The Photochemistry and Photophysics of Cholesta-5,7,9(11)-triene-3β-ol In Vivo

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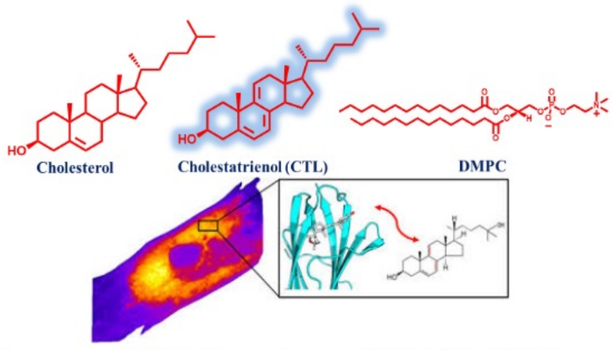
Abstract

Cholesta-5,7,9(11)-triene-3β-ol (CTL) differs from cholesterol in having two extra double bonds in the 7 and 9 positions. The triene moiety is unusual because the rigid steroid skeleton has rendered it fluorescent. CTL's fluorescence has led to its use in monitoring cholesterol tracking within cells and membranes. Knowledge of cholesterol trafficking is essential to a better understanding of membrane structure and allows the creation of more accurate models of membrane function. Our lab has studied the photochemistry and photophysics of CTL and its 25-OH (HOCTL) derivative in aprotic and protic solutions. Photobleaching studies by others show that CTL is photochemically active in membrane media. Phosphatidylcholine and sphingomyelin, both capable of forming sterol domains and vesicles, are examples of biomimetic media. Our goal is to study the photochemistry and photophysics of CTL inside such domains. The synthesis of CTL from 7-dehydrocholesterol is in progress. Once CTL is on hand, we will study its photochemistry and photophysics inside vesicles. These experiments will yield the identification of photoproducts, the mechanism and quantum yields of their formation and the lifetimes of the excited state precursors. The possible toxicity of the photoproducts would influence the future use of CTL in vivo.

Methods

- Synthesis of CTL to acquire an adequate amount.
- Lipid Composition of DMPC
- Irradiation of samples



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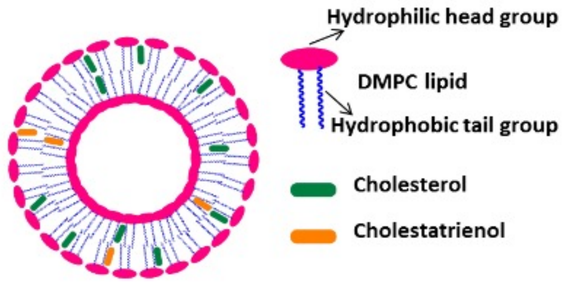
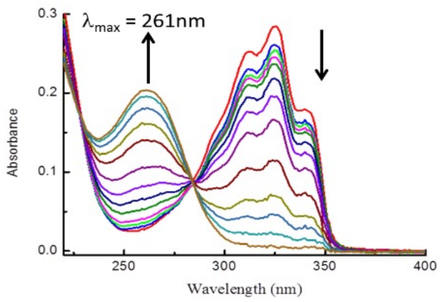
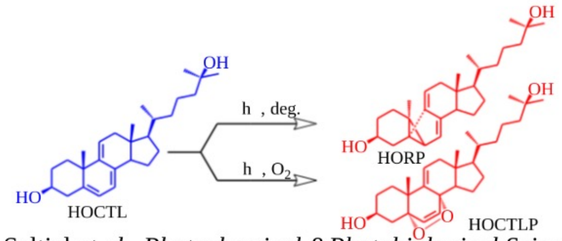


Results

Photoproducts in THF



Photochemistry of HOCTL in THF



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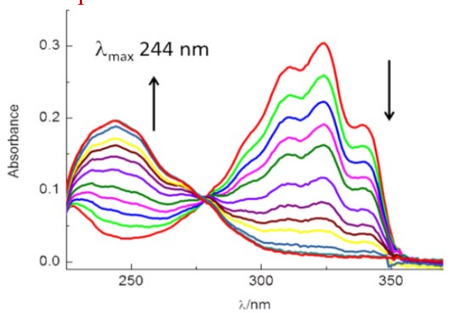
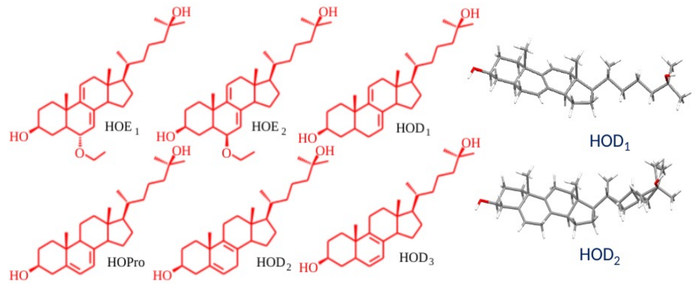
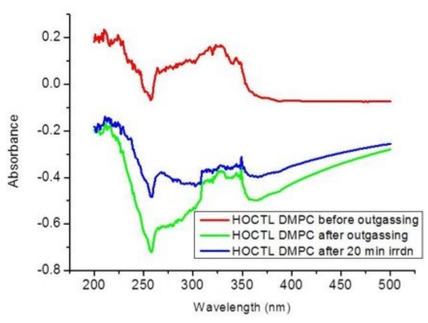
Photoproducts in Ethanol



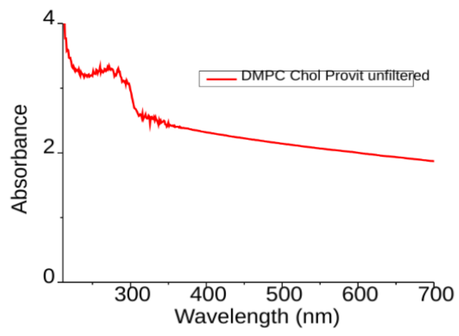
Additional Photoproducts in Ethanol



Spectra of HOCTL in DMPC + CTL



Spectra of Provitamin D + CHL in DMPC



Future Work

With an adequate amount of CTL, a sample of lipid ordered DMPC vesicles can be made and irradiated with a proper absorbance and quantum yield. These samples can then be compared to controls to determine the photoproducts of CTL in vivo.

Acknowledgments

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