Functionalized DNA as the Spatial Control of Photosensitizer and Catalyst in Light Driven Hydrogen Evolution

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In a study of hydrogen evolution using CoTmpyp (Tmpyp=meso-tetrakis(1-metyl-pyridinium-4-yl)-porphyrin) as catalyst (CAT) and $Ru(bpy)_3^{2+}$(bpy=2,2'-bipyridine) as photosensitizer (PS), found that the key processes triggering the photocatalytic hydrogen production is the electron transfer from the reduced photosensitizer to the catalyst[1].To overcome this problem, we are using DNA as the bridge to transfer electron from the PS to the CAT. G4-quadruplex is a well-known DNA-structure that is rich in stacked guanine base. This architecture enables CoTmpyp to be intercalated because of the π-π stacking between the porphyrin ring and the guanine base. The combination of DNA duplex and G4-quadruplex in one strand can be a spatial control because $Ru(bpy)_3^{2+}$ can have hydrophobic intercalation with the major grooves of the DNA duplex. With this system, PS and CAT will always be at the same distance that makes the electron transfer more effective.

This study highlights the essential role of DNA in modulating photocatalytic activity and provides valuable insights for optimizing light-driven catalysis of hydrogen evolution. The CAT-PS-DNA conjugates not only facilitates enhanced photocatalysis but also establishes a versatile and efficient platform for future research

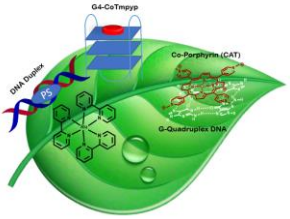

Figure 1: water oxidation catalysis in liposomes

[1] Natali M, Luisa A, Iengo E, Scandola F. Efficient photocatalytic hydrogen generation from water by a cationic cobalt(II) porphyrin. *Chemical Communications*. 2014;50(15):1842-1844. doi:10.1039/c3cc48882a