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Polymersomes in Drug Delivery: A Comparative Review with Liposomes and Micelles

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Abstract : Since the mid 50's, enormous attention has been paid towards nanocarriers and their applications in drug and gene delivery. Among these vesicles, liposomes and micelles have been heavily investigated due to their many advantages over other types. Liposomes, for instance, are mostly distinguished by their ability to encapsulate hydrophobic, hydrophilic and amphiphilic drugs. Micelles, on the other hand, are self-assembled shells of lipids, amphiphilic or oppositely charged block copolymers that, once exposed to aqueous media, can entrap hydrophobic agents, and possess prolonged circulation in the bloodstream. Both carriers are considered compatible and biodegradable. Nevertheless, they have limited stabilities, chemical versatilities, and drug encapsulation efficiencies. In order to overcome these downsides, strategies for optimizing a novel drug delivery system that has the architecture of liposomes and polymeric characteristics of micelles have been evolved. Polymersomes are vehicles with fluidic cores and hydrophobic shells that are protected and isolated from the aqueous media by the hydrated hydrophilic brushes which give the carrier its distinctive polymeric bilayer shape. Similar to liposomes, this merit enables the carrier to encapsulate a wide range of agents, despite their affinities and solubilities in water. Adding to this, the high molecular weight of the amphiphiles that build the body of the polymersomes increases their colloidal and chemical stabilities and reduces the permeability of the polymeric membranes, which makes the vesicles more protective to the encapsulated drug. These carriers can also be modified in ways that make them responsive when targeted or triggered, by manipulating their composition and attaching moieties and conjugates to the body of the carriers. These appealing characteristics, in addition to the ease of synthesis, gave the polymersomes greater potentials in the area of drug delivery. Thus, their design and characterization, in comparison with liposomes and micelles, are briefly reviewed in this work.

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