

Lab-on-a-Chip device for rapid detection of Thrombin and other Protease activities directly in whole blood samples

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A novel assay technique and electrokinetic device has been developed which allows thrombin and other proteases to be detected and measured directly in a few microliters of whole blood. Many indigenous proteases like thrombin are important for blood clotting activities and related cardiac diseases (DVT, atherosclerosis, etc.). Additionally, the appearance of certain non-indigenous proteases like trypsin, chymotrypsin, and MMP's are frequently biomarkers for shock, cancer and other diseases. Thus, the ability to measure protease activity in whole blood will allow researchers and clinicians to further elucidate the relationship between circulating protease levels and many important diseases. We have now developed a number of synthetic charge-changing fluorescent peptide substrates which are specific for trypsin, chymotrypsin, MMP2/9, elastase and thrombin. These unique substrates allow one to directly detect protease activity in whole blood and essentially eliminate the need for any sample preparation. The substrates are added to a few microliters of blood sample for reaction, and the cleaved products are then rapidly separated in a simple electrophoretic microgel format. In the past year, using our new thrombin substrate we demonstrated the monitoring of thrombin enzyme activity in untreated whole blood, which directly correlates with blood clotting. The technique provides an unprecedented quantification approach to measure coagulation kinetics and moreover, to monitor thrombin levels in blood. A simple battery operated lab-on-a-chip proto-type device is now being developed for point-of-care applications. This device will allow for the rapid measurement of thrombin activity in whole blood without the need for sample preparation

Biography

Michael J. Heller received his Ph.D. in Biochemistry from Colorado State University in 1973. He was an NIH Postdoctoral Fellow at Northwestern University from 1973-1976. Dr. Heller was supervisor of the DNA Technology Group at Amoco Corporation from 1976-1984; Director of Molecular Biology at Molecular Biosystems, Inc., from 1984-1987; a co-founder of Integrated DNA Technologies and President/COO from 1987-1989; and a co-found of Nanotronics and Nanogen and Chief Technical Officer from 1993-2001. Dr. Heller is now a Professor in the Departments of Nanoengineering and Bioengineering at the University California San Diego, and recently co-founded a new company called Biological Dynamics.

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