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To advance translational science, remove these roadblocks to studying team knowledge integration

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Perspective

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When challenges such as big data, the reproducibility crisis, social determinants of health, and artificial intelligence demand knowledge synthesis across domains, how many translational teams instead end up as "fake interdisciplinary collaborations" [1]? Such collaborations list diverse experts on the proposal, but their team members don't integrate each other's expertise [1]. Instead, each person or sub-group works in multidisciplinary "parallel play" or performs transactional handoffs with the others. When more synthesis and co-learning is called for, such multidisciplinary strategies are not only misleading, but they are also ineffective and inefficient (Figure 1). They miss opportunities for insights and ultimately slow progress on complex health issues like obesity and teenage depression [2]. In a time of tightening resources, how can translational teams harness knowledge integration to accelerate breakthroughs?

We don't know yet. Fields such as the science of team science and integrative interdisciplinary studies have identified several keys to successful integration of expertise: boundary spanners, epistemic inclusivity, shared mental models, etc. [3,4]. But the recent National Academies consensus study on team science notes, "Not all recommended practices will work for every team" [3, p3]. Why? How do these strategies apply, and what impact do they have, for translational research breakthroughs?

The emerging science of translation, or translational science, seeks to answer such questions in order to remove translational research roadblocks and accelerate health solutions [5]. However, there are fundamental, *conceptual* roadblocks hindering the study of expertise integration in translational teams, creating barriers to evidence-based recommendations. There is thus a pressing need for translational scientists to overcome these conceptual roadblocks. Otherwise, translational teams and those who support them will continue to rely on hope and habit for the integrative insights that they need for innovative solutions.

Conceptual roadblock 1: What is "team science" in translational research settings?

The US National Institutes of Health (NIH) National Center for Advancing Translational Science (NCATS) lists knowledge integration as an example approach to cross-disciplinary team science [6]. In our experience, however, teamwork in health research is not often thought of as knowledge integration. Rather, it is framed as task coordination or even delegation on the way "from bench to bedside." This is evident in NIH funding programs that require leadership or team management plans but not integrated conceptual frameworks, such as the NIH HEAL Initiative's R15 grant [7]. By contrast, other programs call for integrated conceptual frameworks, problem statements, and research methods. Examples include the US National Science Foundation's Manufacturing Systems Integration [8] and the Convergence Accelerator [9] and the US Department of Agriculture's Sustainable Agricultural Systems [10].

Framing team science as primarily a coordination problem is a red herring for translational scientists: it focuses attention on member interactions rather than on the epistemic changes such interactions could create. How, when, or if coordination leads to epistemic synthesis has not been established in the translational science literature or in translational research practice.

Task coordination alone offers little support for leveraging the meanings, assumptions, and nuances that come with each member's expertise [11]. When assumptions diverge, miscommunication, hard feelings, and serious mistakes are more likely [12,13]. Lacking effective tools and strategies for bridging divergent perspectives, teams often resort to shallow interactions (multidisciplinarity), more homogenous teams (narrow interdisciplinarity), oversimplified questions, hierarchical norms, and/or voice suppression. These simplifying strategies undermine team effectiveness for complex problems by reducing psychological safety, creativity, and insight [2,14]. When studying translational research, translational scientists cannot afford to focus only on traditional project delivery strategies such as clarity of team roles or project management practices. Future translational science must uncover how such teamwork strategies are linked to epistemic synthesis and breakthroughs.

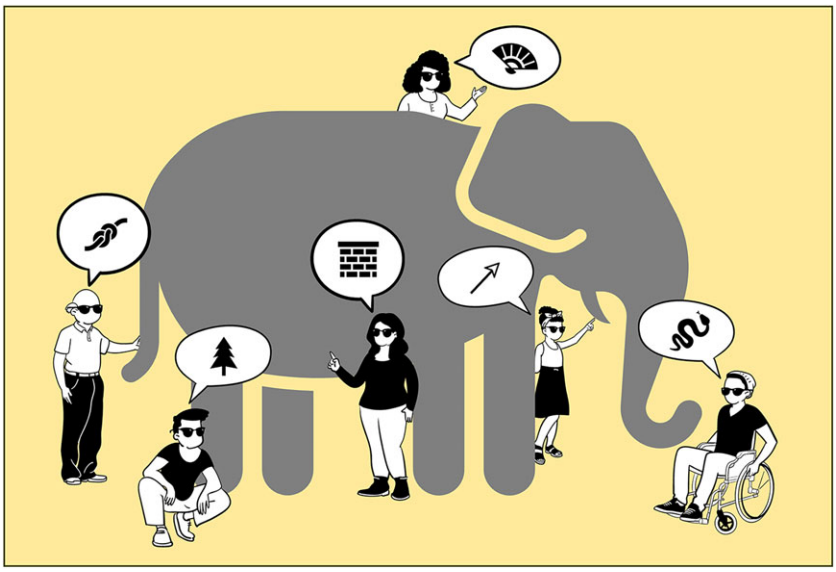


Figure 1. A modern interpretation of the ancient parable of six blind men learning about an elephant without integrating their perspectives.

Conceptual roadblock 2: What do "integrated insights" look like for translational teams?

Some translational teams aim to answer narrow research questions, work within existing paradigms, or bundle information without synthesizing it. At times, these may be worthwhile goals, however incremental, that are appropriately addressed with multidisciplinary or narrowly interdisciplinary approaches. When teams overcome impasses in such work, translational scientists may count these moments as "integrated insights."

By contrast, what if the translational goal is to discover interacting causal factors, reframe cross-scale problems, synthesize disparate phenomena, reveal practice-based evidence, or advise decision makers under uncertainty [2]? These insights require novel connections between highly diverse sources of information, and they may appear in surprising forms. If translational teams and scientists are satisfied with incremental insights, they may never even look for breakthroughs.

Conceptual roadblock 3: How can translational scientists observe and analyze insights unfolding in translational teams?

There are methodological challenges for observing and analyzing insights as they unfold in translational teams. First, what processes lead to novel insights? We have been calling it knowledge or expertise "integration" [15], but it could be macrocognition writ large [16], sense making in particular [17], collaborative problem solving [18], interdisciplinary learning [19], interdisciplinary reasoning [20], boundary spanning [21], or something else. The nature of the process has implications for the methods used to observe it. For example, translational scientists looking for sense making may look for expressions of uncertainty and declarations of how to proceed [22]. But if they look for boundary spanning, they may look for identity or role talk and brokering moves like translation and negotiation [23].

Second, however the process(es) are understood, translational scientists will need to decide how to demarcate them for data collection and analysis. For example, should analysts include the social interactions (social networking, trust formation, information management, task coordination, etc.) that support epistemic blending [24]? Such choices will be informed by one's theory of what the process is. However, these theories are often underspecified, and each analyst must justify their own boundary decisions. The field has no shared understanding of what kinds of justifications would be reasonable in this space.

Third, the methodological options are wide open for most of these processes with little guidance on how to choose among them. For example, a meeting transcript can be analyzed for argumentation or for epistemic networks, and both outputs – or neither – could be taken as evidence of collaborative reasoning, since that theory is underdeveloped.

Conceptual roadblock 4: How can translational scientists discover the causal links between integrative processes and insights to guide team science interventions?

Even if translational scientists define and describe the insight-making processes likely at work and the insights these produce, that would still not uncover causal links between the processes and outcomes. Informative methods must be embedded in an overall study design that supports causal inferences. Depending on one's philosophy of science, these designs could include randomized controlled trials (RCTs) or variations on the General Elimination Methodology. Examples include process tracing case studies and qualitative comparative analysis [25]. Uncovering causal mechanisms will be essential for designing team interventions, tools, and strategies that facilitate well-calibrated integration.

Conclusion

Conceptual clarity, efficiency, and rigor are essential to build a robust evidence base of what works for translational team knowledge integration. To understand the processes that underlie knowledge integration, intrepid scholars must first dismantle the conceptual roadblocks hindering the study of integration in translational science. This work will demand a blend of theory and practice, merging fresh ideas with established ones. We invite all

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passionate scholars to join in tackling these roadblocks to create the evidence base for supporting science teams in authentic interdisciplinary collaboration, advancing the breakthroughs society urgently needs.

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