Applied team science

Working collaboratively to compete effectively for funding and to drive innovation

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What is a Scientific Research Team?
.....think of it as a continuum.....

Level of Interaction and Integration

LOW

Investigator-initiated research
Investigator works on a scientific problem – largely on his or her own.

Research Collaboration
• Group works on a scientific problem, each bringing some expertise to the problem.
• Each member works on separate parts that are integrated at the end.
• The interaction of the lead investigators varies from limited to frequent with regard to data sharing or brainstorming.

HIGH

Integrated Research Team
• Team works on a research problem with each member bringing specific expertise to the table.
• There are regular meetings and discussions of the team’s overall goals, objectives of the individuals on the team, data sharing, and next steps.
• One person takes the lead while other members have key leadership roles in achieving the goal.

Disciplinarity

- (Uni) Disciplinary research
- Three Cross-Disciplinary collaborative research orientations
  - **Multidisciplinary**:
    - Independent, sequential, divisional
    - Exchange
  - **Interdisciplinary**
    - Joint, interactive, partnership
    - Dialog, hybridization, complementary
  - **Transdisciplinary**
    - Integrative, interdependence, emergence
    - Reciprocity, discourse, share vocabulary, extends

Sustained Rise in Teamwork Over Five Decades and Across Multiple Fields

(Data drawn from Web of Science and all U.S. Patents. From Wuchty, S., B. F. Jones, et al. (2007, Science) "The increasing dominance of teams in production of knowledge."
Collective Intelligence …

Ant Colony

Herd of Sheep

Meerkats

Flock of Geese
Collective Intelligence … Does it exist in human groups? YES

Sometimes called ‘process gain’ (Steiner, 1972) or ‘synergy’ (Larson, 2010)
Collective Intelligence: What predicts collective intelligence in teams?

- *Not* members’ intelligence
- *Not* team satisfaction, cohesion, or motivation
- *Not* personality traits of individuals
- Proportion of females in group (Woolley et al., 2010)

Diversity, in general increases collective intelligence of teams.
Challenges of Interdisciplinary Research and Training

- **Labor Intensive** (greater coordination, communication, training required)

- **Administrative Complexities** (higher potential for disagreements, conflict, formalized collaborative arrangements)

- **Opportunity Costs** (loss of individual creativity, career jeopardy among junior scholars?)
Prepare for Team Science at the Institutional Level

- In recruitment letters, include a section describing expectation relative to collaboration
- Establish clear team collaboration expectations and assessment criteria for promotion and tenure
- Train leadership and trainees
Recruitment letters

- Include sections on
  - Roles, Responsibilities, Expectations - relative to interdisciplinary research
  - Review and Reward - what is success? How is credit and data shared?
  - Mentoring – who is showing the newbies the ropes?
  - Joint Appointments – a creative way to foster cross-discipline work, but sometimes takes some administrative work
Example of T&P Policy Language from Arkansas Medical Sciences

“The College values the contributions of collaborators who clearly demonstrate their critical importance to teambuilding and successful teamwork. Those individuals will merit recognition whether their participation is as a principal investigator, co-principal investigator, or co-investigator… the Promotion and Tenure Committee invites and welcomes evidence of collaboration and includes this as an important component in the assessment of a faculty member’s contributions. Documentation of collaboration may include and is not limited to participation in multidisciplinary grant proposals, research projects, clinical care teams that create innovations and/or improvements in care, educational activities, and manuscript production. It will be the responsibility of the faculty member to solicit and submit to the Promotion and Tenure Committee letters documenting collaborative activity from colleagues, relevant division chief(s), and department chair(s) to support their promotion and tenure requests.”
What to train?

I've hired the "Dogbert Touchy-Feely Institute" to teach us about teamwork.

We'll start with an exercise about trust. I want each of you to sign blank checks and give them to me.

What will this teach us about trust?

It will teach you that trust is an excellent quality for other people to have.
Model of Team Development

- Forming
- Storming
- Norming
- Performing
- Adjourning & Transforming

Bruce Tuckman, 1965, 1977
Building Teams and Fostering Trust

• Identifying collaborators
  – Traditional methods
  – Commercial tools (Elsevier, Digital Sciences)
  – Institutional Team-building activities
Building Teams and Fostering Trust

• Leadership
  – Self-awareness
  – Awareness about that around you
  – Shared responsibility for success
  – Accountability for issues and problems
  – Mentoring others
  – Managing up and across
  – Creating a “safe environment”
  – Difficult conversations

– Speaking up, challenging ideas
– Giving your best everyday
– Serving as a role model
Building Teams and Fostering Trust

• Developing a Shared Vision
  – Can be done by the leader(s) or the team as a whole
  – Everyone is able to describe the “big picture”
  – Each team member can state his/her research goal and how it relates to the “overall vision”
  – Regular discussions of each members accomplishments and challenges in achieving the goal – visions often need to be revised overtime

  – Instill ownership of roles and responsibility for attaining goals
  – Team accepts responsibility and accountability for both accomplishments and failures – without blaming
I dislike the words “boss” and “employee.” From now on, we are all “team members.”

I’ll be the team member that makes the decisions and gets paid the most. You’ll be the team members I punish when things go wrong.

But otherwise we are all equal?

Whoa! Calm down, Spartacus.
Building Teams and Fostering Trust

• Communication into and out of the team: Active Listening

  – Do you pay attention?
    ▪ Look at the person you are talking to and don’t daydream during the conversation

  – Do you show that you’re listening?
    ▪ Nod, smile, “uh-huh”, etc…..

  – Are you a reflective listener?
    ▪ Paraphrase, summarize what they’ve said, ask clarifying questions

  – Do you quickly judge or make assumptions?
    ▪ Don’t interrupt before they finish their thought

  – Do you respond appropriately?
    ▪ Be open and honest, demonstrate respect
Sharing recognition and credit

- Develop a team contract that states how recognition and credit will be shared (among other things)
  
  - A good template was developed by Office of the Ombuds at NIH includes sections on:
    
    - Overall goals and vision
    - Who will do what?
    - Authorship and credit
    - How and how often will the team communicate
    - Oversight of the project direction and changes
    - How will conflicts be addressed? – financial, scientific

Revised September 2011 http://ombudsman.nih.gov/partnerAgree.html
Strengthen Team Dynamics

• Show up
• Be respectful
• Be consistent and follow what was agreed to at the start
• Deal with problems quickly
Team Ideation Exercise

An example
Model of Team Development

- Adjourning & Transforming
- Forming
- Performing
- Storming
- Norming

Bruce Tuckman, 1965, 1977
Introduction

- **In under 1 min** - introduce yourself to your tablemates:
  - name,
  - role and institution,
  - expertise/research area of interest past or present, and
  - where someone is likely to find you on a Saturday afternoon
Team Forming – Introduction and Ice-Breaker

Paper Airplane Building Contest

– In 10 min or less, Design and Build a paper airplane that is:

  ▪ optimized to fly the longest distance when thrown in the ‘optimal’ way (by a member of the team) on the “testing ground” (like a javelin);

  ▪ Made from only the limited materials on your table:
    • 1 piece of paper
    • 1 paper clip

  ▪ Please name your plane and write that on the airplane along with 1 table contact name

  ▪ Attention to nice aesthetics is encouraged.

– Flight trials (2 min)
Team Storming, Norming, and Performing Exercise -
Modeling a teamwork session using
NAE Grand Challenges as mock projects

Prepare for RAPID IDEA PROTOTYPING:

- Each table selects a scribe
- Each table picks ONE (from list of 3 NAE Grand Challenges) challenge on which to focus a project idea
- In 5 min or less, identify no more than 3 engineering hurdles associated with this challenge

- Consider: What are critical engineering hurdles underlying this theme (e.g., construction methods, or methods to simultaneously measure complex nerve firing, or resolution of VR video display)?
Team Storming - Individual Ideation:

– Keeping in mind the challenge and the engineering hurdles that the team identified; What is a high level approach to solving one or two of these hurdles?

– Write down as many individual ideas on Post-It notes that you can in 7 min.
Team Iterative Storming and Norming – Team Ideation:

- Still keeping in mind the challenge and the engineering hurdles that the team identified; What are high level approaches to solving one or two of these hurdles?

- Each person throws down their solutions/ideas onto the table like cards in a game as they describe what they have proposed, grouping similar individual ideas, and allowing free association and riffing off of those ideas with new Post-it notes. (10 mins of collective thinking)

- Coalesce around 3 or 4 solution ideas; captured by scribe
Team Performing – Project Outline:

- Based on those ideas, articulate a pilot project that you could put together to pursue one or two of these solutions. The scribe will capture this idea and some will present it to group (30 minutes).

  ▪ Team composition - Who needs to be involved in the solution? Think broadly and cross-disciplinary.
  ▪ Potential funding – ?
  ▪ Key milestone/deliverables
Any interesting project ideas?

– Team composition - Who needs to be involved in the solution? Think broadly and cross-disciplinary.

– Potential funding – ?

– Key milestone/deliverables

– Who is responsible for getting the next meeting on the books?
Keeping a team going after a networking event

- Assign a staff person to ensure that follow-on meetings get scheduled
  - Topical brown bag lunches
  - Team meetings
  - Email reminders to interested researcher to reach out to each other

- Identify very specific potential funding mechanisms to support any proposals that come from ideas
  - Seed grants
  - Other intramural funds
  - Regularly scheduled federal or other extramural grants

- If none of those, potential collaborators prepare a short 2-pager with high level budget that could be given to the institutional Development team to look for philanthropic sources of support
UCSF is driven by the idea that great breakthroughs are achieved when the best research, the best education and the best patient care converge.

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