

## Lemelson-MIT Program

### Goals, Objectives, Priorities, and Accomplishments

The Lemelson-MIT Program (LMIT) continued its mission of celebrating outstanding inventors and inspiring youths through its awards, invention education, and communication activities. The Lemelson-MIT Program also continued its implementation of the national awards program, invention education activities, and EurekaFest. A new strategic plan and a four-year proposal was finalized at the end of 2017 that informs current and new activities for the four-year grant period with The Lemelson Foundation. Noteworthy outcomes for academic year 2017 include:

- Awarded the \$500,000 Lemelson-MIT Prize to MIT inventor of CRISPR technology and optogenetics
- Continued partnership with *MIT Technology Review* to celebrate the Lemelson-MIT Prize winner
- Awarded six winners in the national student prize competition for graduate and undergraduate students
- Offered webinars for educators and for the first fee-based summer professional development offerings
- Continued direct mail marketing efforts to promote free *JV InvenTeam* activity guides for educators and for professional development offerings
- Published new invention education journal article in *Elsevier*
- Continued recognition for InvenTeams from elected officials through community engagement efforts
- Relocated office to East Cambridge from Building 10 on the MIT campus

### Recognizing Outstanding Inventors

LMIT recognizes outstanding inventors and inspires young people to pursue creative lives through invention with two annual awards: the \$500,000 Lemelson-MIT Prize and the \$10-15K Lemelson-MIT Student Prize Competition.

The program strives to increase the number and diversity of high-quality nominations for the \$500,000 Lemelson-MIT Prize each year. The goals for the prize aimed to have 20 new nominations and two women nominees. The nomination pool resulted in a total of 45 nominations, with 40 from academia and five from the private sector. Thirty-four out of the 45 nominations were new nominees and two female nominees placed in the top 12.

The screening committee—comprised of MIT alumni and faculty, and members of the no-longer-awarded Lemelson-MIT Award for Global Innovation (to provide global perspective)—reviewed the 45 nominations and identified four finalists who advanced to the national jury. LMIT's national awards jury of influence makers from the scientific,

entrepreneurial/venture capital, and media industries met and selected the winner of the 2017 \$500,000 Lemelson-MIT Prize in mid-May. The winner, Professor Feng Zhang, inventor of the CRISPR gene editing technology and core member of the Broad Institute of MIT and Harvard, was announced in early September, prior to the EmTech 2017 Conference at the MIT Media Lab, where he was celebrated. His press announcement exceeded 27.17 million impressions, largely generated by social media (19.06 million). Total impressions attributed solely to traditional media (online, print, and broadcast) amounted to 8.10 million impressions.

### **Lemelson-MIT Student Prize Competition**

The national Lemelson-MIT Student Prize competition is open to graduate students and teams of undergraduate students that are selected based on their inventive work and the significance of that work to the US economy. The non-monetary student prize incentives include prestige, communication training, media training, and networking opportunities with other inventive students, judges, past winners, the Lemelson network overall, and a push for significant media coverage to bolster the winners' trajectory. The prize categories remained the same for 2018: "Cure it!" (healthcare); "Use it!" (consumer devices); "Eat it!" (food/water and agriculture); and "Drive it!" (transportation).

The Lemelson-MIT Student Prize recruiting efforts reached 190 applications, an increase from last year's 140 applications, and a near achievement of the goal of 200 applicants per year. The "Drive it!" category and the "Cure it!" undergraduate subcategory saw increases in applications, with nearly three times as many applicants to "Drive it!" from the previous year and double the number of undergraduate "Cure it!" applicants. Representation by underrepresented minorities as a percentage of the total pool of applicants remained fairly stable for undergraduate applicants but increased from 11% to 14% for graduate applicants. Despite the overall increase in applications, there was a decrease in female graduate student applicants from 33% the prior year to 17% of the total graduate student applicants in 2018. However, representation of female undergraduate student team members increased from 26% to 37%.

Screening committees were formed to select graduate student and undergraduate student team finalists in the competition's four categories. These committees included experienced screeners from the Lemelson-MIT Student Prize and experts in health technology, consumer products, transportation, and food and agriculture. Finalists submitted videos of their inventive work and additional letters of support. The same national jury that selected the winner of the \$500,000 Lemelson-MIT Prize then reviewed and selected the winners of the \$15,000 graduate prizes and \$10,000 undergraduate team prizes. Six prizes were awarded in April of 2018 with awards going to four graduate students and two undergraduate student teams. No prizes were awarded this year to the "Eat it!" and "Drive it!" undergraduate team subcategories, as the jury felt that the finalists in those two subcategories were not quite at the level of Lemelson-MIT Student Prize winner standards, and of past winners. Three of the six winners the jury selected were from MIT. The six winners of the 2018 Lemelson-MIT Student Prize are:

Tyler Clites, "Cure it!" graduate student winner from MIT, developed a new approach to amputation called the Agonist-antagonist Myoneural Interface (AMI)—a system comprised of a novel surgical technique for limb amputation

and a complementary prosthetic control system. The AMI system is unique in its ability to provide patients with proprioception—the sense of the relative positioning of their prosthetic body parts in space—which is not possible in the current clinical standard of care.

Treyetech (team members: Kali Barnes, Stephanie Cai, Akash Chaurasia, Conan Chen, and Eric Chiang), "Cure it!" undergraduate team winner from Johns Hopkins University, developed a device to help surgeons successfully perform corneal transplant surgery. About three million Americans are at risk of corneal diseases, but surgeons are hesitant to perform the only procedure that can restore vision to 20/20 because of a challenging and sometimes unsuccessful portion of the operation that involves unrolling a delicate cornea tissue graft into a patient's eye.

Guy Satat, "Drive it!" graduate student winner from MIT, invented All Photons Imaging—a system that can image through dense fog, intended for augmented driving, autonomous vehicles, drones, airplanes, and helicopters. The system computationally removes dense fog from camera images in order to produce an image as if the fog were not there.

Maher Damak, "Eat it!" graduate student winner from MIT, developed a polymer additive that can be mixed with pesticides and other agricultural sprays to help them adhere to plants more effectively. Plants currently retain only a tiny portion of chemical sprays, resulting in runoff that leads to the contamination of soil, ground water, and surface water. Maher's invention would result in the use of 10 times less pesticides and could save farmers 10–20% of their total production costs.

Kayla Nguyen, "Use it!" graduate student winner from Cornell University, invented the EMPAD—a fast and highly efficient detector that enhances imaging for a range of microscopic applications. The detector is a special camera designed to detect and display electrons in microscopes at a much greater level of detail than existing versions. This detailed data can be utilized to make faster computers, more effective drugs, more advanced electric cars, and can even aid with art conservation.

AssistENT (team members: Melissa Austin, Eric Cao, Talia Kirschbaum, Theodore Lee, and Harrison Nguyen), "Use it!" undergraduate team winner from Johns Hopkins University, developed N-Stent—a comfortable and discreet nasal dilator designed to improve breathing for those who suffer from nasal obstruction. Unlike existing external nasal dilators, N-Stent is inserted into the nose, making it undetectable and comfortable for wear during the day or night.

Winners were announced through a national press release and in coordination with their respective schools on April 10, 2018. The Lemelson-MIT Student Prize continued to serve as a highlight of LMIT's recognition activities, with more than 138 million total media impressions. LMIT celebrated the winners at EurekaFest, which was held on June 20–22, 2018 at MIT.

### **Inspiring Youths**

LMIT's activities to inspire youths to lead creative lives through invention include Invention Education, InvenTeams, Junior Varsity InvenTeams (JV InvenTeams), Community Engagement, and EurekaFest.

### **Invention Education**

LMIT's invention education activity consists of collaborations with partners, such as national youth organizations, to promote inventive thinking and doing. This is also the arena in which LMIT pursues new research, opportunities, and engages with the MIT K-12 STEM community. New partnerships and opportunities for invention education are described further below.

### **InvenTeams**

InvenTeams, LMIT's premier hands-on invention experience for teams of high-school students, educators, and mentors, continued as a national program. LMIT announced the selection of 15 InvenTeams, representing 12 US states on October 24, 2017.

InvenTeams' projects were underway in November with teams completing research and outreach to beneficiaries/customers. Prototypes were built and iterated from December through late April, when teams began to think about EurekaFest.

Recruitment for 2017-2018 InvenTeams resulted in 43% female student representation and 67% of schools with free or reduced-price lunch. There was also a JV InvenTeam at the same school as an InvenTeam for the first time. This occurred at Energy Institute High School in Houston, TX. One former JV InvenTeam grantee was selected as an Excite Award recipient in 2018. The teacher attended EurekaFest in June, therefore, is eligible to submit an InvenTeam grant application in September 2018.

LMIT continued programmatic InvenTeams activities. These include:

- Conducted all 15 InvenTeams site visits prior to the end of 2017 (site visits early in the grant cycle offer guidance to teams for successful start-up of the invention process)
- Exhibited and presented at Association for Career and Technical Education and the National Science Teachers Association regional conferences in fall 2017 to raise educators' awareness of LMIT's invention education programmatic offerings (JV InvenTeams, InvenTeams, and invention education in general)
- Held trainings in communications/public relations and "finance 101" using Adobe Connect video conferencing with the teams
- Supported InvenTeam Master Teachers in attending site visits/mid-grant technical reviews for InvenTeams
- Ensured teams held mid-grant technical progress reviews that were open to their respective communities

### **Junior Varsity InvenTeams**

The Junior Varsity InvenTeam (JV InvenTeam) initiative has traditionally run from January through June each year with students served primarily in 21st Century Community Learning Center (CCLC) sites in Massachusetts; Houston, Texas; Oregon; and Los Angeles, California.

However, 2017–2018 was a transition year in which some grantees were interested in summer and fall activities, too. Fewer CCLC sites participated this year with Citizen Schools/Boston area entering the grantee pool. Piloted activities included working with all feeder middle schools in one southern California school district (Tustin Unified School District) and continued work with feeder schools to the Antelope Valley High School District (also in southern California). LMIT piloted JV InvenTeams with middle school students in Cambridge, MA, through the Frisoli Youth Center during April vacation. This week-long camp imbedded math concepts to support the JV InvenTeam activity. LMIT partnered for a second time with Boston College for a week-long February camp for middle school students in Waltham, MA. Two new geographic locations were tested, specifically: Camden, NJ, with Camden Dream Center—a Cisco sponsored out-of-school time organization—and a middle school in Baltimore, MD, with additional support by the Center for STEM Outreach in the Whiting School of Engineering at Johns Hopkins University.

Forty JV InvenTeam grants went to schools in California, Massachusetts, Oregon, and Texas. All schools and organizations served student populations that are high free and reduced-price lunch (FRPL) eligible. Twenty-one teams were middle schoolers and 19 teams were high schoolers. Two hundred ninety-five students and 72 educators participated in JV InvenTeam activities.

Work also continued with the kitting contractor to utilize a new order system to simplify JV InvenTeam invention kits ordering through the website by non-LMIT grantees. The new ordering system also enabled LMIT to view orders and shipments both inside and outside of LMIT grantees. Eight free JV InvenTeam activity guides were available on the LMIT website for educators to download worldwide. Downloads continue to increase over time as a result of direct marketing efforts launched in the spring.

### **Community Engagement**

LMIT started a community engagement campaign in 2011 with the goal of creating awareness among political and community leaders about the InvenTeam projects happening in their community and the support needed from the community to sustain the projects throughout the school year and beyond. The success of this campaign is dependent upon consistent outreach on an ongoing basis. LMIT sends a letter to political leaders at the start of the InvenTeam grant period. The schools receive a certificate of appreciation citation from political leaders in response to LMIT's letters. This recognition helps excite and encourage InvenTeams. A list of local officials and supporting mentors/local organizations are included in the final grant application for InvenTeams. Community engagement efforts for this year focused on letter and email campaigns that encouraged recognition of the InvenTeam, which were executed in late January in anticipation of the letters arriving on the desks of elected and school officials during February's National Inventors Day. Emails were sent to school administrators and additional supporting local companies that were listed in the application. A second letter and email campaign in mid-May invites special community members, partners, and elected officials—who either participated at their school events or gave recognition/donations to the teams—to EurekaFest. Highlights from the campaign were:

- Garey High School InvenTeam from Pomona, CA built Heart & Sole—a device that monitors the health of the foot—to prevent the risk of future damages from diabetes. The team came up with this idea to help a family member of one of the students. This InvenTeam project garnered enthusiasm and support from the community, including *La Nueva Voz*—Pomona’s community newspaper that produced a musical fundraiser in April raising nearly \$3,000 to help the team with travel expenses to EurekaFest. The InvenTeams students created their own video to thank the community for their support and the students were so inspired by the experience that they want to continue working on Heart & Sole after EurekaFest.
- Northeast High School’s InvenTeam was awarded a proclamation by Commissioner Chip LaMarca declaring April 4, 2018 Northeast High School InvenTeam Day in Broward County, FL. The local NBC and ABC affiliates featured the InvenTeam’s invention project in May.
- Nine total governors and elected officials sent certificates of recognition to the InvenTeams for the award of the InvenTeam grant and to support their work in creating an invention prototype.

### EurekaFest 2018

LMIT held its 12th annual EurekaFest event on June 20–22, 2018 to celebrate InvenTeams and the Lemelson-MIT Student Prize winners. Changes were made to accommodate a decreased budget for the event.

EurekaFest is a multi-day celebration designed to establish a tradition of invention through activities that inspire youths, honor role models, and encourage creativity and problem solving. It is comprised of a series of events held at MIT over two days that serves as a capstone for InvenTeams students. It is also training for prospective InvenTeams educators. New last year, LMIT held a series of workshops for student prize winners, such as Financing Your Invention/Business, and How to Market Your Venture. The two days included presentations by InvenTeam students and public showcase of inventions from InvenTeams and Lemelson-MIT Student Prize winners. LMIT’s faculty director, Professor Michael Cima, presided over the awards ceremony on June 20, 2018. Carol Dahl, the Lemelson Foundation’s executive director, and Eric Lemelson, a foundation board member, attended EurekaFest and spoke on behalf of the foundation.

LMIT discontinued its partnership with the Museum of Science, Boston for the daylong design challenge called Duck ‘n Hover on the Saturday after EurekaFest. Instead, InvenTeams participated in a mini-design challenge on the MIT campus on June 22, 2018.

During the awards ceremony, Lemelson-MIT Student Prize winners did not present to the audience of InvenTeams, as in past years. Instead, they were featured in a short video that included two-minute descriptions of their winning inventions. They continued to watch and ask questions during InvenTeam’s presentations. Excite Award recipients (finalists for InvenTeams grants) participated in active learning workshops. They were also able to learn about the InvenTeams experience from teachers and students. Surveys

were conducted at the end of the event to collect information on InvenTeam student and educator experiences.

LMIT marketed EurekaFest in local events calendars, letters to local businesses, on-campus promotions intended to reach the broader MIT community, and sponsorship on Boston’s National Public Radio station to announce the event to the greater Boston community.

### Partnerships and New Activities

#### MIT EmTech

LMIT established a partnership with *MIT Technology Review* in 2013 to provide an annual celebration of the Lemelson-MIT Prize winner at a peer-level event. Feng Zhang, the James and Patricia Poitras Professor of Neuroscience, was lauded on the first night of EmTech 2017, which included a presentation and fireside chat with *MIT Technology Review*’s editor, remarks from Dahl, and a celebratory reception. The partnership and event were deemed successful, with more than 800 people in attendance including around 61% of MIT’s senior leadership, directors, and vice presidents.

The 2018 winner, who was selected in early June, will be announced on September 12, 2018 and celebrated later that evening at EmTech 2018. The celebration will again include a brief presentation, fireside chat with the editor, presentation of the prize, and a reception.

#### Dewey Square Group

LMIT re-engaged with the public relations firm Dewey Square Group on January 1, 2018 for a national media awareness campaign for the Lemelson-MIT Prize winner and Lemelson-MIT Student Prize winners.

#### Invention Education New Activities and Opportunities

LMIT staff spent time outlining a potential partnership effort with Beyond Benign, which is interested in creating a JV InvenTeam activity guide that addresses green chemistry. The staff also worked to envision potential joint efforts with the New England Biomimicry Institute.

LMIT also launched a new fee-based professional development offering on the west coast on July 12–14, 2017 (on the campus of the University of California, Irvine) and on the east coast on July 24–26, 2017 (on the MIT campus) in which a total of 95 educators participated. A new invention education webinar series for educators interested in using the JV InvenTeam activity guides in their classrooms was launched in October 2017 and carried through April 2018. The webinar series was free and consisted of “minds-on” and “hands-on” topics.

An analysis of the experiences of six K-12 students that participated in the InvenTeams initiative were inscribed into two journal articles submitted for publication highlighting the InvenTeams’ positive impact. The first article written by the program’s executive director Stephanie Couch and the program’s invention education officer Leigh Estabrooks was published April 2018 in *Elsevier*. The article, [“Failure as an Active Agent](#)

in the *Development of Creative and Inventive Mindsets*,” explores the ways in which high school student inventors define the terms failure and learning from failure. It also explores what they learn about creative failure while inventing that may be applicable to other contexts. The study’s findings were taken from the national InvenTeam initiative and its 14-year history of helping young people from diverse backgrounds develop working prototypes of their inventions.

### Administration

The close of 2017 marked the end point in the Lemelson-MIT Program’s interim grant period of 18 months. It was also a time during which a new executive director was brought on board. LMIT will continue to celebrate, inspire, and educate its target audiences starting January 1, 2018—the conventional four-year grant period.

Agreements were also reached to relocate the Lemelson-MIT Program office in February 2018 from Room 10-110 to 222 Third Street inside the American Twine Building—a vibrant part of East Cambridge where external partnerships can flourish and deliver a lower indirect cost.

### Finances and Funding

LMIT adjusted the date range for its 2018 fiscal year to January 1–December 31, 2018. The current funding level from The Lemelson Foundation for this fiscal year is \$3,445,119.

### Personnel Changes

Three hires were made in 2017–2018. Adam Santone was hired to replace Liza Goldstein as the JV InvenTeams coordinator. Zoe Vanderschmidt was hired into a new program assistant position that is split between supporting Stephanie Couch and the Invention Education programs. Emily Meehan was hired to replace Gayle Golding as the administrative assistant for LMIT. Kayley Bolstad Brown, Program Assistant II, resigned on June 22, 2018 and a search is underway to refill the position.

### Future Plans

The Lemelson-MIT Program plans to:

- Continue to carry out the program initiatives in accordance with the four-year grant proposal with The Lemelson Foundation
- Increase diversity in recruitment efforts for the prize program
- Cultivate additional sources of funding and partnerships that support expansion of the program
- Continue marketing efforts surrounding the availability of JV InvenTeam activity guides and kits
- Offer ongoing professional development webinars and workshops for middle school and high school educators

- Work with Cambridge, schools, and other organizations to develop a Pathway to Invention for young people in Cambridge and other cities where InvenTeams and JV InvenTeams are supported in the school culture
- Coordinate efforts with the National Association of Community College Entrepreneurship and the California Community Colleges Doing What Matters for Jobs and the Economy initiative to offer the first invention education convening in Burlingame, CA on September 20–21, 2018
- Document Lemelson-MIT’s programmatic efforts and engagement in research partnerships that help LMIT advance understandings of invention education
- Continue national media campaigns to bring awareness of inventors/Lemelson-MIT award winners

**Stephanie Couch**  
Executive Director