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A multiplexed microfluidic platform for antibiotic susceptibility testing of polymicrobial communities

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Numerous infections (e.g., bacteraemic urinary tract infections) are due to multiple bacteria (polymicrobial), requiring a distinct antibiotic dosing regimen. These infections, however, are largely understudied and antibiotic susceptibility information is inferred from their constituent bacterial isolates. We report a novel technology for determining antibiotic susceptibility of mixed cultures comprising *E. coli, P. aeruginosa, S. aureus,* and *K. pneumoniae* using a multiplexed microfluidic platform and time lapse fluorescence microscopy (TLFM).

We utilized a 4x12-array microfluidic chip that confines mixed populations of bacteria and antibiotics in 3 nL compartments enabling automatic quantitative analysis by direct enumeration of individual cells and integration of assay steps in an on-chip format. We used green and red fluorescent reporters to distinguish the polymicrobial community. Specifically, we employed the device to compare the minimum inhibitory concentration (MIC) of the bacterial species against commonly used antibiotics in mixed cultures to the MIC of their constituent bacterial isolates. Interestingly, we observed that the MIC changes drastically when going from pure to a mixed culture. For example, in a mixed culture of *P. aeruginosa* and *E. coli*, the MIC of P. aeruginosa against tobramycin increased by a factor of 10, while the MIC of *E. coli* against ampicillin decreased by a factor of 10.

In summary, these results confirm that the susceptibility of bacteria in mixed and pure cultures differs significantly. This microfluidic platform enables the study of the understudied, yet clinically important field of polymicrobial infections, and it has potential to be used for diagnosis and rapid determination of the most suitable antibiotic dosing regimen.

Biography

Ritika Mohan received her B.Sc degree in Chemical Engineering from the University of Arizona, Tucson. She received her M.Sc in Chemical Engineering from the University of Illinois, Urbana-Champaign. Currently, she is in the fourth year of her Ph.D. at the same institution. Her current research efforts are in the area of microfluidics, including the development of pneumatic normally closed microvalves for integrated microfluidics and microfluidic devices for antibiotic susceptibility testing especially for polymicrobial infections.

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