COMBATTING EMERGING BIOLOGICAL THREATS – PREPARING FOR THE FUTURE TODAY

Optimization And Development Of Technologies For Environmental Biosurveillance

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Biosurveillance approaches, when designed and executed effectively, can provide a pre-symptomatic view of circulating pathogens of concern and help mitigate damages from outbreaks. As demonstrated during the ongoing pandemic, wastewater surveillance methods are capable of detecting SARS-CoV-2 variants and predicting outbreaks in communities before being confirmed by other methods. Such approaches can also be extended for all pathogens, traits related to pathogenesis, such as antimicrobial resistance and virulent factors, and detection of emerging pathogens. However, a modular biosurveillance method that leverages technical advances in genomics and manufacturing is currently absent, but critical for detection of diverse biological threats. To advance the current state of surveillance approach, we developed and updated wet lab and informatic methods for sequencing and processing wastewater and air samples. Specifically, we used simple filtering methods to partition complex samples into bins of microbes of similar sizes, creating bins specific to fungi, bacteria, and virus. We then implemented multiple DNA/RNA extraction methods, sequenced, and obtained taxonomic and functional compositions. These data were further analyzed to assess the effect of wet lab protocols and sequencing bins of similar sized microbes. Additionally, for better characterization of taxonomic and functional composition, we also created a reference wastewater sequencing database by scavenging publicly available data from wastewater and air. Our results set important baselines for establishing environmental sampling as a robust approach for biosurveillance.