# Ultrasensitive in-vitro monitoring of monoamine neurotransmitters from dopaminergic cells

The design of biosensing assay of monoamine neurotransmitters (MANTs) such as epinephrine (Ep), norepinephrine (NE), and dopamine (DA), as well as the monitoring of these MANTs released from dopaminergic cells, are of particular interest. Electrochemical sensors based on the novel construction of nickel oxides (NiO) were fabricated and employed for electrochemical screening of MANTs. A novel NiO-lacy flower-like (NLF) geometrical structure with semi-spherical head surfaces connected with a trunk as an arm was achieved. The designed semi-spherical head associated with abundant and the well-dispersed tubular branches with needle-like open ends might lead to the creation of vascular vessels for facile diffusion and suitable accommodation of the released MANTs throughout active and wide-surface-area coverage, multi-diffusive pores, and caves with connective open macro-/meso-windows along the entire top-view nanoneedles of lacy flower head and trunk. These electrode surfaces possess high-index catalytic site facets associated with the formation of ridges/defects on {110}-top-cover surface dominants for strong binding, fast response, and signaling of MANTs. The NLF- modified electrode enabled high sensitivity for MANTs and a low limit of detection of 6 nM. Ultrasensitive in-vitro monitoring of DA released from dopaminergic cells (such as PC12) was realized. The NLF electrode was used to detect MANTs from its sources (PC12), and it could be used for clinical diagnosis.