A Label Free Optical Technique to Detect Protein-Protein Binding

Fernando-Peiris, Sulekh

Surface plasmons are vibrations from free electrons residing on the surfaces of metals such as gold. Since the frequency (or the wavelength) of these vibrations is very sensitive to surface characteristics, it can be used to investigate molecular activity occurring on the surface. In this project the surface plasmons produced on gold surfaces were utilized to investigate the binding between proteins. Specifically, the reaction between bovine serum albumin (BSA) and anti-BSA was investigated. Initially, a gold-deposited glass slide was used to construct a cell that held solutions inside it. Because the index of refraction of the solution, covering the gold surface, changes the wavelength of the surface plasmon of the gold a calibration curve of the surface plasmon wavelength vs. the index of refraction was obtained. This was accomplished by mixing various dilutions of glycerin and water because the indices of refraction of water (1.33) and glycerin (1.47) are well known. Using this calibration curve, the index of refraction of any unknown solution can be determined. Next, the gold-cell was tested to see if the signal was stable. The results indicated that if the cell was sufficiently clamped, it can retain the signal for up to 2 days. In the next experiment, a solution of BSA was incorporated into the gold cell. The results showed that the wavelength of the plasmon of gold red-shifted by 3-5 nm due to the insertion of BSA. Subsequently, when the anti-BSA was injected into the gold-cell, the plasmon red-shifted further, indicating that the BSA and the anti-BSA were interacting. Further experiments, related to time and pH dependence, shed more light on this interaction, and set the platform to study a wide spectrum of other protein-protein interactions.

Awards Won:

Second Award of $2,000