FULL-STEAM AHEAD: Beall and Brown design exhibits and programs that draw kids to engineering and computer science at the Museum of Science, Boston.

Curating Curiosity

Say you're taking your daughter to a science museum. Do you expect she'll be drawn to the engineering and computer science exhibits? She will if **Lydia Beall** '02 has anything to do with it.

Beall is the newly appointed manager of the Tech Studio at the Museum of Science, Boston, a space under development that aims to introduce visitors—especially kids from age seven and up—to the fun of computer science. For the past dozen years, Beall has run the engineering design workshop at the museum.

"She's really creating a new standard in science museums for science engagement," says Paul Fontaine, vice president of education for the museum. "Lydia is an incredible inventor of original activities and environments for learning engineering." Now the museum is looking to her to help them spark for visitors the same excitement about computer science and other technology.

"I think one of the challenges both of these fields are faced with is people think of them as being too complicated for younger kids, so we want kids to get this on their radar sooner rather than later," says Beall.

Engaging Girls

Lydia Beall shares these tips for encouraging girls' interest in science and math:

Engage girls in play that fosters spatial learning. Traditional "girls' " toys—such as dolls, stuffed animals, and tea sets—develop social skills, while "boys' " toys encourage spatial learning. Both boys and girls can benefit from toys that develop social and spatial reasoning. Girls should be encouraged to play with blocks and building sets like Kapla blocks, K'Nex, and Legos. Research suggests that playing with construction sets can be an early indicator of students' success in academic subjects like geometry and math.

Examine the messages your daughter receives about science and math. Often, I'll overhear mothers say things like "I was bad at math, too" or "An engineering project? Let me get your dad." Such statements may send a message to girls that certain fields are not for them.

Engage your daughter in practical applications of science and technology in your daily lives. Have your daughter help with a home repair, a computer update, fixing a broken toy, or assembling furniture. Point out the connections between what you're doing and what scientists and engineers do—using specialized tools, taking measurements, repurposing a material in a creative way, etc.

Show that science is for girls. Check out books and biographies about women scientists and talk about research and new technologies being developed by women.

Encourage your daughter to experiment and take risks. Girls can often be discouraged if they don't "get" something right away. Scientists and engineers learn from mistakes and failures and rarely get something right on the first try. Being willing to experiment with a new idea builds problem-solving skills and fosters creative confidence.

Beall recommends the guide *Science Can Take Her Places! Encouraging Your Daughter's Interests in Science, Math, and Technology* by Sally Ride (Sally Ride Science), a resource that influenced her list.

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And she is particularly focused on getting girls involved. "A lot of times if someone is lucky enough to take a computer science or engineering course before college, they do it in high school—and a lot of data shows that girls fall out of the math-science pipeline around fourth grade," she says. "We're trying to make sure girls know that engineering and computer science are things they can be successful in."

The museum—which drew almost 1.5 million visitors last year—is doing that in part by making its engineering and computer science exhibits appealing to kids of all sorts, and emphasizing the fun and creativity involved in pursuits that are too often depicted as dry and precise. For Beall and colleague **Christopher Brown** '09, an interactive software developer working on the museum's Science Behind Pixar exhibition, opening in June, creativity is a key, if often overlooked, component of engineering and computer science.

The exhibition explores how Pixar Animation Studios merge computer science, technology, and math with artistry. Brown hopes it will encourage people to see just how creative technology fields can be.

"STEM"—science, technology, engineering, and math—"is everywhere, and I don't think people realize that. It is in the music you listen to, the car you drive, the video games you play, the sports you cheer for, the movies you watch, the advertisements you look at, the buildings you live in, the phones you call, and the computer you type on," says Brown. "Almost no meaningful product was built solely from one domain of knowledge. Most things require a team of artists, designers, engineers, scientists, mathematicians, and more."

Activities in the museum are also influenced by the notion of STEAM, a recent twist on STEM that adds art to the mix. "It's the new push, incorporating elements of design. And that's important. If you're designing a car, it has to look good or no one is going to buy it. It's the human dimension of design," says Beall.

Vital to drawing kids into engineering and computer science is designing accessible, engaging exhibitions, both say.

"We're really cognizant about the language we use," says Beall. "When we say we're developing engineering projects, we don't say 'build,' we say 'create,' because create is a word girls already relate to from art and design."

The look of exhibition space is deliberate, too. "When you think of technology exhibits, they're gray, blue, metallic, angular—we do orange, green, purple, rounded shapes. I have a lot of things that are pink, too. The boys are going to build no matter what. But it might bring girls over who were on the fence. And it's a message to parents, too. If parents had a bad experience in math or science, they might be hesitant to take their daughters over."

The Tech Studio is expected to open next year. For now, activities are on the floor, and Beall and colleagues are soliciting feedback. They're looking into teaching both the hardware and software ends of computer science, including electronics and circuitry, subjects kids aren't typically exposed to in elementary school.

"Lydia and Chris are bringing originality, energy, and creativity to both of their fields that's transforming this museum—and the museum professionals who come to visit are really blown away by what they see these folks do," says Fontaine. Months and even years go into developing exhibits that are engaging and intuitive, thanks to prototyping, iterative design, visitor feedback, and experimentation.

"It looks simple, but there's a lot that happens behind the scenes—and that's what Lydia and Chris do," Fontaine says.

—KATHLEEN MCGARVEY

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LIVES

Pulling Teeth?

Last summer, the Harvard School of Dental Medicine gave special recognition to **John Manhold** '41, who returned to the school on the 70th anniversary of his graduation. Witness to a long stretch of the history of modern dentistry, Manhold shared many of his observations in an essay in the summer 2014 edition of the *Harvard Dental Bulletin*.

Manhold spent much of his career as a dental reformer. A pioneer in the now established subspecialty of psychosomatic, or biobehavioral, dentistry, he recalled early, skeptical reactions to his first studies. He persevered, publishing a textbook, *Introductory Psychosomatic Dentistry*, in 1956. "Dentistry was hesitant to accept my studies, while medicine and psychiatry embraced them," Manhold says. He later became a fellow in the Academy of Psychosomatic Medicine as well as president of the group.

After dental school, he returned to Rochester for a fellowship in pathology. He worked with the School of Medicine and Dentistry's founding dean, George Whipple, briefly, before serving in World War II. After the war, he taught at Tufts and then at Washington University. In the mid-1950s, he left St. Louis for New Jersey, to become one of the first faculty members at the new Seton Hall College of Medicine and Dentistry. For 31 years, he remained at the school, now the Rutgers School of Dental Medicine, helping establish and leading its pathology department and serving as dean.

HONORED: Manhold, pictured with his wife, Kit, was recognized by Harvard School of Dental Medicine for his role as a reformer.

At Rutgers, Manhold pressed for greater integration of dental and medical education. "Numerous physical problems provide early indicative symptomatology in the oral cavity. If a dental practitioner is alert and knowledgeable, he or she is in a prime position to discern a budding medical problem," he says.

Dental and medical education have indeed grown more integrated over the years. Says Eli Eliav, director of the Eastman Institute for Oral Health, "The two professions use similar bases of knowledge and the separation between them is quickly shrinking." Faculty and residents at the Eastman Institute work closely with multiple departments within the Medical Center.

Manhold says he's "gratified" by the changes in modern dentistry. "Recognition by one's peers always is most heartwarming," he adds, "and even more so when you have been away from the profession for some time."

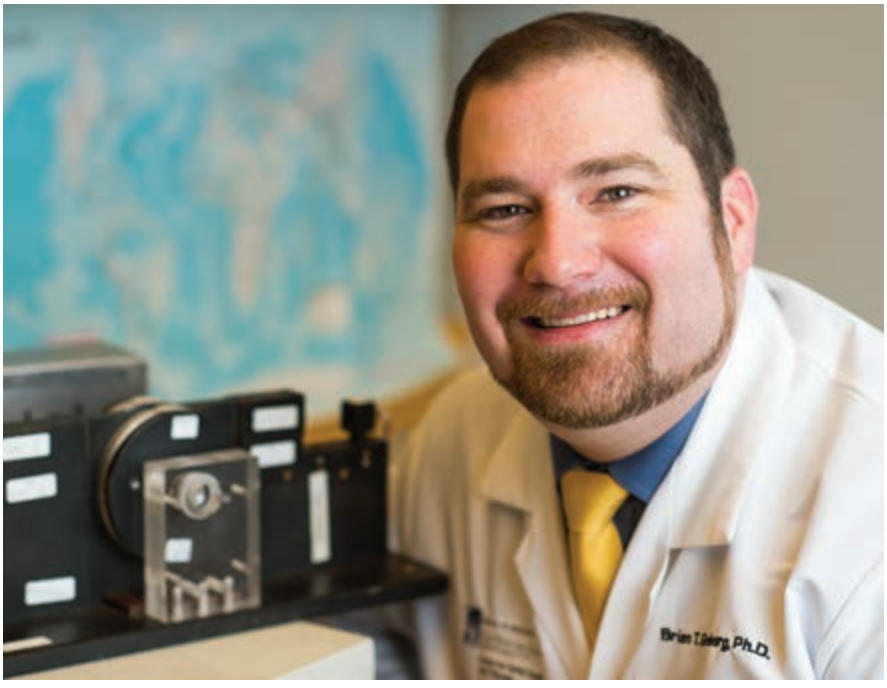
—KAREN MCCALLY '02 (PHD)

A Small, Plastic Box that Could End Malaria

Brian Grimberg '96 wants to end malaria. It's a team effort, to be sure, but he says it can be done, and he hopes to play a major role.

It's an ambitious goal. The World Health Organization estimates that in 2013, there were nearly 200 million cases of the illness worldwide, and well over half a million deaths, overwhelmingly among children under the age of five. That's almost 50 percent fewer deaths than in 2000, suggesting that international efforts to prevent, treat, and control malaria outbreaks have made enormous headway. But as with many global health challenges, problems with the delivery of care have made further progress elusive.

Grimberg hopes that will change in the next decade. He's an assistant professor of international health at Case Western Reserve University and an expert on the cell biology of malaria parasites. In the past couple of years, he's been the principal investigator on a project that has led to the development of a handheld, rapid malaria detection device. Called the Rapid Assessment of Malaria, or RAM, it would allow someone with little specialized training to screen entire villages for the illness in a matter of hours.



LEADING GLOBAL THINKER: Malaria, poverty, and underdevelopment are deeply intertwined, says Grimberg. Grimberg was named one of 100 Leading Global Thinkers of 2014 by *Foreign Policy* magazine.

Last fall, *Foreign Policy* magazine named Grimberg one of 100 Leading Global Thinkers for 2014 in recognition of his work.

The RAM device presents a "unique opportunity," say John Vulule, chief research officer at the Kenya Medical Research Institute in Nairobi, and a partner of Grimberg's on the project. "With this device we can rapidly screen large populations in an inexpensive way, localizing the disease so as to focus treatment and control."

The RAM looks simple enough: a small plastic box with some magnets, a laser, and a battery inside. It works on a simple principle as well. Malaria is caused by a parasite that relies both on humans and certain types of mosquitos as its hosts. When a mosquito infected with the parasite bites a person, the person becomes infected as well.

Malaria parasites are filled with iron, which they ingest from their host's hemoglobin. As a result, the parasites are highly magnetic. Using a simple drop of blood diluted with water, the RAM shines a laser on the sample. If malaria parasites are present, iron-rich hemozoin crystals align, blocking the amount of light that can shine through the sample. The device detects not only whether the parasites are present, but also the level of infection.

The RAM delivers results within minutes, which is critical, says Grimberg. "That's really the whole benefit of this technology. A lot of people can be walking around with malaria but not know it. But they're acting as carriers, transmitting the malaria to other people in their community." Older adults often carry low levels of the infection, but don't feel sick. This is partly because they've built up a level of resistance. But the parasite still lives close to the surface of the skin—close enough to infect a mosquito, which will then go on to bite and infect other people, often very young people, who have little to no resistance to the parasite, Grimberg explains.

Improved detection is a major area of research now. Current methods to control the disease include the use of herbicides, which present their own dangers, vaccines of varying effectiveness and availability, and testing performed at health clinics, at the initiative of individuals who suspect they may have contracted the disease. Not only do people often have to travel great distances to reach those clinics, but the tests require trained clinicians to administer them, as well as refrigeration, making them far more costly than a RAM test, which Grimberg estimates costs 20 cents per test, versus about 50 cents for rapid tests conducted at clinics. He also claims RAM tests have so far delivered more accurate results in one minute than have existing tests that take more than one hour to yield results.

The device is now in the clinical trial phase. Grimberg has already overseen a round of trials in Peru. "We learned a lot about how we needed to improve the device for field use by nursing staff," he says. The RAM is built to be durable and waterproof, and Grimberg says his team has worked to make it even more so. Starting this year, he and Vulule are collaborating on a five-year, $2.25 million dollar grant from the National Institutes of Health to test the improved device in six villages across Kenya.

It's been hard to keep the fight against malaria in the limelight. "More people die of malaria every three days than have ever died of Ebola," Grimberg says. And malaria has global as well as local consequences. People who survive with malaria feel persistently sick. "When people feel sick all the time, it makes it hard to work, and for communities to grow and expand, and for countries to grow out of poverty."

—KAREN MCCALLY '02 (PHD)

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