Transforming Healthcare through Technology

Program Overview

CIMIT Programs represent a balanced portfolio of multidisciplinary and inter-institutional research projects in every phase of innovation—from idea to adoption into clinical practice. Directing these programs are clinical champions, each a nationally-renowned specialist in an emerging area of medical innovation.

CIMIT Programs

- **Biodetection & Sepsis Control**
- **Biomaterials & Tissue Engineering**
- **Cardiovascular Disease**
- **Clinical Systems Innovation**
- **Global Health**
- **Image Guided Therapy**
- **Minimally Invasive Surgery**
- **Neurotechnology**
- **Optical Diagnostics**
- **Simulation**
- **Trauma & Casualty Care**

Program Leaders form the clinical nucleus of the CIMIT innovation community—a vibrant and powerful network connecting many of the most accomplished scientists, engineers and clinicians in Boston.

Biodetection & Sepsis Control

IMPROVING CAPABILITIES IN THE DETECTION AND THERAPY OF SERIOUS INFECTIONS IN INDIVIDUALS AND THE POPULATION

Jeffrey A. Gelfand, MD, MGH

Naturally occurring infectious diseases and bioterrorism emergencies have the potential to cause shock- and sepsis-related fatalities. The ability to screen people efficiently for a wide variety of infections could significantly limit the devastating impact of an epidemic or bioterrorism incident on civilian or soldier populations.

CIMIT's Biodetection & Sepsis Control Program leverages CIMIT's extensive network of academic institutions and government agencies to develop novel technologies capable of detecting infection, screening antigens or developing vaccines.

CIMIT Supported Solutions

- Developing new diagnostic techniques using interdigitated electrode technology and microfluidic detectors for early diagnosis of HIV/AIDS
- Using microfluidic technology for early detection and diagnosis of avian influenza and other infectious diseases
- Developing a rapid, sensitive test to detect sepsis and allow early treatment to minimize or eliminate the spread of infection
- Developing a novel technique for removing infectious agents from the blood quickly and efficiently

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Biomaterials & Tissue Engineering

HELPING SOLVE ORGAN SHORTAGES THROUGH THE CREATION OF "LIVING REPLACEMENT STRUCTURES"

Jeff Borenstein, PhD, Draper Laboratory
Joseph Vacanti, MD, MGH

Nearly one hundred thousand Americans are waiting for a life-saving organ transplant. Thirty thousand patients a year need a new kidney, and while treatments like dialysis can buy time, on average, one in four die before receiving a transplant. This severe organ shortage could be mitigated if a viable substitute for human tissue could be found.

Tissue engineering is a complex challenge. An interdisciplinary field, innovations in tissue engineering seek to apply the principles of engineering and life sciences in the pursuit of biological substitutes that restore, maintain, or improve tissue function.

CIMIT's Biomaterials & Tissue Engineering Program is working to create "living replacement structures" for organs, tissue, and neural repair.

CIMIT Supported Solutions

- Invent and implement Micro-ElectroMechanical Systems (MEMS) to build complex organs, such as kidneys and livers, and biocompatible replacement tissues for organ repair
- Design a small, improved kidney dialysis device to improve a technology that had not progressed in more than thirty years—and lead to a kidney-dialysis machine small enough to be worn around a patient's waist

"Aided by a CIMIT grant, I began a program in tissue engineering that included the development of a completely novel platform for tissue engineering. This led to the creation of a multidisciplinary team including our laboratory, Jeff Borenstein's laboratory at Draper and Roger Kamm's laboratory at MIT. The results of this effort have been scientifically successful and are now reaching the stage of early commercialization."

Joseph Vacanti

Papers Published in 2007

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Cardiovascular Disease

REDUCING DEATHS AND DISABILITY FROM HEART DISEASE AND STROKES THROUGH IMPROVED DIAGNOSIS

Ahmed Tawakol, MD, MGH
Tom Brady, MD, MGH

The leading cause of death and disability in the developed world, Cardiovascular Disease affects millions of people of all ages and frequently requires expensive and invasive treatments. Most advances in treating heart disease have focused on drug interventions and lifestyle changes. Technological innovations to date tend to concentrate on treating structural cardiovascular disease which requires creative methods of diagnosis and innovative procedural therapy.

Heart disease costs the United States billions of dollars every year, yet much of the biology is still not understood. By continually evaluating the complex set of conditions cardiac patients experience, CIMIT investigators seek novel approaches to diagnosis and minimally invasive therapy.

CIMIT's Cardiovascular Disease Program is working to develop novel methods for the identification of and therapy for patients at highest risk for developing myocardial infarction and stroke.

CIMIT Supported Solutions

- Advance optical coherence tomography, a highly sensitive, advanced imaging tool able to detect vulnerable plaques which may rupture, triggering many heart attacks and strokes
- Develop safer, minimally invasive treatments and procedures to replace diseased aortic heart valves, post heart attack mitral valve regurgitation, and early detection of cardiac arrhythmias

Papers Published in 2007

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** also listed under Optical Diagnostics Program*

Clinical Systems Innovation

MAKING PATIENT CARE SAFER, MORE ACCESSIBLE, MORE EFFICIENT, AND LESS COSTLY ACROSS THE ENTIRE CONTINUUM OF CARE

Jay Schnitzer, MD, PhD, MGH

Clinical healthcare environments are demanding, fast-paced, and complex. The barriers to innovation are significant, including the need to avoid disrupting ongoing day-to-day activities.

CIMIT's model of developing clinical innovation "learning laboratories" across the continuum of care—from the hospital to the home—provides venues for technology and process innovation to address these challenges in realistic settings. It also provides a controlled environment to measure the impact of change.

The Clinical Systems Innovation Program is CIMIT's on-the-ground initiative to improve and advance the systems that support clinical care in real-world healthcare settings. CIMIT helps clinicians and institutions craft novel approaches to implementing a complex new care pathway or designing a new facility or better process, usually incorporating new technology.

CIMIT Supported Solutions

- Establish partnerships between clinicians, technologists, and industry partners to define and develop innovative technologies and systems to enable elders to live independently in the home and to ensure care continuity across healthcare settings
- Develop alternative models of low acuity care beyond the physical confines of the hospital that preserve the relationships between

CIMIT Learning Laboratories

Operating Room of the Future, a state-of-the-art surgical space developed at MGH in which advanced technologies are used to increase efficiency and safety for staff and patients.

BASIS initiative, a BWH operating room of the future, from which 16 new operating rooms will incorporate design and processing efficiencies.

BIDMC Emergency Department of the Future, an innovative physical facility with advanced informatics capabilities, supported by CIMIT, to create a physiologic monitoring and pain management surveillance system.

Neonatal ICU of the Future at Children's Hospital, an initiative to design a state-of-the-art unit that combines cutting edge technology, non-invasive monitoring and testing.

Ambulatory Practice of the Future, an innovative physical space redesign leveraging process re-engineering, redefinition of team roles, remote physiologic monitoring and virtual outreach for patient-centric care at MGH.

Medical Device Plug-and-Play initiative, a national collaboration promoting the adoption of open standards for medical device interoperability to benefit patient safety and healthcare efficiency.

patients and their care teams and seamlessly integrate into provider workflow and informations systems

- Develop and pilot new and effective technologies for integrating wearable physiologic sensors, short-range communication, and knowledge-management software and display
- Create deployable, flexible, affordable, robust systems for managing the monitoring, tracking and location of large numbers of patients in unconventional settings outside the walls of existing medical facilities, such as large-scale emergencies
- Establish device interoperability standards that enable medical device integration for safety and clinical decision-making, produce complete and accurate electronic health records, and create error-resistant systems

Papers Published in 2007

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**also listed under Minimally Invasive Surgery*

Global Health

PROVIDING PROGRAMS TO HELP THOSE IN EMERGING NATIONS HELP THEMSELVES

Kristian Olson, MD, MPH, MGH

Delivering healthcare to patients in austere environments calls for innovative approaches. Over challenge is to apply proven problem-solving capabilities to the design and development of medical devices and technologies specifically targeted to improving care in underserved patient populations, both at home and abroad. A "setting-driven" approach integrated with clinical training enables better technology solutions for developing countries. By utilizing existing local resources, both human and industrial, there is less reliance on medical product importation.

CIMIT's Global Health Program is focused on developing instruments, equipment and training programs for low-resource settings.

CIMIT Supported Solutions

- Create and leverage a multidisciplinary network to identify available medical resources and advocate for non-traditional solutions to high-impact problems
- Use locally available "replacement parts" in the design and manufacture of life saving devices (infant incubators) to help sustain life
- Design and launch a program that teaches how to use an existing "low-tech" device to open the air passages of asphyxiated newborns
- Teach midwives and mothers about techniques for pre- and post-natal safety, simple approaches that they can teach others in their communities
- Support the development of point-of-care technologies to enhance field-based diagnosis of conditions ranging from HIV to avian influenza

Image Guided Therapy

PROVIDING HIGH RESOLUTION, THREE-DIMENSIONAL IMAGES OF THE OPERATING FIELD IN REAL TIME FOR MINIMALLY INVASIVE PROCEDURES

Ferenc Jolesz, MD, BWH
Ron Kikinis, MD, BWH

Imaging techniques like X-ray and MRI are invaluable for treating a wide variety of illnesses and injuries. The challenge remains to shorten the lapse of time between image acquisition and procedure. Patient preference for minimally invasive surgery makes real-time imaging information vital.

Image Guided Therapy techniques help improve therapeutic outcomes. By providing precise ways to "visualize" intra-procedural anatomical changes in real time, Image Guided Therapy helps clarify a surgeon's understanding of the patient's anatomy and enables minimally invasive procedures to be performed inside solid organs. Guided by real-time imaging, surgeons can make decisions based on accurate data—sometimes the crucial difference between life and death.

CIMIT's Image Guided Therapy Program is focused on providing precise high-resolution, three-dimensional ways to "visualize" intra-procedural changes in real time, allowing minimally invasive surgery to be performed on solid organs that would otherwise require traditional surgical procedures.

CIMIT Supported Solutions

- Design and construct the first advanced, image-guided operating room, which incorporates multiple state-of-the-art imaging systems such as 3T MRI, PET/CT, and optical imaging (AMIGO Project)
- Develop noninvasive, focused ultrasound treatment for ablation of brain tumors and uterine fibroid tumors
- Advance novel approaches like MRI-guided cardiac ablation, an effective treatment for heart rhythm abnormalities

Papers Published in 2007

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Minimally Invasive Surgery

MAKING SURGERY SAFER, AND RECOVERY FASTER AND LESS PAINFUL FOR PATIENTS

David Rattner, MD, MGH

Minimally Invasive Surgery decreases risk and shortens post-surgical recovery time. Improved minimally invasive techniques, like laparoscopic surgery, are most effective when the tools are flexible, sophisticated, and incorporate advanced imaging techniques.

New devices, better optics and creative multimodal approaches to disease management have set the stage for the next phase of less invasive surgical therapy.

CIMIT's Minimally Invasive Surgery progam is focused on making surgery safer and more precise, exploring the next generation of less invasive surgical therapy. Recent projects involve developing tools and procedures for Natural Orifice Translumenal Endoscopic Surgery (NOTES), which could make surgery completely free of incisions, while drastically reducing the chances of infection, pain, and disability. Through NOTES, many complex surgeries could eventually become outpatient procedures.

CIMIT Supported Solutions

- Novel surgical procedures performed through the mouth and other natural orifices, making surgery virtually incision-less and painless for patients
- Convening experts at the national level, funding high-risk ventures and promoting information sharing across disciplines to encourage medical device development
- Developing a minimally invasive procedure that uses the patient's own blood components mixed with a biodegradable gel for enhanced repair of knee injuries

Papers Published in 2007

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**also listed under Clinical Systems Innovation*

Neurotechnology

FINDING MORE EFFECTIVE, MINIMALLY-INVASIVE WAYS TO PREVENT, DETECT AND TREAT NEUROLOGIC DISORDERS

Steven Schachter, MD, BIDMC

One in five Americans suffers from a neurological disease. Epilepsy alone affects four to six million Americans. Many neurological diseases are usually diagnosed in their advanced stages, and treatments tend to be palliative rather than curative, leaving patients debilitated for years. One in three patients with epilepsy continues to have seizures, which may be fatal or cause serious disability.

New engineering techniques coupled to recent discoveries in neuroscience could dramatically improve patient quality of life. Potential benefits include reversing or ameliorating a variety of neurological diseases and making earlier diagnosis possible.

CIMIT's Neurotechnology Program is focused on developing novel approaches to diagnosis and treatment that integrate the expanding field of neuroscience with the rapidly evolving technologies of the applied sciences.

CIMIT Supported Solutions

- Develop a device that can detect the early-onset of epileptic seizures and abort them before symptoms occur
- Design and construct a wearable, wireless, sensor-network to monitor motor recovery in stroke patients
- Develop protocols for transcranial stimulation and deep brain stimulation for depression therapy

Papers Published 2007

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Optical Diagnostics

REDUCING PAIN, DISCOMFORT AND DEATHS BY DEVELOPING MINIMALLY INVASIVE TOOLS AND PROCEDURES EFFECTIVE AT DIAGNOSING DISEASES

Gary Tearney, MD, PhD, MGH

Early diagnosis is critically important for effective therapy. Studies have conclusively shown that the earlier a disease is diagnosed, the greater the patient's chance of recovery. Current diagnostic techniques for many diseases, however, are often invasive and inefficient. Certain types of cancer, like esophageal cancer, are diagnosed through repetitive random biopsies. Other diseases leave markers that are not feasible to access surgically, like the vulnerable plaque that can indicate heart disease.

CIMIT's Optical Diagnostics Program seeks to make diagnosis efficient, effective, and non-invasive. Projects like Optical Coherence Tomography (OCT) and Optical Frequency Domain Imaging (OFDI) make it possible to identify precancerous lesions or arterial plaque at very early stages.

CIMIT Supported Solutions

- Reduce deaths by developing tools effective at diagnosing diseases
- Explore new optical methods of gaining information from tissue, including research on a three-dimensional miniature endoscope
- Develop an Optical Frequency Domain Imaging (OFDI) procedure, to obtain essential data from large sections of the esophagus and coronary arteries

Papers Published in 2007

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**also listed under Cardiovascular Program*

Simulation

Steve Dawson, MD, MGH

PROVIDING REALISTIC TRAINING TOOLS FOR CLINICIANS TO AVOID PRACTICING PAINFUL, RISKY PROCEDURES ON PEOPLE

Whether the medical practitioner is a new resident, a young battlefield medic, or an experienced surgeon, the traditional method of learning a new skill is to observe or read about a new technique, then attempt it on a patient. Contemporary technology is making it possible for physicians and caregivers to practice certain techniques on simulators. However, these simulators are rarely sophisticated enough to provide a realistic experience that factors in the psychological pressures and the multiple medical issues of a true procedure.

CIMIT's Simulation Program is focused on creating realistic training tools so that doctors, medics and first responders can practice on a mannequin in a simulated trauma setting. Projects like COMETS, an interactive, full-body trauma casualty system that is programmed to react autonomously to an extensive range of situations, allow medics and first responders to access and practice treatments involving complex medical conditions in a field setting.

"Our vision is that medical students, interns and residents will train on smart mannequins to master basic diagnostic and surgical techniques, which will make young doctors smarter and more confident."

Steve Dawson, MD

CIMIT Supported Solutions

- Design and build a physiologically realistic mannequin to train first responders to perform chest tube insertion and prevent a leading cause of trauma deaths
- Develop a mechanical system to train surgeons to perform laparoscopic surgery
- Create an interactive, full body-trauma casualty system (computer programmed to behave autonomously and spontaneously) to provide realistic training for army medics
- Design a powerful and interactive tool for real-time incident preparedness, training, and coordination of efforts between medical responders, hospitals, local, state, and federal agencies
- Develop a straightforward, realistic smallpox inoculation training system that accurately replicates the feel and responses of traditional smallpox inoculation

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Trauma & Casualty Care

PREVENTING DEATHS IN THE CRITICAL MINUTES FOLLOWING TRAUMA

George Velmahos, MD, PhD, MGH

Trauma care has improved dramatically. A victim with near-fatal injuries who reaches the hospital alive is likely to survive. However, little progress has been made to treat patients in the critical period before they reach a treatment facility. As a result, most traumatic deaths occur in the prehospital setting and before any meaningful medical intervention becomes available. Translational research efforts are targeting the early phases of injury in order to develop novel therapies and interventions for prehospital and early in-hospital trauma care.

"I envision an era when critically injured patients in shock are saved, even if found in a remote location because paramedics are equipped with a high-tech sensor that detects internal abdominal bleeding. A new, life-saving injection of a gaseous material increases pressure at the site of bleeding to stop the loss of blood—and the patient is stabilized for transport to the nearest hospital. For obvious reasons, this project is very important to the Department of Defense."

George Velmahos, MD, PhD

CIMIT's Trauma & Casualty Care Program works to facilitate projects that enable first responders to stabilize patients at the site of the casualty, offering critical care to the patient rapidly and effectively. Several projects aim to explore solutions to stop internal and external bleeding as well as improve resuscitation and survival.

CIMIT Supported Solutions

- Develop new tools for first-responders that can quickly detect and reduce internal bleeding
- Develop a method of rapidly lowering the body's temperature in the first moments of injury to help keep patients alive
- Connect the prehospital ambulance and in-hospital trauma teams by telemedicine

- Explore fluidless resuscitation as a method of decreasing mortality and organ failures
- Implement a process to establish the comparative benefit of new treatments in trials with trauma patients

Papers Published in 2007

Alam HB, Shults C, Ahuja N, Ayuste EC, Chen H, Koustova E, Sailhamer EA, Li Y, Liu B, de Moya M, Velmahos GC. Impact of resuscitation strategies on the acetylation status of cardiac histones in a swine model of hemorrhage. Resuscitation. 2007 Sep 4.

Sailhamer EA, Chen Z, Ahuja N, Velmahos GC, de Moya M, Rhee P, Shults C, Alam HB. Profound hypothermic cardiopulmonary bypass facilitates survival without a high complication rate in a swine model of complex vascular, splenic, and colon injuries. J Am Coll Surg. 2007 Apr;204(4):642-53, 2007.

Velmahos GC, Spaniolas K, Duggan M, Alam HB, Tabbara M, de Moya M, Vosburgh K. Abdominal insufflation for control of bleeding after severe splenic injury. J Trauma. 63(2):285-8; discussion 288-90, 2007.

CIMIT Invests Early in Emerging Leaders

The Young Clinician Awards help clinicians find that extra time to advance their research careers.

In 2007, five emerging leaders were awarded Young Clinician grants: Yolonda Colson, MD, PhD, Brigham and Women's Hospital; Michael Davidson, MD, Brigham and Women's Hospital; James Ellsmere, MD, Beth Israel Deaconess Medical Center; Daniel Kohane, MD, PhD, Massachusetts General Hospital; and Audrey Chung Marshall, MD, Children's Hospital Boston.

For Dr. Ellsmere, the grant was crucial to pursue a dual career goal of clinical care and research. "Junior surgery faculty have a tendency to become heavily loaded with clinical care responsibilities, and put their research interests on a back burner," said Dr. Ellsmere, who is working on a novel device to effectively manage the care of patients after gastric bypass surgery. "The Young Clinician funding enabled me to set aside time to focus on device development, and I look forward to several future projects building on the success of this work."

Dr. Marshall is developing a fetus-positioning device to enable minimally invasive *in-utero* cardiac intervention for babies with congenital heart disease. "The Young Clinician Award has given me the resources that makes it easier to pursue my ideas in a very exploratory way," said Dr. Marshall. "Because I am usually with patients, the grant has provided flexibility in terms of time and budget. And it has made it easier to find collaborators and attract others to join me in this research."

CIMIT's commitment to education has helped clinicians not only to launch research projects, but to disseminate information and share the learning.

Dr. Davidson, a cardiac surgeon at Brigham and Women's Hospital, is working on percutaneous repair of damaged heart valves without the need for open-heart surgery. His Young Clinician Award enabled him to cross-train with surgeons from Boston and Cleveland to learn new techniques. "The experience enabled me to learn from others, and I am trying to pass that knowledge along to other doctors at BWH," said Dr. Davidson. He said that surgeons and cardiologists could learn from each other in the rapidly growing field of minimally invasive surgery.

Grants & Awards

CIMIT provides critical seed funding for investigators whose research may be considered too embryonic or high-risk by traditional funding sources. Consistent with CIMIT's mission, grants are awarded to investigators conducting translational research projects focused on novel, technology-driven solutions to urgent healthcare problems.

CIMIT grants enable individual investigators or multidisciplinary teams to explore emerging technologies, develop systems to improve healthcare facilities or processes, or create novel approaches to managing a specific disease. CIMIT awards support the career development of investigators, young clinicians, and graduate students whose interests align with the CIMIT mission.

CIMIT encourages grant proposals by teams that reach across member institutions and whose novel ideas may lead to technologies that can benefit several medical disciplines. In particular, CIMIT seeks innovative approaches that can benefit soldiers, civilians and populations in austere settings. Proposals must be collaborative, multidisciplinary and specific about how the work will lead to improved patient care. In 2007, CIMIT received over 200 proposals, of which 67 projects were funded.

In their own words . . .

CIMIT has provided our team with the seed funding necessary to initiate the development of a device that is now proving to be valuable. The one-year funding enabled us to launch this project. We now have enough momentum to determine if the device will indeed be useful for basic biology or for diagnostics. This is catalytic funding!

Proposal Evaluation Criteria for all CIMIT Grants:

- Programmatic fit within an existing CIMIT Program, or desirable expansion to an important new area within the CIMIT mission (CIMIT does not fund projects in drug development, information-technology areas, basic research, or clinical trials)
- Collaborative nature of the project (interdisciplinary and inter-institutional)
- Potential for significant positive impact on the career of the investigators
- Innovation
- Intellectual property opportunities
- Viable exit strategies for the project, including future alternative funding sources, contacts with industry, licensing and venturing opportunities
- Probability of clinical adoption, if the project is concluded successfully
- Proposed project is not likely to be funded by another established funding mechanism (CIMIT does not fund projects for which corporate sponsorship or federal support is appropriate)
- High likelihood the project could benefit from the assistance of CIMIT facilitation support
- Potential to improve the standard of care and benefit patients

Proposals are peer-reviewed for scientific quality and fit with the CIMIT mission. Submitted through an open request for proposals, all proposals are evaluated by a scientific review committee comprised of internal and external expert reviewers. At the conclusion of the scientific,

technical, programmatic and patient benefit evaluations, all proposals are ranked and submitted to the executive director for final funding decisions.

In their own words . . .

The professional collaborations and knowledge gained through CIMIT has positioned me for career advancement.

CIMIT Science Grants

Science Grants recognize early-stage, interdisciplinary and inter-institutional research projects for improving patient care, with emphasis on diagnosis, intervention and peri-procedural systems. Three types of science grants help innovators with proof of concept or proof of principal. In 2007, CIMIT made awards in three categories: Small (up to $40,000), Medium (up to $100,000) and Large (up to $250,000).

CIMIT Clinical Systems Innovation Grants

Clinical Systems Innovation grants (up to $100,000) are awarded to teams seeking to address a specific need at a CIMIT healthcare institution. These grants are designed to help the institution re-think its approach to implementing a complex care pathway or design a new facility or process.

Career Development Awards

Career Development Awards (up to $50,000) allow an individual with established expertise in one medical or technical area to acquire knowledge in a second medical or technical area; experience that will allow the clinician to make unique subsequent interdisciplinary contributions. A mentor must be identified in the new area. Together, the applicant and mentor present an educational curriculum to acquire the additional knowledge base and a description of the benefits likely to be enabled by this training.

Working Group Grants

Working Groups are interdisciplinary and inter-institutional teams formed to explore emerging areas of new health care technology. These grants (up to $25,000) help new teams investigate a novel idea. Working Groups seek to understand current solutions, determine new approaches being developed by industry, and evaluate other areas of opportunity. When the team determines there is a potential area of exploration, the Working Group may apply for subsequent CIMIT grants or other funding sources to prove the concept.

Clinical Fast-Forward Grants

Jointly funded by the sponsoring hospital and CIMIT, Clinical Fast-Forwards help clinicians bring promising new clinical techniques from other sites (national or international) to CIMIT Consortium member institutions. Grants in this category must involve direct patient care. Clinical Fast Forwards seek to change the way care is delivered. The grant provides funding up to $25,000 to help the innovative clinician travel and learn at a leading center, practice the new skill or technique in a laboratory setting, and obtain proctoring when performing the initial clinical cases at a CIMIT site.

Young Clinician Awards

Established as a pilot program in 2007, this new award is funded by industry. A generous gift from Johnson & Johnson provided the funding for the first year of this award. The Young Clinician Award recognizes outstanding clinicians, early in their careers, who are engaged in the development of breakthrough medical devices and technologies.

Medical Engineering Fellowships

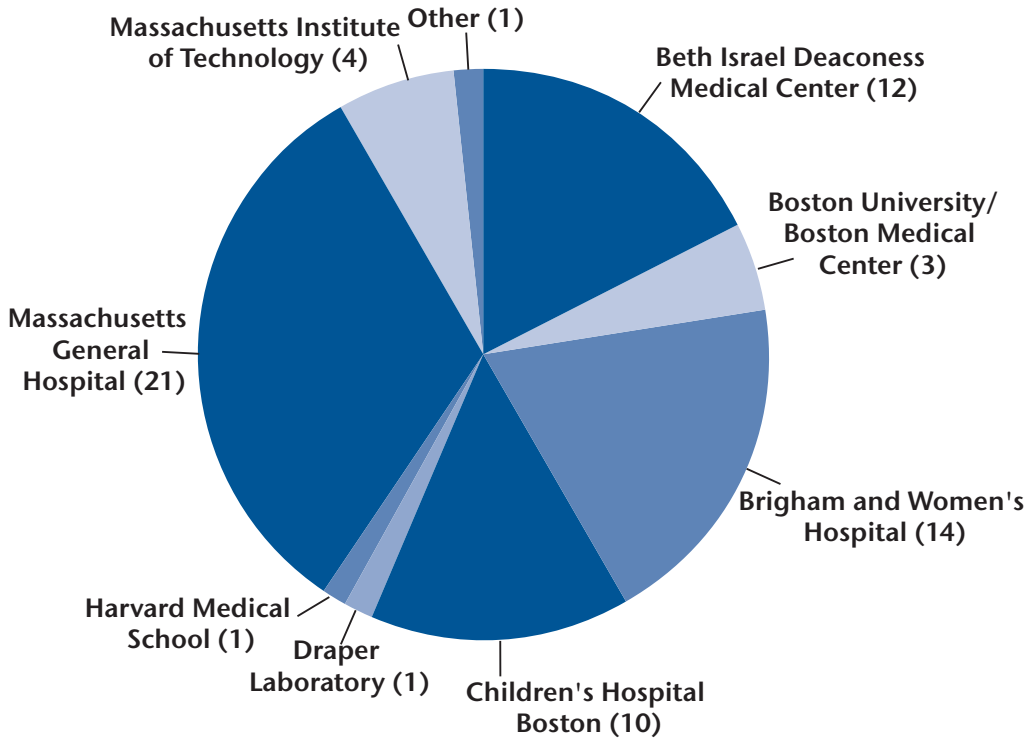
Jointly funded by MIT and CIMIT in 2007, this new fellowship offers multi-year support for graduate engineering students to work in highly innovative yet classically under-funded areas of healthcare research.

In their own words . . .

The biggest value of CIMIT is the ability to generate preliminary data for future grant applications. It can be difficult to get cutting edge and innovative work funded without some form of supporting data, and CIMIT's early stage investments have really paid off.

Number of Grants in 2007

by Consortium Institution
67 Projects and Fellowships



Measuring Impact

CIMIT concentrates on early stage, high-risk ideas—projects in the first phase of innovation. Success is evaluated through a variety of benchmark measures recognized by both academia and industry.

In their own words . . .

CIMIT is the first—and only—organization focused solely on bringing clinicians, engineers and scientists together; encouraging them to collaborate and find innovative technological solutions to important healthcare problems; and supporting them at every step of the way, from concept through implementation.

Delivering Results by Improving Patient Care

In Use/Patient Care	Patients Referred to Date	Other Benefits
Laser Treatment for Vocal Cord Dysplasia and Papillomatosis	500	Inpatient to Outpatient Treatment
MR Guided Brachytherapy of Prostate Cancer	480	Fewer complications; quicker return to work
Uterine Fibroid Surgery with Focused Ultrasound	136	Shorter hospital stay
Reorganizing Patient Care and Workflow in a Minimally Invasive Surgery Operating Room at MGH	3,688	Non-operative time compared to standard OR is 40% less
"Surgical Laboratory" Suite of Operating Rooms for Testing New Devices and Procedures at BWH	3,510	Methods of improved tracking and decision-making
Distraction Osteogenesis for Jaw Reconstruction	125	No ICU time; no bone graft
TeleStroke	780	Real-time diagnosis can minimize disability
Laparoscopic Obesity Surgery	700	Fewer post or peri-operative complications, reduces stay from 3-5 days to 1 day
Laparoscopic Uterine Fibroid Surgery	600	Return to work in 1 week instead of 6 weeks
Laparoscopic Nephrectomy	175	
Real-Time Incident Preparedness Simulator (RIPS)		Communities and first responders can simulate disaster scenarios
Radianse RFID Tracking Systems		Commercially available; used in 29 hospitals
LiveData Operating Room Dashboard		Commercially available
Allergy Documentation and Alert in Operating Room		30% error rate reduced to 10% within a few days of implementing system

Procedures in Clinical Trials	Patients Entered Into Trials	Observed Benefits to Date
OCT for Vulnerable Plaque	85	Minimally invasive detection prior to catastrophic event
OCT for GI Endoscopy	800	Minimally invasive detection superior to biopsy
Seizure Prediction and Vagus Nerve Stimulation	6	
Omniguide Laser System for Tumor Ablation	1	
Using Fine Needle Aspiration and Genomics for Early Detection of Lung Cancer	62	Earlier diagnosis will improve care and outcomes
Real-time ER Breath Analysis for Early Diagnosis of Infectious Disease	20	
eVisits in the Ambulatory Practice of the Future	100	Now going into patient care
Portable Gait Evaluator and Biofeedback Intervention Tool	28	
Initiation of a Near-Infrared Imaging Platform in Women with Ovarian Cancer	16	Sub-mm tumors detected (8 to 10 cells)
Video Rate OCT for Early Diagnosis of Glaucoma	23	Licensed for further development and commercialization
Video Rate OCT for Early Diagnosis of Age-related Macular Degeneration	2	Licensed for further development and commercialization
Remotely Monitored Inhaler to Predict and Prevent Asthma Attacks	400	Allows time-sensitive intervention
Sentinel Lymph Node Mapping of Breast Cancer Using Invisible NIR Fluorescent Light	Initiating April 2008	
Sentinel Lymph Node Mapping of Human Lung Cancer	Initiating April 2008	
Motion Tolerant Respiration Monitor	Initiating April 2008	
Hand Washing and Compliance Training	Initiating April 2008	

Devices and Procedures in the Pipeline

- A portable abdominal insufflator (usable by first responder) to treat trauma-induced abdominal bleeding in the field
- Wearable real-time blood pressure sensor that can recognize reduced cardiac output before blood pressure begins to fall
- Optically-guided laser therapy for esophageal cancer
- A portable device to treat hypothermia in the field using warmed inhaled mist
- Tissue engineered tooth and jaw replacement
- Novel negative pressure ventilator useful in the field or home
- Breath analysis for instant diagnosis of certain infectious diseases
- Real time MRI-guided cardiac ablation to treat arrhythmias
- Indwelling intrapericardial catheter for long-term access and therapy
- Local incorporation of anti-neoplastic agents into surgical resection margins
- Rapid optical diagnosis of early-stage glaucoma and macular degeneration
- Implanted lung assist device
- Surgery without incisions: natural orifice translumenal endoscopic surgery
- Non-surgical repair of meniscus or ACL
- Wide-field, high-resolution imaging for detection of non-melanoma skin cancers
- Cardio-port for minimally invasive, intracardiac beating heart surgery
- Endoscopic fiberoptic device and biodegradable scaffolds for minimally invasive closure of tracheoesophageal fistulas
- A handheld electrical impedance probe for the assessment of neuromuscular disease
- Three dimensional ultrasound imaging of testicular perfusion
- Percutaneous biopsy and implantation catheter device for autologous myocardial tissue transplantation into myocardial infarction scar
- “Smart” wearable emergency triage monitor
- Fetal positioning device for use during ultrasound-guided, percutaneous in utero cardiac intervention
- Controlled release technology to prevent tracheal stenosis
- Transcatheter mitral valve repair with adjustable artificial chordae
- Blood pressure measurement by touch (“bioglove”)
- Remotely monitored inhaler to predict and prevent asthma attacks
- Optical frequency domain interferometry to determine cerebral aneurysm rupture risk
- Wearable wireless sensor network to monitor motor recovery in post stroke patients
- Percutaneous, image-guided cochlear implantation
- Photochemical tissue bonding – a nanosuture approach to vascular repair
- Tissue engineered pulmonary valves
- Photochemical repair of vocal chords

Developing World-Class Innovators

During 2007, CIMIT reached out to all current and past recipients of CIMIT grants to collect data on the success of their research and to survey their satisfaction with CIMIT facilitation services. One hundred investigators responded (55% response rate) to the written survey; forty investigators participated in follow-on 1:1 personal interviews.

- 96% report that CIMIT funding helped secure second round funding from other sources. 69% report that the CIMIT grant absolutely made the difference in securing additional funding
- 73% report that the CIMIT grant was critical to their research; it would not have happened without CIMIT funding
- 22% of all CIMIT investigators have benefited from in-kind contributions (connections made by CIMIT with industry and other sources)
- 98% report that their careers have definitely benefited through the CIMIT network
- Areas of facilitation that investigators value most are: networking: finding and connecting with potential collaborators, inter- and intra- institutional connections; access to other clinical collaborators; developing device prototypes

CIMIT projects involving multiple institutions	2007	Cumulative through 2007
2 consortium institutions	32	167
3 consortium institutions	7	19
4 consortium institutions	0	5

Multi-institutional collaborations are a hallmark of CIMIT. In 2007, 65% of all projects funded represented collaborations of 2 or more institutions, an increase from 25% in 1999.

Metrics

History **10 years**

Projects Funded **460**

Peer-Review Publications **500+**

Invention Disclosures **200+**

Invention Disclosures Filed for Patent **75+**

Patent Applications Generated **200+**

Patents Issued **30+**

Licenses **10+**

Companies Formed or Redirected Into Healthcare **10+**

Patients Benefiting from CIMIT-Supported Devices & Procedures **11,000+**

Building a Vibrant CIMIT Network

At the epicenter of one of the world's most intellectually stimulating communities, CIMIT fosters and nurtures interdisciplinary collaboration among world-class experts in medicine, science and engineering, in concert with industry and government to rapidly improve patient care.

The CIMIT network is unique. Program Leaders are nationally recognized experts in their fields, frequently serving in leadership positions of the most highly respected professional medical societies. The CIMIT Industry Program collaborates closely with national and regional biotechnology and medical device membership organizations. These relationships help investigators connect with commercialization experts whose experience can guide their innovative ideas into opportunities for product development. And, through its strategic affiliations and regulatory affairs network, CIMIT facilitates connections with key leaders of government agencies and other international academic centers.

The CIMIT Innovation Congress is where the network comes to life. This annual convening event brings together innovators and entrepreneurs from across the globe. Participants include leaders from academic medical centers, government, universities, non-profit organizations, military, industry, law firms, small business, venture capital and other healthcare providers and payers.

In just two years, CIMIT has expanded its reach nationally and internationally, attracting participants from over 8 countries and 21 states. By 2007 total attendance at the Innovation Congress reached 650, including 244 first time attendees.

Whether through convening events like the CIMIT Innovation Congress or forming strategic affiliations, CIMIT leverages its greater Boston network worldwide.

The CIMIT Innovation Congress attracts

Industry
Sony
Johnson & Johnson
Olympus Surgical America
BioSTAR
IBM
Medtronic
Boston Scientific
GE Imaging
GE Research
InTouch Health
Image Stream Medical
Philips
TNCO Inc.
Smith & Nephew
Stethographics, Inc.
IDEO
iRobot
Intel/Digital Health
Analog Devices
Samsung
SRI International
Siemens
Avancen
Karl Storz
Getinge
BodyMedia
LiveData

Hospitals and Academic Medical Centers
Massachusetts General Hospital
Brigham and Women's Hospital
Children's Hospital Boston
Boston Medical Center
Beth Israel Deaconess Medical Center
Newton-Wellesley Hospital
Mayo Clinic
Johns Hopkins
Cleveland Clinic
Tufts NE Medical Center
NY Presbyterian
NYU Epilepsy Center
Kaiser Permanente
University of Manchester, UK

Government
NIH
FDA
Department of Defense
Veterans Administration
Office of Naval Research
TATRC
Army MRMC
National Health Service UK

Non-profit Community
Innovation Learning Network
Wellcome Trust
Bio21/Melbourne

Soldier Medicine

High technology devices and systems are enabling new approaches to characterize and manage acute care, rehabilitation, trauma and disease. By funding early-stage, high-risk ideas for patient care, CIMIT encourages its project teams to seek solutions that benefit soldiers, civilians and populations in austere environments.

In the early days, CIMIT gained a reputation for innovation through its Simulation and Clinical Systems Innovation initiatives. Since that time, CIMIT has become a national leader in new systems for patient safety, caregiver training, and systems designed to deliver care in the most appropriate and efficient setting. While the technical and medical practice skill sets for these improved processes apply equally to civilian and military medicine, CIMIT emphasizes the unique needs of the soldier.

CIMIT has a diverse and growing portfolio of projects that benefit soldiers.

Devices for Screening & Diagnostics

- Improve tools for triage
- Image for base-lining and classifying traumatic brain injury (TBI) and post traumatic stress disorder (PTSD)
- High field MRI for differentiating TBI from PTSD
- Detection/characterization of infection
- Serum screens for TB, HIV, and other infectious disease
- Early detection of hemorrhage
- Identify post-acute patients at risk of heart attack/stroke
- Systems and monitoring devices to help manage large numbers of casualties

Therapy

- Treating the soldier patient at point of injury for abdominal hemorrhage
- Improving intravenous access for drug delivery
- Designing new systems to characterize and mitigate traumatic pain
- Predicting seizure onset in traumatized patients to initiate therapy
- Quantifying benefits of novel surgery (reduced infection rate, faster recovery)
- Localizing therapy in the brain non-invasively with focused ultrasound
- Exploring ways to mitigate TBI (laser stimulation, transcranial magnetics)
- Improving vaccines
- Moderating inflammatory response to traumatic injury (cooling and pharmacologic therapies)

Rehabilitation

- Introducing longitudinal imaging approaches to manage TBI care
- Using nerve function sensors to stage therapy
- Evaluating brain-body interface characterization for TBI, prosthetic therapies

Training and Improved Care Systems

- Realistic trauma simulators for medic and first responder training
- Systems for improved care safety (hand washing compliance)