A Chemist's Role in Genomics and Proteomics

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Over the past couple of decades, many areas of science and technology have been geared toward improving molecular detection and genetic characterization of human disease. One area of research that has great potential to revolutionize diagnostic testing is the microdevice, lab-on-a-chip or micro-Total Analysis System (μTAS). These devices will be able to perform analytical tests in a fraction of the time required for their predecessors.

In one focus of this talk, genetic mutation detection methods traditionally performed using the slab gel format have been modified for capillary and microchip electrophoretic methods in order to significantly improve throughput by reducing analysis time while maintaining quality. Several electrophoretic parameters were investigated such as the electric field strength, length of the separation channel, operational conditions, as well as the sieving matrix employed. As a demonstration, two genetic applications were exploited: determination of the antibiotic susceptibility of Mycobacterium tuberculosis and identification of genetic markers for colorectal cancer, using mutation specific and mutation scanning methods, respectively.

Just as the Human Genome Project drew to a close, a new focus in proteomics emerged. Current research exploring the potential of photopolymerizable hydrogels as an immobilization scheme for protein analysis will also discussed. Hydrogel sensors capable of specific capture of target antigens within microfluidic channels are presented as demonstration of the potential of this technology for protein based assays. Effects such as microchannel surface treatment, hydrogel composition and incubation time will be illustrated using antibody/antigen model systems.