Assembly of DNA-Wrapped SWCNT-Protein Hybrids

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Precisely controlling the conjugation of functional biomolecules with electrodes is an important step in the creation of bioelectronic interfaces for electron transport studies in biological systems, and for the development of novel biosensing devices. Electrical detection based on nanomaterials offers unique advantages, such as simplicity, low-cost, portability, and label-free real-time electrical monitoring in a non-destructive manner. Furthermore, by approaching the size-scale of individual biomolecules, nanoscale control could conceivably allow us to carry out single-molecule investigations that in turn enable monitoring biomolecular interactions with high sensitivity and selectivity in real time, using extremely small analyte volumes and concentrations. In particular, there has been great interest in the use of one-dimensional nanostructured materials for the development of new nanoscale interfaces with single-molecule control, and single walled carbon nanotubes (SWCNTs) emerged as strong candidates. Here we present novel methods to interface individual proteins to SWCNTs in aqueous solution. We controlled the formation of SWCNT-protein conjugates via two methods: the covalent coupling with molecular linkers, and through DNA hybridisation. In both cases we can selectively functionalise the ends of SWCNTs; moreover, the DNA hybridisation strategy allows us to introduce variables such as length and sequence composition, and the potential for higher order structures. The approach presented is of general applicability for the controlled assembly of biohybrid interfaces towards the fabrication of solution-processable bioelectronic devices with single-molecule resolution.

Abstracts should be submitted in Word format via email to s.goldup@soton.ac.uk by 3rd of June 2016.