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Advancing the Arizona State University Knowledge Enterprise

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Rapid Antibiotic Susceptibility Testing

Antibiotic resistance has become a significant public health threat. It causes billions of healthcare-related costs as well as 2 million hospitalizations and 23,000 deaths annually in the US alone. Clinical treatment of bacterial infections, especially in acute cases of sepsis, requires multiple steps, including antibiotic susceptibility testing (AST). Current AST techniques are slow and limited to cultivable strains of bacteria, leading to delayed administration of appropriate antibiotics and often putting patients at risk. This also leads to rampant broad-spectrum antibiotic use, which contributes to the antibiotic resistance epidemic. Rapid AST technologies are needed to reduce morbidity and mortality rates and administer accurate antibiotic treatment at the earliest possible treatment stage.

Researchers at Arizona State University have developed a rapid AST based on the detection of individual bacterial cells in a clinical sample with an imaging technology. This technique detects bacterial cells without the need to culture or enrich the sample. It also includes a novel algorithm that allows automatic determination of antibiotic minimum inhibitory concentration and minimum bactericidal concentration values from the images. This algorithm can automatically differentiate antibiotic susceptible bacterial cells from antibiotic resistant cells.

This rapid test is a powerful tool for clinical diagnostics and antimicrobial drug development that enables precise antibiotic administration to help reduce morbidity and save patient lives.

Potential Applications

- Clinical diagnostics
- Drug development

Benefits and Advantages

- Rapid, universal detection of antibiotic resistant strains (<1hr) – works on cultivable, non-cultivable and slow growing microbial species
- Can image single bacterial cells at concentrations as low as 103 CFU/mL

- Doesn’t require culturing and sample enrichment
- Automatically determines antibiotic minimum inhibitory concentration and minimum bactericidal concentration values
- Characterizes antibiotic susceptibility on single cells in a mixed bacterial population
- Tracks the metabolically driven motion of each cell
- Can resolve bacterial cells in a complex matrix of sera, body fluid, etc.
- Improved clinical diagnoses leading to reduced healthcare costs

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