Light-driven coordination compounds and hybrid assemblies as multimodal (bio)imaging agents, ROS-sensitizers, oxygen sensors and (electro)luminophores – From synthesis to implementation

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Diverse approaches have allowed us to fully control the aggregation of planar coordination compounds and to tune their photophysical properties for phototherapy, functional microscopy and multimodal bioimaging.

We have designed a series of photosensitizers able to target, to label and to photoinactivate pathogenic and antibiotic resistant bacteria upon irradiation with red light. For this purpose, it was necessary to avoid stacking by diverse (supra)molecular strategies [1-4]. Currently, we are extending these concepts to targeted, fully water-soluble and biodegradable platforms, a prerequisite for biomedical applications. These approaches include the use of dextrin conjugates [5] and cyclodextrin vesicles [6] that selectively photoinactivate Gram-positive strains. On the other hand, axially decorated dicationic Si(IV) phthalocyanines can kill both Gram-positive and Gram-negative bacteria, despite showing antibiotic resistance [7]. We have also implemented light-driven arrays for spatiotemporally resolved functional microscopy to monitor *in situ* the response towards ROS of eukaryotic [8] as well as prokaryotic [9] cells and biofilms. Insertion of open-shell transition metal cations and tuning of the macrocycles' substitution pattern yielded NIR-absorbing sonophores for *in vivo* photoacoustic imaging [10]. An outlook will be presented regarding the use of Pt(II)-based triplet emitters as multimodal agents for electron microscopy and phosphorescence lifetime imaging without unwanted quenching by triplet molecular dioxygen and related cytotoxicity due to photoproduction of reactive oxygen species [11,12,13]. Finally, our recent progress in the design and realization of Pt(II) complexes as triplet molecular dioxygen sensors and for electroluminescent devices will be discussed, going from bidentate [14] to tridentate [15,16,17,18] and tetradentate [19,20,21] luminophores.

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References:

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