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Label-Free Imaging and Biomarker Analysis of Exosomes

Exosomes play an important role in many cellular processes including communication, immune response, signal transduction, antigen presentation and more. As such, exosome analysis is a promising tool for both biological and clinical research applications. However, exosome detection and biomarker quantification is challenging due to their small size and heterogeneous nature. Traditional analysis techniques require large sample quantities or extensive post-labelling processes, hindering rapid detection. Surface plasmon resonance (SPR) allows for some analysis of exosomes, however, it is expensive and only provides a semi-circular field of view, limiting throughput.

Researchers at the Biodesign Institute of Arizona State University have developed a novel plasmonic scattering microscopy (PSM)-based approach for imaging exosomes and quantifying their protein biomarkers. This approach can select exosomes from extracellular vesicles using a modified sensor surface and provide a millimeter-scale field of view for high throughput exosome size distribution analysis. Additionally, this approach provides high sensitivity for monitoring the response of exosomes to antibodies, allowing for effective analyses of content levels and binding kinetics. This PSM can be easily constructed on common prism-couple SPR systems using commercially available components.

This PSM-based approach provides an economical and powerful tool for clinical exosome analyses as well as exploration of fundamental exosome properties.

Potential Applications

- Exosome analyses for clinical and research applications
  - Diagnostics
  - Therapeutics
  - Drug delivery

Benefits and Advantages

- Can select exosomes from extracellular vesicles and provide a millimeter-scale field of view
  - ~40 and 100 times larger than the surface plasmon resonance (SPR) microscopy and nanoparticle tracking instrument respectively
  - Captures sufficient exosomes for statistical and high throughput exosome size distribution analysis
- High sensitivity for monitoring exosome-antibody responses
  - Enables content analysis and binding kinetics of multiple biomarkers
- Easy construction on popular prism-coupled SPR systems readily available components
- Label-free
- Can simplify the operation and suppress the measurement error resulting from batch-to-batch heterogeneity
- Provides similar signal-to-noise as SPR for single exosome detection
  - Eliminates the irregular particle scattering patterns

For more information about this opportunity, please see

Zhang et al - Chem Sci. - 2022

For more information about the inventor(s) and their research, please see

Dr. Wang's departmental webpage

Dr. Wang’s laboratory webpage