Enhancing the Effectiveness of Team Science
(National Research Council, 2015)

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Committee Charge

Conduct a consensus study on the science of team science to recommend opportunities to enhance the effectiveness of collaborative research in science teams, research centers, and institutes... Explore:

• How individual factors influence team dynamics, effectiveness and productivity
• Factors at team/center/institute level influencing effectiveness
• Different management approaches and leadership styles that influence effectiveness
• How tenure and promotion policies acknowledge academic researchers who join teams
• Organizational factors that influence effectiveness of science teams (e.g., human resource policies, cyber infrastructure)
• Organizational structures, policies and practices to promote effective teams
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Why Team Science?

- Solving complex modern problems requires a team
- Team Science has been shown to
  - Have large impact (Wuchty, et al., 2007; Uzzi, et al., 2013)
  - Demonstrate high levels of innovation (Uzzi, 2013)
  - Increase productivity (Hall, et al., 2012)
  - Have a broad reach/uptake (Stipelman, et al., 2014)
Defining Key Terms

- **Team science** – collaborative, interdependent research by more than one individual
- **Science team** - Two to 10 individuals who conduct team science
- **Larger group** - More than 10 individuals who conduct team science
- **Team effectiveness** – A team’s capacity to achieve its goals and objectives
Key Features that Create Challenges for Team Science

- Large membership diversity
- Deep knowledge integration
- Sometimes large size
- Goal misalignment with other teams
- Permeable boundaries
- Geographic dispersion
- High task interdependence
Improving Team Effectiveness

Conclusion: A strong body of research conducted over decades demonstrates team processes related to team effectiveness. Interventions that foster positive team processes offer the most promising route to enhance team effectiveness.

Interventions in 3 Areas:
- Team Composition
- Team Development
- Team Leadership
Composing the Team

Conclusion: Research in non-science contexts finds that **team composition influences team effectiveness**; relationship depends on **complexity** of the task, degree of **interdependence**, and **team familiarity**. **Task-relevant diversity** is critical and has a positive influence on team effectiveness.

Conclusion: **Task analytic methods** developed in non-science contexts and **research networking tools** developed in science contexts allow practitioners to **consider team composition systematically**.
Team Composition: Recommendation

Team science leaders and others involved in assembling science teams and larger groups should:

- **Consider using** task analytic methods that identify necessary **knowledge, skills, and attitudes**
  - *Use methods to match task-related diversity among team or group members with project needs*

- **Consider applying** tools such as **research networking systems** designed to **facilitate assembly** of science teams

- **Partner** with researchers to **evaluate and refine** these tools and task analytic methods
Conclusion: Research in contexts outside of science has demonstrated that several types of team professional development interventions improve team processes and outcomes.
Team-training researchers, universities, and science team leaders should **partner to translate, extend, and evaluate** the promising training **strategies**, shown to improve the effectiveness of teams in other contexts, to **create professional development opportunities** for science teams.
Leadership

Conclusion: Fifty years of research on team and organizational leadership in contexts other than science provides a robust foundation of evidence to guide professional development for leaders of science teams and larger groups.
Leadership: Recommendation

Researchers, universities, and team science leaders should partner to translate and extend the leadership literature to create and evaluate science leadership development opportunities for team science leaders and funding agency program officers.
Challenges of Virtual Collaboration

Conclusion: Research on geographically dispersed science teams and groups has found that communicating and developing trust are more challenging relative to face-to-face teams and groups.

- Limitations of virtual collaboration may not be obvious to members and leaders of the team or group.
Virtual Collaboration: Recommendation

Leaders of geographically dispersed science teams should:

• **Utilize activities** validated to help participants **develop shared knowledge** (e.g., common vocabulary)

• Consider task assignments within semi-independent units at each location to **reduce the burden of constant electronic communication**.
Conclusion: Universities have launched new efforts to promote interdisciplinary team science (e.g., creating research centers and institutes), but the impact of these initiatives on the amount and quality of team science has not been systematically evaluated.
Conclusion: University promotion and tenure review policies typically do not provide comprehensive, clearly articulated criteria for evaluating individual contributions to team-based research. The extent to which researchers are rewarded for team-based research varies widely across and within universities. Where team-based research is not rewarded, young faculty may be discouraged from joining those projects.
Funding Agencies

Conclusion: Public and private funders are in the position to foster a culture within the scientific community that supports those who want to undertake team science through:

- funding, white papers, training workshops, and other approaches.
Funders:
Recommendation

Funders should work with the scientific community to:

- Encourage the development and implementation of new collaborative models (e.g., research networks, consortia)

- Develop incentives for team science (e.g., new p&t policies)

- Provide resources (e.g., information repositories, training modules).
Funding Agencies

• Conclusion: Funders are inconsistent in balancing their focus on scientific merit with consideration of how teams and larger groups are going to execute the work (collaborative merit).

• Funding announcements often include vague language about the type of collaboration and the level of knowledge integration being sought.
Funders: Recommendation

Funders should

• Require team science proposals to present collaboration plans; provide guidance for developing and evaluating these plans

• Require interdisciplinary or transdisciplinary proposals to specify how they will integrate disciplinary perspectives and methods throughout the life of the research project.
Advancing the Research

• **Conclusion:** Targeted research is needed to evaluate and refine the tools, interventions, and policies recommended in this report, *along with more basic research* on team science to guide continued improvement in the effectiveness of team science.

• **Few, if any, funding programs support research** on the effectiveness of science teams and larger groups.
Research: Recommendation

• Public and private funders should support research on team science effectiveness through funding.

• Support ongoing evaluation and refinement of the interventions and policies recommended above.

• Support research on the role of scientific organizations (e.g., research centers, networks, consortia) in supporting science teams and larger groups.

• Collaborate with universities and the scientific community to facilitate researchers’ access to key team science personnel and data sets.
Conclusions

• There is a rich and robust science of teams that can be extended to improve team science effectiveness
• The science points to interventions through:
  ▪ Assembling teams
  ▪ Providing professional development and education opportunities and
  ▪ Leadership development opportunities
• Other interventions can improve:
  ▪ Virtual collaboration
  ▪ Promotion and tenure credit for team-based work
  ▪ Support from funding agencies for team science
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