Cantilever sensors: Nanomechanical tools for diagnostics

Cantilever sensors have attracted considerable attention over the last decade because of their potential as a highly sensitive sensor platform for high throughput and multiplexed detection of proteins and nucleic acids. A micromachined cantilever platform integrates nanoscale science and microfabrication technology for the label-free detection of biological molecules, allowing miniaturization. Molecular adsorption, when restricted to a single side of a deformable cantilever beam, results in measurable bending of the cantilever. This nanoscale deflection is caused by a variation in the cantilever surface stress due to biomolecular interactions and can be measured by optical or electrical means, thereby reporting on the presence of biomolecules. Biological specificity in detection is typically achieved by immobilizing selective receptors or probe molecules on one side of the cantilever using surface functionalization processes. When target molecules are injected into the fluid bathing the cantilever, the cantilever bends as a function of the number of molecules bound to the probe molecules on its surface. Mass-produced, miniature silicon and silicon nitride microcantilever arrays offer a clear path to the development of miniature sensors with unprecedented sensitivity for biodetection applications, such as toxin detection, DNA hybridization, and selective detection of pathogens through immunological techniques. This article discusses applications of cantilever sensors in cancer diagnosis.