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Elucidating the mechanism of bio-sensing with carbon nanotube devices in solution. IDDO HELLER, ANNE JANSSENS, ETHAN MINOT, HENDRIK HEERING, SERGE LEMAY, CEES DEKKER, Kavli Institute of NanoScience, Delft University of Technology — We address the mechanism of electronic sensing with carbon nanotube field-effect transistors in solution. It has been demonstrated that the electrostatic interaction of proteins with single-walled carbon nanotube (SWNT) devices can strongly modulate the transport properties. The exact nature of this electrostatic interaction however remains ill-defined. Recent reports suggest that protein adsorption at the metal-SWNT contact interface plays a more dominant role than adsorption along the bulk of the SWNT. We will report on scanned probe experiments that demonstrate that sensing is not only localized at the contacts. Furthermore, through protein adsorption experiments we show that the effect of either bulk or contact adsorption can dominate depending on the electrolyte gate potential. Because protein adsorption at bulk and contacts can have opposite effects on device conductivity, the two mechanisms can even cancel each other out. This makes it crucial to carefully choose the operating gate potential for protein sensing experiments where the device conductivity is monitored over time.

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