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Special Issue on

Collaboration Science and Translational Medicine

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Editorial

Defining Collaboration Science in an Age of Translational Medicine

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“Teamwork is the ability to work together toward a common vision, the ability to direct individual accomplishments toward organizational objectives. It is the fuel that allows common people to attain uncommon results” -- Andrew Carnegie

Collaboration is a basic social activity. It exemplifies our uniquely human capacity and creative desires to solve problems using all available resources through shared social goals. We learn the behaviors associated with this survival technique at a very young age when we are taught to share and are subsequently made aware of the benefits of doing so. This very basic strategy of social survival becomes complicated as we mature and as internal motivations and external factors become part of the complex array of conditions that make up our decision-making lives.

Collaboration Science in the Context of Translational Medicine

The capacity to coordinate our efforts with others assumes that complex networks of individuals make up communities of influential individual, group, organizational, and environmental agents. Collaboration science at the boundary-crossing [1] capacity and the study of how coordination works on multiple levels of interaction. As a science it enjoys a variety

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of definitions depending on one's worldview. Collaboration science focuses on problems about stakeholder involvement and knowledge exchange in shared goals [2-4], understanding different interfacing frames of thought and culture [5-8], complex problem solving [6,7,9,10], resource management [11-14], ethical considerations unique to collaborative projects [15,16], and the engaging of scientists and non-scientists alike in public policy decision-making [17-20]. The implications of studying these dynamics sheds light on structures within networks of commonality like industry, universities, research, and practice settings [21-24] as they work toward closer mutual engagement and operative cultures. Collaboration must therefore always be imagined as an evolving reality. It is a process by which multiple entities are in constant dialogue with the hopes of coming closer together in their scope and intentions, fully realizing that there may be at times a reciprocal ebb-and-flow between entities as they move toward more commonality in their goals [25].

Katz and Martin assert that scientific collaborations have some very general and often problematic assumptions that may not always translate into shared motivations for scientific stakeholders to collaborate [26]. First is the assumption that

research collaboration is well understood. While the concept of collaboration may be an understood and even valued approach to solving complex problems, when considered across diverse social pockets, meaning and how this is operationalized can differ greatly. Collaboration can range from pairings of scientists working together as sub-specialists, to the exchanging of resources leveraged from different sources, to actual inclusion of marginalized stakeholders with only limited shared investments into the process of research designs [27].

Second, we often assume that collaboration between individuals, groups, institutions, and sectors will have similar characteristics. This is hardly the case as boundary-crossing skills differ greatly across contributors on a joint enterprise [28,29]. Academia, practice environments, industry, and policy sectors, all possess different internal boundaries and thus different boundary spans that are easier or more challenging to cross. This is not to mention that crossing between these sectors can sometimes be unachievable because of a sector's social design and culture and a lack of receptivity to adjacent sector worldviews [30-32]. Some sectors engage in interdisciplinary activity as commonplace task activity while others struggle with the concept of managing different stakeholder worldviews and crafting them into shared designs and processes.

A third faulty assumption is that we can measure collaboration unilaterally across a diversity of relationships. No relationship can be truly measured similarly to an adjacent one without the consideration of context. Individual, team, and organizational relationships differ greatly in character. Multilevel measurement is a difficult task and is generally grounded in novel methods that require multilevel evidence [33]. This is a challenge as not all collaborative endeavors consider the breadth of enterprise level impacts. In addition, not all collaborators are in the position to consider the complete enterprise due to a lack of skill or worldview necessary to envision, gather, and analyze multilevel evidence and outcomes.

Fourth, more collaboration is better than less. This continues to be an assumption worth further reflection as scientists, practitioners, policy makers, and consumers grapple with the emerging benefits of collaborative enterprises and struggle to understand the motivations and benefits of working together as specialists. While the threshold of balance between specialization and collaboration is not always apparent, we do know that without specialization the value and legacy of unidisciplinary knowledge can become minimized for the sake of collaborative enterprise. Ultimately, we will need to rely on evidence-based approaches that rigorously study the science of collaboration that clearly identifies the benefits of scientific problem solving in light of real-life situations that are both the outcomes of multiple specialties working together and the development of new and more complex interdisciplines [26,34].

Interests in collaboration and its benefits especially in biomedical and healthcare settings stem from a heightened expectation that through team collaborations outcomes otherwise unrealizable will result [17,35]. Collaboration science in the context of the recent outlook of scientific communities in healthcare [36] provides some challenging exemplars in understanding how collaboration can be employed and exercised

in the emerging and ever-changing field of translational medicine. Its hallmark, the crossing of traditional boundaries that have hampered its collaborative causes, allows for more systemic outlooks bringing entire networks of contributors together to meet goals that impact large populations. The Clinical and Translational Science Awards (CTSA) initiative launched in 2006, for example, was established by the National Center for Research Resources (NCRR) of the National Institutes of Health (NIH) to create "academic homes" for clinical and translational researchers. Its goal is to develop teams of researchers intent on outcomes of patient care delivery of novel therapeutics and treatments through inter- and transdisciplinary collaboration methodologies. The goals of these national center awards are:

- 1) to build national clinical and translational research capability;
- 2) to provide training and improve career development of clinical and translational scientists;
- 3) to enhance consortium-wide collaborations;
- 4) to improve the health of our communities and the nation; and
- 5) to advance T1 translational research to move basic laboratory discoveries and knowledge into clinical testing [37].

The introduction of these awards into the scientific mainstream incited radical changes in the relationships between policy and scientific communities affected by federal funding mechanisms for research. The historical goals of science had been greatly oriented toward the unbiased reporting of data with only a secondary concern with the translation and implementation of operational outcomes of research. This initiative broadened scientific inquiry for the 21st century to include the social, educational, outcome, and ethical capacities of researchers and practitioners and challenged scientists to look beyond their individualized scientific inquiries and to serve as catalyst for network contributions and change [38,39]. This was a major departure from the traditional role of scientists established over the last century.

"Scientific research has evolved from comprising primarily simple, well-controlled studies to complex, multi-faceted ones. For instance in 1921, Dr. Frederick Banting and his assistant Charles Best, a medical student at the time, began a series of experiments to identify the glucose-regulating substance in the pancreas...For this work, Dr. Banting shared the Nobel Prize in 1923, only two years after initiating his studies. In contrast, Dr. Shinya Yamanaka, who shared the Nobel Prize in 2012 for his work on induced pluripotent stem cells, was publishing detailed studies with numerous collaborators for almost 10 years prior to receiving this prestigious award" [40].

Shifting toward more collaborative and translational research requires more interdependent relationships drawing the researcher closer to the policy maker and the consumer. Implications of doing so reach far beyond the mere generation of new knowledge to include dissemination of information to invested stakeholders. More importantly, this shift requires changing behaviors and attitudes previously grounded in unidisciplinary assumptions but also exercised across national and cultural worldviews. Creating a scientific culture that values change and gravitation toward boundary spanning and crossing is as much a matter of creating new science policy as is establishing local and national norms for scientists. As Gertrude Hirsch-

Hadorn, MD a physician-entrepreneur and executive director of the Massachusetts Institute of Technology (MIT) Center for BioMedical Innovation Center has stated, “Multi-stakeholder collaborations provide the opportunity to create an environment that allows for new kinds of interactions among players” [41]. What was once a mere consideration of sharing research techniques and styles, collaboration now entails the expansion of the scientific problem-solving enterprise to include collaborative processes that challenge the attitudes and skills of professionals in translational research of all types. Hinkley, Ellenberg, and Kessler see this relationship between scientific and more collaborative models as key to understanding what the former can learn from the latter (Table 1). The intersection of these provides challenges for acquiring skills and changing attitudes about collective enterprising overall as scientific endeavors reach toward translational applications [27]. Key to shifting attitudes and behaviors is emphasis on multiplicity of viewpoints, action research, population studies, expansion beyond experimentation research, collaboration and implementation strategies, shared leadership strategies, marketability and market response, self reflection, organizational learning, and a focus on in-group team effectiveness significance.

The goals of the CTSA introduce a measure of success that depends on the interaction of federal intervention to encourage

and support scientific endeavors in a way it hadn't before, that is, to be involved in the construction of scientific methods and outcomes impacting the national community. This has led to a re-envisioning of the role of government funding and its impact on population health but furthermore has realigned our consideration of the needed skills and attitudes that help the scientific community reach the extended community that will bring its important and relevant work to persons in need. This is a shift in values as much as it is one of directedness toward implementation science and bringing science to market. Lynn Morrison, the president of the Washington Health Advocates, a lobbying firm that represents the American Federation for Medical Research (AFMR) expounds on this shift in priorities:

“The clash of cultures has repeated itself time and time again in my office. Usually, we reach a happy medium, the day on the Hill goes well, and in the end both the scientist and I are pleased that he or she can return to a world where the only path to meaningful accomplishments is through hypothesis-driven research complete with methods, results, and conclusions. Suddenly, I was the one turning green as NIH proposed a massive change in the mechanisms of support for patient-oriented research training and infrastructure without benefit of any experimental data to back up the conclusion that the CTSA would make the world a better place for clinical researchers” [42].

These shifting values have served as an impetus for both local and national initiatives that focus on the challenges of collaboration amongst diverse stakeholders and consideration of

Table 1: Collaborative and scientific problem solving processes and challenges to attitudes and behaviors.

**Adapted from NOAA Coastal Services Center (2000). Navigating in rough Seas: public issues and conflict management. Workshop Manual Charleston, SC.*

Collaborative Problem-Solving Process	Scientific Problem-Solving Process	Attitude and Behavior challenges for translational professionals
Identify the Problem	Identify a problem through initial observations	Expand observation to include multiple viewpoints and perceptive measures beyond typical observation techniques
Frame the problem (“How do we...?”)	Frame the Problem (“Is this different than the hypothesis?”)	Focus on action research and bringing tangible and marketable solutions to market
Identify participants	Identify what others have done through a literature search	Ground research in population studies.
Design a strategy and a structure to answer the framed problem	Design experimental methods and materials that will test the hypothesis	Think beyond experimentation and hypothesis testing
Conduct the collaborative process according to the establish strategy and structure, i.e., the process a. Preliminary meetings to define parameters b. Develop a complete understanding of the problem by learning and educating, gathering information, analyzing the information and situation	Conduct the research according to the prescribed methods and materials, i.e. the process a. Gather preliminary data b. Develop a complete understanding of the problem by continuing to observe and record data, gathering sufficient data to draw meaningful solutions, analyzing the data	Allow collaborative processes to dictate structure and rely on group driven emergence of ideas. Use learning as a means for sharing ideas and problem solving.
Generate options	Interpret the data	Use data to support implementation strategies.
Evaluate the options and select the best one(s) to solve the problem	Develop descriptions, explanations, or models from the evidence	Analyze data in support of implementation strategies.
Come to an agreement	Reach conclusions	Utilize shared leadership strategies
Develop an action plan for implementing the agreement	Develop and present possible alternative solutions	Plan for actionable results and market response.
Report on progress and capture lessons learned	Report on the experimental process and results	Utilize group self-reflection and organizational learning techniques.
Evaluate the decision-making process, including lessons learned	Evaluate the research methods used, include lessons learned	Become accustomed to self evaluate in-group functions as part of significance.

the issues that surround these changes in our scientific culture. In its attempt to address some of the structural antecedents necessary for collaborative processes to infect translational and medical research enterprises spurred by the CTSA emerging culture, the Association of American Medical Colleges' (AAMC) Taskforce on Information Technology Infrastructure Requirements for Cross-Institutional Research have put forth a series of recommendations to ensure that collaborative engagement can occur without being hampered. They recommend that several collaborative adjustments are needed to traditional scientific endeavors in order to ensure the support of virtual research communities, cross-institutional authentication and authorization, and development of policies, procedures, and standards that secure integrity of data and networks. They recommend use of learning management systems as means for institutional collaborations, development of common data agreements between institutions, adoption of standards for representing research data, automation of shared data and services in academic medicine, and creation of automated methods for researcher to share credentials and expertise. Some of these endorsements are echoed in the Institutes of Medicine's (IOM) recommendations for the CTSA's calling for advanced innovations and ensuring community engagement [43]. The endorsements of these influencers on the scientific community impress the importance of moving away from scientific cultures that clench tightly to individual ownership of discovery to the sharing and fluid exchange of ideas in a spirit of collaborative problem solving.

Though the problem of establishing collaborative antecedents and models has been accepted by many as a clear pathway to advancing the healthcare science agenda, federally organized science is still in need of advanced and grounded techniques to guide the evolution of this shifting paradigm for the 21st century of clinical and translational science. The Collaboration and Team Science Field Guide distributed through the NIH [44], has encouraged a trend of focusing on effectiveness practices for teams of scientists and those interested in developing them. It provides fundamental and strategic recommendations for strengthening skills and adjusting attitudes in groups of scientists and stakeholders using basic and evidence-based interaction and social science techniques as applied to team dynamics. In 2011, the IOM hosted a workshop entitled "Strengthening a Workforce for Innovative Regulatory Science In Therapeutics Development" that targeted the development of models for collaboration as part of its agenda. Its key message was to underscore the importance of collaboration amongst stakeholders and its power to create an ecosystem for turning discovery into therapeutics that benefit human health, and the need for real work pilot studies while keeping collaborators engaged and committed into their partnerships [45]. In addition, The National Academies of Science hosted a four-part series on the "Science-of-Team-Science" sponsored by the National Science Foundation (NSF) in 2012-13 meant to extrapolate basic questions concerning team approaches to science. The series focused on individual, team, center and institute level factors, management approaches and leadership styles, policies about advancement and promotion for team scholars, productivity and effectiveness in research, and general science policy and the impact these discourses

have on advancing national science trends. The goals of this project includes recommending "opportunities to enhance the effectiveness of collaborative research in science teams, research centers, and institutes" and the NAS plans to provide a report in late 2014 [46].

In addition to these federal initiatives, associations, university, and research centers continue to contribute to this discourse providing important evidence-based and practice-oriented materials for scientists and teams that support collaborative models. The National Organization of Research Development Professionals (NORDP) provides a continual forum for support to collaborative methods and projects and maintains public access records of funding opportunities from both federal and non-federal agencies that target collaborative science [47]. The Team Science Tool Kit managed by the NIH National Cancer Institute (NCI) provides an electronic workspace of tools, resources, and extensive bibliographic material for scientists engaged in team enterprises along with a listserv network of group and team researchers and practitioners from around the world [48].

Since much of collaboration science is the result of the interdisciplinary approaches brought together from management, leadership, psychology, organizational, and social scientists, associations have emerged that are dedicated to perpetuating the interdisciplines of team science. The Interdisciplinary Network for Group Research (INGroup) strives to unify scholars who study teams across multiple scientific disciplines, promotes communication about group research, advances the understanding of group dynamics through research, advances methods, and promotes interdisciplinary research [49]. The importance of the study of teams and collaborative endeavors encourages the development of research institutes within academia that serve as collaborative models for conducting research as well as sources for evidence-based material on practices of successful collaborative teams. The University of Nebraska, Omaha, Center for Collaboration Science (www.collaboration.unomaha.edu) and Carnegie Mellon University Silicon Valley Campus, Center for Collaboration Science and Applications (www.cmu.edu/silicon-valley/ccsa), each strive to model collaborative science, make evidence-based recommendations and consultations, as well as support the research of collaborative science teams. But as more collaborative enterprises emerge, and the culture of doing science changes rapidly, there is a need to continually reconsider the ethical arrangements that scientists have maintained for the last 75 years.

As new social structures toward conducting science emerge so too do new ethical conversations focus on how collaboration science challenges our interpersonal arrangements and the historical protocols of doing science. Question about *why* collaboration are important are also met with questions about *what* are the problems associated with doing this type of research. Guidance continues to emerge from federal offices of research integrity and the academy that address these questions as a recognition of the importance of management plans, "pre-nuptial" agreements between researchers that establish responsibilities and requirements of team members, and research ownership and credit criteria [50-52].

The CTSA serves as means for juxtaposing the criteria that

measures scientific success as it acts as a catalyst for change. It promotes the expectation that if science is to be more effective as a means for integrating cross-disciplinary capacity it will need to be more commonly understood and employed throughout the system. This has a causal effect on several important considerations when stakeholders choose to work together. These considerations include collaboration readiness which address social-ecological perspectives that go beyond traditional scientific hierarchies and tap into readiness for cooperation [53,54], sustainability of team science [55,56], training of transdisciplinary researchers [57-59], team science models and methods [60,61], and forging of new cross-disciplinary partnerships across sectors [62].

“Team science initiatives are designed to promote collaborative and often cross-disciplinary approaches to analyzing research questions about particular phenomena. [They] are designed to promote collaborative and often cross-disciplinary approaches to analyzing research questions about particular phenomena” [63].

The shift from independent and self-organized disciplinary views to collective viewpoints that yield new paradigms suggested here are transdisciplinary in nature and describe a context by which new definitions of influences may be recognized within and across specific communities of knowledge.

Introduction to the Special Issue

This special issue of the Journal of Translational Medicine and Epidemiology is focused on the intersection of ‘Collaboration Science and Translational Medicine’. The impetus for the issue was to assist in bridging two worlds that have struggled to find a common engagement. For students of collaborative science, the characteristics of our interdiscipline challenges us to strive toward an integration of ideas from a variety of fields like management, psychology, sociology, leadership, and anthropology thus requiring constant reconsideration of the discourse amidst shifting disciplinary boundaries all of which are often foreign to the knowledge constructs of medicine. For those in the translational medicine world, the inherent shifts associated with the changing landscape of medical research have represented an upsetting of historical values in search of commonality as individuals and organizations grapple with this new environment and resultant requirements for medical stakeholders that can often benefit from but often are not affected by the study of collaboration. We feel that the special issue brings together insights and professionals that strive to assist in bridging these two fluctuating worlds. In this issue are included discourses on collaboration science and its impact on translational medicine, the education and training of translational professionals, case studies and research on translational teams, comparative and cross disciplinary perspectives on conducting translational science, ethical considerations for collaborators, self assessment of collaborative functioning within translational medicine projects, and leadership and team capacity in translational medicine.

Commonality of language and definition is key to the conversation of what is attempted in collaborative environments. In the first offering of the issue Klein discusses the very nature

of cross-disciplinary efforts in translational medicine by focusing on meaning of terms in **“Interdisciplinarity and Transdisciplinarity: Keyword Meanings for Collaboration Science and Translational Medicine”**. She explores the complexity of crossing disciplinary boundaries, profession, and knowledge frames in light of our current terminology use and argues for more authenticity that encompasses the multiplicity of boundary crossing. The paper focuses on how within translational medical contexts the normative and extraordinary capacity of clinical and translational science is intrinsically bound to the similar issues within implementation science, team science, and issues associated with convergence. The author presents a case for a shift in our terminology that can assist in bridging not only the divide between collaborative science and translational medicine but more importantly between the many levels of convergence that are of common interest in both worlds thus providing for a more useful approach that satisfies goals for both collaboration scientists and medical practitioners.

In **“How to Tell the Truth with Statistics: The Case for Accountable Data Analyses in Team-Based Science”**, Gelfond, Klugman, Welty, Heitman, Loudon and Pollock challenge the basic assumption that team work and collaboration are commonly understood functions and that models for collaboration are actively utilized in the collection and analysis of data in research. Focusing on collaboration in statistical analysis, the authors propose an Accountable Data Analysis Process (ADAP) model. Their tool has similar characteristics with the goals of the Electronic Medical Record (EMR) that allows for multiple users to retrieve and contribute to a data warehouse. The ADAP is a means for teams and stakeholders to participate in group-engaged statistical analysis departing from what has traditionally been the unidisciplinary contribution of statisticians to research projects. The framework has the capacity to allow for group level analysis and collective reasoning, encourage material mentor-driven engagement, and has the potential for reviewers to become an integral part of the process of analysis prior to presentation of results.

In **“Research Networking Systems: The State of Adoptions at Institutions Aiming to Augment Translational Research Infrastructure”**, by Obeid, Johnson, Stallings, and Eichmann, the authors measure the state of adoption of research networking systems (RNS) across the CTSA network. They posit that use of these technologies, many of which are becoming more easily and abundantly available are important tools in the matching of shared interest collaborators. The study informs not only how these tools have impacted the CTSA landscape but also serves as a means for individual centers to gain a glimpse into the usability and usefulness of these tools nationally. They present an important recognition that amidst the fluctuations within translational medicine, the evolution of technology continues to change even the most basic of collaborative functions—the intersection of individuals and their ideas.

Vogel, Stipelman, Hall, Nebeling, Stokols, and Spruijt-Metz take a qualitative approach to measure a federally funded project by gathering data from grantees supported by one of the flagship transdisciplinary programs organized within the National Cancer Institute (NCI). In **“Pioneering the Transdisciplinary Team Science Approach: Lessons Learned from the National Cancer Institute Grantees”**,

the authors present what grantee participants find are some of the challenges to conducting transdisciplinary research success, emergent strategies for success, and also illuminate the benefits of working within transdisciplinary teams. Their findings provide needed evidence on what we can learn from the study of teams striving to achieve collaboration as well as collective priority setting for the future of collaborative endeavors especially in national level initiatives.

“Improving Collaboration: Guidelines for Team Training”, by Lacerenza and Salas addresses the role and need for training for collaboration training to occur within science and medical communities. They challenge that our collaborative science knowledge must be met with guidelines for training that will generate greater collaborative enterprises and improve team cognition, performance, and overall effectiveness. They provide guidelines and competency-based criteria for expanding capacity amongst collaborators.

Colleagues Ekmecki, Corcoran and I discuss developmental education for clinical and translational professions in higher education. We offer theory and application for curriculum review that focuses on team leadership by instructors and the need for cross-disciplinary modeling in graduate level instructional design in **“The Devil is in the (Mis)Alignment: Developing Curriculum for Clinical and Translational Science Professionals”**. We apply constructive alignment theory and transformational leadership concepts to program outcomes, learning objectives, content, activities, and graded assignments as part of a scaffolding experience of multiple interactive learning components engaging overlapping and aligned cross-disciplinary content. The proposed process argues the need to consider conceptual, interactive, material, and deliverable synergy between coursework contributing to a system of instructing and learning in a translational and collaborative curriculum that specifically prepares graduates for careers in team-oriented translational professions.

“Case Studies in Pediatric Team Science” by pediatric fellows Amin, Malcolm, and Bedwell, utilizes the author's unique vantage point to investigate the process and practice of collaboration science in clinical and research pediatrics. Through the use of surveys and case study analyses they contribute to the assessment of collaboration readiness in a pediatric subspecialty, explore problem-solving in a surgical perioperative, and measure leadership characteristics amongst a team of pediatricians. This work highlights the applicability of team science discourse in the assessment of clinical practice and research environments and shows how within relatively similar subspecialties diversity is commonplace.

In **“Promoting Teamwork in Translational Medical Teams: Insights and Recommendations from Science and Practice”** by Benishek, Hughes, Gregory, Sonesh, Salas, and Lazzara the intersection between strong team characteristics and their application to patient-center effective care teams is explored. The author's particular approach emphasizes culture and change as normative components of medical teaming and critical to effective and consistent performance.

“Advancing Transdisciplinary Research: The Transdisciplinary Research on Energetics and Cancer Initiative,” by Gehlert, Hall, Vogel, Hohl, Hartman, Nebling, Schmitz, Thornquist, Patterson, and Thompson shows how a

flagship national effort of transdisciplinary engagement, the Transdisciplinary Research in Energetics and Cancer 2 (TREC2) initiative yields important lessons as it moves through the development, conceptualization, implementation and translational phases. Through multi-phasic and asynchronous interactions amongst center stakeholders, the authors argue the importance of external advisors, national meeting engagement, and the value of strengthened individual and center ties over time and challenge assumptions about unilateral change qualities and the advancement of collaborative efforts in a multicenter project.

Stipelman, Hal, Zoss, Okamoto, Stokols, and Börner present through visualization techniques, an overview of topical matter in a national network's publication record in **“Mapping the Impact of Transdisciplinary Research: A Visual Comparison of Investigator Initiated and Team Based Tobacco Use Research Publications”**. Their study finds that transdisciplinary research centers disseminate and have greater impact across science topic maps than other types of collaborations, thus supporting the trend toward greater return on from cross-disciplinary investments.

“Ethics in Collaboration for Translational Professionals” by Payne, Callier, and Hertelendy provide an often underrepresented discussion on team ethics documented in the medical literature warehouse PubMed. Their search for literature on interdisciplinary studies, ethics, and translational medicine yield topical material in the areas of conflict of interest, training competencies, data sharing, and community versus research-based questions. The discussion on ethics provides for a platform in which to consider the cross-boundary discussion of impact and practice of collaborative and translational scientists as it shows how ethical considerations cross many interest boundaries in collaborative enterprises.

“The Welcome Letter: A Useful Tool for Laboratories and Teams” by Bennett, Maraia, and Gadlin is a practitioner-scientist's reflection on a very basic and equally overlooked aspect of collaborative science, namely, the role of team leaders in establishing collaborative expectations that nurture trust amongst project members. As part of the indoctrination of teams the author's ardently support the ‘Welcome Letter’ as a necessary and effective tool in ensuring team effectiveness. Through this tool the authors present a model for use in teams and laboratories but also assert how clarifying criteria, boundaries, and expected behaviors can ensure more productive and effective teams.

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