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Label-Free Quantification of Cell Surface Membrane Protein Binding Kinetics

-Molecular interactions in live cells play an important role in both cellular functions and drug discovery. Quantification of binding kinetics between drugs and cell membrane proteins is an essential step in drug evaluation. Current methods for measuring binding kinetics require the membrane protein to be extracted and labelled, both of which are difficult because of low solubility and expression levels. Techniques which work on fixed cells, such as surface plasmon resonance imaging (SPRi), aren't effective with live cells because the signal can be affected by cell micromotion related noises.

Researchers at the Biodesign Institute of Arizona State University have developed an optical imaging method to measure molecular interaction with live cells by tracking nanometer cellular membrane fluctuations with sub-nanometer precision. To show proof of concept and to test the performance of the optical imaging system, the binding kinetics of glycoproteins on single live red blood cells were measured. The fast timescale membrane fluctuation eliminate the slow timescale micromotion noise with frequency filtration to show more consistent binding results for single live cell study. This provides a non-invasive approach for both cell mechanics and molecular binding interaction measurement.

This label-free method presents a novel means to measure molecular binding to membrane proteins on live cells with single cell resolution and in real time.

Potential Applications

- Understanding cell interactions and communication
- Mechanical assessment of cancer or other diseases at the single-cell level
- Screening membrane protein targeting drugs
- Biomarker discovery
- Diagnostics

Benefits and Advantages

- Less sensitive to environmental noise and cell movement
- Works on live cells in real time
  - This helps prevent false binding kinetics from amino acid crosslinking (from fixation)
  - Enables measurements of cell-to-cell variability in binding kinetics
- Label free optical detection
- Non-invasive approach for both cell mechanics and molecular binding interaction measurement
- Sub-nanometer precision

For more information about this opportunity, please see

Yao et al – Small - 2022

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

Dr. Wang's departmental webpage