Ramanome-based technology shortens mycobacteria antimicrobial susceptibility testing to 24 hours

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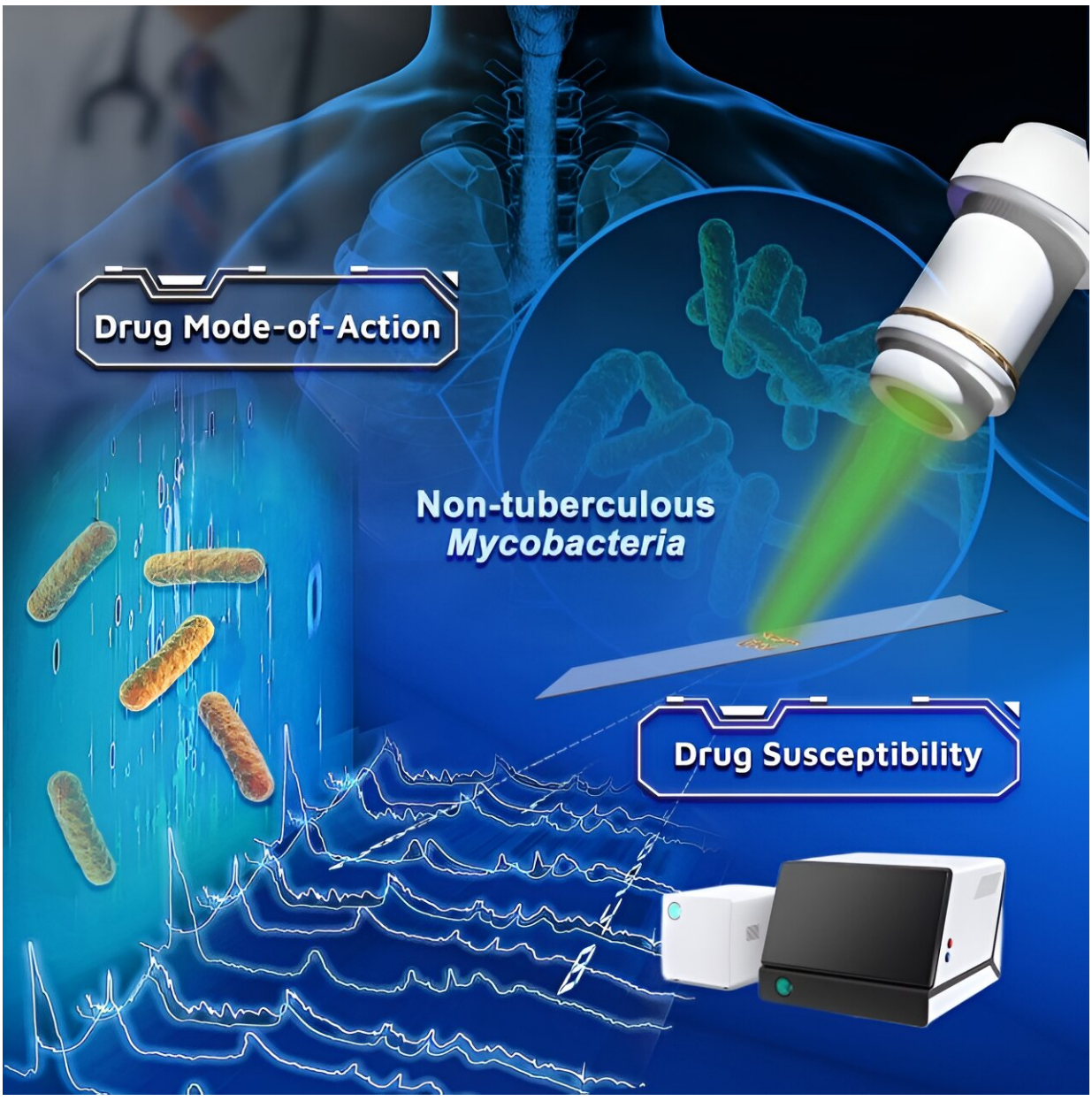

Rapid antimicrobial susceptibility testing technology for rapidly growing mycobacteria based on Raman Spectroscopy. Credit: QIBEBT

In response to the escalating challenges posed by the high drug resistance of rapidly growing mycobacteria (RGM), a collaborative team from the Qingdao Institute of Bioenergy and Bioprocess Technology (QIBEBT) of the Chinese Academy of Sciences, the Beijing Chest Hospital, and the Qingdao Single-Cell Biotech has achieved a breakthrough in rapid antimicrobial susceptibility testing (AST) of RGM.

The results were published in the *Annals of Clinical Microbiology and Antimicrobials* on Oct. 30.

Widespread in the environment, RGM pose challenges due to their high level of antibiotic resistance, mostly notably Mycobacterium abscessus. A rapid, accurate AST for RGM is urgently needed to improve clinical management, given the limitations of traditional culture methods and emerging molecular diagnostics.

Using the self-developed Clinical Antimicrobial Susceptibility Test Ramanometry (CAST-R) instrument, the team focused on Mycobacterium abscessus, the predominant pathogenic type among RGM, as a model to establish the heavy water–labeled rapid AST workflow for RGM (CAST-R-RGM). They obtained AST results based on "metabolic inhibition levels" calculated from Raman spectra data.

Compared to the traditional gold standard for AST (3–5 days), CAST-R-RGM shortens the test cycle to just 24 hours. Mao Yuli, co-first author of the study from QIBEBT, highlighted an accuracy rate of 90% for

detecting clarithromycin susceptibility and 83% for detecting linezolid susceptibility in clinical isolates of Mycobacterium abscessus. This represents a significant improvement in both the speed and accuracy of detection.

Through a comprehensive analysis of Raman spectroscopy, the researchers further identified distinctive Raman spectra features of Mycobacterium abscessus standard strains under different concentrations and durations of exposure to two drugs. These features, termed the Raman barcode of cellular stress-response (RBCS), outline the dynamic cellular metabolic profile under drug exposure.

Prof. Sun Luyang, co-corresponding author of the study, said that the RBCS not only characterizes the metabolic heterogeneity of drug-exposed Mycobacterium abscessus cell populations at the level of the metabolic phenome, but also reveals the mechanism of bacterial metabolic transformation after drug exposure.

"Effective evaluation of drug sensitivity in RGM is essential to improve patient prognosis. The CAST-R-RGM technology represents a significant advance in achieving rapid and accurate drug susceptibility testing," said Prof. Pang Yu, co-corresponding author of the study from the Beijing Chest Hospital.

"CAST-R-RGM demonstrates the capabilities of our innovative CAST-R instrument in addressing urgent clinical needs for rapid pathogenic microorganism AST. We are committed to expanding the application of CAST-R to various types of pathogens," said by Prof. Xu Jian, co-corresponding author of the study from QIBEBT.

More information: Weicong Ren et al, Rapid Mycobacterium abscessus antimicrobial susceptibility testing based on antibiotic treatment response mapping via Raman Microspectroscopy, *Annals of*

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