Deshpande Center for Technological Innovation

The Deshpande Center for Technological Innovation serves as a catalyst for innovation and entrepreneurship by supporting the research of MIT faculty and students and facilitating collaboration with entrepreneurs, venture capitalists, and innovative businesses. It carries out its mission though several activities, including the Grant Program, the Catalyst Program, the Innovation Teams course, and sponsored events. The center's goal is to be able to accelerate the movement of technology from the laboratories at MIT into the commercial marketplace where the technology can have an impact.

The Deshpande Center was founded in 2002 through a generous $20 million gift from Jaishree and Gururaj "Desh" Deshpande, cofounder and chairman of Sycamore Networks Inc. The center depends on the generous support of industry, the entrepreneurial community, and the MIT alumni communities to sustain its programs.

Executive director Leon Sandler spearheads the Deshpande Center's efforts, along with Professor Timothy M. Swager, faculty director. Guidance is provided by a steering committee that includes Vladimir Bulović, associate dean for innovation and professor of emerging technology; Charles Cooney, professor emeritus; Hemang Dave; Desh Deshpande; Karen Gleason, associate provost and professor of chemical engineering; Mark Gorenberg, venture investor and member of the MIT Corporation; Paul Jansen, medical device executive; and Institute Professor Robert Langer.

Highlights

In academic year 2017, the center continued to see many of its projects move toward commercialization. Since its inception, the Deshpande Center has funded more than 133 projects with more than $17 million in grants. Thirty-two projects have spun out of the center into commercial ventures that have collectively raised more than $700 million in outside financing.

This year, in collaboration with the Abdul Latif Jameel Water and Food Systems Lab (J-WAFS), the Deshpande Center managed the J-WAFS Solutions program and helped MIT faculty and students commercialize breakthrough technologies and inventions transform their promising ideas into innovative products and cutting-edge spinout companies. The J-WAFS Solutions program is sponsored by Abdul Latif Jameel Community Initiatives, which is represented on the governing committee of the program. Projects must align with J-WAFS' strategic research focus around and research should be aimed at conceptualizing and developing products and services that will have a significant impact on water and food security, with related economic and societal benefits.

Deshpande Grant Program Awards

The Grant Program provides research funds that permit MIT faculty and students to create and investigate new technologies and support the transfer of new knowledge and technologies from the Institute to young companies. The Grant Program consists of two types of awards: Ignition Grants of up to $50,000 and Innovation Grants of up to $250,000. Multiple experts in academia and industry review each application in two stages: pre-proposal and full proposal. The center announces awards annually.

The Deshpande Center awarded 13 grants in fiscal year 2017 totaling $1,055,985. The awards support a wide range of emerging technologies and included eight new and five renewal grants. The Masdar Institute and MIT Innovation Program awarded $50,000 in grant funding to a single project, and the J-WAFS Solutions program awarded $750,000 to five projects.

Ignition Grants

Ignition Grants target projects focusing on novel, enabling, and potentially useful ideas in all areas of technology. Although it might only support exploratory experiments to establish proof of concept, an Ignition Grant can position projects to receive further funding, such as an Innovation Grant, to take a concept to full development.

Innovation Grants

An Innovation Grant benefits projects that have established proof of concept and identified a research and development path and intellectual property strategy. Each grant helps a project advance its technology and reduce technical and market risk. The goal is to bring a project to a point where investors would invest in a start-up to commercialize the technology or where an existing company might license the technology and further develop it.

FY2017 Grant Recipients

Fikile Brushett: Convection-Enhanced Electrochemical Energy Storage

Modern enclosed rechargeable batteries are generally limited in performance because inactive components occupy a majority of the battery weight and volume, leading to lower energy densities and higher costs. This project focuses on a new energy storage concept—a convection-enhanced rechargeable battery that overcomes the diffusive transport losses, leading to higher energy density, lower cost, and safer operation.

Angela Belcher: Bulk Heterojunction Structural Batteries

Currently, 60–90% of the weight of the battery package in an electric car or an unmanned aerial vehicle does not contribute to energy storage. This project will develop a structural approach for building vehicle components from materials that do contribute to energy storage, which will lead to electrical vehicles with a longer battery life.

Kerri Cahoy: The Nanosatellite Optical Downlink Experiment

By 2020, small satellites could generate over two million terabytes of data per year. Most data must be downlinked to Earth to have value, but small satellite radio systems do not scale to handle this data volume, creating a bottleneck. Laser communication (lasercom) systems can outperform radio systems, are more secure, and have more bandwidth. The Nanosatellite Optical Downlink Experiment (NODE) enables lasercom using precise pointing systems and commercially available ground telescopes.

Henry Smith: Handling Assembly of Ultra-Thin Silicon Membranes

Integrated circuitry has evolved to include powerful device architectures in which thin pre-patterned chips are stacked up to form a three-dimensional electronic component. The stacking process relies on temporarily bonding these chips to a supporting carrier through thinning and sectioning processes; failure to reliably release chips can cost thousands of dollars per wafer. This project is a solution that guarantees release regardless of device layer thickness thus circumventing a major limitation of competing temporary bonding approaches.

Daniela Rus and Dina Katabi: Indoor WiFi-Based Localization

While the Global Positioning System (GPS) has revolutionized outdoor positioning, it does not work indoors. Current solutions to this problem compromise accuracy or require expensive hardware or fingerprinting of the environment. Ubiety is an indoor positioning platform that is accurate, compatible with any WiFi-enabled user device (smartphones, tablets), and easily deployable. It provides centimeter-scale accuracy for users via easily manufactured compact WiFi nodes built from commodity hardware. Ubiety would have retail, social, and robotics applications.

Gang Chen: Plastics for Thermal Management

Polymers have low thermal conductivities and are not used to transfer heat. However, highly thermally conducting plastics have been developed in the lab using customized polyethylene. These plastics also exhibit a unique combination of electrical, mechanical, and optical characteristics not possible with other heat-transfer materials. This project investigates the potential of plastics for heat-transfer materials.

Chris Zegras: Digital Tools for In-Field Data Collection

The promise of "big data" does not ensure that the right data will make it into the right hands to solve today's urban challenges. Flocktracker provides an easy-to-deploy-and-manage, low-cost, cloud-based, field data–gathering method leveraging smartphone technology. The platform takes the complexity out of the design of digital data collection, enabling users to quickly set up projects that allow an unlimited number of mobile devices to upload information to the cloud.

Stephen Buchwald and Bradley Pentelute: Novel Approaches to Antibody-Drug Conjugates

Antibody-Drug Conjugates (ADCs) have shown promise to revolutionize cancer therapy, with two ADCs currently marketed and more than 50 in clinical trials. This project has developed a platform for rapid and efficient chemical conjugation of highly cytotoxic drug molecules to antibodies with significant control over stability, drug loading, and accessible chemical space. The expectation is for Aryl-Linker ADCs to be superior to traditional ADCs in stability and efficacy, providing an improved method for targeted cancer therapy.

Angela Koehler: Exploring the Therapeutic Potential of Small Molecules that Modulate the c-Myc Oncoprotein

The oncoprotein c-Myc is a promising—yet untested—target for cancer therapy because of the lack of potent small molecules that directly modulate oncoprotein function in cells. This project will characterize two lead series that bind to Myc or Max and modulate Myc-driven transcription in cells, emphasizing *in vitro* and *in vivo* pharmacologic studies with the goal translating hits into leads for transcription-based therapy.

Paul Blainey: An Efficient Discovery Engine for Combinatorial Antibiotics

Annually in the United States, antibiotic-resistant infections cause more than 23,000 deaths and create $20–$35 billion in direct healthcare costs. Modern biology suggests that treatments with combinations of multiple drugs could be a rich source of new antibacterials, but searching large combinatorial spaces is an intractable challenge. For example, testing all pairs of 1000 or 5000 drugs respectively requires 500,000 or 12.5 million tests. This project is bringing combinatorial discovery within reach by lowering costs and increasing throughput more than ten times greater than the current state-of-the-art.

Martha Gray: Non-invasive White Cell Count Prototype

Several chemotherapy regimens yield better survival when administered with higher frequency and dose. However, because chemotherapy administration can only be given when there is an adequate white blood cell count (to confer the ability to fight infection) the typical treatment is conservatively set at a lower frequency and dose. This project is to develop a noninvasive white blood cell test that enables much more frequent measurement, thereby enabling physicians to personalize chemotherapy planning and improve the efficacy and safety of the overall treatment.

Katharina Ribbeck: Mucin-Inspired Virulence Neutralizing Agents for the Management of Infections

The global rise of antibiotic resistance presents a clear danger and urges the development of innovative anti-virulence treatments that do not drive resistance. We propose to build mucin-inspired Virulence Neutralizing Agents (VNAs), radically new forms of therapeutics that treat and prevent infections without killing the microbes, thus avoiding the selective pressure that causes resistance against antibiotics currently in use. The basis for this design is the natural mucus barrier, which domesticates microbes by suppressing their virulence while providing a livable habitat, thereby establishing in the body the diversity of microbes that is vital for our health. The microbe-taming potential of mucus stems from mucins, densely glycosylated polymers that give mucus its gel-like properties. We have developed technology that enables the creation of essential functional building blocks of mucins. With this technology, the first set of functional VNAs can be designed to prevent dental cavity formation, a well-characterized microbial infection. Oral health constitutes a significant market (more than $54 billion), is technologically tractable, and enables synergy with already ongoing collaborations with pharmaceutical companies, thus providing a suitable first medical target. If successful, this technology could be extended to manage virtually any disease-causing microbe.

James Fox: Bedside Testing of Coagulation Function and Biomarkers

Many diseases disrupt the balance of the blood coagulation system and result in life-threatening bleeding and clotting events. While there have been many new anticoagulant drugs, the lack of timely testing for these new drugs is a crucial limiting factor. This project is developing rapid, bedside blood diagnostics and drug monitoring capabilities to be read in less than 10 minutes.

Masdar Institute and MIT Innovation Program Grant Recipients

Tomás Palacios: GaN High Efficiency Transmitters for Wireless Communication

This project pushes the state of the art in radio-frequency electronics through a novel, highly integrated GaN digital transmitter solution with a record combination of efficiency and linearity for wireless communications. The integrated chip will considerably reduce the footprint and power consumption in wireless radios. At the same time, new technologies are being pursued to insert these integrated radios into harsh environments, such as those typical in gas and oil exploitation.

Abdul Latif Jameel Water and Food Systems Solutions Program Grant Recipients

Rohit Karnik: Low Cost Water Filter Using Sapwood Xylem

This project explores the largely unmet need to provide safe and affordable drinking water to low-income groups by developing low-cost water filters that use the natural filtration capabilities of xylem tissue in wood. Progress is being made to develop and validate filtration performance in the lab and in the field, while also assessing the usability, desirability, and affordability of low-cost filters and devising a strategy for local manufacture and commercialization. With low cost, ease of manufacture, light weight, and disposability, xylem filters have the potential to improve access to safe drinking water through engaging local communities in its manufacture as household water filters or as portable filters for rapid distribution in emergencies.

Gang Chen: Floating, Heat Localizing Solar Receivers for Distributed Desalination

Increasingly, communities are turning to seawater desalination to manage intense droughts and satisfy growing freshwater demand. This project addresses the challenges associated with scalability, cost, and water safety by using solar receivers to localize high temperatures to the water surface for distributed desalination and/or waste-water treatment.

T. Alan Hatton: Targeted Electrochemical Water Remediation

A particular challenge in wastewater treatment is contamination through extremely toxic pollutants and other contaminants, often present at low levels and energetically costly to remove. In industrial processes, there is an increasing desire to remove contaminants for water reuse, and at the same time, to recover specific species of high economic value.

The project team is developing an electrochemical platform technology to selectively separate targeted compounds and make the process significantly more energy efficient.

Michael Strano: A Multiplex, Nanosensor Platform for the Real-Time Monitoring of Food- and Water-Borne Contaminants

Rapid detection of food- and water-borne contaminants remains a major challenge in the developing world. Multiplexed sensor arrays are a promising approach as they offer the ability to screen food and water supplies for a variety of harmful contaminants simultaneously. This project focuses on the development of label-free fluorescent nanosensors capable of detecting common contaminants, and on the design of a form factor that is readily deployable.

Timothy M. Swager: Rapid Detection of Pathogenic Bacteria

Foodborne illnesses can lead to human suffering, expensive medical treatments, lawsuits, government sanctions, product recalls, tarnished corporate reputations, and sometimes death. This project will develop an inexpensive biosensor able to rapidly detect multiple types of pathogenic bacteria in food and water to prevent widespread infection.

Catalyst Program

Volunteers from the business community, called Catalysts, are integral to the Deshpande Center's mission of helping MIT innovators achieve market impact.

Catalysts are a highly vetted group of individuals with experience relevant to innovation, technology commercialization, and entrepreneurship. They provide individual contributions to the center and do not represent any company interests in their role as catalysts.

Catalysts are chosen based on the following qualifications:

- Experience in commercializing early-stage technologies and/or mentoring researchers and entrepreneurs as well as industry expertise
- Willingness to proactively provide assistance to MIT research teams
- Willingness to abide by time commitment, confidentiality, and conflict-of-interest guidelines
- Commitment to the interests of MIT researchers and the Deshpande Center

All catalysts must sign a catalyst guidelines document and agree to abide by the Deshpande Center's volunteer guidelines for managing privileged information and conflict of interest.

Deshpande Center Events

Through its sponsored events, the Deshpande Center seeks to bring together the components MIT technologies need to reach commercialization, such as by connecting faculty and students with members of the emerging technology industry.

IdeaStream Symposium

On March 31, 2017, the Deshpande Center held its annual IdeaStream symposium, designed to connect MIT researchers with the entrepreneurial community. The event included presentations and posters highlighting grantees at different stages of work, from new grant recipients to spin-off companies. Over 200 entrepreneurs, industry executives, venture capitalists, and MIT researchers attended the conference, which had the generous support of four corporate sponsors.

Catalyst Events

Near the start of each semester, the Deshpande Center arranges a small reception to celebrate the latest grant recipients. This event is held in advance of announcing the grant awards to the general public. It is an opportunity for the grant recipient teams and catalysts to get to meet and mingle with one another and with staff and other volunteers. All new grant recipients are asked to give a brief "elevator pitch" of their project.

Open House

The Deshpande Center hosted its annual fall open house in November 2016 at the Samberg Conference Center. This event offered the opportunity for grant project teams to present a poster and share their research findings. The open house welcomed nearly 200 members of the Deshpande Center community for an evening of camaraderie and networking.

Other Collaborations

The Deshpande Center met with delegates from many national and international universities and organizations to discuss MIT's (and the center's) approach to innovation and technology commercialization. Deshpande Center staff spoke at numerous forums, conferences, and events. The center is seen as an internationally renowned model for stimulating technological innovation.

Within the MIT community, the Deshpande Center actively collaborates with other members of MIT's innovation ecosystem, including the Technology Licensing Office, the Martin Trust Center for MIT Entrepreneurship, the Venture Mentoring Service, the Industrial Liaison Program, and numerous student organizations.

Leon Sandler
Executive Director