New organisation to develop and clinically evaluate a prototype metagenomic sequencing-based test

Clinical metagenomics is the genomic sequencing of all microorganisms in a patient sample to uncover complete pathogen and other microbial information, ideally in a single test within a few hours. This means not only providing the species or names of pathogenic bacteria, fungi, or viruses, but also whether they carry antimicrobial resistance or virulence factors, and whether they are common, rare, unexpected, or completely novel. This information can inform the best antimicrobial treatment with immediate patient benefit. It can also be shared with infection control and public health teams for surveillance of emerging variants, resistant organisms, or novel organisms including those with pandemic potential, to inform public health strategies including rapid interventions and vaccine campaigns.

Our vision is for metagenomic testing to be equitably embedded in healthcare systems around the world at the first points of contact of patients presenting with an infectious disease. Although this will be a journey, there is an urgent need to shorten the implementation timeline as much as possible. There are concerning increases in antimicrobial resistance, predicted to be the biggest killer globally by 2050, multiple examples of emerging infections and predictions of further pandemics either naturally occurring or artificially constructed.

To deliver on this vision, Guy's and St Thomas' NHS Foundation Trust will develop a new partnership for the public benefit to design and clinically evaluate a prototype metagenomic sequencing device, with the dual purpose of providing immediate clinical results for patient care and pathogen sequence data for real-time national and international surveillance. The partnership will collaborate with Oxford Nanopore Technologies (ONT) who have developed ground-breaking portable rapid sequencing devices and potentially with additional organisations with expertise in processing samples for clinical application.

This new organisation will benefit from over 5 years of intensive translational research developing metagenomic workflows that have gone through successful multi-year proof-of-concept pilot service evaluation on the intensive care unit. These largely manual laboratory process will be developed into an automated solution that can handle capacity requirements of a routine hospital service. The metagenomic device will focus on respiratory infection, the biggest infectious killer globally and most common cause of sepsis, but the intention is that it can be configured to process other patient or animal fluid samples or air and water samples, to have relevance across the One Health agenda.

The new organisation will bring together specialists from a range of professional backgrounds and will be designed to shorten the traditional delivery time for innovation into healthcare from estimates of 15+ years to about 5 year. This will be facilitated by co-locating staff on campus to provide a shared understanding of clinical needs alongside the practicalities of developing and taking a new regulated technology into routine laboratory service. This will help break-down familiar barriers between academia, industry and healthcare which can hinder timely progress towards an end-goal. This is particularly important when developing a technological solution at the intersection of the major societal challenges of respiratory infection and sepsis, antimicrobial resistance, future pandemics and greater protection against threats to Biosecurity.

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