CTAM grant supports development of new diagnostic technology

Baker researchers have received a $50,000 grant from the Cornell Technology Acceleration and Maturation (CTAM) Fund, to further develop their "tethered enzyme technology" as a rapid diagnostic tool.

Dr. Roy Cohen, a research assistant professor and Dr. Alexander Travis, professor of Reproductive Biology, are developing a new system for diagnosing disease that uses disposable testing cards to analyze a drop of blood. The test takes minutes and can detect a wide variety of disease biomarkers including proteins, ions, metabolites, toxins, and nucleic acids such as microRNAs. Though Cohen and Travis are still in the testing and development phase, they envision that this technology could be the basis for a point-of-care testing device for use on ambulances, battlefields or anywhere lacking access to medical testing.

"Instead of going to the lab or to the hospital to do bloodwork, point-of-care testing means we bring the lab to you," said Cohen.

The technology builds on Travis' previous research to engineer enzymes that add function to nanoparticles, funded by a National Institutes of Health Director's Pioneer Award, which funds high-risk, high-reward research. His group developed a system to tether hundreds of enzymes to a nanoparticle in a way that mimics how enzymes are anchored into sperm cells. In most cell types, the enzymes that turn sugars into energy are floating loose, but sperm cells attach the enzymes to their internal scaffolding. By tethering the enzymes, the reaction proceeds more efficiently, so sperm can power their rapidly beating tails.

"Enzymes are basically like super-efficient nanomachines, and they operate extremely fast," said Cohen. Instead of using them like the sperm to generate energy, the researchers engineer the tethered enzymes on the nanoparticles to detect and quantify a specific disease biomarker and to give off light to report the positive result.

Currently the researchers are running pre-clinical trials with an area hospital to test the technology's effectiveness at rapidly diagnosing stroke, a condition where every second counts. "Strokes can be treated if you diagnose them quickly enough," said Cohen. "There's a lot of value to diagnose stroke within minutes rather than hours, which is what it takes in a hospital."

Additionally, the diagnostic technology does not require an outside energy source, because the enzymes create light biologically. The associated reader would require only a small battery such as in a cell phone, which could also transmit the results to the nearest hospital. So a device based on this technology could be used to diagnose brain injuries and other conditions in remote regions in developing countries.

With the help of the new funding the researchers are exploring ways to detect biomarkers for other types of disease. "The CTAM award lets us move the original science forward to apply it in ways that are clinically useful, to improve medical treatment for humans and animals," said Travis.