research-in-context.html

A method for assessing quality and relevance of research for science and society based on experiences in agricultural sciences and in pharmaceutical sciences. The Research Embedment and Performance Profile (REPP) is a quantitative reconstruction of a group's activities and performance based on analysis of the missions and/or profile of a research program or group, stakeholder analysis, and feedback and discussion.

- The REPP is adaptable to many contexts, enabling groups to depict in a graphic radar plot a broad range of indicators of research performance and outcomes across multi-, inter-, and trans-disciplinary projects, programs, and fields.

See also:

Centers for Population Health and Health Disparities (Nov. 2007). *Cells to Society: Overcoming Health Disparities.* Bethesda, M.D.
http://cancercontrol.cancer.gov/populationhealthcenters/cphhd/documents/CPHHD_report.pdf

Provides overview of meta-theoretical frameworks, disease-specific conceptual models, and exemplars of collaboration. Includes integration of biological, behavioral, ecological, social, and cultural factors related to population health disparities at proximal, intermediate, and distal dimensions.

- Leaders and teams can focus of models and best practices to inform planning and implementation at multiple levels of analysis and cross-center cooperation, research infrastructure, communication with the community, and translation of research into prevention/intervention.

Hall, K. L (2012). Science of team science: Understanding and facilitating transdisciplinary teams [PowerPoint slides]. Retrieved from the National Cancer Institute. Website. http://www.ncsu.edu/iucrc/Jun'10/Hall%20SciTS%20for%20NSF%20IUCRC%20Evaluator%20Meeting%202010_0602.pdf

Presents a comprehensive overview of methods for evaluating team science, the evidence base promoting team science efforts, and tools and resources for implementing science projects.

- Leaders and teams can use for presentations and reviews of progress with checklists.

FAQ # 4: Where can I obtain resources for training and professional development? For further resources see also the Education and Training module on this website.

Stokols, D. (2014). Training the next generation of transdisciplinarians. In O'Rourke, M., Crowley, S. Eigenbrode, S., & Wulfhorst. J.D. (Eds.) *Enhancing Communication and Collaboration in Interdisciplinary Research* (pp. 56- 81). Los Angeles: Sage.

Provides a conceptual overview of transdisciplinary (TD) training based on literature review. Argues that a TD orientation is an intra-individual construct that should allow for broad exposure at undergraduate, post-graduate, and post-doctoral levels, as well as career mentoring.

• Individual researchers, mentors, and groups can use the five-factor framework as a checklist for developing and assessing a transdisciplinary orientation. It may also form a basis for designing inter- and trans-disciplinary programs, assuring each step develops requisite skills.

Valuing: a broad and comprehensive understanding of complex research and social issues and translating these broader conceptions into solutions

Attitudes: positive dispositions for bridging boundaries of multiple disciplines in seeking solutions to research and social issues

Belief: conviction that integration is essential to furthering understanding of complex scientific and social phenomena

Knowledge Base: sufficient breadth and depth to allow for high levels of integration and synthesis

Behaviors: actions such as working with colleagues in different disciplines, coursework in other areas, and efforts to develop and promote transdisciplinary concepts and methods.

Borrego, M., & Newswander, L. K. (2010). Definitions of interdisciplinary research: Toward graduate-level interdisciplinary learning outcomes. *The Review of Higher Education 34*(1), 61-84.
http://muse.jhu.edu.proxy.lib.wayne.edu/journals/review_of_higher_education/v034/34.1.borrego.html

Provides results of content analysis of 129 NSF grants emphasizing interdisciplinary training and/or research.

- Leaders and teams can use to guide discussion of five central categories of disciplinary grounding, conceptual and methodological integration, effectively working in teams, communication skills, and critical awareness.

Chang, S., Hursting, S. D., Perkins, S. N., Dores, G. M., & Weed, D. L. (2005). Adapting postdoctoral training to interdisciplinary science in the 21st century: the Cancer Prevention Fellowship Program at the National Cancer Institute. *Academic Medicine*, *80*(3), 261-265.
http://journals.lww.com.proxy.lib.wayne.edu/academicmedicine/Abstract/2005/03000/Adapting_Postdoctoral_Training_to.11.aspx

Describes Cancer Prevention Fellowship Program (CPFP) of National Cancer Institute as an model of how to train new health science researchers for careers in interdisciplinary areas.

- Leaders and teams can use for review of options including didactic education, research mentoring, a professional development series, and best practices integrating effective features of traditional postdoctoral training with newer approaches more suited to interdisciplinary training.

Gebbie, K. M., Mason Meier, B., Bakken, S., Carrasquillo, O., Formicola, A., Aboelela, S. W., & Larson, E. (2008). Training for interdisciplinary health research defining the required competencies. *Journal of Allied Health*, *37*(2), 65-70.
http://waynestdetroitmi.library.ingentaconnect.com.proxy.lib.wayne.edu/content/asahp/jah/2008/00000037/00000002/art00002

Reports results of a key informant approach to defining core competencies of interdisciplinary research. Includes activities outside home discipline such as reading, teaching courses, employing methodologies, and meeting with colleagues.

- Leaders and team can use the 19 core competencies as a checklist for assessing student learning, divided into categories of Conduct Research, Communicate, and Interact with Others.

Nash, J. M. (2008). Transdisciplinary training: key components and prerequisites for success. *American Journal of Preventive Medicine*, *35*(2), S133-S140.
http://www.sciencedirect.com.proxy.lib.wayne.edu/science/article/pii/S0749379708004108

Presents an overview of mentorship, methods, and common concerns with accompanying discussion of nomenclature, and preparation for career trajectories.

- Individuals may use tools and conceptual overviews for self-tutorials and mentoring.
- Groups may use the article use as a discussion piece.
- **Figure 1** will be a helpful handout and conceptual framework for writing a training grant, with a "big picture" model of training approaches, barriers, and facilitators.
- **Table 2** could be handout or presentation guide describing the range of training strategies and specific elements that have proven to be successful.
- **Table 3** is useful as a handout or rubric for evaluating the degree to which a proposal or a manuscript meets criteria for interdisciplinarity. Faculty mentors can use it to guide assignments, evaluations, training, and conducting research.

See also:

Domino, S. E., Smith, Y. R., & Johnson, T. R. (2007). Opportunities and challenges of interdisciplinary research career development: Implementation of a women's health research training program. *Journal of Women's Health*, *16*(2), 256-261.
http://online.liebertpub.com.proxy.lib.wayne.edu/doi/abs/10.1089/jwh.2006.0129

Presents a qualitative evaluation of the Building Interdisciplinary Research Careers in Women's Health (BIRCWH) program at the University of Michigan.

- Leaders and teams can use to structure activities for mentoring interdisciplinary careers and collaborative research.

FAQ#5: How can I find more resources and stay up-to-date?

Tool Kit: A Resource Repository
Contains an online repository of over 875 resources, applications, and instruments. Includes models, methods, and materials for evaluation with assessment interviews, metrics, and algorithms as well as peer-reviewed articles and reports of both theories and methods.
http://www.teamsciencetoolkit.cancer.gov/public/home.aspx?

- Any user may browse tools, measures, or bibliography, or search by topics.

SciTS ListServ: Mendeley
Offers a forum for cross-disciplinary and inter-professional exchange of information and resources on a broad range of topics related to team science.
http://www.mendeley.com/groups/3556001/science-of-team-science-scits/

- Members can search resources, create subgroups, and add references and comments.

For Further Background Reading, see also:

Derry, S. J., Schunn, C. D., and Gernsbacher, M. A. (eds.). *Interdisciplinary Collaboration: An Emerging Cognitive Science*. Mahwah, N.J.: Erlbaum, 2005.
http://books.google.com.proxy.lib.wayne.edu/books?hl=en&lr=&id=Ktx4AgAAQBAJ&oi=fnd&pg=PP1&dq=%22Interdisciplinary+Collaboration:+An+Emerging+Cognitive+Science.+%22&ots=d6RmnMNeKs&sig=LzB6YIHWjSguTan-8Vm8-0dPKdw#v=onepage&q=%22Interdisciplinary%20Collaboration%3A%20An%20Emerging%20Cognitive%20Science.%20%22&f=false

A collection of postconference essays on the nature of interdisciplinary collaboration and problems and processes of inquiry, representing all seven disciplines of the Cognitive Science Society. Contains case studies of collaboration *in situ* and a closing section on the exemplar of cognitive science.

Amey, M. J., and Brown, D. F. *Breaking Out of the Box: Interdisciplinary Collaboration and Faculty Work*. Greenwich Conn.: Information Age Publishing, 2004.
http://books.google.com.proxy.lib.wayne.edu/books?hl=en&lr=&id=forE0oHeHQQC&oi=fnd&pg=PR7&dq=Breaking+Out+of+the+Box:+Interdisciplinary+Collaboration+and+Faculty+Work&ots=U2ZX4DlfEE&sig=cAl8CEoTT3nqo7_lkdFsU6SIrcQ#v=onepage&q=Breaking%20Out%20of%20the%20Box%3A%20Interdisciplinary%20Collaboration%20and%20Faculty%20Work&f=false

A three-stage model of collaboration and discussion of the four dimensions of disciplinary orientation, knowledge engagement, work orientation, and leadership orientation; based on literature review, experience in postsecondary education, and an in-depth study of a research team contracted to an inner-city community council.