Chemists devise inexpensive, accurate way to detect prostate cancer

May 22 2013

Early screening for prostate cancer could become as easy for men as personal pregnancy testing is for women, thanks to UC Irvine research published today in the *Journal of the American Chemical Society*.

After more than a decade of work, UC Irvine chemists have created a way to clearly identify clinically usable markers for prostate cancer in urine, meaning that the disease could be detected far sooner, with greater accuracy and at dramatically lower cost. The same technology could potentially be used for bladder and multiple myeloma cancers, which also shed identifiable markers in urine.

"Our goal is a device the size of a home pregnancy test priced around $10. You would buy it at the drugstore or the grocery store and test yourself," said the study's corresponding author, Reginald Penner, UC Irvine Chancellor's Professor of chemistry. "We're on the verge of a very important breakthrough in a new era of personal health management."

About 240,000 men in the U.S. are diagnosed with prostate cancer each year, and 29,000 are expected to die of it in 2013. But current, widely utilized testing does not always catch the disease in its early stages, often yields false positives and can lead to unnecessary, risky treatments. A recent report concluded that the prostate-specific antigen, or PSA, test can be more harmful than beneficial, although it remains important for detecting recurring prostate cancer. The UC Irvine researchers used a different biomarker, PSMA, and plan to test others to pinpoint if a cancer is growing aggressively or not.

"A big problem is that the approach used now does not catch cancer soon enough," said co-author Gregory Weiss, a UC Irvine biochemist. "We want this to be a disruptive technology that will change how we save lives and that will bring down healthcare costs drastically."

The researchers used a combination of readily available chemicals and unique electronic sensors to create the screening process.

Salt in urine helps conduct electricity but also makes it challenging for typical biosensors to differentiate the "signals" of cancer molecules from "noise" around them in the electrodes. The UC Irvine team developed a new type of sensor: They added nanoscale protein receptors to tiny, pencil-like viruses called phages that live only within bacteria. Double wrapping the phages with additional receptors greatly increases the capture and transmission of cancer molecule signals.

"We add a high concentration of the viruses, and they get trapped directly in the electrode. We're jamming the signal with the cancer marker, and it stays on louder than all the other material," said lead author Kritika Mohan, a graduate student with Weiss' lab. "To our surprise, it works really well in the ingredients that make up urine."

The next step is human clinical trials, which the researchers hope can be conducted fairly quickly since the testing will be noninvasive. The method has been patented and licensed, and a commercial partner has been identified.

Ultimately, the scientists aim to capitalize on related nanowire research to design invisible filaments that could carry cancer signals to a smartphone or other electrical device. Software would notify users whether they're in the safe range or should contact a physician.

Other prostate cancer tests coming to market cost up to $4,000 each. The

UC Irvine team made price a key design factor of their work.

"The manufacturing costs would be low, because the material costs are very, very low. The receptors for recognizing the cancer markers are really inexpensive to make. That's why we chose these viruses," Weiss said. "They're grown in a yeasty, brothy solution – kind of like chicken broth – that could easily be mixed on a huge scale."

He added that the receptors are also "incredibly tough." They don't need to be refrigerated and can withstand nearly boiling temperatures, meaning the portable tests could be used in myriad weather conditions and storage situations.

Provided by University of California, Irvine