Biomedical Innovation

Academic and Research Staff
Prof. Martha L. Gray
Farzana Mohamed

Key Collaborators
Prof. Lee Gehrke, Dr. Satyajit Rath[1], Prof. Elfar Adalsteinsson, Prof. Deborah Burstein[2], Prof. Brett Bouma[3], Karl Koster, Prof. Fiona Murray, Prof. Kashik SunderRajan[4]

Technical and Support Staff
Mercy Ameyaw, Dorothy Curtis

Group Overview
Ours is a new group devoted to developing and implementing organizational entities designed to promote and accelerate the pace of biomedical innovation. For our purposes, the term *innovation* refers to important new ideas (discoveries, inventions, etc.) that are realized (translated) to widespread utility, thereby changing what people think, do, or experience. The fundamental premise is that an appropriate organizational culture and a robust professional network are required to facilitate biomedical innovation. Without these features, it is difficult to define the real unmet need, to appropriately frame a problem, and to see a solution through to implementation and widespread impact. Integral to the network and organizational culture is the notion of embracing and respecting multiple disciplines and professions. Although recent efforts and attitudes have touted the importance of multidisciplinary environments, in reality, organizational culture, especially in academia, remains predominantly focused on the disciplinary identity of individuals and their work. Our vision is that multi-disciplinary, multi-professional models should co-exist with the conventional (strong and important) disciplinary models. To reach that vision our group is engaged in several efforts through which – by example and by analysis – we hope to codify the principles and processes required to establish and sustain diverse and robust networks imbued with an organizational culture that promotes innovation, leadership, and impact. Among the questions we seek to explore are the following:

Why are some organizations successful at breaking down barriers across disciplines? What policies, practices and organizational norms distinguish these entities from others? What spurs translation? Why do some breakthrough discoveries make it into the field or widespread practice while others languish in the laboratory? What can we say about networks of distribution and the environment surrounding an organization that catalyze and nurture translation?   Can we intentionally design sustainable organizational systems and models that facilitate translation and multidisciplinary innovation? Are these different for organizations at varying stages of growth and development, size, and scope?

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[1] National Institute of Immunology, Delhi, India

[2] Beth Israel Deaconess Medical Center (BIDMC), Boston, MA and Harvard-MIT Divison of Health Sciences and Technology (HST)

[3] Massachusetts General Hospital (MGH), Boston, MA and Harvard-MIT Divison of Health Sciences and Technology (HST)

[4] University of Chicago, Chicago, IL

1. Translational Health Science and Technology Institute – Faculty Development Program

Sponsors:
Department of Biotechnology, Government of India

Project Staff:
Prof. Martha Gray, Farzana Mohamed, Dr. Satyajit Rath[1], Prof. Lee Gehrke, Dr. Satyajit Mayor[5], Dr. Rajesh Gokhale[6], Dr. L.S. Shashidhara[7], Dr. Shubha Tole[8], Dr. Vijayalakshmi Ravindranath[9], Prof. Tayyaba Hasan[3], Prof. Shiladitya Sengupta[10], Prof. Collin Stultz , Prof. Jagesh Shah[10], Prof. Sangeeta Bhatia, Prof. Maria Mody[3], Prof. Brett Bouma[3], Prof. Guillermo Tearny[3], Prof. Fiona Murray,   Prof. George Verghese, Prof. Kaushik SunderRajan[4], Mercy Ameyaw, Prof VijayRaghavan , NCBS[5], Prof. Vinay Kumar[4]

The Translational Health Science and Technology Institute (THSTI) is a newly founded autonomous institute to be located in the National Capital Region of Delhi, India. By contrast to the existing universities and science institutes in India, the vision for THSTI is to bring multiple disciplines and professions together to develop and translate advances that ultimately improve human health in India and the world. THSTI is to be modeled on the Harvard-MIT Division of Health Sciences and Technology. The specific objective of this project is to recruit and select the founding faculty for THSTI, and then to mentor them as they create the policies and programs of THSTI.

The strategy is to leverage the considerable experience of MIT-Harvard HST (a) in identifying world-class faculty who have the drive and aptitude to develop and sustain a multi-disciplinary, multi-professional, entrepreneurial environment focused on advancing human health; and (b) to provide an interim environment within Harvard-MIT where the founding faculty can develop the initial programs and policies for THSTI.

The opportunity and challenge in hiring the founding faculty for THSTI lie in the reality that faculty will be recruited to an institution still under development. While this nascent state provides an opportunity for young, talented individuals to play a significant role in developing a new kind of institution, one with a very different culture and mandate than exists at other scientific institutions in India and the world, there is an inherent challenge in providing a sufficient enough foundation to mitigate the risk associated with building a career within a new institution, so that THSTI can successfully compete with other world-class institutions for this outstanding talent.

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[5] National Centre for Biological Sciences (NCBS), Bangalore, India

[6] Institute of Genomics and Integrative Biology (IGIB), Delhi, India

[7] Indian Institute of Science Education and Research (IISER) Pune, Pune, India

[8] Tata Institute of Fundamental Research (TIFR) Mumbai, Mumbai, India

[9] National Brain Research Centre (NBRC), Manesar, India

[10] Brigham and Women's Hospital (BWH) and Harvard-MIT Division of Health Sciences and Technology (HST)

During this program year, we focused on publicizing the opportunity and on design and execution of the selection process.

1a. Publicizing the THSTI opportunity

In terms of publicizing, the objectives were three fold. First, we needed to address the prevailing perception that conducting a world-class research endeavor in India was virtually impossible. In fact, in recent years, opportunities have exploded in India and substantial progress has been made in establishing infrastructure and other schemes to facilitate research. So, we partnered with the leaders of top Indian institutions to provide concrete examples of this progress and to express the near-universal enthusiasm for what was now possible.

Second, we needed to make candidates aware of opportunities for new faculty in THSTI. And third, we needed to convey the vision for HST as distinct from more conventional institutions. We did this, in part, by highlighting the partnership between THSTI and MIT.

Overall, our communications strategy comprised electronic newsletters distributed via targeted mailing lists, a Young Investigator meeting in Boston that generated significant word of mouth outreach, and the development of online and print materials including brochures. Examples of these are included in the publication list below.

1b. Selection process

Working with colleagues in India we established a robust selection process designed to select candidates who would be most able to build a new kind of institution in India. We took the unusual step of inviting candidates to apply as individuals or as a team. Our evaluation process involved a diverse variety of stakeholders, and was structured in a manner that reflected the unique needs and nature of THSTI at this stage of its organizational evolution. We paid particular attention to the interview process, as we wanted not only to evaluate candidates' academic prowess and aptitude for conducting independent research, but also their ability to work together and to engage one another as partners in institution building. Each finalist candidate made a presentation at a research symposium, taught a class, participated as part of a team in a THSTI visioning exercise, and met with several MIT and Harvard faculty members, alumni, and students over the course of an in-person selection week, which they attended as part of a group of promising candidates. They participated in facilitated discussion sessions on creating a culture for translation, multidisciplinary curricula, and faculty development. The candidates also had an opportunity to visit laboratories that are excellent models of the kinds of "research nuclei" that foster collaborative multidisciplinary work and facilitate translation. Further, each candidate had the chance to meet with faculty members or visit

laboratories conducting research in his or her respective field. All of these stakeholders

were invited to participate in the candidate evaluation process. (We held a follow-up session with the students who attended these sessions, so that they have a chance to understand the mechanics of a faculty search process as they contemplate their own careers.) The design of the selection process yielded some very useful information about the candidates' academic aptitude and ability to conduct independent research and about each individual's potential strengths and weaknesses as a member of a fledgling institute, where founding faculty will need to work together to provide an administrative backbone for a nascent organization.   The search committee ultimately identified 3 candidates recommended for founding faculty positions, and 2 candidates for other important and unconventional positions within THSTI.

2. Madrid-MIT M+Vision Consortium

Project Staff:
Prof. Martha Gray, Prof. Elfar Adalsteinsson, Mr. Karl Koster, Prof. Debbie Burstein, Dr. Prof. Brett Bouma

The Community of Madrid (one of Spain's 17 autonomous communities, which includes the capital city of Madrid) tapped MIT to develop a program that would address its aspirations to establish a knowledge economy through an effort focused on biomedical imaging.

Biomedical imaging is a domain that intrinsically draws on the academic, medical, and business sectors; and, Boston has long been a region of excellence in Biomedical Imaging. Through many discussions, what is emerging is a consortium – tentatively call the Madrid-MIT M+Visión Consortium - as a partnership of leaders in science, medicine, engineering, business, and the public sector dedicated to accelerating innovation in biomedical imaging, to promoting translational research and encouraging entrepreneurship, and to strengthening Madrid's position as a global center of biomedical research.

The Consortium's central strategy consists of a concerted effort to develop a strong foundation of human resources by (a) attracting top talent from around the world to be groomed for leadership opportunities directed to making Madrid a magnet for Biomedical Imaging, (b) engaging existing talent in Madrid and Boston to do the same, and (c) establishing a global network to provide advice, mentorship, and attention to the development of Madrid.

We expect a formal contract and funding to be finalized in fall 2010, and anticipate an immediate start.

3. Capacity Building

Project Staff:
Prof. Martha Gray, Prof. Kaushik SunderRajan, Prof. Michael Fisher

To a large extent, our ability to accelerate biomedical innovation lies in our ability to establish, develop and nurture the human resources capable of driving innovation. Again, innovation refers to the totality of finding important new ideas, realizing (translating) them, and thereby changing what people think and/or do.   It isn't that one person does it all, but that we need many individuals who appreciate what is required and who can play a central role in part of the process. The question is – in practical terms, how do we build this necessary capacity?

We expect to establish a series of workshops to collectively explore human resource development in the context of capacity building for the life sciences and biomedical innovation. The first such workshop was held on Nov 30, 2009, bringing together practitioners and academics from a variety of institutional settings in the US, India, and the UK to explore – using THSTI as a

concrete example of an institution putatively in a position to implement any outcomes – the following issues:

- What do we mean by translation? What constitutes translational research?
- Are there metrics by which translation can be evaluated? If so, what are they? How might they be implemented in an academic institution? (Should they be implemented?)
- Does "translation" operate at the level of the individual? Or can the institutional milieu establish, enable, or constrain the translational ethos?

The workshop comprised panels representing many of the key stakeholders (basic science, industry, medical, public/community health, and policy) who considered the problem of capacity building for translation from their perspectives.

A full description of the workshop and its outcomes can be found in the resulting white paper (see references). Summarized below is a distillation of the ten key points that emerged from the discussion. The first five relate to themes that emerged recurrently at various points in the conversation, and suggest areas of consensus among the participants despite of their diverse locations and investments. The next five deal with the productive tensions and critiques that emerged during the course of conversation. They are not necessarily points on which participants would agree; they nevertheless generated lively discussion and debate, and their further exploration would therefore be fruitful.

Recurrent themes and areas of consensus

- That translational research is, by definition, **problem-focused and context-driven**, a radical departure from an earlier modality of research that could be considered topic-focused and decontextualized. A context-driven problem necessarily involves different skill sets, and different approaches to finding its solution. It also demands different intellectual and institutional resources than topic-focused research.
- That such problem-focused research must, necessarily, be **multi-disciplinary**. Traditional disciplinary forms of training and recruiting have limited value in solving translational problems. Training people in, and recruiting people with, multi-disciplinary backgrounds and skill sets becomes crucial.
- That if one is serious about fostering a multi-disciplinary ethos, then one has to come up with a new set of **evaluation metrics** that can identify and reward high quality multi-disciplinary researchers. Traditional metrics may have limited value in identifying truly creative translational researchers who can work across disciplines.. The challenge here is to devise metrics that can rigorously identify quality, but which can also encourage diversity and create a faculty and student body with multiple, heterogenous skill sets.
- That attracting the best people is dependent upon coming up with appropriate **incentives**. These could include internationally competitive salaries; but could also include the challenge of being part of something that is nationally transformative, where hires are given the opportunity and the freedom to shape not only their own research agendas but to shape institutional agendas as well; and
- Finally, that for research to be translational, one must not simply be concerned with the creation of innovative technology, but also with its mechanisms of **dissemination**. Therefore, thinking through the relationship of innovation to diffusion is key. This idea has many interconnected dimensions: academic, business, social, regulatory, etc.

Issues for further productive exploration and consideration

- A fundamental problem with translation concerns the gap between the academic entity that does innovative research, and the commercial entity that has the capacity to bring the innovations to market. This gap has been referred to as the **translational valley of death**.

- A fundamental need to build capacity for **advocacy**. It is not just enough to do cutting-edge research. It is also important to be able to make plausible claims for the need to support such research.
- **Infrastructure** should be created to facilitate the interaction of basic and clinical researchers. This gap cannot be bridged solely by hiring multi-disciplinary researchers; bridging the gap requires drawing researchers from multiple disciplines and professions, and creating resources, structures, and opportunities for these researchers to work side-by-side.
- It can be very useful to draw upon **social science expertise** during the conceptualization and operation of an organization like THSTI. Many of the challenges of translation are not scientific or technological. Rather, they pertain to the retooling of organizational structures and cultures; the building of an adequate and responsive regulatory environment that is conducive to translation; the devising of incentive structures and metrics that facilitate collaborative productivity and dissemination; and an attentiveness to social and historical context so that technological developments can have positive social impact. Anthropologists, sociologists, historians, economists, management theorists, legal experts and policy analysts have studied these issues at great length, and much can be learned by partnering with them in joint exploration.
- Given that the aim of translational research is to have beneficial, downstream social effects, it is worthwhile to think of THSTI not just as a center of innovative excellence, but as one that facilitates mechanisms by which such innovation can be widely diffused. In this regard, it is relevant to think of how an institution like THSTI can represent **a new type of social contract** between the research university and society.

Publications

1. Health Science and Technology Opportunities in India (June 2009)
2. THSTI Faculty Recruitment Brochure (March 2010)
3. Capacity Building for Translational Research – White paper; from Workshop on Capacity Building Workshop: Transnational and Cross-Institutional Perspectives, 30 November 2009, Boston MA