Human taste receptor protein-functionalized swCNT-FET as a high-performance artificial tongue

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Artificial taste sensors, so called 'electronic tongues', are normally used in food and beverage industry. These electronic tongues based on synthetic materials still have many limitations in terms of selectivity and sensitivity. To overcome these limitations, we applied biological human taste receptor to the development of artificial tongue. Here, we demonstrated human bitter taste receptor, hTAS2R38, produced from E. coli-functionalized single-walled carbon nanotube (swCNT)-field effect transistor (FET) can detect target tastant with high selectivity and sencitivity. The human bitter taste receptor gene, hTAS2R38, was cloned into bacterial expression vector and expressed in *E. coli* at high-level. The receptor was then immobilized on swCNT-FET sensor platform and stimulated by various tastants. hTAS2R38-functionalized swCNT-FET detected only target bitter tastants, phenylthiocabamide (PTC) and propylthiouracil (PROP), among sweet, umami and bitter tastants with high sensitivity up to concentration as low as 100 fM. This study is the first example of artificial tongue which uses biological taste receptor proteins as sensing materials.