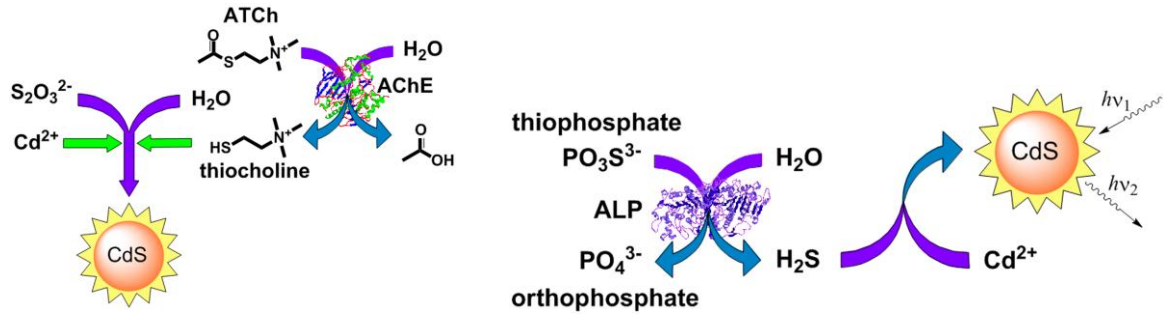
Enzymes and fluorescent nanoparticles

Valeri Pavlov, Laura Saa, Gaizka Garrai
CIC BiomaGUNE, Paseo Miramon 182, San Sebastian, Spain
vpavlov@cicbiomagune.es

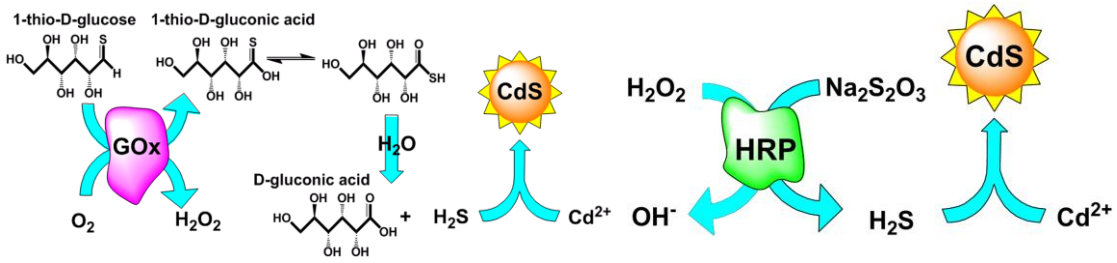
Abstract

Semiconductor inorganic NPs can be photoexcited to generate electron/hole couples which recombine to yield fluorescent emission of light. The stable and bright emission of semiconductor NPs arises from quantum confinement effects that occur in nanometer-sized semiconductors hence such NPs are called quantum dots (QDs). QDs modified with antibodies, DNA and small molecules found application as labels in bioanalytical affinity assays and imaging. Decorated hybrid NPs, iron oxide NPs and nanostructures with an elongated assembly of cores are utilized in magnetic resonance and fluorescence imaging for detection of cancer. The above mentioned analytical systems are based on presynthesized NPs decorated with recognition elements acting as labels or donor/quencher FRET pairs for quantification of enzymatic activities. Their performance is frequently hindered by high background signals caused by nonspecific adsorption of decorated NPs on surfaces or poor quenching of donor couples. Generation of NPs *in situ* can address these drawbacks of relevant analytical systems by decreasing the background signals.

We developed some methods employing enzymatically driven formation of CdS QDs. The examples are represented in Scheme 1, Scheme 2, Scheme 3 and Scheme 4.



Scheme 1. Assay for acetylchololinesterase (AChE)[1]. Scheme 2. Assay for alkalinephosphatase (ALP)[1].



Scheme 3. Assay for glucose oxidase (GOx)[2]. Scheme 4. Assay for horseradish peroxidase (HRP)[2].

The above mentioned enzymatic assays demonstrated sensitivity better by one-two orders of magnitude than previously reported assays using commercially available chromogenic substrates.

References

1. Saa L., Virel A., Sanchez-Lopez J., Pavlov V., Chem-Eur. J. **16** (2010) 6187.
2. Saa L., Pavlov V., Small, **8** (2012) 3449.