

Photodynamic therapy as an alternative antimicrobial modality

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From ancient times, humanity has made use of the health benefits of sunlight. The heliotherapy was used by ancient Egyptian, China, Greeks, India and Romans. Although the antique civilization did not understand the mechanism of health sunlight action, they knew that light enables the alleviation or sometimes treatment of various disorders such as microbial infections, rickets, psoriasis and even psychosis.¹ The breakthrough in the development of the therapies based on light occurred at the end of the twentieth century when a medical student accidentally observed lethal effect of photoactivated acridine on *Paramecium*.² The great potential of antimicrobial photoinactivation was forgotten when the anti-tumor efficacy of the photoactivated heparin was discovered. Photodynamic therapy independently on final target (cancer cells or pathogens) bases on three elements: light, photosensitizer and oxygen and all photochemical reactions lead to reactive oxygen species (ROS) production which are considered to be the main lethal agent (Figure 1). If the photodynamic actions are focused on pathogen destruction, the phenomenon is called antimicrobial photodynamic therapy (APDT). Its efficiency was confirmed in the eradication of bacteria, fungi, viruses and parasites, however, the mechanisms of photodynamic action is still not fully understood.³

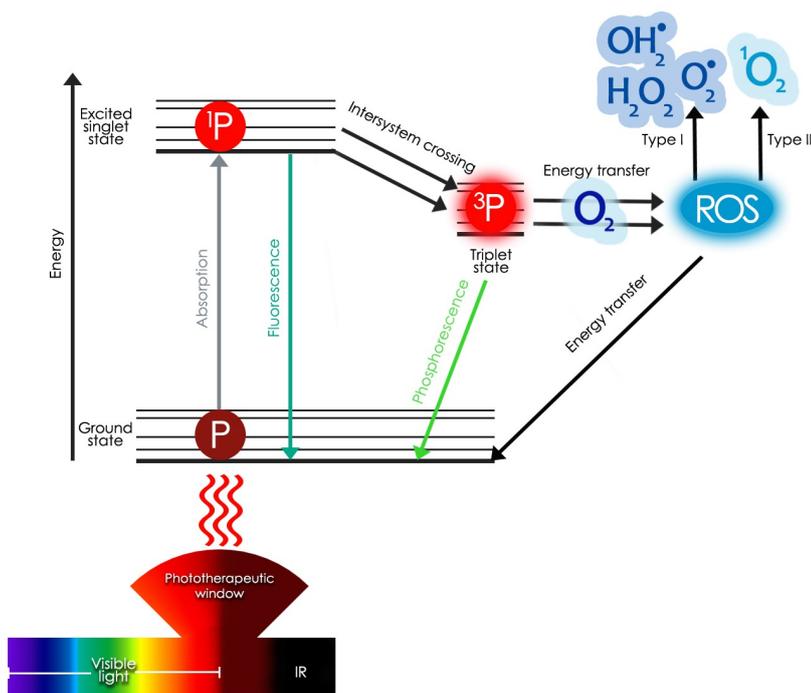


Figure 1

An energy distribution during photodynamic reactions. The absorbance of the light energy leads to an excitation and through Intersystem crossing PS achieves triplet state in which it interacts directly with oxygen molecules leading to production of reactive oxygen species on the photochemical pathway type I (oxygen radicals) or type II (singlet oxygen).

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3. Maisch, T. *et al.* Photodynamic inactivation of multi-resistant bacteria (PIB) - a new approach to treat superficial infections in the 21st century. *JDDG J. der Dtsch. Dermatologischen Gesellschaft* **9**, 360–366 (2011).