Jon Gilbert Fox

Gregory Tsongalis in his lab at DHMC

NEW DEVICE MAY SPEED UP HIV TESTING IN THE DEVELOPING WORLD

A CHANCE ENCOUNTER HAS LED to the creation of a device that could speed up the detection of HIV in the developing world.

Axel Scherer, head of a nanotechnology research group at the California Institute of Technology, was serving as a visiting professor at the Thayer School of Engineering when he happened to come across the name of Greg Tsongalis, a professor of pathology at Geisel and director of molecular pathology at Dartmouth-Hitchcock Norris Cotton Cancer Center, while flipping through a pathology textbook. He got in touch with Tsongalis to talk about the clinical applications of an idea he had, and the two ended up working together to develop a small device that could test for HIV accurately even in areas with little or no electricity, high temperatures, and few health-care professionals.

Tsongalis said he thought the idea was "crazy," but with the help of a grant from the Gates Foundation, they're close to their goal. "Gates loved it and funded the project," says Tsongalis. "We went gangbusters from there."

Tsongalis believes the device will have a huge impact on developing countries where infectious diseases, such as HIV/AIDS, continue to take an enormous toll. According to the World Health Organization, in 2011 about 34 million people worldwide were living with AIDS, 70 percent (including almost three million children) in sub-Saharan Africa.

The device, which is a little bigger than a Rubik's Cube, is portable, runs on nine-volt batteries, and uses a freeze-drying process to keep blood samples and enzymes cold, and therefore stable. It is also fully automated and works quickly. A health-care worker does a finger stick to obtain a small blood sample—less than a drop is needed—and puts the sample in the device. The result is available in less than 40 minutes. With a rapid turnaround, patients can receive therapies at the same visit. The test is also very effective; it can detect as few as 50 copies of the HIV virus in one milliliter of blood (a little more than a tablespoon). The device can then transmit its data through smartphones.

The device runs a test, called reverse transcriptase polymerase chain reaction (RT-PCR), which makes millions of copies of RNA from a patient's blood sample. The copies are tested, using an inexpensive fluorescent dye, to see if viral RNA is present. The device also runs a control, using synthetic RNA, to ensure it is operating correctly.

Tsongalis and his team tested a larger version of the device at DHMC on 48 patient blood samples negative for HIV. The device correctly identified all the samples as negative. They ran a test on five HIV-positive samples, also with successful results. Their findings were published in *Experimental and Molecular Pathology*.

The development team is working on final tweaks to the device and on gaining full government approval before it can be used worldwide. Tsongalis, Scherer, and their colleagues at Dartmouth and Caltech are also developing technology that uses their test to detect other diseases, including a full panel of sexually transmitted diseases, and they're working on a prototype that will detect up to 40 targets simultaneously, including respiratory and diarrheal diseases. "So one test, one sample, and we can screen for a lot of different things," says Tsongalis.

What started with a phone call has turned into a major technology that could potentially help millions of people affected by HIV/AIDS and other infectious diseases. "It was the flukiest thing that's ever happened to me," says Tsongalis. "It's an exciting project."

MATTHEW C. WIENCKE

OVERHEARD

"Unfortunately, when patients hear the word cancer, most assume they have a disease that will progress, metastasize, and cause death. Many physicians think so as well, and act or advise their patients accordingly. However, since many tumors do not have the unrelenting capacity for progression and death, new guidance is needed to describe and label the heterogeneous diseases currently referred to as cancer."

—**WILLIAM BLACK**, MD, A PROFESSOR OF RADIOLOGY; **H. GILBERT WELCH**, MD, A PROFESSOR OF MEDICINE; AND COAUTHORS WRITING IN *THE LANCET ONCOLOGY*.