Microfluidic Multiplexed Assays Using Tissue Samples of Human Breast Cancer

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Recent progress on the micro total analysis systems is highly related with the development of a nanobiosensor, microfluidic device, and lab-on-a-chip as a new platform for biological sample processing, separation, and detection. Many inspired works in this research field have been facilitated by exploiting fluid mechanics, mass transport, and biochemical interactions. Previously, our group developed a PDMS-based microfluidic interface that enables multiplexed immunohistochemistry measurements on breast tissue samples. By directly pressing the PDMS device onto a conventional thin-sectioned tissue slide, we demonstrated a simple immunostaining process in a microchannel, without any leakage, bubble formation, or cross-contamination. In addition, we exploited the microfluidic technology for the multiplexed detection of proteins. Nevertheless, the use of a multichannel microfluidic devices for multiplexed antibody incubation requires improvement, because the microchannel-based staining procedure lacked the ability to locate densely populated tumor regions in tissues. In this presentation, I will present a new optical detection strategy using quantum dot (QD)-based protein detection for cancer tissue, combined with reference-based protein quantification and autofluorescence removal. Visualization of the tumor-cell area was carried out to realize microfluidic parallel biomarker multiplexing using cancer tissue samples. This platform could be applied to develop an integrated analytical system and/or diagnostic tool for accurate histopathological diagnosis based on multiplexed protein quantification.