Interaction of specific drug in mitochondrial biomimetic membranes

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The lipid bilayer, alongside the protein component, is crucial for regulating the structure and function of cell membranes. It serves as a template for key molecular processes and is often targeted by various exogenous and endogenous ligands. Over the years, cell membrane models, particularly lipid bilayers and their interactions with drugs, have garnered significant attention in the biomedical and biotechnological fields. This includes drug design and delivery, cellular drug uptake, and understanding side effects. In this context it is fundamental to understand how drugs interacts with specific lipids and cell membranes. In this communication we will focus on the interaction between curcumin, a polyphenol from the Chinese herb turmeric, and models of mitochondrial membranes composed of dimyristoylphosphatidylcholine (DMPC). Curcumin is notable for its multifunctional properties, including antioxidant, anti-inflammatory, antimicrobial, and anticancer activities. It specifically interacts with cardiolipin (CL), a unique lipid in mitochondrial membranes. We have investigated the interaction of curcumin with mitochondrial membrane models using several techniques. Our findings on the cardiolipin-curcumin interplay in affecting membrane properties are significant in two ways: they suggest that cardiolipin-based model membranes can serve as a biocompatible platform to incorporate water-insoluble curcumin, aiding in the design of efficient drug-delivery systems for in vivo use, and they highlight curcumin's preferential effect on mitochondrial membranes, which is crucial for its therapeutic role in mitochondrial-related physiopathologies..