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Nanoparticle Tracking for Protein Separation and Binding Kinetics Analysis

-Quantifying protein interaction kinetics is important in many biotechnology applications including biosensor development, biomarker discovery, drug screening and basic research. Current label-free techniques for quantifying protein-protein interactions often require separating the protein samples from complex media using magnetic nanoparticles. Unfortunately, because the separated proteins are attached to the nanoparticles, additional separation steps are needed before measurements can be obtained.

Researchers at the Biodesign Institute of Arizona State University have developed a novel method to directly quantify protein binding kinetics on nanoparticles without elution and immobilization by optically tracking the nanoparticle size change upon ligand binding. A protein of interest is pulled down and separated from its original medium using magnetic nanoparticles and then the binding kinetics to ligand molecules can be directly measured on the nanoparticle. Multiple noise analyses were performed to increase accuracy in the measurements. This method is able to quantify antibody kinetics at concentrations ranging from sub-nM to hundreds of nM.

This streamlined method simplifies the workflow from protein separation to detection while providing the necessary information regarding binding kinetics and affinity to support protein studies.

Potential Applications

- Quantifying protein interaction kinetics
  - Biosensor development
  - Biomarker discovery
  - Drug screening
  - Basic research

Benefits and Advantages

- Directly quantifies protein binding kinetics on nanoparticles
- Sensitive enough to detect small size changes (even as little as a few nm)
- Eliminates the need to elute the proteins off the nanoparticles or immobilize them on the sensing surface
  - Simplifies and speeds up the protein purification process
- Can quantify antibody binding kinetics at concentrations from sub-nM to hundreds of nM
  - This covers the typical concentration range in immunoassays

For more information about this opportunity, please see

Zhao et al – J Electrochem Soc - 2022

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

Dr. Wang's departmental webpage