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# Structural characterization of electron transfer in D.m (6-4) photolyase by time-resolved X-ray crystallography

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# Abstract

Photolyases are flavoproteins widely spread in bacteria, archea, fungi, plants and animals. These enzymes absorb blue light and use it as an energy source for repairing damages that are induced on DNA after a prolonged exposure to UV-light. The mechanism of DNA repair in photolyases requires a first step of photo-excitation known as photoactivation. During this process, the chromophore uptakes an electron from a close tryptophan. This event triggers an electron transfer along a chain of tryptophans and results into the reduction of the chromophore to its catalytic form.
This thesis is focusing on unravelling the structural changes associated with photoactivation in a photolyase from Drosophila Melanogaster. We employed time-resolved serial crystallography as the main technique of investigation. In the three papers, we present the crystallography techniques and conditions that were used for time-resolved experiments in synchrotron and in x-ray free electron laser facilities (XFEL). At first, we solved the structure of the protein in its resting state and then we characterized the structural changes that occur after light activation. We recorded data at different time delays from illumination ranging from ps to ms. The findings show structural changes around the chromophore and the tryptophans involved in the electron transfer.
These results contribute to the understanding of the structural adaptation of photolyase during the first electron transfer process. However, further studies are needed to structurally characterized the second step of photoactivation and the process of DNA-repair.



**Keywords**: time-resolved serial crystallography, photolyase, photoactivation