Proposition de stage M2 2024/2025 au Laboratoire de Physique de l'ENS de Lyon

# Imaging bacterial response to photoinduced oxidation

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Photodynamic therapy or PDT is a local clinical treatment used to kill abnormal cells (for instance in cancer lesions, without surgical ablation) or to bacterial pathogens on open wounds. In the latter case, the technique is called APDT (antibacterial photodynamic therapy). The technique is based on the strong local oxidation of biological cells by singlet oxygen under light exposure. Oxidation is promoted by photosensitizers, such as methylene blue (MB). Although APDT-based clinical treatments have been developed, the precise response of individual bacteria is still poorly understood. We seek to decipher the mechanisms by which bacteria respond to oxidative stress. Recently, we have optimized a model experimental approach based on the *in situ* imaging of 2D-confined bacteria, followed by extensive image analysis to quantify instantaneous bacterial growth. In the presence of MB, our results evidence a strong response of *Escherichia coli* to red light (figure).

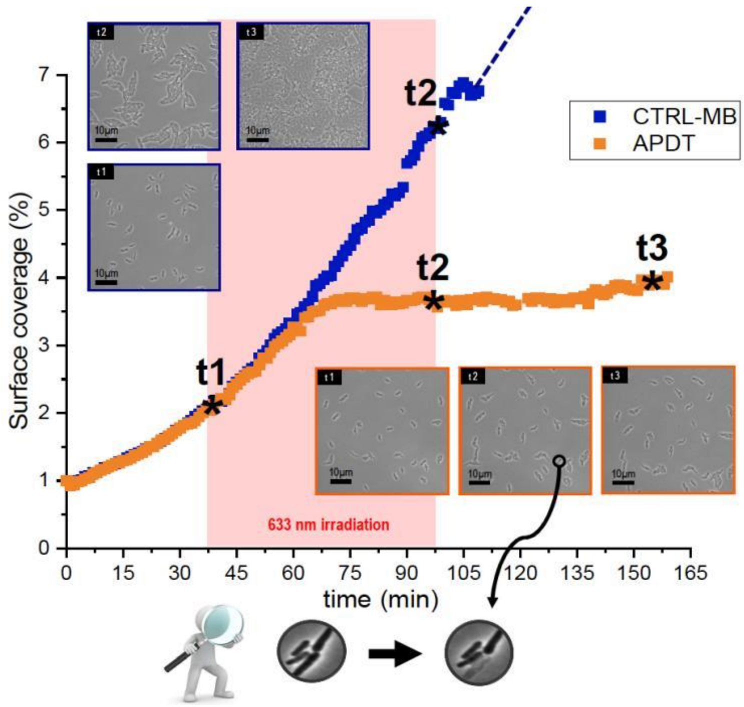


*Figure: Bacterial surface coverage in the presence (orange) or absence (blue) of red light exposure evidences the strong effect of oxidative stress on bacterial growth.*

The goal of this internship will be two-fold: i) to explore the role of the photosensitizer, by varying its concentration, and using new molecules synthetized in LCENSL and ii) to extend our methods to the study of other clinically-relevant pathogens, such as *Pseudomonas aeruginosa* or *Acinetobacter baumanii*, and check whether APDT response varies between microorganisms. By better understanding the conditions requested to kill bacteria, our results will help optimizing clinical APDT protocols. The Master intern should have a keen interest in biophysical work at the crossroads of Biolology, Chemistry and Physics. She (he) will develop his work in the team of Sigolène Lecuyer at the Physics Laboratory in close collaboration with the team of Carlos Marques at the ENS de Lyon.