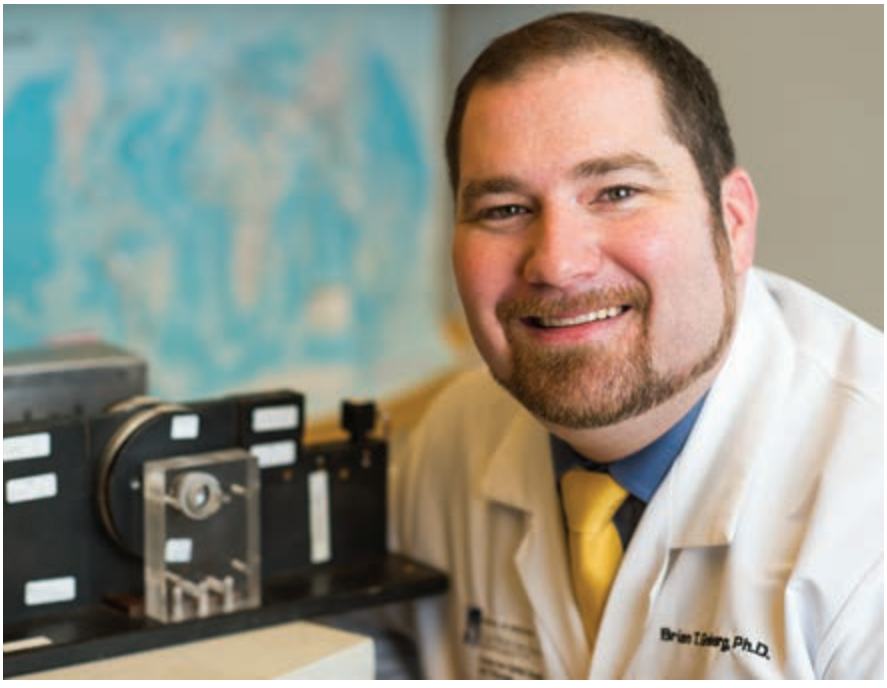
A Small, Plastic Box that Could End Malaria

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)

JASON MILLER/AP IMAGES FOR *ROCHESTER REVIEW*