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By Kerry Grens

NOTEBOOK

Filter my blood, please

December 2006

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It's World War III, vaccine shortages have plagued the country, and a suspicious-looking cloud hangs over the city. Bioterror has been a serious threat, and you wonder if



Aethlon Medical's blood filter Courtesy of Kerry Grens

maybe that cloud is full of pathogens, or perhaps it's just going to rain. Better not take a chance: You reach for your stash of Hemopurifiers, clasp one to your belt, plug it into your bloodstream, and sit down to watch the evening news while your blood is cleared of any viral interlopers.

That's essentially the vision of Aethlon Medical, a San Diego company that is building and testing the Hemopurifier. The device is a rolling-pin sized filter designed to capture a wide variety of viruses circulating in the blood. In Aethlon's laboratory CEO James Joyce points out the different versions his company is testing: one that sits on a tabletop pump, another that plugs into a dialysis machine, and even a smaller model designed for first responders to use in the field. "With this," explains Joyce, "you have the ability to have a countermeasure

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[against bioterrorism] while you're starting to figure out what the pathogen is."

While the applications for the blood filter might seem a bit far-fetched, the technology behind it is well established. It is a two-stage separation process: Viruses are filtered out of the blood and then they get stuck to the purifier so they don't return to the bloodstream. First, blood is pumped out of the body, either using a hemofiltration pump or a dialysis machine. It flows through a cartridge containing about 2,000 hollow fibers, each lined with 250-nm pores that allow viruses to exit the fibers and enter an affinity chromatography column lined with proteins called lectins, which grab hold of the viruses. As larger molecules and cells are blocked from entering the affinity column, they pass through the filter cartridge and return to the blood stream.

The lectins, specifically cyanovirin and griffithsin, bind tightly to glycoproteins on the surface of the viruses. Studies at the National Cancer Institute's Molecular Targets Development Program have shown that cyanovirin, originally isolated from blue-green algae, can bind to, and inactivate numerous strains of HIV and influenza. Griffithsin, isolated from red algae, also binds to HIV. The goal of the Hemopurifier is to filter out pathogens while they are still circulating in the blood, before they infect cells. "We think it could be very important in filling the voids in treating drug- and vaccine-resistant viral pathogens," says Joyce.

"It sounds pretty attractive and easy," says Tingyue Gu, an associate professor in the Department of Chemical and Biomolecular Engineering at Ohio University in Athens. "As a separation specialist, I would consider this workable." Gu says affinity interactions are strong enough to capture up to 99.9% of targets that pass through a column.

Aethlon tested the gadget on four dialysis patients at Apollo Hospital in Delhi, India, and the device came away "safe and well tolerated," according to the company. Researchers were able to simply plug the Hemopurifier into the dialysis machine and filter patients' blood for up to four hours at a time. The results have not yet been submitted to a peer-reviewed journal, and Joyce is working to get approval from the FDA to conduct clinical trials in the United States on the safety of the device.

Safety is one thing, and efficacy another. "You'll be able to clean blood," says C. David Pauza, a professor of microbiology and immunology at the Institute of Human Virology in Baltimore. "Whether

or not it's going to fight the disease is another question." He says the filter could be useful against some of the hematologic viruses, such as hepatitis or HIV, but it is unlikely to be effective against respiratory or enteric viruses. Pauza also questions whether a filter treatment could keep up with the regenerative capacity of a virus, as the filter would not be removing cells that are already replicating the virus. "It's pretty hard to predict the ultimate utility of something like this," he says.

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