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Antibiotic Susceptibility Testing

Antibiotic-resistant bacterial infections cost billions of dollars to the US in healthcare and result in 2 million hospitalizations and 23,000 deaths. Clinical treatment of bacterial infections, especially in acute cases of sepsis, requires multiple steps, including antibiotic susceptibility tests (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. A faster AST will reduce morbidity and mortality rates significantly along with helping administer narrow spectrum antibiotics at the earliest possible treatment stage.

Researchers at Arizona State University have developed a rapid AST based on the detection and quantification of the movement of single bacterial cells with an imaging and tracking technology. The imaging-based AST detects changes in the metabolic activity of the bacterial cells long before cell replication, and thus allows rapid AST for both cultivable and non-cultivable strains. This approach can track 3D movement with sub-nanometer resolution and millisecond temporal resolution. In addition to precise tracking of cellular movement, this test also allows simultaneous measurement of the binding kinetic constants of antibiotics and bacterial metabolic state after the introduction of antibiotics.

This rapid test is a powerful tool for clinical diagnostics and antimicrobial drug development, and could help reduce morbidity, decrease cost, and most importantly, save patient lives.

Potential Applications

- Rapid, universal detection of antibiotic resistant strains (<1hr) - works on cultivable, non-cultivable and slow growing microbial species
- Precise tracking of cellular movement (even single cells) with sub-nanometer resolution and millisecond temporal resolution
- Characterizes antibiotic susceptibility on single cells in a mixed bacterial population
- Can resolve bacterial cells in a complex matrix of sera, body fluid, etc.
- Simultaneously measures the binding kinetics of antibiotics to a single bacterial cell and the cellular metabolic effect of antibiotic binding
- Detects metabolic changes due to external metabolites long before cells replicate
- Improved clinical diagnoses leading to reduced healthcare costs

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

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