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Rapid Antimicrobial Susceptibility Testing (AST)

Because of the misuse and overuse of broad-spectrum antibiotics, antimicrobial resistance has become a significant public health threat, causing billions of healthcare-related costs as well as millions of hospitalizations and 35,000 deaths annually in the US alone. Clinical treatment of bacterial infections, especially in cases of acute sepsis, includes antibiotic susceptibility testing (AST). Most AST techniques are slow, requiring culture, isolation and enrichment of the bacteria, which delays treatment and can put patients at risk. Dipstick-type tests and manual microscopy are faster, but less reliable. Better, rapid tests, for determining antibiotic susceptibility, are needed so that accurate antibiotic treatment can be administered at the earliest possible stage.

Researchers at the Biodesign Institute of Arizona State University have developed a rapid imaging-based AST that directly assess clinical samples without microfluidics. This technique uses background-free, video-based object scattering intensity (OSID-AST) to look at the effects of antibiotics on bacterial growth. Background noises are removed so only the scattered light from the moving bacterial cells and particles is tracked to provide accurate information on cellular responsiveness to antibiotics. This technique has been validated with stationary-phase Escherichia coli and Staphylococcus saprophyticus and applied to 130 clinical urine samples from patients with suspected UTIs.

This rapid AST reduces measurement time from days to under 2 hours enabling prompt treatment and more judicious use of antibiotics to hopefully reduce the emergence of antibiotic resistance and ultimately save lives.

Potential Applications

- POC clinical diagnostics
  - AST, UTIs, etc.
- Drug development
  - Single cell detection for studying response to antibiotics and antibiotic resistance evolution
- Bacteria detection in non-medical applications

Benefits and Advantages

- Rapid bacterial detection in free solution (results in ~60 minutes with 90% accuracy)
- Works directly with raw clinical samples at clinically relevant bacterial concentrations (i.e. 103-104 CFU/mL – tenfold less than the threshold for most samples)
- Enables single cell detection capability
- Studying cell heterogeneity response to antibiotics and antibiotic resistance evolution
- Real-time tracking of individual cell growth and division without need for DNA primers, reagents or long incubation periods
- Eliminates microfluidics and pumps/valves – provides a simpler and more reliable measurement
- Accepts a wider dynamic range of bacterial loads, simplifying the sample preparation process while providing robust results

For more information about this opportunity, please see

Zhang et al - Anal. Chem - 2021

For more information about the inventor(s) and their research, please see

Dr. Wang's Biodesign webpage