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Use of Polymer Micro-Structures for Drug & Gene Delivery

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The design of polymer microstructures, including polyelectrolyte-surfactant complex formation, plays an important role in the protection and controlled release of drugs & DNA fragments. Two examples are presented: one for drug release and one for gene delivery. Non-viral gene therapy is a challenging problem that has not yet met much success even though numerous attempts have been made. The gene delivery illustration aims to present one specific approach on how DNA fragments can be delivered to a cell by using an electro-spun scaffold as a carrier, i.e., to consider how DNA fragments can be trapped into a scaffold for subsequent release and transfection. Our scheme is to capture the DNA fragments by taking advantage of the DNA coil-to-globule transition and to encapsulate the condensed DNA globule by using block copolymers. The supra-molecular capsule can then be incorporated into a nano-structured biodegradable polymer scaffold by means of electro-spinning. Subsequent DNA release to cells that adhere to the scaffolds was measured by using fluorescence microscopy.

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