170a Focusing, Collection, and Metering of DNA Using Microfabricated Electrode Arrays

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Microfluidic technology is a key component in the development of microfabricated lab-on-a-chip systems for use in bioanalytical and biosensing applications. These devices continue to be developed to perform a variety of DNA analysis assays, however many of these applications deal with such minute amounts of DNA that it must first be pre-concentrated to a detectable level. On the macroscale, this pre-concentration is typically performed using centrifugation processes which are difficult to miniaturize and interface with other microfluidic components. On the microscale, considerable progress has been made toward the development of sample injection techniques, however none have been able to achieve simultaneous concentration, focusing and metering capabilities. In order to address this issue, we have developed microfluidic devices incorporating arrays of on-chip electrodes to locally increase the concentration of DNA in solution. Using these electrode arrays, we demonstrate how DNA is concentrated, focused into a narrow plug, metered in a microchannel and injected into an analysis channel. The technique is based on electrokinetic transport of DNA between the electrodes and requires the application of a small electrical potential difference (1V), making it ideal for portable systems. A 50-fold concentration has been achieved in a channel length of less than 4 mm, with the concentrated DNA focused to a plug width of 50 μm.