The Science of Team Science

Frederick J. Meyers, MD, MACP
Executive Associate Dean
Professor of Medicine
University of California, Davis, School of Medicine

ACRT/AFMR/SCTS Joint Annual Meeting
April 18-20, 2012
Omni Shoreham Hotel
Washington DC

Themes To Watch For

- Innovation at the interface/intersection of disciplines
  - The myth of the lone genius
  - The value of networks
- Core competencies
  - Embrace (disciplinary/cognitive) diversity
  - Value the ambiguity of being multi-cultural and multi-lingual
  - Engage effectively in conflict management
- Solutions – a new conceptual model in evolution
The new biology: 21st Century solution to societal problems

National Academy Press 2009

Team Science

Scholars promoting inter-disciplinary collaboration
Noriko Satake, M.D.  
Dept of Pediatrics  
leukemia-targeted therapy  

Elva Diaz, Ph.D.  
Dept of Pharmacology  
molecular targeting  

Kit Lam, M.D., Ph.D.  
Dept of Biochemistry and Molecular Medicine  
leukemia-specific targeting and nanodelivery  

Nitin Nitin, Ph.D.  
Dept of Biological and Agricultural Engineering  
siRNA nanoformulation  

Jan Nolta, Ph.D.  
Stem Cell Program  
mouse xenograft models and clinical trials  

New teams with diverse interdisciplinary perspectives
Building Watson: Changing the culture of how science works

- Early Failures
- Many refusals to participate

“Compared to the way we work now, it’s like we were standing still before.”

Ferrucci, D. NY Times, January 2, 2012
Technology and Recombinant Innovation

- Technology is the arrangement of people, ideas, and objects
- Technology Brokering: combining technology in new ways: Fulton, Howe, Ford

Hargadon, UC Davis Graduate School of Management

Recombinant Innovation

- **1972**: email - the combination of an intra-computer messaging app with an inter-computer file transfer protocol.
- **1908**: Automobile mass production
  - interchangeable parts
  - continuous work flow
  - assembly line
  - electric motor

“Ford invented neither the automobile not the techniques to mass produce it. He brought these ideas together in ways no one else had.” - Hargadon
Edison and Jobs – (not) the lone geniuses

- **1879**: “Edison neither invented the light bulb nor acted alone to improve it.” Menlo Park, NY: Batcheldor (machinist), Kruesi (clockmaker), Boehm (glass blower), Upton (math) - Hargadon

- **1983**: The Mac = 3 years of work, software and hardware engineers working together (concurrent Engineering)

**Millennium Park**

Cloud Gate – The Bean
The Water Cube - Beijing Olympics

Teamwork on the fly

- Building Iconic Structures – The Water Cube
  - 20 disciplines
  - 4 countries

- Teaming: Executing and learning at the same time
  - Flexible, temporary groups
  - Effective in coping with unexpected problems, emerging opportunities, far flung disciplines

Edmondson, Harvard Business Review, April 2012
Bridging and building new worlds

- Recombinant Innovation
  and

- Building New Worlds:
  Collective (Positive) Deviance - Thinking differently, together
  - The Impressionists
  - Building the Transistor

The Discipline of Teams
(not all groups are teams)

- A common purpose that the team owns
- Specific performance goals
- A mix of complementary skills
- A commitment to how the work gets done
- Mutual accountability

Katzenbach and Smith, HBR, 1993
Not all groups are teams

<table>
<thead>
<tr>
<th>Working Group</th>
<th>Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong, focused leader</td>
<td>Shared leadership</td>
</tr>
<tr>
<td>Individual accountability</td>
<td>And mutual accountability</td>
</tr>
<tr>
<td>Purpose is the same as the organization</td>
<td>Specific to what the team delivers</td>
</tr>
<tr>
<td>Individual work products</td>
<td>Collective work products</td>
</tr>
<tr>
<td>Efficient meetings</td>
<td>Open and active problem solving</td>
</tr>
<tr>
<td>Discusses, decides and delegates</td>
<td>And does real work together</td>
</tr>
</tbody>
</table>

HBR, 1993

Dream teams can fail

- Enron

- 2004 U.S. Olympic basketball team (3rd-lost to Lithuania)

- 1980 U.S. hockey team – “I’m not lookin’ for the best players, Craig. I’m lookin’ for the right players.” - Herb Brooks

Colvin, Fortune Magazine, June 8, 2006
What are the consequences of ineffective teams?
August 5, 1997 - KAL 801, Guam

- A corporate culture?
- Rate of “loss” in the period 1988-98
- United Airlines – 0.27 per million departures
- Korean Airlines – 4.79 per million departures

**WHY??**
The multi-cultural multi-lingual persona

“Such isolation is sometimes bitter but I do not regret being cut off from the understanding and sympathy of other men ... I am compensated ... by being rendered independent ...” - Einstein

Teams may not organically engage

Interventions?

Collaboration network visualization

K12 - BIRCWH scholar

# Publications: 8
# Collaborators: 31
# Ties: 219
% Cross-degree: 57%
% Cross-discipline: 65%
Matchmaking

Software such as SciVal and Profiles allow researchers to search for other researchers who study in their area.

What is the best template for human creativity?

- Debate > brainstorming
- Unfamiliar perspectives can stimulate creativity
- Uzzi and the Broadway musical
  - Too familiar or not at all familiar both inhibited creativity
  - West Side story: Bernstein, Robbins, Laurents, and a new comer...Sondheim!

  And

  - Physical proximity is important, too
    - Pixar; MIT Building 20

Consensus building vs. conflict

One cannot enjoy “the tranquility of resolution without the catharsis of conflict.”

Hertzberg, New Yorker, Oct. 3, 2011

“Conflict among collaborators can feel like conflict, but differences in perspective are a core reason for teamwork in the first place, and resolving them effectively creates opportunities.”

Edmondson, HBR, 2012

Team of Rivals- Doris Kearns Goodwin

The Performance Pressure Paradox
(Gardner)

- **NO**: Premature consensus
- Safe Generic solutions
- Anxiety
- Risk averse

- **YES**: put client experts on the team
- Kickoff meetings with expected contributions
- Check in and get back on track
- Make unique knowledge accessible
Communication matters

- Sociometrics – Mapping Teamwork
- Energy - Contribution by members
- Engagement – Communication between members
- Exploration – Communication Between Teams

“The most valuable form of communication is face-to-face. Email and texting are the least valuable.”

Pentland, HBR, April, 2012

Five Modes for Handling Conflict

Two basic aspects of all conflict handling modes

Your Conflict Mode = Skill + Situation

© Copyright 1996 Xicom, Incorporated. All rights reserved. Xicom, Incorporated is a subsidiary of Consulting Psychologists Press, Inc. May be reproduced for use with the Conflict Workshop Facilitator’s Guide only.
The Five Conflict Handling Modes

COOPERATIVENESS

Uncooperative → Cooperative

ASSERTIVENESS

Unassertive → Assertive

Competing
“My way or the highway”

- Quick Action
- Unpopular Decisions
- Vital Issues
- Protection
Collaborating

“Two heads are better than one”

- Integrating Solutions
- Learning
- Merging Perspectives
- Gaining Commitment
- Improving Relationships

Theories of the Motivations for Team Assembly

- Self-interest
- Social and resource exchange
- Mutual interest and collective action
- Contagion
- Balance
- Homophily
- Proximity

Sources:
A conceptual model: Team tensions

Organizational Cohesion ➔ Recombinant Innovation

Disciplinary Excellence ➔ Cognitive Diversity

Goal focused ➔ High Risk Exploration/Positive Deviance

Collaboration ➔ Creative Conflict

Institutional specific aims

Organizational Cohesion ➔ Recombinant Innovation
- Embrace level 5 leadership
- Strategic plans
- Emphasize diversity, teamwork, inter-disciplinary goals
- Set shared goals, e.g. IT

Disciplinary Excellence ➔ Cognitive Diversity
- Incubate innovation ecosystems
- Construct physical neighborhoods
- Build virtual matrix neighborhoods
Institutional specific aims

**Goal focused**
- Aim 3: High Risk Exploration/Positive Deviance
  - Invest in exploration and recombination

**Collaboration**
- Aim 4: Creative Conflict
  - Build curricula to teach and assess socio-behavioral competencies
  - Learn as teams
  - Reward mentoring and mentoring academies

---

**References**

- Ibid. The Discipline of Teams. HBR. 1993.
References

- The Secrets of Great Teams. HBR. April 2012
  - Pentland A. The Science of Building Great Teams
  - Edmondson AC. Teamwork on the Fly
  - Gardner HK. Coming Through When It Matters Most
- Disis ML, Slattery JT. The Road We Must Take: Multi-disciplinary Team Science. STM 2010;2(22).
- Meyers FJ, Pomeroy C. Creating the Future Biomedical Research Workforce. STM 2011;3(102).

Thank you
The innovator’s DNA

Creative Intelligence:
- Connecting (Recombination)
  - eBay; Ford Motor assembly lines
- Questioning: why, what if, imagine opposites, embrace constraints
- Observing behavioral details
  - Intuit and Quicken software
- Experimenting: Jobs, Shultz, Bezos
- Networking with diverse individuals: TED

Dyer, Gregersen, Christensen, HBR, 2009