Spectroscopic Study of UV-Irradiated DNA

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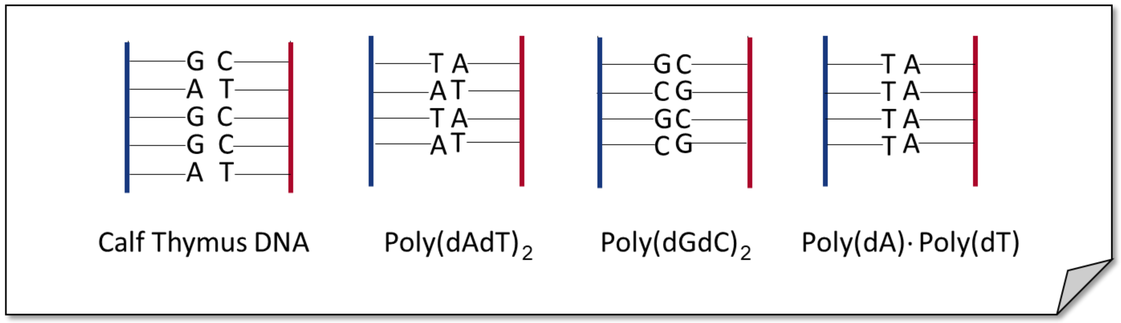
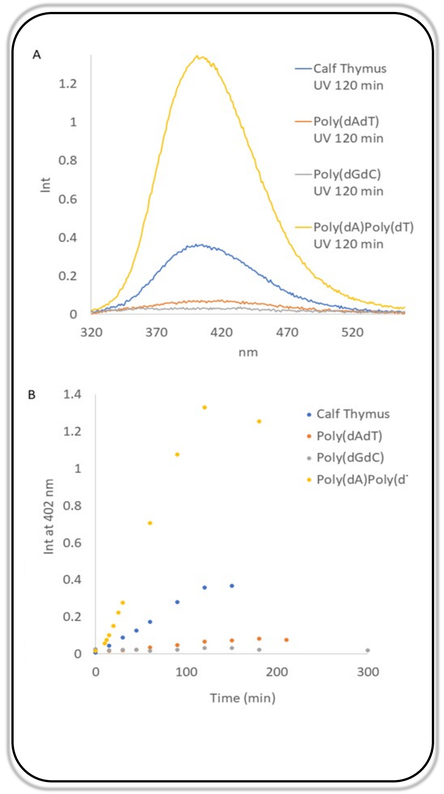
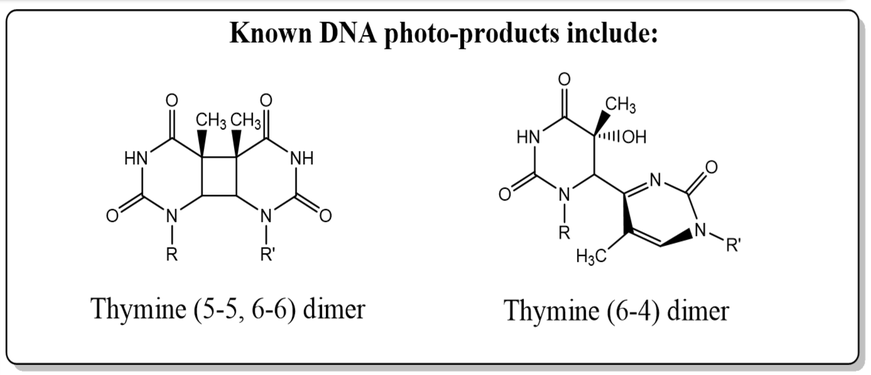
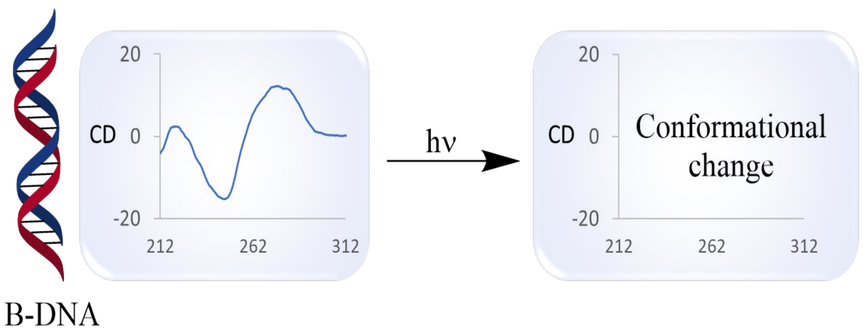
Abstract: In this project, we analyze the changes to DNA upon irradiation with UV light. We used three spectroscopic techniques: UV-Vis absorption, Circular Dichroism (CD), and fluorescence to follow the changes in four different nucleic acid sequences irradiated at selected exposure times with an Hg Lamp. We analyze: calf thymus DNA, poly (deoxyadenylic-deoxythymidylic) acid [poly(dA-dT)$_2$], poly (deoxyguanylic-deoxycytidylic) acid [poly(dG-dC)$_2$] and poly (deoxyadenylic acid) · poly (deoxythymidylic acid) [poly(dA) · poly(dT)]. In all cases, both the CD and UV-Vis spectra undergo sequence dependent changes. On the other hand, fluorescence was observed only when thymine and adenine base pairs are present and is enhanced when the thymine nucleobases are adjacent to each other on the same strand. Poly(dA) · poly(dT) undergoes changes more rapidly than the other sequences investigated and therefore represents the most interesting results obtained in this project.
In particular, after irradiation with UV light we observed:
1) a fluorescent photo-product with an emission spectrum with a maximum at approximately 402 nm produced upon excitation of the samples at 298 nm;
2) the CD spectrum of poly(dA) · poly(dT) gradually undergoes an inversion, suggesting a change in helicity, before disappearing due to the unfolding of the double strand.

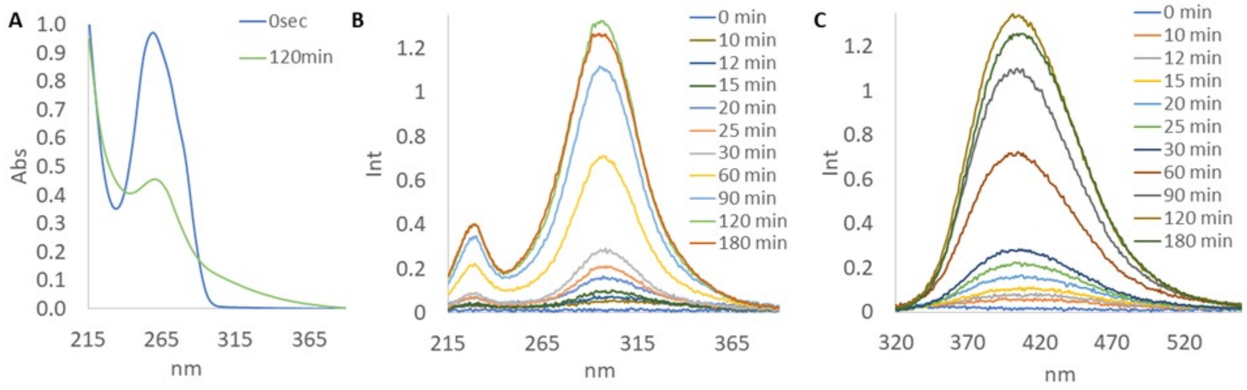


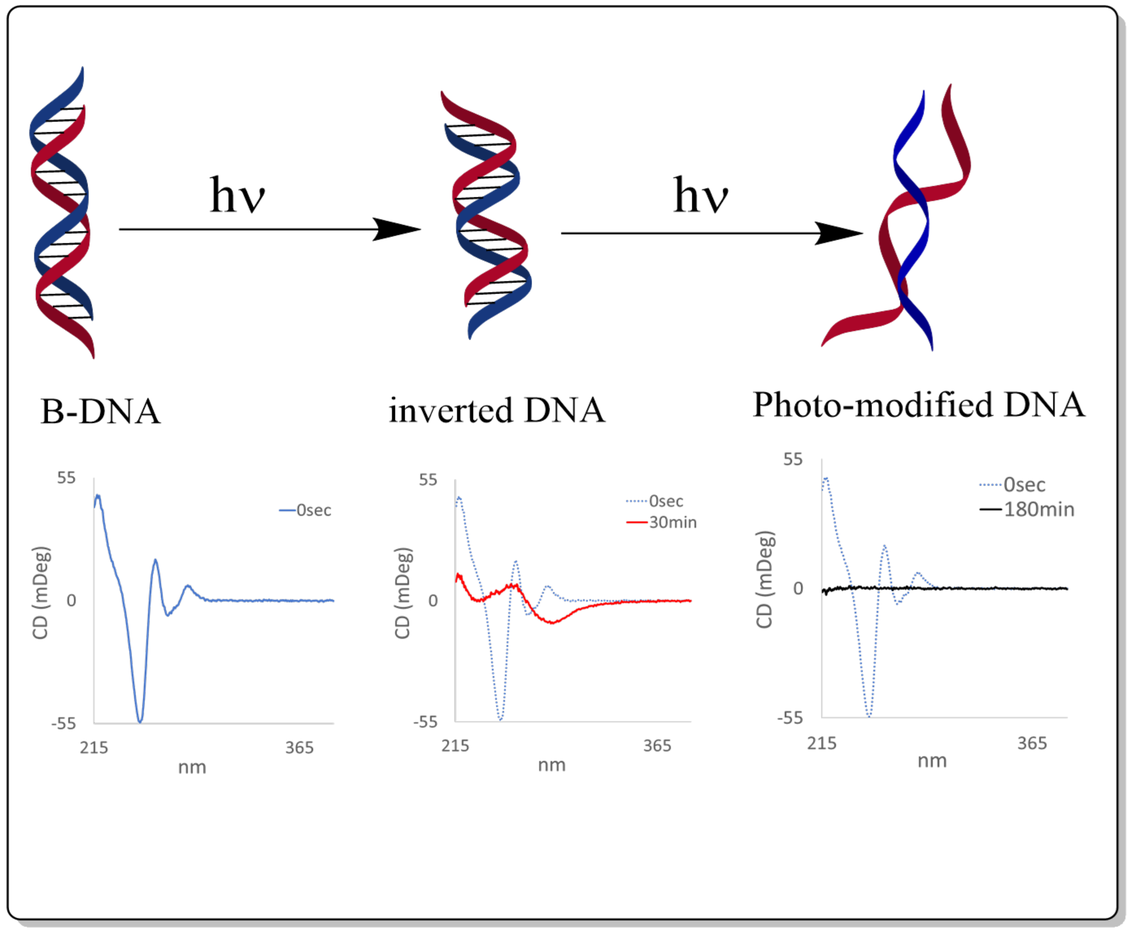






UV-Vis absorption spectra of poly(dA)·poly(dT) before and after irradiation with UV light for 120 minutes (A). Fluorescence spectra of poly(dA)·poly(dT) after irradiation with UV light for selected amounts of time: Excitation spectra – emission monitored at 405 nm (B); Emission spectra – sample excited at 298 nm (C)





References
Gregory T. Carroll, Reed C. Dowling, David L. Kirschman, Mark B. Masthay, Angela Mammana
Intrinsic fluorescence of UV-irradiated DNA,Journal of Photochemistry and Photobiology A: Chemistry, Volume 437,2023

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