A single-DNA chip for biosensing

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The last two decades have seen the emergence of single-molecule experiments [1]. By avoiding the ensemble averaging inherent to traditional bulk-phase biochemistry, the study of molecular machineries at the single-molecule level permits a better understanding of the behavior of living systems. Indeed the dynamics of the machineries processes can be characterized and rare subpopulations can be identified [2].

In our laboratory, we implemented the Tethered Particle Motion (TPM) technique to monitor the conformational dynamics of single DNA molecules. To increase the output of this powerful but time-consuming single-molecule assay, we have developed a novel single DNA chip allowing the simultaneous analysis of hundreds of single DNA molecules (see Fig 1).

The principle of a TPM experiment consists in tracking a bead tethered at the free end of a DNA molecule immobilized by the other end to a coverslip by means of optical videomicroscopy coupled to image analysis. The amplitude of the Brownian motion of the bead is related to the effective length of the DNA molecule [3]. In our biochip, the controlled positioning of individual DNA molecules is achieved by self-assembly on nanoscale arrays fabricated through a standard microcontact printing method. Using this improved patented method, we currently analyze more than 500 single DNA molecules in parallel [4, 5].

After the description of our technology, we will discuss the capacities of the single DNA biochip, the sensitivity of our methodology and, the future developments and industrial applications in the field of biosensing.

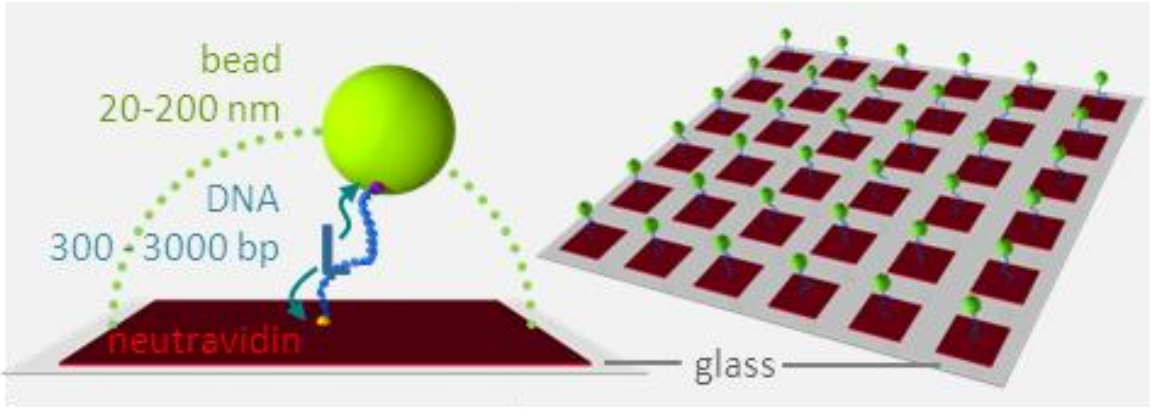

Figure 1. A nanoarray for the parallel analysis of DNA conformational changes by Tethered Particle Motion.

References

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