Dopamine (DA), a well-known neurotransmitter usually associated with feelings of pleasure and reward, is a small organic molecule involved in several biological mechanisms that take part in the central nervous, cardiovascular and renal systems. DA monitoring is important in both clinical field and neuroscience. For instance, quantification of DA in urine and plasma is a first assessment test for two neuroblastoma and pheocrocytomas diagnosis. In both diseases, the rapid and reliable quantification of DA is critical for ensuring a successful treatment. At the moment, most of the available methods cannot fully comply with these requirements. To surmount these difficulties, luminescent methods (fluorescence and phosphorescence) have been proposed as a powerful and alternative tool for DA optical sensing due to its high sensitivity, detection reliability, safe manipulation, operational simplicity, real-time detection, and cost-effectiveness.

Given Quantum Dots (QDs) unique optical properties, they have been considered as suitable DA optical nanosensors. However, most of the QDs system used contain Cd, which have raised many safety concerns due to the metal toxicity. Moreover, recent studies have shown that Cd based QDs can interfere with the storage and release of DA from dopaminergic cells, affecting their execution as nanoprobes. To overcome toxicity concerns, we have proposed fluorescent probes based on Mn doped ZnS QDs. Such QDs exhibit two characteristic emission bands, the fluorescent blue band at ~416 nm (ascribed to their surface states) and a prominent phosphorescence orange emission band at ~598 nm. The latter band exhibits a decay time of approximately a few milliseconds, which might help avoid auto-emission interferences from biological matrices. Our first nanoprobe based on L-cysteine Mn-doped ZnS QDs has shown prominent results and these results have been reported in the Journal of Biosensors and Biolectronics. Our next aim is to incorporate additional functional groups in the QDs surface that can attach DA with a higher selectivity and sensitivity. Additionally, we are currently evaluating the QDs biocompatibility with dopaminergic cells.