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# Label-free Detection of Small Molecules

The ability to measure molecular binding and interactions is important for understanding many biological processes. Particularly important is detecting the binding of small molecule drugs with their corresponding membrane protein receptors, which currently account for more than half of all drug targets. For effective measurements, purified membrane proteins must retain their native conformation and functions, however the labels in traditional measurement methods may affect the native binding behaviors of the molecular receptors. Label-free techniques exist, but they lack the spatial resolution required to study the variability between different individual cells, map heterogeneous distribution of receptors in the cell membrane, and distinguish non-specific binding. Surface plasmon resonance (SPR) has been used and is label-free, however, it has limited sensitivity for detecting small molecular mass drugs.

Researchers at the Biodesign Institute of Arizona State University have developed a system and method for measuring the interactions of both large and small molecules with their membrane receptor targets in native cellular membranes, and to analyze cell-to-cell variability of the binding kinetics. The system can be also used to detect the electrical activities of cells, such as ion channels opening and closing and action potential propagation. These capabilities can benefit not only drug discovery, but also drug resistance study, which is a common but difficult problem in medicine.

This novel method will help in screening and development of drugs as well as drug discovery, validation and detection of biomarkers for disease.

Potential Applications

- Label-free detection of small and large molecule interactions
  - Interactions of molecules with molecular receptors on cell surfaces
  - Examinations of cell-cell variations and heterogeneity within a cell
- Detection of electrical activities in cells
  - Ion channels opening and closing
  - Action potential propagation in neuronal cells
- Drug development, discovery and studying drug resistance
- Detection of biomarkers for disease

Benefits and Advantages

- Increased sensitivity - can view small molecule interactions or weak molecular binding events
- Label-free - isn't labor intensive and doesn't affect the native conformation of receptor membranes
- Simplified methods for analyzing the data and reducing the possibility for errors
- Allows for measuring membrane protein activities in the native environment of the proteins
- Real-time and high precision

For more information about the inventor(s) and their research, please see Dr. Tao's directory webpageDr. Tao's laboratory webpage Dr. Tao's Biodesign directory webpage