The fulfillment of the promise of translational research for improving the health and longevity of the world’s populations depends on the development of broad-based teams of scientists and scholars who are able to focus their efforts on linking basic scientific discoveries with the arena of clinical investigation, as well as taking the results of clinical trials and translating them into changes in clinical practice. This type of team approach is quite common in large, successful businesses.

However, investigators within academic medical centers often face impediments that inhibit collaborative interactions across the silos of academia. Academic medical centers must build new structures and modify their cultures to facilitate the development of seamless collaboration and cooperation among diverse groups of investigators.

Training and Recognition

One important area of focus for the academic medical center of the future will be the development of multidisciplinary training programs to prepare the next generation of clinicians and scientists to enter the field of translational research. Through its Clinical and Translational Science Award program, the National Institutes of Health (NIH) has provided substantive support for training. In addition, private foundations have developed novel programs for introducing medical students to translational research and for supporting translational research in underfunded and overlooked areas. A number of institutions, including the University of Pennsylvania in Philadelphia, Stanford University in Stanford, California, and Duke University in Durham, North Carolina, have launched specific programs aimed at training both PhDs and MDs in translational research. In this issue of CTS, Charles Huskins, MD, discusses novel educational initiatives at the Mayo Clinic for individuals interested in translational medicine. Also found in this issue is information about a novel master’s degree program in translational science at the University of Connecticut, Farmington.

To be successful, the new educational programs in translational research must overcome inherent academic barriers. For example, students must work with a multidisciplinary mentoring team, and research rotations need to include exposure to bench science as well as to patient-based and population-based research. Because individual departments often receive funding based on the number of students that are enrolled in their programs, allocations must be adjudicated so that having a student in a multidisciplinary program does not economically penalize individual departments. Academic medical centers and the NIH must also develop mechanisms to support the transition of the translational science trainee to an independent investigator when it is increasingly difficult to attract the best and the brightest to academia because of the large indebtedness of most medical school graduates and the time required for clinical and research training.

One potential solution is for the NIH or individual medical centers to develop tuition debt-remission programs for physicians who pursue careers in translational research and remain in the academic environment. Academic medical centers must also develop mechanisms to provide protected time for clinician-investigators who undertake translational research while also providing clinical care. New sources of salary support for the clinician-investigator may come from efforts to bridge the historical divide between industry and the academic medical center, from private foundations, or from the academic medical center itself. As competition between academic medical centers and community hospitals has become increasingly intense, successful translational medicine programs give academic centers the opportunity to provide patients with the latest in diagnostic techniques and innovative therapies. Thus, it must be recognized that translational medicine serves as an important competitive edge for academic hospitals in the health care marketplace.

Inherent impediments to developing translational research programs also exist in the standards established by university appointment and promotion committees. Promotion committees characteristically evaluate candidates based on the following criteria: 1) Are they “independent” investigators? 2) What was their “contribution” to the work they have published? 3) Are they recognized as the leader of the work that they have undertaken? Young investigators demonstrate both independence and peer recognition by being awarded independent NIH RO1 (or equivalent) grants. Similarly, their contribution to published work is evidenced by their designation as first author or communicating author. However, because translational research involves a team approach, it is difficult—if not impossible—to assess each individual’s contribution using these mechanisms, particularly when the NIH application has only one spot for the principal investigator.

In addition, it is far more challenging to perform experiments in patient populations than in model systems or in animal models. Thus, there is a higher level of uncertainty that any study in patients will result in publication in a high-impact journal because many journals today report only the results of positive clinical studies. There is also an inherent antipathy between the academic cultures of clinical and basic research that often comes to the forefront at meetings of appointment and promotion committees. Dale Dauphinee, executive director of the Medical Council of Canada, and Joseph B. Martin, dean of the faculty of medicine at Harvard Medical School in Boston, noted that achieving success in translational research is challenging: “Because it "requires ... breaking down of longstanding institutional walls, the scholarship of integration has been slower than the other forms of scholarship to gain acceptance as an integral activity of the professorate.” Thus, universities must take proactive steps to ensure that promotion

There is widespread agreement that academic medical centers, the focal point for translational research, must build new structures and modify their cultures to facilitate the development of seamless collaboration and cooperation among diverse groups of investigators.

—Arthur M. Feldman, MD, PhD
committees judge the achievements of clinical scientists by a different barometer than that used to judge laboratory-based research. In addition, efforts must be undertaken to amalgamate the cultures of these 2 different academic worlds.

**Challenge of Separation**

Another impediment to the development of translational medicine at academic medical centers is the physical separation of basic scientists and clinical researchers, making the gap between clinicians and basic scientists more than just cultural. In the past, basic scientists were often members of clinical departments; however, the continuing economic stresses in academic clinical departments and a refocusing on cost accountability and clinical volume has resulted in many scientists, including those with medical degrees, leaving clinical departments. One alternative to the traditional departmental model was the development of multidisciplinary centers. However, such centers have often been unsuccessful because they threaten the power base of individual departments and, unless substantially endowed, often collapse under the weight of their financial obligations during downturns in NIH funding. Without funding for support staff and representation among the upper echelons of university leadership, these centers rarely have the level of influence necessary to affect university or medical center funds flow. New initiatives aimed at developing clinical “service lines” in place of the traditional departmental structure at some academic medical centers may provide an interesting and unique opportunity for incorporating translational research into the structure of the service line. Because these service line organizations will be disease-focused and multidisciplinary, they promise to provide an ideal platform on which to incorporate translational research.

**Community Research**

Another novel benefit of a translational medicine program is the opportunity to use it as a platform for developing closer relationships with primary care practices. So-called primary care practice-based research networks (PBRN) are becoming research arenas in which scientists use traditional and nontraditional methods to identify, disseminate, and integrate knowledge, thereby improving the ability of primary care physicians to treat their patients. The evaluation by social scientists of the traditional strategies used to educate community physicians about new methodologies of care fulfills the T3 mission of translational medicine, and the cost-effectiveness of these types of efforts can provide important investigative opportunities for health care economists.

However, when these studies are managed through the auspices of an academic medical center, the investigators are faced with an interesting conundrum. Quality improvement initiatives carried out in community practices or in academic medical centers can only be considered research and be published if patients sign an informed consent form. However, medical records can be thoroughly analyzed without informed consent as long as the investigators do not intend to publish their findings. Thus, academicians who pursue scholarly evaluations of quality improvement activities which focus on an institution’s ability to translate information from clinical trials to patient care are often penalized because their bibliographies may not reflect a large amount of scholarly work that goes unpublished.

In order to facilitate T3 studies by academic scholars, efforts must be made to develop algorithms that ensure patient confidentiality while also allowing investigators to publish their work. Alternatively, criteria must be established by appointment and promotion committees that recognize the fact that scholarly efforts might enhance patient care but might not be publishable.

Casaret and colleagues proposed 2 criteria to determine whether a quality improvement initiative should be reviewed as research: 1) the majority of patients involved expected to benefit directly from the knowledge to be gained; or 2) additional risks or burdens imposed make the results generalizable. However, to date, no clear guidelines exist that can guide internal review committees, governmental regulatory agencies, or individual investigators through these complex issues.

**Publishing Research**

When assessing the impediments to the development of the translational research field, one cannot overlook the role of scientific journals. Some journals limit the number of authors who can appear on the masthead. Because translational research often involves multidisciplinary teams consisting of both basic scientists and clinician-investigators, this practice may restrict the ability to recognize individuals who have contributed substantively to the study design or to the data interpretation, and may eliminate the author’s ability to recognize the many support people in the various participating laboratories without whose input the study could not have been completed. In addition, the typical masthead inculcates the traditional notion that the only places on the author list that matter are first and last.

There are a variety of ways to mitigate these concerns. For example, large multicenter clinical trials can be un-authored, with the individuals who provided different roles being detailed in the appendix. This type of “authorship” provides an opportunity not only to recognize many contributors, but also to detail their responsibilities. When one group of individuals all share an equal role in the publication of a manuscript, listing the authors alphabetically and noting that the authors were intentionally listed in that manner can provide a mechanism that ensures equal academic rewards for a given work. In addition, the use of co-first authors or even co-senior authors can provide a means to recognize the fact that 2 individuals—often young investigators—contributed equally to the success of a scientific project. While assiduously following the guidelines for authorship established by the International Committee of Medical Journal Editors, and scholarly societies, the editors of CTS will work closely with authors to develop novel algorithms and citations for authorship that will allow the many members of large collaborative teams to be recognized on manuscripts. This type of approach will hopefully be an important step toward facilitating the ability of institutional appointment and promotion committees to fully appreciate the role their colleagues play in specific translational research projects.

**Conclusion**

Translational research holds great promise for improving health around the world. The concept of a multidisciplinary approach to basic science and clinical research and the linkage of these “research” undertakings with the transfer of new knowledge to the clinical arena are, in and of themselves, transformational. As such, the success of these ambitious initiatives will require that the academic medical center restructures physically, economically, and culturally to accommodate these new and complex multidisciplinary programs.

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