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Rapid Bacteria Detection and Antibiotic Susceptibility Testing

Diagnosing bacterial infections in an accurate and timely manner is critical for administering appropriate drugs and ensuring quality care. Typically, healthcare providers use a dipstick method for bacterial infection diagnosis which is simple and inexpensive, but also very inaccurate. Optical microscopy offers an alternative for identifying bacterial cells, but it is bulky, expensive and difficult to use. Additionally, the field of view for optical microscopes is traditionally small, making it difficult to find bacterial cells in a low concentration sample.

Antibiotic resistance has become a significant public health threat that causes billions of healthcare-related costs and 23,000 deaths, each year, in the US alone. Clinical treatment of bacterial infections requires multiple steps, including antibiotic susceptibility testing (AST). Current AST techniques are slow and limited to cultivable strains of bacteria. Rapid, easy to use, techniques are needed that can not only detect bacterial infections but also provide information on susceptibility to antibiotic compositions.

Researchers at Arizona State University have developed rapid and automated methods for determining the presence or absence of bacterial cells in patient samples and for analyzing antibiotic susceptibility. These methods utilize a large field of view so that bacterial cells can be detected without first having to culture or enrich the sample. Single bacterial cells can be detected from an image volume of 1µL, at a concentration of 105 CFU/mL. Further, antibiotic susceptible bacterial cells can be automatically differentiated from antibiotic resistant cells.

These methods represent a rapid and powerful new technique for clinical and non-clinical detection of bacteria in addition to promoting advances in antimicrobial drug development.

Potential Applications

- Clinical diagnostics
- Bacterial detection in non-medical applications
- Drinking water

- Beverages and food
- Air

Benefits and Advantages

- Rapid, universal detection of bacterial cells (<1hr) – works on cultivable, non-cultivable and slow growing microbial species
- Can image single bacterial cells, from an image volume of 1µL, at a concentration of 105 CFU/mL
- Can image a large sample volume
- Doesn't require culturing and sample enrichment
- Detects single bacterial cells in a mixed population while simultaneously characterizing antibiotic susceptibility
- Can resolve bacterial cells in a complex matrix of sera, body fluid (urine, sputum), etc.
- Improving clinical diagnoses leads to reduced healthcare costs

For more information about the inventor(s) and their research, please see Dr. Tao's departmental webpage