52g Reversible Changes in Protein Secondary Structure with Light Using Photoresponsive Surfactants

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The ability to use simple light illumination to reversibly control protein folding will be discussed, with particular emphasis on light-induced changes in protein secondary structure (α-helices, β-sheet, etc.). This novel method utilizes photoresponsive azobenzene surfactants as a means to induce reversible conformation changes in proteins. The surfactant undergoes a photoisomerization upon exposure to 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 can reversibly bind to the hydrophobic domains of proteins, leading to photocontrol of protein folding, demonstrated in this work using a range of proteins (e.g., BSA, lysozyme, bacteriorhodopsin, etc.). Several experimental techniques will be employed to study these photosurfactant-protein systems, with particular emphasis on Fourier transform infrared spectroscopy (FTIR) as a means of quantifying the reversible changes in secondary structure elements, providing protein conformational information and insight into the folding and unfolding mechanisms of proteins. Light-induced changes of protein secondary structure will be compared to similar changes in protein tertiary structure obtained from relatively high-resolution *in vitro* conformations determined with small-angle neutron scattering data. The process is shown to be remarkably reversible. Throughout several unfolded-refolded cycles induced by light, both the secondary and tertiary structures of the light-denatured and light-refolded states are independent of cycle number.