Acoustic trapping for investigating cell-drug interactions

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Acoustic trapping is a technique in which an ultrasound standing wave is used to trap cells or particles in a microchannel. The standing wave, generated by a piezoelectric transducer, exerts forces on the particles, keeping them stationary against a liquid flow in the microchannel. Acoustic trapping has been used e.g. for biomedical research and investigational clinical applications. The investigation of the interactions of medical compounds with cells and receptors is the cornerstone of developing new medicines, which makes it a fundamental procedure for the innovative drug industry. The research and development of new medicines is a process that consumes vast amounts of both time and money. Healthcare systems around the world demand safe and effective pharmacotherapies that should be affordable as well. The investigation of new and efficient methods for the research and development of drugs is one solution to reduce the costs related.

In this work, the performance of a new nanobiotechnology platform in the investigation of cell-drug interactions was studied. The platform involved acoustic trapping of cells in a microchannel, which allowed both incubating the cells with a drug solution as well as eluting the drug from the cells. After this, the eluent samples were pretreated with ISET (integrated selective enrichment target), a miniaturized method for solid phase extraction, followed by analysis using MALDI MS (matrix assisted laser desorption/ionization mass spectrometry), a technique allowing label-free detection of the drug.

In this proof-of-principle study, the interaction of an antidepressant fluoxetine with human platelets was investigated. The expression of serotonin transporter, the molecular target of fluoxetine, on the platelets makes them a simple and convenient model for the study. The results obtained were not conclusive and the suitability of the platform could not be thoroughly substantiated. However, the platform shows some promise for the purpose, and further research on the topic is to be expected.