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Apparatus for Analyzing Molecules, Molecular Interactions and Reactions

Measuring molecular interactions, reactions and conformational changes of molecules is an important component of molecular scale biomedical research, drug discovery and diagnostic applications. Current detection technologies fall into two categories, label-based and label-free technologies. Label-based approaches are end-point assays – they detect molecules before and after molecular binding occurrences. While specific, they lack kinetic information. Label-free approaches are particularly attractive for kinetic studies as they enable real-time monitoring of binding or reaction processes; sensitivity however tends to diminish with molecule size, so they are less effective with small molecules. With existing label-free techniques it is also difficult to detect conformational changes and biochemical reactions of molecules.

Prof. Nongjian Tao, at the Biodesign institute of Arizona State University, has developed an apparatus for label-free, real-time kinetic analysis of molecules. This apparatus overcomes the deficiencies in current systems and is able to achieve highly sensitive detection of molecular binding or reaction processes. It can detect both small and large molecule-protein interactions as well as conformational changes of proteins. Because this device can detect small molecules with such sensitivity, it would be very useful in drug screening.

This apparatus could be used to screen drug molecules, analyze posttranslational modifications of proteins and detect both large and small molecule-protein interactions.

Potential Applications

- Screening of drug molecules - quantify the binding kinetics of large and small molecules
- Quantitated kinetic analysis of posttranslational modifications
 - o Phosphorylation of proteins
 - o Dephosphorylation of proteins
- Small molecule protein interactions

- Detecting molecules expressed on virus or bacterial cells
- o Studying binding kinetics of molecules with membrane proteins without needing to extract the membrane proteins

Benefits and Advantages

- Movement of molecules as small as 0.1 nm can be accurately detected with this apparatus
- Allows for screening of multiple drug candidates simultaneously
- High sensitivity
- Label-free
- Able to quantify the binding kinetics of large and small molecules
- Can study membrane protein interactions without needing to extract the membrane proteins

For more information about the inventor(s) and their research, please see [Dr. Tao's departmental webpage](#)