

Monitor | Zap!

Medical technology: Researchers are devising laser-defence systems to shoot down mosquitoes and prevent the spread of malaria. No, really

TOWARDS the end of the cold war Ronald Reagan announced plans to use powerful lasers to shoot down any incoming intercontinental ballistic missiles that the Soviet Union aimed at America. The lasers were real but the plan was fanciful. Scientists now propose a more modest system, aimed at insects rather than nuclear warheads. They think lasers could be used to zap the mosquitoes that carry malaria, a disease which kills more than a million people each year, most of them children, and debilitates hundreds of millions more.

Researchers at Intellectual Ventures, an innovations company established by former Microsoft executives in Bellevue, Washington, have developed what they call a photonic mosquito fence. It has a series of posts, each of which is equipped with a cheap camera and a light bulb (which will be swapped for a light-emitting diode in future versions). The cameras are connected to a central computer. When a camera detects movement, the computer analyses it to see whether it is consistent with the behaviour of a mosquito. If it is, then the computer trains a laser onto the insect and blasts it into oblivion.

Jordin Kare, an astrophysicist and a former scientist on the missile-defence programme, leads the effort. He says it is possible to detect different species of mosquito because their wings beat with a distinctive frequency. He is aiming for *Anopheles gambiae*, the species most effective at spreading plasmodium, the parasite that causes malaria, when it bites people to feed on their blood.

Dr Kare imagines that the mosquito fence will be set up around a hospital or a village in a malarial area. His experiments with prototypes have shown that posts spaced 100 metres apart work best. The lasers would target only mosquitoes, although Dr

Kare says some work still needs to be done to ensure that the laser is safe for people and animals. Although he will not give an exact figure, Dr Kare says he built his prototype from parts bought at surplus stores and on eBay, and has calculated that the cost will be comparable to that of supplying all the inhabitants of a medium-sized village with bed nets.

Another, somewhat simpler, approach is being developed by Szabolcs Marka, an astrophysicist, and his colleagues at Columbia University in New York. Dr Marka has created a curtain of invisible light that mosquitoes cannot penetrate. He uses a common diode laser, a simple lens and a power supply to generate an infra-red barrier that can cover a door or window. Mosquitoes are very sensitive to heat and light (indeed, their sensitivity to infra-red radiation helps them sense the presence of food, in the form of people). The idea is that when a mosquito encounters the infra-red curtain, its senses are overwhelmed and it flies away. Tests have shown that the curtain kills some mosquitoes that fly into it.

Even if a mosquito somehow managed to penetrate such a barrier, a second light curtain set up around a bed, for example, would provide further protection. Dr Marka envisages two or three light curtains in a home: one at the door, one around a sleeping person and one surrounding the area in which mosquitoes typically hide (under the thatched roof of a hut, for example). Dr Marka calculates that if there is a 6% chance that a mosquito will penetrate a light curtain, and a hut contains four curtains, then only one in 100,000 mosquitoes will be able to spread malaria. Dr Marka, whose research is funded by the Gates Foundation, says that a prototype of his machine costs a little over \$100.