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Disease Detection Goes Mobile

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The contagious and sometimes lethal disease tuberculosis, which usually affects a person's lungs, infected some **8.7 million people (http://www.who.int/tb/publications/factsheet_global.pdf)** worldwide in 2011 and killed 1.4 million, according to the World Health Organization. Most of the

people afflicted live in impoverished countries, where the roads and utility infrastructure is poor and where health personnel make due with few resources.

Testing blood samples for the disease and waiting for the results can take weeks, which delays treatment and can cause the spread of infection. If tuberculosis testing could be done on the spot and quickly, it could save lives and stop the spread of this deadly disease.

BLOG: TB Tracker Halts Disease's Spread (http://news.discovery.com/human/tb-tracker-infectious-disease-121129.htm)

Two different research teams led by Ralph Weissleder, director of the the Massachusetts General Hospital Center for Systems Biology, have created devices that can positively identify the TB pathogen in hours, telling clinicians what drugs should be administered.

Both of these devices are about the size of a standard microscope slide and also use imaging technology similar to MRIs to detect the presence of DNA from tuberculosis in a patient's body fluids.

The first device, developed by Monty Liong and designed by Hahko Lee, is a flat slide-like cartridge that contains a tiny computer chip and a miniature chemistry lab. A sample of body fluid is put on the chip and a chemical reaction duplicates the DNA in the sample.

Next, very small polymer beads coated with bits of DNA are released into the fluid. These bits of DNA have been designed to only link up with one side of the DNA of the bacteria that causes tuberculosis. (It's just one side because DNA is double-stranded molecule.)

Much smaller particles made of iron oxide are also released into the fluid. These particles have been designed to link up with the bits of DNA on the polymer beads.

A tiny coil in the device generates an oscillating magnetic field, which makes all the magnetic particles line up with the field and relax. That movement generates a signal that can be detected — just as in an MRI machine. If no TB is present, the polymer particles do not link with anything and no signal is created.

The second device, also designed by Lee, uses a similar system of tiny polymer and iron oxide particles, although it relies on ribosomal RNA (rRNA) instead of DNA. The researchers developed bits of DNA designed to stick to pieces of rRNA commonly found many bacteria; other bits of DNA are used to target 13 dangerous diseases, including Strep, E. coli and methicillin-resistant Staphylococcus aureus (MRSA). Applying a magnetic field to the particles generates signals that differ depending on the kind of DNA they stick to.

BLOG: Lamprey Micro-Robot Could Detect Disease (http://news.discovery.com/tech/robotics/cyberplasm-micro-robot-120330.htm)

The devices performed as well or better than other laboratory tests and worked faster — results came in two to three hours, and both gadgets were able to pick up lower levels of bacterial exposure with smaller samples. On top of that, they could tell what strain of TB was present.

Both systems are some time away from commercialization. Hakho Lee, a physicist and co-author on both papers, said the big issue is making it robust enough for field conditions. "It should operate with a battery, in a lot of different temperature variations," he told Discovery News. "We want the device to be automatic, and we can't have any contamination [of the sample] or we'll get false positives." MGH is looking for partners to help develop the technology, he said.

The researchers reported their work in the journals Nature Communications and Nature Nanotechnology.

Credit: Center for Systems Biology, Massachusetts General Hospital

via: ***Science Daily* (http://www.sciencedaily.com/releases/2013/05/130505150042.htm)**

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