Abstract

The Center for Integration of Medicine & Innovative Technology (CIMIT) is a nonprofit consortium of Boston academic medical centers and universities, with a growing list of affiliates across the globe. It aims to accelerate the healthcare innovation cycle by fostering interdisciplinary, inter-institutional collaboration among experts in translational research, medicine, science, engineering, healthcare implementation, and entrepreneurship in concert with industry, foundations, and government to rapidly improve patient care.

Mission

CIMIT’s mission is to accelerate the healthcare innovation cycle to improve patient care by facilitating collaboration among clinicians, technologists, and implementation experts to stimulate and catalyze the discovery, development, and implementation of innovative products, services, and procedures. CIMIT concentrates on early-stage, high-risk translational research projects and supports them through to a “commercial exit” from academia.
Consortium History

CIMIT was founded formally in 1998 as “living lab” of innovation. A “center-without-walls,” its charter is to foster multidisciplinary collaborations that bridge silos of medicine, technology, and business to improve patient care. At the time, CIMIT was a new type of partnership designed to support innovative translational research by leveraging technological expertise from academia, industry, and government, in particular the Department of Defense (DoD) to target unmet medical needs.

The early groundwork for CIMIT was laid in mid-1990 by four Boston-based clinicians concerned about the lack of infrastructure that could advance the use of technologies for minimally invasive surgery. Around the same time, two researchers at Massachusetts General Hospital (MGH) produced a white paper calling for a “place where ideas and people could meet, form teams and receive financial support to meet their goals.” These two parallel efforts enabled the creation of CIMIT, an organization focused on translational research and designed to accelerate the pace of research and development by leveraging technological expertise—from industry or academia—for targeted medical application.

CIMIT’s model for translational research connects clinical, engineering, and commercialization communities across departments, institutions, and universities, to form networks of experts in medicine, biology, chemistry, mathematics, engineering, physics, regulation, and industry and links them to implementation resources.

CIMIT has created a Boston-wide community of innovators by:

- Promoting and facilitating interconnectivity, communication, and interactions among communities of scientists, engineers, and clinicians across the consortium’s different institutions
- Attracting and supporting “rising stars” in engineering and medicine to pursue careers in translational medicine
- Identifying and supporting ideas from the CIMIT community with high-impact potential in clinical care that would be too early to be supported by traditional funding sources

CIMIT is a consortium of 13 research institutions, universities, and hospitals in the greater Boston area and 3 international affiliates along with strategic supporters. CIMIT provides funders and investigators
alike with a single portal to a pool of clinical and technology domain experts in areas relevant to all aspects of healthcare. Many of these experts are international thought leaders whose contributions to innovative approaches to patient care have become standards of care.

CIMIT is based on the premise that sophisticated innovation methods, along with technologies that have been developed for nonmedical uses, could be applied to unmet medical needs. However early-stage, nontraditional, multidisciplinary translational projects have little chance of funding from conventional sources. In response, CIMIT focused on the often unrecognized and undervalued function of actively facilitating collaborations between investigators with clinical, engineering, and commercial expertise throughout the project lifecycle in order to achieve near-term clinical impact.

Over the years, CIMIT has evolved processes necessary to define an unmet medical need and then conceive, test, develop, commercialize, and clinically implement a technology-based solution, calling this set of processes the Healthcare Innovation Cycle. CIMIT has funded more than 600 projects. Some examples of CIMIT-supported programs, projects, and relationships include the following:

- **Innovation Awards**: Seed grants that support early-stage, collaborative research projects for improving patient care, with emphasis on devices, procedures, diagnosis, and the delivery of healthcare

- **Accelerator Program**: Awards that include funding and the proactive involvement of seasoned MedTech executives that support innovations that have a reasonable chance of being handed off to industry within 12 to 18 months

- **MGH “Operating Room of the Future”**: A framework that explores new technology platforms and systems of care for improving the safety and effectiveness of today's operating suites. The “living lab” concept expanded in the development of Neonatal Intensive Care Unit of the Future, Emergency Department of the Future, and Ambulatory Practice of the Future

- **Simulation Program**: Focused on creating simulated environments where clinicians and others care providers can develop, test, and refine optimal approaches to clinical care as well as the real-time training and education of students and practicing clinicians. The program received the Edward M. Kennedy Award for Healthcare Innovation

- **Boston Simulation Consortium**: A collaborative partnership across CIMIT member hospitals and universities that builds upon the success of the Simulation Program to unify the Boston medical
CIMIT CoLab®: A cloud-based platform that enables a team, group, institution, or network to stimulate, manage, and measure innovation

MIMIT (Manchester: Integrating Medicine and Innovative Technology): CIMIT’s first international affiliate. A*STAR and Eastern Health Alliance in Singapore and the Catalan Ministry of health have followed, with the list expanding

National Institutes of Health (NIH) Point of Care Technology Resource Network (POC TRN): A National “center-without-walls” focused on the transformation of emerging point-of-care technologies into the commercial market

Structure & Governance

CIMIT is managed by a leadership team that includes a chief executive officer (CEO), chief academic officer, and chief operating officer. This team reports to an Executive Committee, which consists of the presidents and CEOs of each consortium member. CIMIT employs central full- and part-time paid staff to help manage and grow its impact. Its faculty consists of part-time site miners and program leaders drawn from member institutions, and full-time facilitators:

- Site miners identify and support people and projects that are appropriate for CIMIT within the different member institutions. They belong to a specific member institution and are funded partially by that member institution, anywhere from 20 percent to 50 percent full-time equivalent to CIMIT-related activities at their institution. The remainder of their time is dedicated to work at their institution. They provide an atmosphere of vested interest and cost-sharing among the institution and the consortium.

- Program leaders are leading clinician scientists and technologists who serve as subject-matter experts and mentor-funded researchers.

- CIMIT facilitators are experts in healthcare innovation, from commercialization and business to regulation and intellectual property (IP), who facilitate and connect the funded projects.
Financing

CIMIT members and affiliates contribute membership fees to support its infrastructure. CIMIT receives most of its funds as grants from various philanthropic, industrial, and government sources. In particular, the DoD has supported CIMIT since its early days to address the unique needs of warfighters and their families. In a recent example, the National Institute of Biomedical Imaging and Bioengineering recently awarded CIMIT $9.5 million to create Point-of-Care innovations for Primary Care.

Intellectual Property

CIMIT does not obtain intellectual property (IP) rights to any of the projects that it supports through its various funding vehicles. All IP remains owned by the consortium institutions. However, CIMIT does participate in the value created by the Accelerator Projects, taking a fraction of the net proceeds in any form generated based on a “pre-money” and investment ratio.

Patent Engagement

Individual patients are not directly engaged with CIMIT organizationally, although CIMIT works with patient advocacy groups and individuals can donate to the organization and may be involved in a variety of ways within individual CIMIT initiatives or educational outreach programs.

CIMIT considers innovation in healthcare to be a process, with the pathway to improvement starting with measurement. As such, CIMIT conducted a self-study, the Clinical Impact Study (CIS; http://www.cimit.org/about-clinical-impact-study.html) in 2009 and updated it again at the end of 2012 (final report in preparation) to assess the outcomes of projects for which CIMIT had applied its “find, fund, and facilitate” model. Each analysis was limited to projects initiated more than three years prior to when the analysis occurred in order to give projects a reasonable time to generate results. For both studies, CIMIT leadership, with the close help of investigators and program leaders, captured, quantified, and analyzed the impact created by the CIMIT-funded projects, including the resulting products, procedures, and services. The team quantified input and output metrics such as CIMIT expenditures, publications, and patents.
The 2012 CIS evaluated 538 Innovation Grant and Accelerator projects, representing $62 million in funding. The portfolio comprised 175 standalone projects and 363 projects as part of 102 packs (defined as a cluster of tightly interconnected projects, typically under multiple principal investigators [PIs], for which the clinical impact created could not be attributed to any single project).

As a sampling of results, as of 2013 CIMIT-supported projects have resulted in more than

- 36 companies or new product lines being formed
- 460 issued U.S. patents (with foreign counterparts in addition) along with more than 320 patent applications
- 700 publications
- 12:1 ratio in follow-on funding generated
  - 3:1 for funding directly to the PI
  - 9:1 for commercial investment

Correlations between the input and output variables provided insights that CIMIT is using to further improve how it utilizes resources. Some examples of the key lessons learned include the following:

- “Sweet Spot”: CIMIT’s greatest “bang-for-the buck” occurred in supporting numerous high-risk, early-stage innovative projects, with funding in the $100,000 to $300,000 range. While more funding created more clinical impact as measured by the above metrics, this range is where CIMIT spends its resources most efficiently, with other organizations providing follow-on funding advancing them further.

- Facilitation: Regardless of the size of the grant or the promise of the study, targeted and skilled facilitation is a powerful amplifier of success. In addition, although valuable at any stage of the innovation cycle, from the pre-proposal phase onward, it is most valuable in the early stages, particularly including the pre-funded team formation stage.

- Clustering: Projects conducted as part of a “cluster” of activities are more effective than those
done in isolation. Clusters represent communities of interest, examples being optical coherence tomography, simulation mannequins for training medics and first responders, and near infrared light for neurological and cancer treatment. Clusters are not managed by a single person or group but are effectively facilitated by peers, CIMIT staff, and strong CIMIT program leaders. They benefit from the broader resource-rich environment of talent across the CIMIT consortium members.

- Packs: A closely related insight is that projects conducted in “packs” were much more likely to achieve commercial success than single projects. Even when normalized by the amount of CIMIT funding, packs received approximately 20 times more commercial follow-on funding and garnered almost 3 times more awarded patents (about nine patents for each $1 million CIMIT invested in packs vs. about three for individual projects per $1 million of CIMIT funding).

- New Translational Investigators: Junior faculty members were as successful as more senior investigators working within the CIMIT model to conduct translational research. Mentorship, raw talent, and “fresh eyes” were cited as potential equalizing factors along with the CIMIT facilitation.

### Data Sharing

Data sharing is based on the CIMIT CoLab platform. CoLab is a web-based, secure, social media platform that allows the scalable implementation of collaborative processes and for people or groups to share data on their own terms. The extent of data sharing and access can be controlled by the original research team.

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Updated: 04/14/2016