

Human Olfactory Receptor-functionalized Polypyrrole Nanotube Biosensor for Ultrasensitive Detection of Gaseous Odorant Molecules

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The olfactory system plays an important role in perception of peripheral environments. Since the interest in olfaction research has been increasing due to its potential industrial applications. Various researches on artificial olfactory biosensors using olfactory receptors (ORs) have been carried out. Herein, we report a highly sensitive and selective gas-phase nanobioelectronic nose that is similar to the natural human olfactory system using carboxylated polypyrrole nanotubes (CPNTs) functionalized with human OR (hOR) protein. The natural human olfaction mechanism was mimicked in this system by utilizing hOR protein hOR3A1. The nanobioelectronic nose developed in this study was able to detect odorants at sub parts-per-trillion (ppt) concentrations and produced measurable signals to odorants at concentrations as low as 0.02 ppt concentration. Our new approach offers the advantage of combining the sensitivity of nanotubes with the selectivity of natural human olfactory receptor.