Synthetic Cell Transduction Agents: Applications of phospholipid membrane interactions

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Abstract

We are attempting to address the interaction with phospholipid membranes from a theoretical view point in order to identify the features used by synthetic transduction agents and how this extends into polymer-cell interactions. This will be achieved through the understanding of liposome formation and liposome-cell interactions.

Liposomes are a very attractive material for drug delivery, owing to their low toxicity and immunogenicity. They allow the cellular uptake of drugs that are naturally unable to diffuse through the cell membrane. They can be manufactured at commercial quantities, be made from entirely natural substances and because their lipid bilayer composition allows them to carry both hydrophilic and hydrophobic drugs; this is because the lipid bilayer of liposomes can fuse with cell membranes, and be absorbed by cells without causing cytotoxic effects. Practical methods for the formation of liposomes will be discussed in terms of their physical characteristic but also encapsulation efficiency and liposome-cell interactions.

We are focussing on the supply chain needs of emerging regenerative medicines for which cells must be made and stored in a stable form for distribution. We can exploit the obtained understanding from these lipid bilayers, to develop these methods. Currently available technologies require that cells are used within a very short time of production, which allows no supply chain flexibility. Previous research carried out in the group has shown that red blood cells can be stabilised for frozen, or even dried, storage by loading with cryoprotectants using synthetic transduction agents. The aim is to obtain the fundamental understanding of these processes in order to extend this stabilisation technology to human red blood cells, other mammalian cell lines and stem cells.