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# Macromolecular Nanovectors for Gene Delivery

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Several types of polymer-based structures including micelles, polymersomes, nano- and microparticles (-capsules/-spheres), molecular imprinting polymers, dendrimers, nanogels, hydrogels and interpenetrated polymer networks have been developed and tested as potential systems of interest for biomedical applications. Advances in polymer science – focusing on an improved control of polymer molecular weight, polydispersity, structure, properties and functionality through the synthetic approach – have led to the development of several novel systems designed for drug/gene delivery and tissue engineering, two recently emerging areas with pivotal role for both research/academic community and industry, new niche markets being generated. They yielded the development of tailored polymer materials, engineered to exert distinct biological functions, implying multifunctionality as well as appropriate form/architectural features (with implication of nanotechnology), and giving rise to specificity and high responsiveness (i.e. stimuli responsive polymers and polymers capable of molecular recognition).

In this context, the presentation summarizes the challenges in the synthesis of macromolecular compounds to be used as nanovectors/carriers for gene delivery, pointing on synthetic polymers as a possible realistic solution to specific challenges, and outlines the current state of the art, focusing on the newest approaches to improve systems effectiveness and responsiveness. Some recent original results are briefly described and expected future directions are underlined.