Rapid chip medical tests prototyped for premature babies

June 15 2020

Credit: CC0 Public Domain

Scientists at the University of Southampton's Zepler Institute for Photonics and Nanoelectronics are developing a rapid bedside test for diagnosing neonatal respiratory distress syndrome (nRDS) in premature

babies.

The photonic platform combines the complementary capabilities of fingerprint Mid-IR and Raman spectroscopies to create a compact, versatile and easily operable device that could underpin a range of next-generation biomedical diagnostic applications.

Researchers are investigating whether biomarkers from COVID-19 could also be identified using the technique while experiments are paused during the national lockdown.

The three and a half year project, led by Associate Professor Dr. Senthil Ganapathy, unites the expertise of the research institute's Optoelectronics Research Centre with scientists from University Hospital Southampton and University College London Hospital.

"There is a pressing need for diagnostic tools that can produce results quickly from patients' bedsides and in doctors' surgeries," Senthil says. "Rapid, accurate results will allow rapid therapeutic decisions and save lives at reduced cost. In contrast, existing technologies require transfer of samples to centrally located laboratories equipped with sophisticated instruments, and highly skilled personnel.

"In this project, we are developing two-in-one attenuated total reflection/Raman chips that are compact, mass-producible, affordable, reliable, user-friendly and highly sensitive. These bedside diagnostics would provide analysis results within a few minutes and transform treatments for many critically ill patients."

Researchers are initially focusing on specific biomarkers for the rapid diagnosis of nRDS in premature babies. There are currently no clinical tests available to diagnose this syndrome so most infants are treated with surfactants whether or not they need them, sometimes leading to severe

complications for those whose lungs are already mature enough.

"Our diagnostic device platform will allow timely, targeted intervention," Senthil says. "Fingerprint Mid-IR and Raman spectroscopies have each been shown to be powerful biodiagnostic tool for specific biomarkers. In addition, we are developing a unique signal enhancement strategy that will simultaneously benefit both spectroscopies and significantly enhance their sensitivities."

The new photonic technology and its portable diagnostic device holds great potential for point-of-care diagnostics but could also unlock major applications in environmental monitoring and sensing including water pollution monitoring and trace toxic gas sensing.

Provided by University of Southampton