Boronates as Hydrogen Peroxide–Reactive Warheads in the Design of Detection Probes and Prodrugs

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Hydrogen peroxide (H_2O_2), a one type of reactive oxygen species, plays a vital role in regulating various cellular functions.[1] Here, we would like to introduce three case studies based on the boronate structure. 1) A fluorescent turn-on probe, **HCyB**, based on both hemicyanine and arylboronate structures, was designed to effectively detect H_2O_2. **HCyB** reacted with H_2O_2 and exhibited a satisfactory linear relationship for H_2O_2 concentrations ranging from 15 to 50 μM and good selectivity over other species. The fluorescent detection limit was 76 nM. **HCyB** exhibited less toxicity and mitochondrial-targeting abilities. **HCyB** was successfully used to monitor exogenous or endogenous H_2O_2 in various cells. 2) Besides, a nano-probe was designed through a combination of gold nanoparticles (AuNPs), a carbohydrate contained arylbronate (AB) derivative **MBS**, and a lectin (a carbohydrate binding protein, Con A) to develop a colorimetric assay for H_2O_2 detection. The aggregation of AuNPs could be directly observed as a color change by the naked eye. The reaction temperature 37 °C provided sufficient energy for the **MBS** to react with H_2O_2 and then trigger intramolecular electronic rearrangement, as confirmed by NMR monitoring.[2] 3) A self-assembled polymeric nanoparticles (**BDOX-GOx@NPs**) was prepred to immbolize glucose oxidase and encapsulate prodrug of arylboronate linked-doxorubicin (BA-DOX) under optimal conditions. The produced H_2O_2 can selectively activate the anticancer prodrug. The triple negative MDA-MB-231 breast cancer cell line expressing the mannose receptor was chosen as a model study.[3]

References

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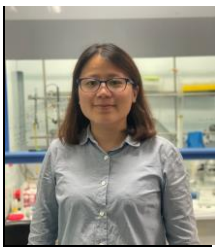

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