Team develops test to rapidly diagnose bloodstream infection

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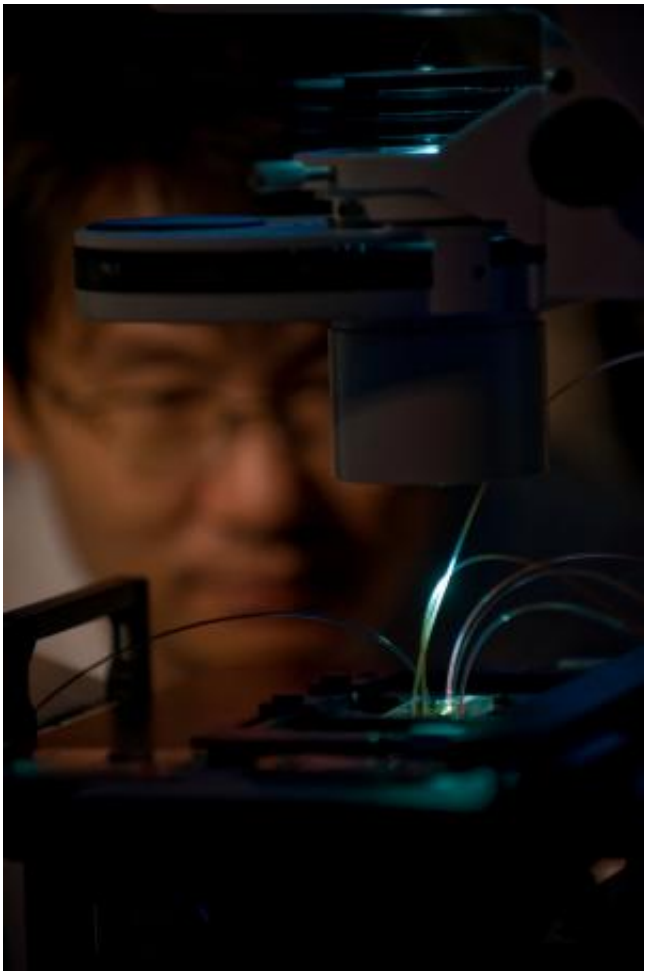

UCI project scientist Don-Ku Kang observes the IC 3D technology, which can rapidly detect bacteria in blood samples

A new bloodstream infection test created by UC Irvine researchers can

speed up diagnosis times with unprecedented accuracy, allowing physicians to treat patients with potentially deadly ailments more promptly and effectively.

The UCI team, led by Weian Zhao, assistant professor of pharmaceutical sciences, developed a new technology called Integrated Comprehensive Droplet Digital Detection. In as little as 90 minutes, IC 3D can detect bacteria in milliliters of blood with single-cell sensitivity; no cell culture is needed.

The work appears online today in *Nature Communications*.

"We are extremely excited about this technology because it addresses a long-standing unmet medical need in the field," Zhao said. "As a platform technology, it may have many applications in detecting extremely low-abundance biomarkers in other areas, such as cancers, HIV and, most notably, Ebola."

Bloodstream infections are a major cause of illness and death. In particular, infections associated with antimicrobial-resistant pathogens are a growing health problem in the U.S. and worldwide. According to the Centers for Disease Control & Prevention, more than 2 million people a year globally get antibiotic-resistant blood infections, with about 23,000 deaths. The extremely high mortality rate for blood infections is due, in part, to the inability to rapidly diagnose and treat patients in the early stages.

Recent molecular diagnosis methods, including polymerase chain reaction, can reduce the assay time to hours but are often not sensitive enough to detect bacteria that occur at low concentrations in blood, as is common in patients with blood infections.

The IC 3D technology differs from other diagnostic techniques in that it

converts blood samples directly into billions of very small droplets. Fluorescent DNA sensor solution infused into the droplets detects those with bacterial markers, lighting them up with an intense fluorescent signal. Zhao said that separating the samples into so many small drops minimizes the interference of other components in blood, making it possible to directly detect target bacteria without the purification typically required in conventional assays.

To identify bacteria-containing droplets among billions of others in a timely fashion, the team incorporated a three-dimensional particle counter developed by UCI biomedical engineer Enrico Gratton and his colleagues that tags fluorescent particles within several minutes.

"The IC 3D instrument is designed to read a large volume in each measurement, to speed up diagnosis," Gratton said. "Importantly, using this technique, we can detect a positive hit with very high confidence."

Provided by University of California, Irvine