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PORPHYRIN INDUCED PHOTOINACTIAVTION OF MODEL VIRUS T7 PHAGE

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The risk of transmitting infections by blood transfusion has been substantially reduced. However, alternative methods for inactivation of pathogens in blood and its components are needed. Application of photoactivated cationic porphyrins can offer an approach to remove non-enveloped viruses from aqueous media. Here we tested the virus inactivation capability of meso-Tetrakis(4-N-methylpyridyl)porphyrin (TMPyP) and meso-Tri-(4-N-methylpyridyl)monophenylporphyrin (TMPyMPP) in the dark and upon irradiation. T7 bacteriophage, as a surrogate on non-enveloped viruses was selected as a test system.

In the case of intracellular viral localization the porphyrin binding of viral genome is in competition with cellular nucleoprotein complexes. The fundamental packing unit of the chromatin is the nucleosome consisting of the core particle and linker DNA between successive nucleosome cores. That is why we also investigated the complexation of TMPyP with HeLa nucleosome core particle and compared to the TMPyP binding to isolated nuclosomeal DNA and T7 nucleoprotein complex (NP).

It was found that TMPyP and TMPyMPP reduce the viability of T7 phage already in the dark, which can be explained by their selective binding to nucleic acid. Using UV and CD melting studies, we revealed that TMPyP binding destabilizes also the nucleosome structure but does not affect protein stability and/or the protein – DNA interaction in T7 NP.

Both compounds proved to be efficient photosensitizers of virus inactivation. The binding of porphyrin to phage DNA was not a prerequisite of phage photosensitization, moreover, photoinactivation was more efficiently induced by free than by DNA bound porphyrin. As optical melting studies and agarose gel electrophoresis of T7 nucleoprotein revealed, photoreactions of TMPyP and TMPyMPP affect the structural integrity of DNA and also of viral proteins, despite their selective DNA binding. Photoinduced reaction of TMPyP caused alterations also in DNA structures and DNA protein interactions within HeLa nucleosome.