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The transduction mechanism of carbon nanotube transistors monitoring single molecule protein dynamics PATRICK C. SIMS, YONGKI CHOI, TIVOLI J. OLSEN, GREGORY A. WEISS, PHILIP G. COLLINS, Depts. of Physics and Astronomy, Chemistry, and Molecular Biology, Univ. of California at Irvine, Irvine, CA 92697 — Recently we have demonstrated high resolution, real-time monitoring of single molecule chemistry using molecules attached to a single-walled carbon nanotube (SWCNT) transistor. The transduction mechanism of SWCNT sensing is often claimed to be due to charge transfer, but here we clearly show the entire effect to be electrostatic. In this study, the chemical system of interest is lysozyme and its enzymatic processing of its binding substrate, peptidoglycan. We investigate the interaction of a lysozyme molecule with the SWCNT conductivity by building devices out of eight different lysozyme variants synthesized by mutagenesis. Each lysozyme variant has a different sequence of surface charges near the SWCNT attachment site, providing a calibrated method of looking at the electrostatic interactions. We observe that positively- and negatively-charged amino acids induce signals of opposite magnitude, while quasi-neutral amino acids like alanine induce little signal at all. The results indicate that careful consideration and manipulation of the charge environment near the attachment site may enhance the signal-to-noise of SWCNT sensors for studying single molecule interactions.

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