Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Highly Selective and Sensitive Detection of Acetylcholine Using Receptor-Modified Single-Walled Carbon Nanotube Sensors SHIHONG XU, BYEONGJU KIM, HYUN SEOK SONG, HYE JUN JIN, EUN JIN PARK, SANG HUN LEE, Seoul National University, BYUNG YANG LEE, Korea University, TAI HYUN PARK, SEUNGHUN HONG, Seoul National University — Acetylcholine (ACh) is a neurotransmitter in a human central nervous system and is related to various neural functions such as memory, learning and muscle contractions. Dysfunctional ACh regulations in a brain can induce several neuropsychiatric diseases such as Alzheimer's disease, Parkinson's disease and myasthenia gravis. In researching such diseases, it is important to measure the concentration of ACh in the extracellular fluid of the brain. Herein, we developed a highly sensitive and selective ACh sensor based on single-walled carbon nanotube-field effect transistors (swCNT-FETs). In our work, M1 mAChR protein, an ACh receptor, was expressed in E.coli and coated on swCNT-FETs with lipid membranes. Here, the binding of ACh onto the receptors could be detected by monitoring the change of electrical currents in the underlying swCNT-FETs, allowing the real-time detection of ACh at a 100 pM concentration. Furthermore, our sensor could selectively detect ACh from other neurotransmitters. This is the first report of the real-time sensing of ACh utilizing specific binding between the ACh and M1 mAChR, and it may lead to breakthroughs in various biomedical applications such as drug screening and disease diagnosis.

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Date submitted: 09 Nov 2014 Electronic form version 1.4