Oxidative stress in biological cells by direct optical excitation of singlet oxygen : towards new strategies for photodynamic cancer therapy

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Singlet oxygen ($^1O_2$) is an electronic state of molecular oxygen which plays a major role in many chemical and biological photo-oxidation processes. It has a high chemical reactivity which is commonly harnessed for therapeutic issues. Indeed, $^1O_2$ is believed to be the major cytotoxic agent in photodynamic therapy. In this treatment of cancer, $^1O_2$ is created, among other reactive species, by an indirect transfer of energy from light to molecular oxygen *via* excitation of a photosensitizer (PS). This PS is believed to be necessary to obtain an efficient $^1O_2$ production.

We will present results demonstrating that production of $^1O_2$ can be achieved in living cells from PS-*free* 1270 nm laser excitation of molecular oxygen. The quantity of $^1O_2$ produced in this way is sufficient to induce an oxidative stress leading to cell death. Other effects such as thermal stress are discriminated and we conclude that cell death is only due to $^1O_2$ creation. This new simplified scheme of $^1O_2$ activation can be seen as a breakthrough for phototherapies of malignant diseases and/or as a noninvasive possibility to generate reactive oxygen species in a tightly controlled manner.