Diagnostics for Infectious Diseases

Early diagnosis of exposure to infectious diseases, preferably before signs and symptoms are apparent, is of utmost importance in order to be able to timely start adequate treatment of the exposed persons and to prevent spreading of the infection. In particular high density populations and numerous travel movements of people across the globe increase the risk of a rapid evolution from an epidemic towards a pandemic. To mitigate this risk, non-invasive and rapid screening technologies should be available at main transport hubs such as airports and harbors in order to diagnose infected travelers upon arrival. When infected, adequate isolation and treatment of the exposed person could be initiated immediately and risk of further spreading of the infection could be mitigated. Mass spectrometry-based methods to rapidly detect and identify infectious particles, such as viruses and bacteria from air samples have been developed. Additionally, these methods are investigated for their application towards diagnosis of disease from human samples such as throat swabs or blood samples. Furthermore the development of non-invasive selective diagnostics based on exhaled breath samples is also ongoing. There is need for rapid detection and identification of infectious particles in humans via minimally invasive means. Moreover, in order to ensure adequate treatment, possible resistance of the infectious agents to available antibiotics needs to be established rapidly. Recently, methodologies have been developed based on analysis of characteristic volatile organic compounds (VOCs) produced by microorganisms during pulmonary infections. For example, based on their VOCs, antibiotic-susceptible and resistant substrains of S. aureus could be distinguished, using headspace GC-MS analysis.

Potential Applications

The military domain as well as first responders in the civil domain would benefit from point-of-care diagnostics tools. Applications such as microbial identification, steroids/endocrinology, vitamin D, and therapeutic drug monitoring are also possibilities with this technology. A large range of diagnostic tests can be researched for both small molecules and proteins.

Customer Benefits

Mass spectrometry can have many advantages over the immunoassays typically used for most diagnostics. Typically, this includes identification of microbes in minutes instead of hours. This time savings is a major benefit in terms or treatment and economics. Early diagnosis at mass transport hubs or in hospitals will mitigate further spread to other civilians national and international. Another benefit is the suitability of usage in the field, or on-the-spot detection or diagnosis. There are challenges regarding the cost and complexity in this technology, however, the technology is established and gradually approved in the regulatory authorities.

Technology Features & Specifications

The technology offered comprises lab-based methods to rapidly identify and quantify virulent particles from air, based on liquid chromatography coupled to mass spectrometry (LC/MS)-based proteomic technologies. The resulting spectrum will provide a unique fingerprint chromatogram resulting from the biomarkers of a microorganism. This methodology allows for discrimination of virulent strains from non-virulent near neighbors. Additionally, gas chromatography coupled to mass spectrometry (GC/MS) based methods are offered to allow for GC/MS profiling of VOCs originating from infections in exhaled breath. Again, the mixture of VOCs detected by GC-MS provides a good indication whether a particular person has been exposed or not.

Market Trends and Opportunities

The infectious disease diagnostic (IDD) market is estimated to grow at a CAGR of 7.9% to reach $18,156.2 million by 2019. Traditional diagnostic techniques such as immunodiagnostics and biochemical characterization are the largest segments of the IDD market. Hospital-acquired MRSA infections and human papillomavirus (HPV) are expected to be the fastest-growing market segments in the forecast period. This growth is attributed to the growing prevalence of these diseases in recent years. GC-MS, LC-MS, and LC-MS/MS techniques has become a popular characterization and diagnostic method in recent years. This technology shows great promise and the market is growing rapidly.

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