Real-time monitoring of live mycobacteria with sound and light

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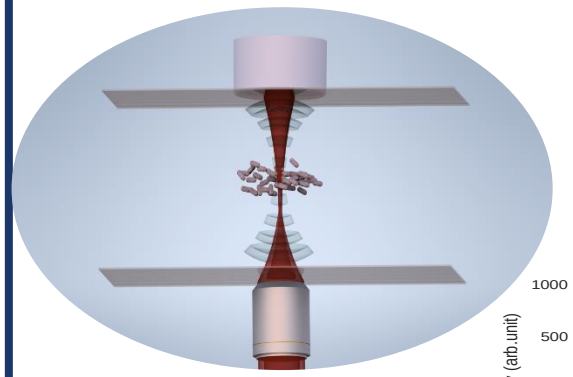
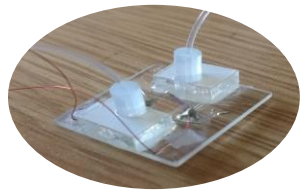
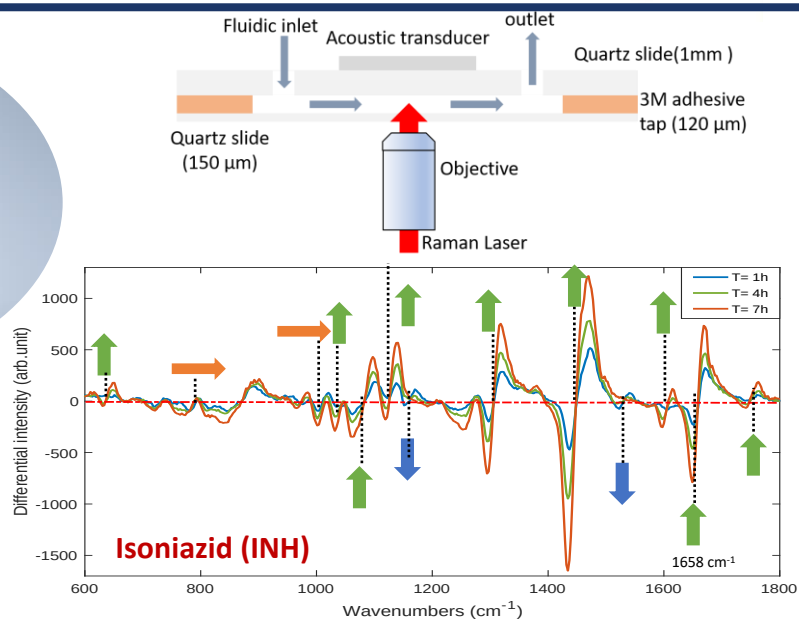
Abstract: A microfluidic system is designed to real-time monitor the impact of antibiotics, isoniazid (INH), on the living mycobacteria using laser and acoustic forces. This lead more detailed understanding of the tolerance to drugs in bacteria and the relapse of tuberculosis (TB) treatments.







Project Description

A 120-um wide microfluidic chamber was carefully designed to ensure that sound waves can form standing waves to confine living bacteria in the middle. Being held by the acoustic forces firmly, 7-day-old living bacteria can form a stable thin film over time. A laser is shining on the trapped bacteria. Scattered from the bacteria, Raman photons are collected to provide rich molecular information of the cells, showing the important changes in the living cells, such as lipid and nucleic acids. When exposed over a long period of time in the antibiotic solution (>8 hours), bacteria are found to be more resistant to drugs.

Conclusions and Impact

- Study infectious disease with lasers and sound;
- A label-free optical method for interrogation;
- Strong acoustic confinement;
- Monitoring living bacteria over long period of time;
- Well-controlled conditions or stimuli;
- A promising platform to look at other organisms with different conditions;
- A feasible approach to test new drugs;

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