M. Christine Zink DVM, PhD

Collaboration & Team Science
Once Upon a Time…

About 12 years ago, at an outstanding medical school south of San Francisco….

**Fiefdom**: The estate or domain of a feudal lord. Something over which **one dominant person or group** exercises control.
In October 2009, the Stanford University CTSA launched its first-ever team science training program. Ten teams and 70 people participated in the workshop.
2009 Cambridge University (UK) mathematician Tim Gowers set up the Polymath Project

An open blog to solve a difficult mathematical problem

Within hours mathematicians and teachers from Canada, Hungary, Arizona and UCLA had chimed in

In just 6 weeks, the problem was solved
Definition: integration of two or more scientific approaches to solve a complex, multifaceted problem

Drivers:
- Advances in technologies
- Vast data sets
- Enormously increased range of questions
Collaborative Science Can:

- Speed up the rate of discovery
- Apply novel methods to solve old problems
- Promote breadth of knowledge
- Apply specialized knowledge to new problems
Collaboration Broadens Horizons

Relatedness of Science Disciplines

The following color coding is used for the disciplinary map:

- Math & Physics
- Chemistry
- Computer Science & EE
- Other Engineering
- Biotechnology
- Earth Sciences
- Biology
- Infectious Diseases
- Medical Specialties
- Brain Research
- Health Professionals
- Social Sciences

Science Commons (http://creativecommons.org/science)
## NIH Commitment to Team Science

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tr>
<td>2003</td>
<td>NIH Bioengineering Consortium (BECON) hosts Catalyzing Team Science symposium</td>
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<td>NIH Roadmap includes Research Teams of the Future as a focus area to solve complex problems</td>
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<td>2006</td>
<td>NIH Tenure Review Committee revises criteria to include team science</td>
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<td></td>
<td>Clinical and Translational Science Awards (CTSA) Consortium is established to support and promote interdisciplinary teams</td>
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<td>2007</td>
<td>NIH Guide for Intramural Research is revised to include a more robust description of collaborative teams</td>
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<td></td>
<td>NIH institutes a multiple-PI grant mechanism</td>
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<td>2011</td>
<td>NIH builds new center - NCATS</td>
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Examples of NIH-Funded Team Science

- R01 with Co-PIs
- P01 Program Project Grants
- P50 Specialized Center Grants
- P60 Comprehensive Center Grants
- T32/T35 Training Grants
- U Grants – Cooperative Agreements

“My project is simple. I want to find out once and for all whether there’s any truth in the belief that money can’t buy happiness.”
People tend to collaborate more within departments. Proximity and unity of mission.

http://esciencenews.com/articles/2010/10/18/is.team.science.productive
A Junior Faculty Member

http://www.experts.scival.com/jhu/
In 2003 WHO formed a team of 11 researchers from 9 countries to identify the pathogen responsible for SARS.
Found at all research institutions
Simple collaborations to complex and interactive research teams
Drawn together by common interests
Opportunities surface because of RFAs or other collaborative grant opportunities.
Motives for Collaboration

- To gain access to:
  - Special equipment or facilities
  - Special skills
  - Unique materials/reagents
- To increase visibility/recognition
- To gain experience
- To train researchers
- To increase productivity
Building a Research Team

- Bring together diverse backgrounds and experiences
- **Clarify** roles, responsibilities, contributions
- Define milestones and success
- Develop an **environment of openness**
- Establish schedule of meetings
- **Discuss** processes for sharing data and managing authorship
- **Prepare** for disagreements
- Have a policy for bringing on new members
Fostering Trust

How to build trust

- Regular meetings
- Constructive but supportive feedback
- Environment of openness
- Teach and train others
- Receive instruction from others
- Follow through on commitments
- Handle disagreements promptly
Developing a Shared Vision

- All **team** members should be able to articulate the team’s ‘big picture” goals
- Each **team member** should be able to articulate their own research goals and how they fit the big picture

“C’mon, put some muscle into it...we’re not getting anywhere!”
The Physical Plant Matters

The Broadway Research Building

Shared Equipment

Open Laboratory Space
Communicating About Science

THEN:
- Location Mattered
  - E.g., Manhattan Project: Thousands of scientists gathered on a remote plateau in Los Alamos, NM

NOW:
- Cyberinfrastructure
  - Connects scientists worldwide

BUT:
- Management needed
Communicating About Science

- Conduct regular meetings
  - In person
  - Conference calls
  - Skype/FaceTime
  - Webinars
- Establish ground rules for communication
- Environment of openness and acceptance
- Contributions at all levels of seniority
- Respectfully address and resolve debates

"Take out your phones. Open the American History app and turn to the page about George Washington."

Dialogue vs. Debate
Handling Conflict

Principled Negotiation:
- Separate the people from the problem
- Focus on the team’s best interest, not positions
- Invent options for mutual gain
- Use objective criteria to evaluate options
Potential Downsides of Collaboration

- Potential for Group Think – stronger, more vocal members supplant their ideas as the goals for the group
- Promotions – team members’ unique strengths and contributions might be unclear
- Unresolved conflicts can slow progress, both of individual careers and towards team goals
- Potential for ambiguity re roles and responsibilities
- Longer decision/communication times
Success Measurement

- In biomedical research, high value is placed on individual accomplishment
- Independence implies a leadership role and recognition by one’s scientific peers for original discoveries
- For decades, the academic incentive system has rewarded independent thought and senior authorship
- Government agencies now emphasizing team approaches
- Paradigm shift
Evaluating the Individual’s Contributions

- What was his/her role in driving the project forward?
- What are his/her key scientific contributions?
- Were his/her contributions essential for the success of the project?
- How was the contribution original?
- How are those contributions regarded in the PI’s field?
What Makes Team Science Difficult

- Often multiple leaders with different styles
- Better interpersonal skills required to coordinate and accomplish the proposed work
- Differing levels of understanding of background science and new data can lead to confusion
- Potential for ownership conflicts

“Norman won’t collaborate.”
Problematic Leadership Styles

- **Absentee** leadership – unavailable or insufficiently involved
- **Inhibited** leadership – conflict avoidant or adverse
- **Defensive** leadership – resistant to feedback regarding systemic problems
- **Hostile** leadership – actively promoting competition/conflict

“Believe me fellows, everyone from the Pharaoh on down is an equal member of the team.”
Scientists are very much like people.

-- Howard Gadlin
## Is It Working?

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
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<td>Team members <strong>grow professionally</strong> in the context of the team</td>
<td>Team members <strong>prioritize their own objectives</strong> before those of the team</td>
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<tr>
<td>Team members are <strong>made aware of</strong> the team’s culture and expectations for working together</td>
<td>Leader <strong>fails to provide clarity</strong> around roles, responsibilities and expectations</td>
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<tr>
<td>If a person joins the team and is a <strong>bad fit</strong>, the individual either leaves of his/her own accord or is encouraged to find a different project</td>
<td>Team members who are a <strong>bad fit remain</strong> and work for their own gain at the expense of the team</td>
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*Cultures self-replicate*
The Collaborative Agreement

1. Expressly states the **goals** of the project and describes how each collaborator will contribute
2. Delineates how to handle **communications**, data sharing, differences of opinion, etc.
3. Addresses **administrative** issues: finances, accountability, staffing, etc.

Forms a basis for trust

http://teamscience.nih.gov (p. 69)
Suggested Reading

Collaboration and Team Science: A Field Guide.  
NIH August 2010

Emphasis: Teams at all levels

http://teamscience.nih.gov

Thriving in an Era of Team Science  
Burroughs Wellcome 2012

Emphasis: Young Scientists

What could be more fun than working with people who share your passions and interests to unravel mysteries and discover new facts?

--- Chris Zink