# Nanoparticles modified biohybrid photoanode for enhancing light-to-electricity conversion

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Shedding light on the interaction between inorganic nanoparticles (NPs) and living microorganisms is at the basis of the development of biohybrid technologies with improved performance.The use of intact microbial cells as biocatalysts for the development of bioelectrochemical systems has found several applications in recent years,[1] going from localized power generation[2] to (self-powered) biosensing[3] and bioelectrosynthesis of high-value products.[4,5] In this context, biophotovoltaics (BPVs) represent attractive technologies for cost-effective and sustainable electricity generation.[1,2] Despite their potential, BPVs face challenges in industrial application due to issues with stability and efficiency. Nanomaterials offer a pathway to enhance these systems, leveraging their unique properties to improve extracellular electron transfer (EET) and light harvesting. Biohybrid systems combine the merits of nanosized materials with those of the whole bacterial cell. Metal NPs, combined with living microorganisms, can be exploited as light absorber to improve light harvesting and as transmembrane and outer-membrane "conductive bridges" to boost charge extraction efficiency from the bacterial cell network to electrode surfaces.[4] Despite the proven efficacy of NPs in facilitating charge transfer at the cell-electrode interface, the mechanisms regulating NP-bacteria interaction and the localization of the NPs within the bacterial cells remained underexplored. Herein, we investigate the interaction of water dispersible and rationally designed Au NPs, designed with specific surface properties, with metabolically active photosynthetic purple bacterial cells (*Rhodobacter capsulatus* DSMZ 152*, R. capsulatus*) monitoring the effect of surface functionalization on the EET process at the biotic-abiotic interface. The NPs are designed to be small enough and have tailored surface properties posely to interact suitably with bacteria[5] while not resulting cytotoxic thereby improving photoelectrochemical conversion and transport efficiency of photogenerated charges at the bacteria/NP/electrode interface.

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