**431g Photocontrol of DNA Condensation Using Photoresponsives Surfactants**

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One of the main challenges in non-viral gene delivery, specifically the use of cationic lipids or polymers to bind to and condense DNA, is that this binding is often effectively irreversible, thereby preventing or slowing the release of the DNA molecule from the condensing agent into the cytoplasm of the cell. This release is necessary for DNA to interact with intracellular molecules such as importin or transportin that recognize the nuclear localization sequence on the DNA molecule and transport DNA into the nucleus. The objective of this study is to use light as a convenient means to photoreversibly condense DNA molecules to attain the same level of efficiency as viral mechanisms without the toxicity. To achieve photocontrolled DNA compaction, we use a photoresponsive azobenzene surfactant as the condensing agent. The cationic surfactant, synthesized in our laboratory, undergoes a photoisomerization upon illumination with the appropriate wavelength of light, with the visible-light (trans) form of the surfactant being more hydrophobic than the UV-light (cis) form. As a consequence, the surfactant reversibly binds to DNA, leading to photocontrol of DNA condensation. A range of experimental techniques will be discussed to demonstrate the reversible photocontrol of λ-DNA compaction, with a particular emphasis on fluorescence microscopy as well as dynamic and static laser light scattering. Specifically, single-molecule fluorescence microscopy is used to directly image light initiated DNA condensation. With the use of UV-visible spectroscopy, we were able to show that there is no DNA degradation due to UV-A (350 nm) light illumination. The ability to photocontrol DNA condensation provides a promising means by which DNA containing therapeutic genes can be delivered to a cell, and then allowed to interact with intracellular molecules for nucleus uptake.