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Lab on a wire: application of silicon nanowires for nanoscience and biotechnology

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Synergy between physics, material sciences and biotechnology during last decade has led to a tremendous scientific progress in the fields of bio detection and nanomedicine. This tight interaction led to the emergence of a new class of bioinspired systems that enables to bring the area of biosensorics e.g., for cell or molecular diagnostics and analytics to the new level. The advances are expected in terms of possibility for early diagnostics of diseases due to the increased sensitivity of the detectors; real time and high through put analysis offered by combination of integrated electronics and microfluidic approach and establishing the new functional formats for the bioassays. Most promising candidates for the future diagnostics are the electronic nano biosensors that have attracted great attention in the last decades since they provide rich quantitative information for medical and biotechnological assays without pre-treatment and specific optical labelling of the detected species. One dimensional nano structures in particular semiconductor and metallic nano wires have attracted attention as highly efficient sensor elements due to their high surface-to-volume ratio, which simplifies the detection of biochemical species down to single molecules. The simultaneous detection of multiple targets within a single chip on a point of care device is a milestone drawing great attention within bio and nanotechnology areas for more than a decade. Here, we demonstrate a multiplexed, label free and real time detection platform for small molecules like hormones, DNA sequence or pathogenic proteins. The nanowires based devices offer noise reduced, versatile and reliable electrical characteristics with high on/off ratios upto 106. A sensitive and selective binding of the targets onto the SiNW-FETs can be realized by using aptamers/ antibodies, etc., as receptors in order to allow high sensitive screenings in physiological conditions.

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