Extended Abstract Journal of Cell and Developmental Biology 2018
Vol.2 No.4

9th International Conference and Exhibition on Advanced Cell and Gene Therapy _Gigahertz acoustic streaming induced cell membrane poration towards intracellular delivery_ Xuexin Duan _ Professor,University of Twente

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Efficient intracellular delivery of exogenous materials remains a critical issue in fundamental biological researches and clinical applications. Here, we developed a novel chemical-free method for intracellular delivery enhancement using a designed gigahertz ultrasonic electromechanical resonator. When excited by a sinusoidal electric signal, the propagation and attenuation of acoustic wave in liquid will generate high-speed acoustic streaming. The liquid above the device working area will be accelerated and strike the substrate surface, thus generates pressure on cells, induces deformation and membrane poration, and finally realizes delivery of exogenous materials. To verify the intracellular delivery ability, DOX was selected as an example, and an enhanced fluorescence of DOX in cells exposed to resonator stimulation can be seen. We also realized the delivery of fluorescent-labeled DNA strains and plasmids. Besides, different power applied to the resonator can induce different fluid velocity, thus generate different force intensity and control the deliver efficiency. Pores on membranes induced by acoustic streaming treatment were observed by SEM. Disrupted cell membranes and porous structures can be seen after treatment, and resealed after 10 min recovery, indicating a strong fluid force exerted on cells and the influence is temporary and reversible.

When light, for example from a switched Q laser operating with nanosecond laser pulses, is concentrated on a single nanoparticle optically trapped, the laser-induced failure can occur, leading to plasma formation and the emission of shock waves by its expansion followed by the vaporization of the nanoparticle or liquid (surrounding water media). This volume of steam does form a cavitation bubble, which expands as the volume of the abbread nanoparticle or vaporized liquid increases. The expansion of the bubbles and its subsequent collapse may be accompanied by the emission of acoustic transients and microjets depending on the position of the cavitation bubble in relation to the substrate. These photomechanical properties can lead to the permeabilisation of the plasma membrane of cells.

The formation and jet emission of acoustic transients on collapse depend on the sizeless stand-off parameter, Between the bubble and the wall, Z0/Rmax, where Z0 is the distance between the bubble center/nanoparticle and the wall, and Rmax is the maximum bubble radius (Hentschel, W. and Lauterborn, W., Appl Sci Res 38, 225-230 (1982)). When the bubble wall is in contact with the boundary, the formation of the jet is predominant in relation to the acoustic emission. On the other hand, when the bubble is free of distortion (i.e., the bubble is free of distortion), the bubble energy is more efficiently transformed into acoustic energy. Thus, the jet can cause localized membrane poration of several cells in a targeted area, while acoustic transients can produce large-scale poration of cells in a large area (hundreds of micrometers) because acoustic waves can propagate a long distance (usually hundreds of micrometers) in the middle of the sample.

It is important to control the volume/size of the cavitation (determines the total bubble energy available for the jet and acoustic energies) as well as its axial position from the limit (determines the relative intensity between the jet and acoustic emissions). Optical clamps allow the containment and positioning of microparticles and nanoparticles at a desired location within the sample. With this approach, the threshold energy required for lib depends on the nanoparticle material and its size and is free of the surrounding environment. Thus, the technique can optimize bubble energy and stand-off parameter, which lead to membrane permeabilisation of mammalian cells with retention of cellular viability.

Biography

Monitoring the binding affinities and kinetics of protein interactions is important in clinical diagnostics and drug development because such information is used to identify new therapeutic candidates. Surface plasmon resonance is at present the standard method used for such analysis, but this is limited by low sensitivity and low-throughput analysis. Here, we show that silicon nanowire field-effect transistors can be used as biosensors to measure protein–ligand binding affinities and kinetics with sensitivities down to femtomolar concentrations. Based on this sensing mechanism, we develop an analytical model to calibrate the sensor response and quantify the molecular binding affinities of two representative protein–ligand binding pairs. The rate constant of the association and dissociation of the protein–ligand pair is determined by monitoring the reaction kinetics, demonstrating that silicon nanowire field-effect

I have attended the conference on March 20-22, 2017 Orlando, USA. It was a tremendous experience for gaining knowledge on

This work is partly presented at the 9th International Conference and Exhibition on Advanced Cell and Gene Therapy March 21-22, 2019, Rome, Italy

pharmaceutical industry. It was a good opportunity for me to learn key notes, and experience the wide range of products in pharmaceutical industry. The main advantage of attending the pharmaceutical exhibition's and expos is you get to hear some great professor's from different countries talking on wide range of products. I even got a chance to hear some of the great People who own leading pharmaceutical industry's around the globe talking on products they manufacture and marketing strategies. For an easy understanding of different aspects in the pharmaceutical industry, there were some stalls in the expos who displayed poster presentations. These posters helped me to understand various procedures in manufacturing and selling of products.

Conference was held for two days and it was really nice and we enjoyed a lot and we even met many people all around world gained so much of knowledge.

Attending an expo was a new experience all together. Speaking of the venue, as everyone knows Rome is a beautiful country to begin with. As I registered online for the expo, I got the access badge and the schedule of 2 days in the mail. On reaching the venue, there was huge welcoming ceremony and everything was just going on time as mentioned in the schedule. On first day, there was welcome speech and details of the companies exhibiting. It took me a bit longer to attend each stall because we had to get introduced to every company exhibiting and in return they had to explain everyone from the start of their company. It was a great opportunity to get introduced to many people from different countries and gaining knowledge and exchanging ideas. By talking to people from different countries, I could get information on Pharmaceutical products and industries of their countries. Second day, there were lot of conferences and every program was on time as mentioned in the schedule. Only negative thing for me was the costing of the entry ticket to the expo. It would be great if the price was affordable which gives many others a good opportunity to gain knowledge.

I thank the expo for giving me an opportunity to speak in front of delegates and many other people from pharmaceuticals industry all over the world. I thank everyone for giving good reviews and testimonials for my talk. It was really a great experience for me to attend this two day conference and I enjoyed all the talks at the conference venue and gained lot of knowledge. I am also interested in attending more and more conference of conference series in future. I also suggest young students to attend the conferences organized by conference series to gain knowledge from the talks that speaker's present. I met colleagues with varying levels of experience in the field of Stem cell therapy and gene therapy.

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