Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Generalized Protein Attachment Chemistry for Highly Sensitive Carbon Nanotube-Based Biosensors MITCHELL LERNER, Univ. of Pennsylvania, Dept. of Physics and Astronomy, TATIANA PAZINA, MATTHEW ROBINSON, Fox Chase Cancer Center, A.T. CHARLIE JOHNSON, Univ. of Pennsylvania, Dept. of Physics and Astronomy — We developed a label free covalent functionalization procedure for attaching proteins to carbon nanotube field effect transistors (CNTFETs). Biomarker proteins are becoming increasingly useful for early diagnosis of disease, ranging from cancer to arthritis to stress. Current clinical immunoassays for measuring patient protein levels are costly and require significant processing time. Using diazonium salts followed by stabilization of carboxylic acid groups, we can attach a variety of proteins to carbon nanotubes as confirmed by atomic force microscopy. Proteins maintain the integrity of their epitope and bind to their corresponding complementary proteins. Carbon nanotube transistors are superior readout elements for such protein binding events due to their speed and comparable scale. Resulting changes in the electronic transport properties of CNTFETs demonstrate a concentration-dependent response. Binding of osteopontin (OPN), a biomarker for prostate cancer, to its complementary single chain variable fragment (scFv) can be detected down to 1 pg/mL with these methods. Moreover, these devices exhibit selectivity for OPN. Such high sensitivity biosensors could be used in parallel to test a single small volume patient sample for any number of potentially ominous biomarker proteins.

Mitchell Lerner
Univ. of Pennsylvania, Dept. of Physics and Astronomy

Date submitted: 12 Nov 2011 Electronic form version 1.4