In situ characterization of lipid vesicle dynamics undergoing photooxidation

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Due to their macrocycle, tetrapyrrole molecules - porphyrins, chlorins, phthalocyanines ... - present very special photo-physical properties. Their light irradiation generates, through their triplet state, reactive species such as singlet oxygen or oxyradicals. These species cause, in the area both irradiated and marked by the tetrapyrrole (photosensitizer), molecular alterations. Specific targeting photosensitizers to one or the other cell compartments thus is the basis of their potential to modify and control the physiology of the cells. For example, the photo-chemical internalization (PCI) of macromolecules into cells is based on the photo-induced alteration of endosomal membranes - before their maturation in lysosomes - allowing the escape of the macromolecules, free to reach their targets within cell. More extensive photo-induced changes, in particular to the mitochondria, lead to cell death by necrosis or apoptosis. This photo-induced cell death is basis of an anticancer therapy so-called PDT.

To better apprehend such complex effects, we turned to model systems. In particular, we focussed on photo-oxidation of membranes lipids, that are important targets of the photodynamic effect, as well as for photodynamic therapy than for photochemical internalization. We extensively studied their modifications under photo-oxidation, involving major différentes modifications within the membranes which can be highly destabilized. Our purpose is to demonstrate that the photo-induced permeabilization of the membranes is correlated with a deep physical stress, which can be relaxed by various pathways, depending on its lipids composition, which is characteristic of the targeted cellular compartment.