Mosquito-repelling light barriers show promise in reducing spread of malaria

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(PhysOrg.com) -- As an experimental physicist, Szabolcs Marka uses data analysis and diagnostics to enhance the reach of laser equipment to detect cosmic gravitational waves. Now he is using his expertise to target something far more earthbound: the common mosquito.

Márka is developing a "light shield" consisting of light barriers that can repel mosquitoes by throwing off the insects' ability to navigate and detect humans via light and heat. His efforts have been rewarded with a $1 million grant from the Bill & Melinda Gates Foundation, one of whose missions is to eradicate malaria. The two-year Grand Challenges Explorations grant is Márka's second from the foundation, making him one of only five grantees to receive the additional funding to continue his promising work. He was awarded an initial $100,000 in 2008.

"Fundamental science—astrophysics, relativity, gravity—is like art," says Márka, an associate professor of physics. "Is it beautiful? Yes. Is it useful? Yes, but rarely directly." So as he advanced in his physics studies, first as a Ph.D. student at Vanderbilt University and then a post-doc at California Institute of Technology, he wondered how to apply his expertise to something that could directly help people. "I wanted to do something that improves the lives of people and is important for humanity right now," he says.

Márka is from Hungary, and he recalled that one of his college dorm mates at Kossuth Lajos University had contracted a fatal case of malaria on a visit to Uganda. He knew the impact of the disease in Africa, where

it accounts for 20 percent of all childhood deaths. A father of four, Márka wondered, if he lived in Africa, how many of his children would survive early childhood. After the basic idea was analyzed with his research partners at Columbia—his wife, associate research scientist Zsuzsa Márka, and physics graduate student Imre Bartos—they started experimenting with mosquitoes' sensory perception. The team is working to develop a device that projects a light barrier that can be strategically positioned by a bed, window or door—any place mosquitoes can hide. "Light is very easy to manipulate and shape to many geometries with optics," Márka says.

The leap from black holes to insect-guiding lasers isn't as improbable as it might sound at first. "People concentrate more on studying mosquitoes' olfactory or chemical sensors, but light or heat seemed like an interesting area," he says. "Overloading, damaging or confusing this sensory system can prevent mosquitoes from reaching their prey."

On a recent day in his lab in Pupin Hall, Márka placed mosquitoes in a test chamber through which he and his team shot an infrared light ray. The mosquitoes, unaware of the barrier, flew toward it but stopped and turned back upon reaching it. "The mosquitoes are probably scared," Márka explained. "They could go through the light barrier without getting hurt, but they don't. That's the beauty of it because you don't have to necessarily kill them. You just make them go away."

While a field prototype for the anti-mosquito light barrier is probably several years away, Márka's team is studying variables such as shape, intensity, color and their effects on mosquitoes. Since all insects have highly developed sensory perception, Márka's research could be applied to other insects like flies, wasps or even bedbugs.

Building things and solving problems is hardly new for Márka. As a child

growing up in Hungary, he constantly pestered his parents, both high schools teachers, with questions; in response, they simply handed him science textbooks. He made his first telescope from scratch at age 13, and today continues to come up with ideas and plans in his spare time for inventions that could rectify “things that are not right,” as he puts it. One example: a stroller that goes up the stairs. The motivation is part problem-solving, part fun.

“Wherever I look I see new ideas and possibility for progress,” he says. “Some turn out to be impossible, some are prohibited by the economy, but some do work. These are worth thinking of.”

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