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Compact portable device for the detection of NIR-fluorescent biosensors

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The demand for specific and sensitive point-of-care (POC) diagnostics is rapidly increasing. To fulfill this need, semiconducting single-wall carbon nanotubes (SWCNTs) offer ideal properties as optical biosensors. After excitation, SWCNTs fluoresce in the near infrared (NIR) from 870 to 2000 nm, depending on their chirality [1]. NIR signals provide major advantages due to the reduced light scattering and absorption as well as the minimized autofluorescence [2]. This results in a higher signal-to-noise ratio as well as lower interfering background signal and ultimately higher sensitivities.

Useful for sensing applications is the high photostability of SWCNTs as well as the possibility to functionalize the SWCNT surface, creating highly sensitive and specific optical biosensors [1]. Biochemical signals such as neurotransmitters [3] are sensed by the functionalized SWCNT, which then transduces the biochemical signal into an optical signal (fluorescence change). By multiplexing with different functionalized sensors, higher specificity can be achieved for example to distinguish pathogens [4].

Here, we present the integration of a SWCNT-based hydrogel biosensor array in an optical-electronic setup. This represents the next step in the development of a POC diagnostic platform, that can be implemented in clinical pathology. Therefor our focus is on creating a compact, portable device that can be automated. As an initial prototype, we choose a design similar to an inverse fluorescence microscope setup. We evaluate the device’s ability to detect various analytes and further characterize its sensitivity and signal-to-noise ratio. All in all, the device demonstrates the potential of SWCNT-based NIR sensors as a new platform for POC diagnostics.

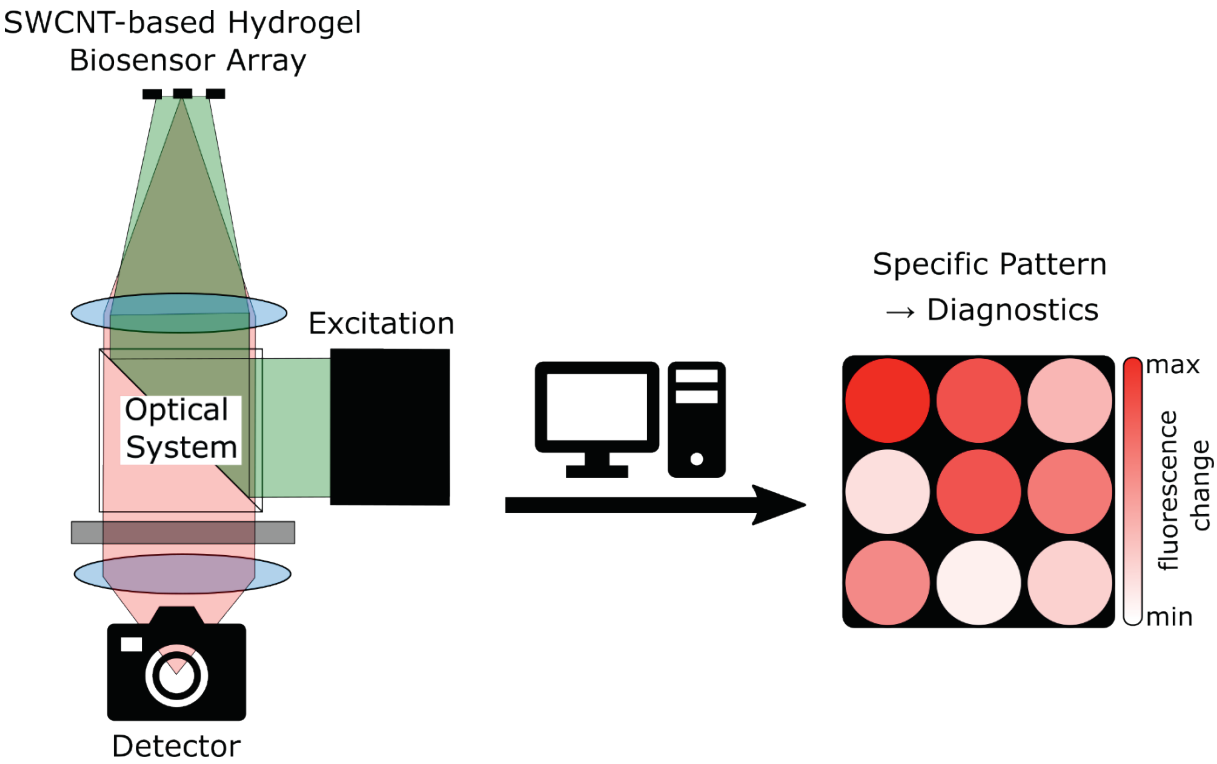

Figure 1: Optical-electronic setup for the sensing of fluorescence changes in a SWCNT-based hydrogel biosensor array, which can be used as a platform for diagnostics.

Referenzen

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