Rapid, Culture Free Detection of Microbial Drug Resistance

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Technology description

Highly sensitive assays for pathogen identification and sensing of metabolite patterns associated with high-risk drug resistance phenotypes.
This technology is highly sensitive, can be brought down to single molecule resolution, and could be improved to a point-of-care diagnostic technology. This approach may be made more sensitive by incorporating nanoparticles to enhance signal at the surface of a biofilm where analytes are at their highest concentration. This approach will facilitate diagnostic readings directly on putatively pathogen-colonized medical device surfaces like catheters where infections are most common.

Background

There exists a clinical market need for rapid diagnostics of infectious disease. The current identification method, microbiological culturing, delays clinical diagnostic results for at least 48 hours, with additional delay for antimicrobial susceptibility testing. This delay can be devastating for neutropenic patients, who frequently present with systemic infections wherein every hour of delay in treatment is associated with an 18% increase in mortality. During this 48-hour period, patients are treated with broad-spectrum antibiotics until a specific pathogen is identified. Though powerful, empiric broad-spectrum antibiotics target microbes indiscriminately, destroying not only pathogens, but the patient’ s healthy microbiome as well.
This elimination of pathogenic and beneficial microfloral populations leaves patients susceptible to overgrowth by pathogens such asCandida albicansandClostridium difficile. When a patient’ s healthy microbiome is not present to prevent proliferation, typically commensal fungi likeCandida albicansare able to spread and become pathogenic. Current technology can discriminate bacteria versus fungi; however, the process of species level discrimination still needs to be refined. A system of rapid detection and identification of microbial metabolites without the need for microbiological culturing would prevent delays and render the prolonged use of broad-spectrum antibiotics unnecessary; thus, sparing patients of exposure to these powerful drugs, and preserving their normal microflora populations.

Technology Description

Researchers at the University of New Mexico and the University of Colorado, Colorado Springs, have developed highly sensitive assays for pathogen identification and sensing of metabolite patterns associated with high-risk drug resistance phenotypes. This technology is highly sensitive, can be brought down to single molecule resolution, and could be improved to a point-of-care diagnostic technology. This approach may be made more sensitive by incorporating nanoparticles to enhance signal at the surface of a biofilm where analytes are at their highest concentration. This approach will facilitate diagnostic readings directly on putatively pathogen-colonized medical device surfaces like catheters where infections are most common.

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Application area

Achieves fast diagnosis of infectious disease, allowing for treatment without the typical delay of microbiological culturing, and saving the patient from the harmful effects of prolonged broad-spectrum antibiotic treatment
Provides pathogen family classification for rapid administration of treatments
Applicable for identification and phenotyping of a variety of pathogens including, for example, pathogens that are responsible for many bloodstream infections and biofilm-mediated contamination of indwelling medical devices, such as central venous catheters, urinary catheters and ventilator tubes

Institution

The University of New Mexico

Inventors

Anatoliy Pinchuk
Aaron Neumann