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Editorial
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Microfluidic Biochips and Plastic-Antibody Biosensors for Point-of-Care Diagnostics

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Microfluidic biochips have been studied since the 1990s. The research area continues to have an increase important role in biological fundamental research and medical diagnostics. In future, microfuidic biochips will continue to play a critical role in genomics, proteomics, and cellulomics, as evidenced by the increased demand for biochips and tissue chips capable of handling personal medicine, toxicity analysis, and point-of-care diagnostics. Microfluidic biochips are becoming inexpensive, multifunctional, reliable, sample/reagent-saving, and process-parallel. Increasing miniaturization of biochips has led to the realization of micro total analysis systems and lab-on-a-chip systems. Traditional biochemical instruments require large amount of fluidic samples, large space occupation, complex procedures and long time for operation, and professional operators. In these years, biomedical microinstrumentation is applying MEMS and microfluidic technologies with biosensors and bioelectronics to speed up the detection and improve the accuracy instead of traditional instruments. However, most of biochips or lab chips are using syringe pumps or off-chip gas tanks with pressure regulators to handle fluidic samples. It will cause the loss of the fluidic samples, contaminations, and difficulties in minimization and portability. It has large demands on developing on-chip pressure or vacuum sources for disposable lab-on-chip systems for multiple steps or multiple samples suction to precisely deliver tiny fluidic samples into the microchannels for biosensing.

Besides microfluidics/nanofluidics, biosensors are one of the most important components in biochips. Biosensors consist of two parts: a molecular recognition layer and a transducer. Because the selectivity of biosensors lies mainly in the specific mechanism between the analyte and the sensor matrix, some biomolecules with special recognizing capabilities have been duly incorporated as the recognition module of sensors. However, all these biorecognition layers, such as antibody and enzyme, have the limitation of instability, such as short lifecycle, liability to other substances, not operable in high temperatures, extreme acidic or alkaline environment, or in organic solvents. This represents a serious setback in the development of biosensors. Molecular imprinted polymer (MIP) is a newly developed technique that provides molecular assemblies of desired chemical structures and properties. MIP technology, which is called biomimietic plastic antibody, has the advantages of high selectivity, high sensitivity, long shelf-life at room temperature, and good resistance against chemical solvents, whereas several researches have used these MIP materials to realize molecular imprint to conduct separation or sensing materials. Times before, MIPs had been realized with optical sensing techniques in biosensing for several analytes, such as Ca^{2+} ion detection, atrazine detection, glucose detection, propofol detection, and protein detection in serum.

Overall, the most important topics in microfluidic biochips are related to nanofluidics/microfluidics, on-chip biosensors, polymer fabrication, surface modification, biology manipulation/detection mechanisms, integration techniques, and their applications. It is clear that the rapid progress in microfluidic biochips will significantly impact the practice of medical care, food safety, environmental safety, and biological studies.

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