

Laser blasts viruses in blood

A father-son research team working from separate laboratory benches across the country has discovered a new use for lasers - zapping viruses out of blood. The technique, which holds promise for disinfecting blood for transfusions, uses a low-power laser beam with a pulse lasting just fractions of a second.

Johns Hopkins University student Shaw-Wei David Tsen says it was during a stroll in the park with his father that the idea was born. Tsen, an immunology researcher in the laboratory of T.C. Wu at Hopkins' Kimmel Cancer Center, sought a new method to rid isolated blood of dangerous pathogens, including the viruses HIV and hepatitis C. He says current techniques using UV irradiation and radioisotopes can leave a trail of mutated or damaged blood components.

Using ultrasonic vibrations to destroy viruses was one possibility, but his father, Kong-Thon Tsen, a laser expert at Arizona State University, had a better idea: Lasers, unlike ultrasound, can penetrate energy-absorbing water surrounding the viruses and directly vibrate the pathogen itself.

The researchers aimed a low-power laser with a pulse lasting 100 femtoseconds (10⁻¹³ second) into glass tubes containing saline-diluted viruses that infect bacteria, also known as bacteriophages. The amount of infectious virus within each cube plummeted 100- to 1000-fold after the laser treatment. "I had to repeat the experiment several times to convince myself that the laser worked this well," says the younger Tsen.

His laser is different from those emitting a continuous beam of visible light. "Our laser repeatedly sends a rapid pulse of light and then relaxes, allowing the solution surrounding the virus to cool off," Tsen says. "This significantly reduces heat damage to normal blood components."

Building on the idea that vibration wrecks a virus' outer shell, the scientists found that their low-power laser selectively destroys viruses and spares normal human cells around them, while stronger beams kill almost everything.

Father and son speculate that laser vibrations could destroy drug-resistant and -sensitive viruses alike.

Wu says that the technique his student developed "could potentially be used to control communicable diseases by giving infusions of laser-treated blood products."

The scientists published their results in the July 13 issue of the *Journal of Physics: Condensed Matter*. They will continue their studies using different viruses.

Says Wu, "We believe this work on bacterial viruses is promising, but the real test will be with more serious pathogens like HIV and hepatitis."

Source: Johns Hopkins Medical Institutions

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