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Science : Discoveries

Superfast Laser Turns Virus Into Rubble

By Alexis Madrigal 11.01.07



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Researchers are using this ultrashort-pulse laser to destroy the protein shell of viruses. They say the laser frequency will not harm human cells.
Photo: Kong-Thon Tsen
 A physicist and his biologist son destroyed a common virus using a superfast pulsing laser, without harming healthy cells. The discovery could lead to new treatments for viruses like HIV that have no cure.
 "We have demonstrated a technique of using a laser to excite vibrations on the shield of a virus and damage it, so that it's no longer functional," said **Kong-Thon Tsen**, a professor of physics at Arizona State University. "We're testing it on HIV and hepatitis right now."
 Tsen and his son Shaw-Wei Tsen, a pathology student at Johns Hopkins University, came up with the idea while strolling in the park and discussing the need for antiviral treatments that go beyond vaccinations. Tsen senior has long experimented with ultrashort-pulse lasers (USPs), devices increasingly used outside of physics.
 Raydiance, a USP laser manufacturer, [signed a deal](#) with the FDA in July to explore laser therapies. As Wired News [reported earlier this year](#), an FDA official estimated there could be a hundred medical uses for USP lasers, from common laser eye treatments to cell-by-cell tumor ablation.
 In the latest research, Tsen and his son demonstrated that their laser technique could shatter the protein shell, or capsid, of the tobacco mosaic virus, leaving behind only a harmless mucus-like mash of molecules.
 The laser shattered the capsid at low energy: 40 times lower, in fact, than the energy level that harmed human T-cells. Other types of radiation, like ultraviolet light, kill microbes [on produce](#), but would damage human cells.
 The virus-deactivating laser works on a principle called forced resonance. The scientists tune the laser to the same frequency the virus vibrates on. Then they crank up the volume. Like a high-pitched sound shattering glass, the laser vibrates the virus until it breaks.
 The USP laser releases energy in **femtosecond** pulses -- one millionth of a nanosecond -- at a time.
 "The extreme brevity of these pulses is creating a physical effect that traditional lasers and other types of non-laser approaches can't do," said Scott Davison, president of the venture-backed USP laser company, **Raydiance**. "What we see is a new wave of exploration and discovery in applying USP in a whole bunch of industries and applications."
 Unlike lasers used to burn through flesh in surgery, USP lasers don't generate a lot of heat. Tsen says the technology could provide immediate benefits for clearing viruses in blood stored in blood banks. Some viruses, like HIV, have a window during which they are very difficult to detect.
 "This technique will be very useful to disinfect all the viruses, known or unknown," Tsen said. "This will make blood transfusion very safe."
 The Tsens' technology has seen success only in test tubes. It must be tested in animals and then humans. Treatments are still far in the future. But with more strolls in the park, anything seems possible.

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