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# Molecular Semaphore Device for Single Molecule Detection

A major limitation of current methods to detect specific DNA sequences is the need to amplify the target DNA to detectable levels using PCR. The additional instrumentation and reagents required for PCR severely limit the portability of PCR based detection systems, greatly extend the time required for analysis, and potentially introduce significant errors into the results. The detection thresholds of the most sensitive detection methods currently available still correspond to a large number - presumably hundreds or thousands - of hybridization events.

Researchers at Arizona State University have invented a system and method for single-molecule detection of bioactive agents through the use of a F1-ATPase biomolecular motor. The technology is composed of a capture probe consisting of a F1-ATPase that is attached to a nickel coated substrate while the subunit remains free to rotate when the substrate ATP is added to the system. Detection probes are free floating in solution and are composed of a gold nano rod attached to an analyte binder. Thus, both probes have binding sites for the analyte of interest. Through a single binding event of a target molecule to both the capture probe and detection probe, the F1-ATPase rotates the gold nanorod. Upon assembly and the addition of the substrate ATP, the rotation of the semaphore scatters red and green light which can be visualized by low power microscopy.

Potential Applications

- DNA microarrays
- Single molecule diagnostics
- Homeland security applications
- Crime scene forensics

Benefits and Advantages

- DNA microarrays
- Single Molecules of target analytes can be detected
- The need for PCR is eliminated in DNA detection
- False positives are virtually eliminated
- Detection can be completed in about 30 minutes
- Detection of the target DNA is simplified to the observations of blinking red and green
- Single nucleotide polymorphisms (SNPs) can be detected by this technology
- Quantization of the number of target molecules is greatly improved over fluorescence methods
- The device is well adapted for the multiplexing detection
- The device has numerous other applications including, detecting RNA, proteins, bio-threat agents, drugs

Link to patent application

http://www.google.com/patentsid=wXV3AAAAEBAJ&dq=6989235http://azte.technologypublisher.com/files/sites/m02-038-and-m03-017-and-m04-0141.pdf