

Moving Toward Team Science at the University of Colorado Anschutz Medical Campus

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Dr. Rod Nairn, Provost of the University of Colorado Denver | Anschutz Medical Campus, tasked our team with addressing the following objective: “Is a team-based approach to delivering the several missions of an academic health campus the best way to ensure the successful future of our institution? If it is, how would we best ensure optimal functioning and leadership of the teams?”

Additional specific questions that were posed to our group included:

- 1) Is moving to team-based approaches really going to be the successful way of the future?
- 2) If it is, how might these team-based approaches best be adopted and implemented?
- 3) Specifically, where and under what conditions in the organization could a team-based approach reap benefits and perhaps serve as an incubator for new approaches?
- 4) Should the implementation of team-based organizational structures be mandated and supported from top administration, or should incentives be used that would allow it to bubble up based on interest?
- 5) If incentivizing faculty is undertaken, what types of incentives might academic health campus leadership use to increase adoption of effective team-based approaches?

The first objective was to assess the evidence that a team-based approach is an effective model. There is considerable evidence in non-academic settings that team-based approaches increase productivity.^{1, 2} More recently, there is growing evidence that supports a team-based approach at academic medical centers. After extensive discussion and review of the literature, we decided that the research mission of CU Anschutz is the area where a team-based approach is not only possible but will become increasingly necessary for the institution to achieve its goals of fostering groundbreaking scientific discovery, increasing funding (from governmental, industry, and philanthropic organizations), and enhancing its national reputation and ranking. The next goal was to clearly define “team science”. Integrating multiple sources, but primarily from the National Science Foundation, we created the following definition of Team Science:

“Team science is a mode of research by teams or multiple individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance understanding or to solve problems whose solutions require fundamental research advances in multiple disciplines and research areas.”

Several factors are important to optimizing the functioning of a team. If done well, team-based approaches lead to better team performance and better individual success, particularly if the incentives/compensation for the individual team members are properly aligned.^{1, 2}

Methods

In order to assess the current culture and attitudes towards Team Science, we identified several key leaders at various levels at CU Anschutz to interview. The in-person interviews (from faculty across 4 Schools) were conducted with 2 Provosts/Vice Presidents for research, 2 Deans, 5 Department Heads, 3 Division/Section Heads, 6 Center Directors, 2 Vice Chairs of Academic Affairs, 1 team and 3 junior faculty members. The in-person interviews were conducted using a standardized interview questionnaire with the following questions:

1. Some people feel very favorable towards team science while others are highly skeptical. Where do you sit along that continuum?

2. What benefits, if any, do you see team science having on your Section/Division/Department/School? How about for the institution as a whole?
3. What would need to be in place in order for team science to happen at our academic health center?
 - a. Specific aspects of tenure/promotion criteria at different units?
 - b. Incentives at different levels of the organization?
4. What are some steps people in your position could take to help build an environment and culture where team science can occur?
5. How committed are you to making team science happen? Using a 10 point scale, with 1 being no will at all and 10 being absolute conviction and devotion, where are you? (If lower than a 10, what would it take to increase by 1 point?)

The interviews were conducted in person, and specific quotes were written down during these conversations, which generally lasted 30 minutes. After the interviews were completed, we met as a group and discussed the responses that were gathered during the interviews. The overall support was very strong for Team Science, as the average rating was 9.5 (from 1-10, with 10 being the most committed) in response to the question “How committed are you to making team science happen?”. All of the written comments that were obtained then underwent a qualitative data extraction to identify key themes that emerged during the interviews.

Incentives for Moving to Team Science

The gains associated with Team Science make an important assumption in that the move to Team Science is done well, with appropriate training and education and with the proper alignment of incentives for all members of the team. The belief is that the risk of inaction and maintaining the status quo likely exceeds the risk associated with moving towards Team Science. The primary incentives to move towards a team-based approach to scientific discovery are two-fold. First, scientific discovery that can be translated into improving health is becoming increasingly complex. As Disis and Slattery noted, “solving the obesity epidemic most likely requires the integrated interactions of researchers who study lipid metabolism, genetics, and cell growth; endocrinologists; pediatricians; internists; surgeons; exercise physiologists; nutritionists; behavioral researchers; psychologists; and economists—to name just a few types of specialists.”³ To make substantial progress in other major diseases will almost certainly require a similar multi-disciplinary team approach. The ability of a single individual or even a small group of collaborators from a single discipline to make significant scientific breakthroughs is becoming increasingly difficult. Team Science could lead to better science, with more transformative advances in scientific discovery as opposed to incremental gains in knowledge. These transformative advances will allow us to more quickly implement that knowledge in ways that can improve human health. The other incentive for moving towards a team-based approach to scientific discovery is that it will enhance our competitiveness for funding. This applies to certain grant mechanisms (including federal and non-federal organizations and societies) that require a team-based multi-disciplinary approach. Furthermore, the ability to attract philanthropic support for disease-specific research could be facilitated by the existence and/or establishment of team-based approaches in specific disease areas.

Challenges to Implementation of a Culture of Team Science

University-based research has traditionally been conducted by scientists working as individuals or in small groups of loosely-affiliated collaborators. Success or failure is often based on the ability of scientists (principal investigators) to lead their staff and trainees to achieve milestones recognized for advancement and funding. It seems likely that a successful shift toward team-based research and away from solo principal investigators as leaders of small research groups may be disruptive and will require adjustments in the behavior and expectation of scientists as well as academic leaders at a given institution (internal challenges). Similarly, complementary changes will be required by institutions formerly geared toward dealing with scientists as individual investigators rather than scientists affiliated with a research team (external challenges).



What are challenges to be faced by institutions that seek to transition to team-based research (internal challenges)?

- The process and documentation criteria for promotion and tenure must be modified to recognize the contributions of individual team members to Team Science projects. Because first or senior authorship of publications will not be available to all key members of a team, new metrics must be developed to recognize and document the key roles fulfilled by individual members of a research team. 360-degree assessment tools may be useful in gathering information on contributions of individuals to the overall team effort.
- Members of promotion and tenure (P&T) committees must be trained to recognize and credit individual contributions to Team Science projects that may not be reflected in the order of publication authorship.
- It is essential that junior scientists participating in Team Science still be mentored and developed in a manner that will allow them to pursue their own future areas of independent investigation.
- Academic leaders must recognize that team building is a complex process that will require time and resources before the appearance of obvious signs of success. The time element dictating a promotion/tenure decision of junior faculty may require adjustment.

What kinds of challenges can be expected in interactions with external agencies?

- The movement toward a team-based science culture could limit the ability of faculty to move institutions unless other institutions recognize the new metrics of skill and productivity from team-based research. This could be especially important to junior faculty members during the developmental stages of their career.
- Funding agencies need to recognize the contributions of individual team members and work with the awardee institution to allocate F&A funds according to the composition of the team and not solely the Program Director. Recognition of individuals will also enable external agencies to expand their network of experts to help guide their policy making and funding decisions.

Risks vs Benefits of Moving Toward Team-Based Science

Disruption of the status quo is always fraught with potential risks. In considering a move toward team-based science, it is prudent to weigh the possible deleterious consequences against potential benefits.

Potential risks

- Loss of key scientists due to poor execution of the transition to team science—If done poorly, the move to team science could result in the loss of individualists who work best in their silos. Not all scientists can be expected to thrive in a team environment, and accommodations need to be made to retain extraordinarily productive scientists who operate as individualists.
- Loss of individual identity when working on teams—Overcoming this possibility will require skills from mentors and leaders, and the ability of the less experienced individual to “stake their claim” and document it adequately.
- Unsuccessful teams—The institution must choose the type of science to support through a team-based approach. It is possible that the institution could choose an area that is ultimately unsuccessful, wasting valuable time, resources, and intellectual capital.
- Diminished research portfolio—The diversity of the university’s research portfolio could be diminished if resources were focused on a relatively small number of research teams. This could make the institution less competitive for external funding in certain areas.
- Perceived winners and losers—If institutional resources are focused in certain areas at the expense of others, there could be “winners” among faculty where expertise clearly aligns with a team, and “losers” who may be required to leave their primary academic home and “make do” with a team whose content and methodological expertise is not clearly aligned with their own.



Potential benefits

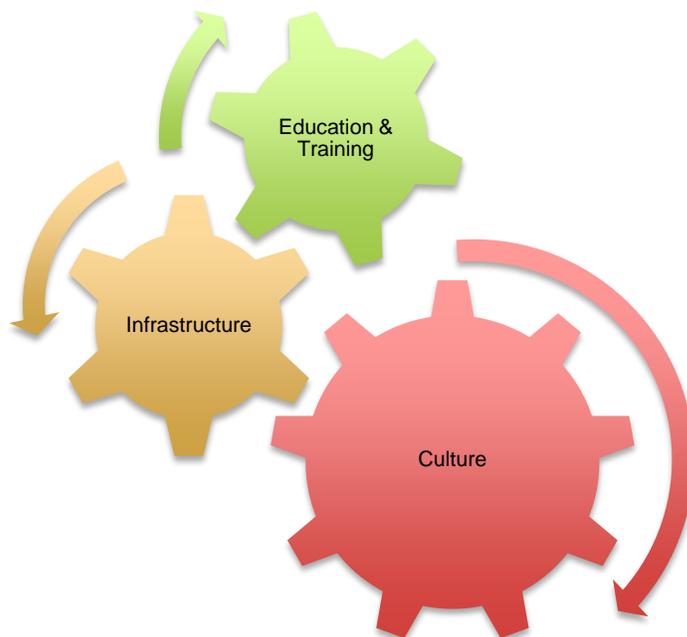
- More creative science—Teams will necessarily leverage the skills and interests of a group of scholars. Collaborative thinking will result in a richer product that will enable the group to compete at a higher level.
- Competitive edge—Excellence in designated research areas will position the university to better compete for diminishing research funds. Build out of infrastructure will enable teams to compete at a higher level and potentially attract support that is limited to only the most sophisticated research teams. This excellence can also be leveraged by the Office of Advancement in fundraising initiatives.
- Recruiting and retaining the best scientists—The research environment surrounding richly endowed teams will provide opportunities for junior scientists to capitalize on access to technology needed to carve out their own niche. Such opportunities might not be available to most ambitious faculty members working in isolation.
- Prestige—Successful teams will bring prestige to the institution by being at the forefront of a scientific discipline and through media exposure following the publication of major discoveries.
- Better training environment—Students and fellows will benefit by having access to a broader range of resources than would be found in a solo laboratory environment. Trainees will have easier access to scientific leaders and exposure to a more diverse set of ideas that will guide the work of the team.

- Increased job satisfaction—Participation in solving complex problems may bring about increased job satisfaction, engendering increased loyalty to the team and the institution and leading to improved job stability.

Recommendations for Team Science at CU-AMC

Build a culture of team science

- Reward faculty for engaging in team science. Provide incentives for mentoring junior colleagues in a team science environment and for the success of that junior investigator.
- Remove barriers that prevent faculty from doing team science. Establish mechanisms to recognize individual contributions to team effort.
- Train and educate Promotion and Tenure committees to recognize and value the importance of team science.
- Train senior PIs on how to engage in Team Science with a focus on both overall team success and individual success of the team members.
- Reward Deans for having faculty engaged in team science.
- Invest in training at all faculty levels to understand how to work effectively in the context of team science.
- Remain open to the individual star. Do not create an environment that would be inhospitable to individuals who can be extraordinarily successful on their own.



Invest in infrastructure to enable research teams to be competitive

- Implement a strategic, well-informed and transparent process to identify content areas. Develop methods to monitor team success and strategies to disband unsuccessful teams that are based upon clear structure and benchmarks. Give teams sufficient time to organize and evolve to ensure an adequate chance of achieving success.
- Identify leaders who are catalysts. Recruit team builders and give them resources to build teams. Provide funding to support the formation and early development of teams.
- Designate space for teams to assemble and work together.
- Upper administration must make a sufficient commitment to allow time for teams to evolve and become productive.
- Provide significant seed money to support multidisciplinary planning teams.
- Develop and execute a competitive process to select “Big Ideas” worthy of funding as a team science venture.

Educate and train tomorrow’s leaders to practice team science

- Allow faculty to be “hybrids” by maintaining competitive individual research projects in addition to being key members of team science projects.
- Provide professional development for faculty to engage in team science.

- Train students to think this way; build a level of trust.
- Develop a sense of urgency and competitiveness to support “Big Ideas”.

References

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