

Model membrane systems: Applications in ocular drug delivery and antimicrobial actions

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A variety of biological processes occur on cell membranes. The complexity of biological membranes makes the determination of their exact composition in a cell quite difficult. A number of simpler model membrane systems have been developed to customize the membrane size, geometry, and compositions with greater precision. In recent years, model membrane systems have been explored and investigated for their interactions with nanocarriers, drugs and antibiotics. Understanding these mechanisms of interactions is essential to the design and development of new drugs and efficient delivery systems. In this talk, I will demonstrate the use of model lipid membranes to understand the biological mechanisms in two different fields.

i) Design of cubosomes for glaucoma drug delivery. Glaucoma is the leading cause of irreversible blindness. It is associated with progressive loss of retinal ganglion cells (RGCs) undergoing apoptosis. We have used cubosomes for glaucoma drug delivery due to their biocompatible constituents and high loading potential for drugs. To enhance the detection of apoptotic cells in glaucoma, cubosomes were first modified with Annexin V. The interactions of Annexin V-containing cubosomes with the apoptotic model and cellular membranes were investigated. After that, we used Annexin V-containing cubosomes as an active targeted delivery system to deliver neuroprotective drugs to the damaged RGCs in vivo. Biophysical studies further revealed that 17% drug loaded cubosomes with Pn3m symmetry have shown better in-situ and in-vitro cell penetration effects than other formulations with Im3m symmetry. This data has important implications for future design and formulation of nanoparticles for therapeutic applications.

ii) Interaction of antibiotics with bacterial outer membranes. “Superbugs” are responsible for more than 35,000 deaths and nearly 3 million illnesses each year. Superbugs can evade last-line antibiotics and the host immune system during a life-threatening infection. Studies have reported that superbugs rapidly adapt their bacterial membrane to circumvent antibiotic and immune killing. We have used neutron reflectometry to characterise the golden staph and gram-negative bacterial membranes, and found that the packing, organisation and density of lipids in the membrane impacted the mechanism of action of antibiotics.

Level of Expertise

Expert

Speakers Gender

Female

Do you wish to take part in the poster slam

No

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