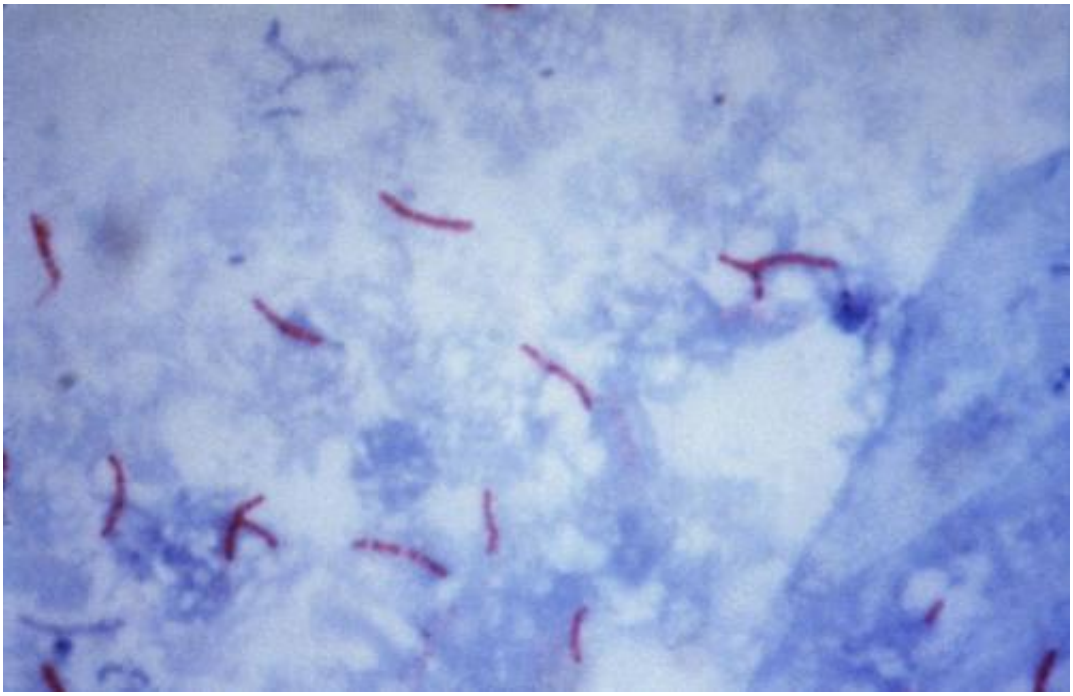
Paper-based tuberculosis test could boost diagnoses in developing countries

September 13 2017



This photomicrograph reveals Mycobacterium tuberculosis bacteria using acid-fast Ziehl-Neelsen stain; Magnified 1000 X. The acid-fast stains depend on the ability of mycobacteria to retain dye when treated with mineral acid or an acid-alcohol solution such as the Ziehl-Neelsen, or the Kinyoun stains that are carbolfuchsin methods specific for M. tuberculosis. Credit: public domain

Diagnosing tuberculosis (TB) early can allow patients to receive the medicine they need and also help prevent the disease from spreading. But in resource-limited areas, equipment requirements and long wait

times for results are obstacles to diagnosis and treatment. To tackle this problem, scientists report in *ACS Sensors* the development of a fast, paper-based tuberculosis test that can be read with a smartphone.

The World Health Organization estimates that in 2015, 1.4 million people died from TB, with most of these deaths occurring in low- and middle-income countries. Early diagnosis could help curb these numbers. But conventional methods such as sputum smear microscopy, chest X-rays and molecular-based tests require equipment, electricity and specialized personnel that are not always available in remote or developing areas. So Chien-Fu Chen and colleagues set out to come up with a more practical diagnostic test that can be read with a smartphone, a technology that is increasingly available in emerging economies.

The researchers combined gold nanoparticles with fluorescent single-stranded DNA sequences that bind to the genetic material of *Mycobacterium tuberculosis*, the bacteria that cause TB. These nanoparticles were then incorporated into a paper-based device. Adding even a minute amount of lab-derived, double-stranded DNA from *M. tuberculosis* changed the color of the test spots within an hour. A smartphone camera was used to analyze the color change to determine the bacterial concentration. The researchers also tested a tissue sample from an infected patient to further demonstrate that the device could be used in the field.

More information: "Diagnosis of Tuberculosis Using Colorimetric Gold Nanoparticles on a Paper-Based Analytical Device" *ACS Sensors*, pubs.acs.org/doi/abs/10.1021/acssensors.7b00450

Provided by American Chemical Society